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The role of the services sector in growing the Australian economy

Submitted by

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Abstract

In today's global economy the service-producing sector increasingly plays a dominant role in promoting growth and improving living standards. While this is now well understood, early theorists initially struggled to recognise explicitly the importance of services, due in part to the difficulties of incorporating the characteristics of services within economic frameworks that were devised for goods. French economist Jean Fourastié was one of the first to propose a concept of economic development that describes how a society eventually moves to a post-industrial services economy, even though the services sector now plays a much more integral role than originally proposed in Fourastié's three-sector hypothesis.

Understanding whether structural change may occur within an economy, and in particular which sectors will be impacted in what way, is a vitally important tool for economic planners to comprehend. The concept of multi-sector growth models, such as that proposed by Ngai and Pissarides, has enabled the incorporation of new theory into traditional growth models and explained how and why sectors rise and fall over time, albeit still in a closed economy setting. Analysing the structure, conduct and performance of each sector of the economy, and most importantly, the ability to calculate and consider multifactor productivity (MFP) on a sector-by-sector basis, is important for understanding whether an economy has reached its "steady state" or whether it is likely to experience continued structural change.

History tells us that European settlement of Australia immediately transformed the continent into a services economy, with services being the dominant sector from around 1840 onwards. The objective of the research contained in this thesis is to determine whether the current economic contribution of the services sector in Australia is at a "steady state", or whether there is likely to be a continuation of structural change into the short-to-medium term.

Backward and forward sectoral linkages using official input-output tables suggest the services sector has deepened its connection to consumers, and that Australia has experienced what I call a "servicification" of its primary sector rather than a servicification of its manufacturing sector, which has been the broad macro experience of many other countries. Analysis of capital, labour and output shows Australia's secondary sector achieved the highest rate of MFP growth, with MFP growth for the services sector less than, and considerably less volatile than, that experienced by the secondary sector.

A cross-country empirical analysis suggests Australia's services sector as a whole is "underweight" compared to the theoretical proportion of Gross Domestic Product (GDP) it should represent. On a sub-sector level, producer services represent a greater proportion of GDP than they theoretically should, while distributive, social and personal services represent a lower proportion of GDP than they theoretically should. An extension to the cross-country empirical analysis has also suggested that government industry policy can positively affect the structure of an economy. An assessment of the national and state government industry policy environment in Australia suggests there is a relationship between the quality of the approach taken to support the services sector through industry policy and the proportion of Gross State Product generated by the services sector within each jurisdiction.

The combination of the findings of this thesis strongly suggests, that despite the services sector holding a dominant position within today's economy, it is likely to continue to increase in importance within Australia's future economic structure. Substantially improving the quality of industry policy supporting the services sector at both Commonwealth and State levels will ensure this anticipated growth not only materialises as expected, but is maximised.

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Thesis Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

I give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

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Chapter 1 Introduction

1.1 Background

French economist Jean Fourastié proposed a concept of economic development that describes how a society moves from a “traditional civilisation” through a “transitional period” of industrialisation, mechanisation and automation and finally to a post-industrial service economy, the “tertiary civilisation”.

This theory, proposed in the middle of the 20th century, is supported empirically, although Fourastié suggested that the proportion of economic activity generated by the services sector in the “tertiary civilisation” phase was only likely to be 30 per cent. In modern developed economies the service sector plays a much more integral role than originally proposed in Fourastié’s three-sector hypothesis. In 2014 the service sector represented nearly 90 per cent of all economic activity in Luxembourg and Cyprus while for Australia about three-quarters of its national output was generated by the services sector.

While economists have recognised the increasingly important role the services sector is now playing in most economies around the world, traditional growth theory has been unable to say whether structural change will continue within an economy or whether it has reached its optimal sectoral allocation. This is simply because one-sector growth models simplify the process of reallocating economic activity across the three key sectors, which Kuzents recognised as “one of the six main features of modern economic growth”.

The conception of multi-sector growth models, such as that proposed by Ngai and Pissarides (2007), has been able to incorporate new theory into traditional growth models, such as those proposed by Harrod (1939), Domar (1946), Solow (1956), Swan (1956), Romer (1990), and Aghion and Howitt (1992), which can explain how and why sectors rise and fall over time, albeit still in a closed-economy setting.

The two key theoretical arguments underpinning the structural change growth model proposed by Ngai and Pissarides are (i) if multifactor productivity (MFP) is the same for the consumption good sector and the manufacturing good sector, a necessary and sufficient condition for structural change is that the rate of change in consumption expenditure is different from the rate of change in output per capita; and (ii) if the rate of change in consumption expenditure is the same as the rate of change in output per capita, a necessary and sufficient condition for structural change is a non-unitary elasticity of substitution for each sector[1].

Economic planners should be able to understand the drivers of structural change within their communities, and where appropriate, implement policies to assist factors of production to transition smoothly from one sector to another. This understanding requires empirical analysis of the structure, conduct and performance of each sector of the economy, and most importantly, the ability to calculate and analyse MFP on a sector-by-sector basis. Appreciating the idiosyncratic factors which differentiate one economy from another is also helpful in being able to frame government policies to maximise the potential of the services sector within an economy.

1.2 Research objective

While various studies have considered the role and importance of the services sector in the Australian economy, the question of whether, despite its already dominant position within the make-up of the economy, the services sector will continue to grow in its relative importance, is under-researched. The objective of the research contained in this thesis is to explore whether the current economic contribution of the services sector in Australia is at a "steady state", or whether there is likely to be a continuation of structural change within the domestic economy into the short to medium term. To address this research objective, a series of questions is proposed, which logically follow each other and enable the answer to the research objective to be gradually built up as the thesis progresses. The core research questions to be answered in this study are:

[1] Noting that on a sector pair's basis, if the elasticity of substitution is less than one, then employment moves from the sector with high MFP to the sector with low MFP, or if the elasticity of substitution is less than one then the opposite occurs.

1. What is a service, how has this definition evolved over time, and what issues should be considered in measuring the contribution of services within an economy?
2. What does theory suggest about how an economy grows, and what causes the economic contribution of different sectors to rise and fall over time?
3. How has the services sector in the Australian economy, as a whole and on a disaggregated sub-sector basis, performed historically and what has influenced its current standing in terms of contribution to Gross Domestic Product (GDP)?
4. How has the recent performance of the services sector in Australia compared with that in other countries?
5. Does government industry policy have the capacity to influence the relative performance of the services sector, and is there any evidence to conclude whether the different approaches taken by jurisdictions in Australia to services sector industry policy have resulted in positive or negative outcomes?
6. Is the current economic contribution of the services sector in Australia at a "steady state" or is there likely to be a continuation of structural change in the short to medium term?

1.3 Structure of the thesis

This thesis contains eight chapters, and is organised into an introductory section, theoretical sections (chapters 2 and 3), an economic history section (chapter 4), empirical sections (chapters 5, 6 and 7), and a conclusion, including future research considerations (chapter 8).

In Chapter 2 a literature review is presented which explores the theory of services as an economic construct. The history of services in economic theory is traced from its earliest formal acknowledgment by Sir William Petty in 1690, through to current propositions proffered by people such as Krugman. The characteristics of a service are discussed, including concepts and principles proposed by various economists, including Hill (1977), Singelmann (1978), Hoekman (1986) and Gadrey (2000), and a discussion on the challenges of valuing services-sector output, including those presented by Griliches (1992), Gordon (1996), Triplett and Bosworth (2000). A definition of Service Activities for the purpose of this thesis is also offered.

Chapter 3 continues the literature review but is focused on presenting formal models of economic growth and how services are considered within those frameworks. It starts with presenting and proving the Solow-Swan exogenous growth model, then the AK endogenous growth model, and then endogenous growth models including those proposed by Romer and Aghion and Howitt. Aghion and Howitt's model has been extended by the current author to enable optimal sectoral economic growth to be determined. The final part of Chapter 3 includes a review of models of economic growth that explicitly allow for structural change within an economy, including those proposed by Kongsamut, Rebelo and Xie (1997) and Ngai and Pissarides (2007).

Chapter 4 discusses the pattern of economic growth in Australia in the period post-European settlement. This period is separated into four distinct time periods: (i) the foundation period up to 1820; (ii) the colonial economy period between 1820 and 1930; (iii) the rise of the secondary sector and protectionism between 1890 and 1972; and (iv) the period of market liberalisation and structural change since 1973. The statistical data presented in this chapter has come from various sources, including the Australian Bureau of Statistics (ABS), the Reserve Bank of Australia (RBA) and various economic historians including Angus Maddison, Noel Butlin, William Sinclair, Matthew Butlin, Brian Haig, Diane Hutchinson and Florian Ploeckl. In order to enable a consistent comparison of the structure of the Australian economy, the current author developed a composite time series of aggregate GDP and GDP by sector for the period 1795 to 2016.

Chapter 5 presents in greater detail the structure, conduct and performance of the Australian economy on a sector-by-sector basis since 1975, with a particular emphasis on undertaking empirical analysis from FY92, which is the first full financial year in which detailed labour input data on the number of hours worked is available on an industry-by-industry basis. An analysis of industry gross value added (IGVA), employment, capital stock, trade and sector profitability is presented in this chapter. Using ABS input-output tables, an analysis of changes in backward and forward linkages and supply-and-use by sector and services sub-sector is completed for FY01 and FY14. MFP is then calculated using four different approaches, including Cobb Douglas production function, Translog production function, Growth Accounting Framework and the Organisation for Economic Co-operation and Development (OECD) and ABS Index Number approach in a production theoretical framework. The Index approach calculations presented in this thesis, which are included in Appendix A, were independently reviewed by the ABS[2] .

Chapter 6 presents a cross-country empirical analysis on the relationship between the log of real GDP per capita (in USD) and IGVA for services as a proportion of GDP. The empirical analysis uses economic performance data sourced from the World Input-Output Database and IMF World Economic Outlook Database, with information on factors of institutional governance gathered from the OECD and World Bank. The economic performance data was initially checked for the presence of spatial dependency within the dataset. A panel regression analysis is then completed, with the relationship tested across four different model specifications: (i) a basic ordinary least squares (OLS) equation; (ii) a basic OLS equation with country-fixed effects; (iii) a basic OLS equation with time-fixed effects; and (iv) a basic OLS equation with country- and time-fixed effects. Reverse causality is tested for as well. A theoretical economic structure of Australia's economy based on the panel modelling is identified, and compared with the actual structure.

Chapter 7 discusses the role government industry policy can play in proactively assisting the development of the services sector within an economy. An extension to the cross-country empirical analysis presented in the previous chapter is completed, with a dummy variable representing the presence of a services sector industry / innovation policy incorporated within the model structure. A detailed assessment of the current industry policy framework supporting the services sector in Australia by jurisdiction is also completed in this chapter. This assessment includes subjectively reviewing each state and territory in Australia in terms of each jurisdiction's approach to developing a supportive policy environment for its services sector, with the initial assessment relating to what proportion of the services sector is "covered" by the policies or plans in place, whether the policies or plans are contemporaneous, and then how these existing policies and plans compare with a set of proposed criteria used by the government of the United Kingdom about what constitutes a "good" public policy.

[2] See Acknowledgment section

Chapter 8 summarises the major findings of the thesis and proposes an answer to the last question posed above: “Is the current economic contribution of the services sector in Australia at a ‘steady state’ or is there likely to be a continuation of structural change in the short to medium term?”. The final section of this chapter discusses a possible future extension of this thesis in seeking to quantify the direct effects of domestic policy barriers identified by the Productivity Commission (PC) on the services sector in Australia, and assess the impact of their removal using Computable General Equilibrium modelling. Such an extension would explore whether the proposed reforms to domestic policy barriers identified by the PC would help in the equalising of sectoral MFP growth, enabling a “steady state” outcome to be reached, or cause a further divergence in sectoral MFP growth, resulting in a continuation of structural change in the Australian economy.

Chapter 2 Concepts, Characteristics, Measurement and Definition of Services

2.1 Introduction

This chapter discusses what constitutes a service and why is it distinct from a good, even though the term “goods and services” is often used by commentators in the one breath when discussing the productive side of the economy. Services have unique features that set them apart from traditional goods and these features historically were seen to be problems in the context of enabling trade and promoting economic growth.

Today, however, these characteristics are recognised by market participants and often priced accordingly to differentiate one offering from another. The characteristics of services, such as intangibility, perishability, and heterogeneity (because of being largely delivered by human capital), are the reasons the creation of a single definition of a service has been challenging.

The economic concept of services from a theoretical perspective has evolved over the past few centuries, from the early views proposed by Sir William Petty to more recent considerations by economists such as Paul Krugman. There has been a body of work completed over the past few decades that has sought to improve classification of services, creating working definitions of groups of heterogenous services to allow for a consistency in cross-border data collection. This chapter examines the theoretical underpinnings of what constitutes a service. It also considers how best to define services for the purposes of this thesis.

2.2 History of Services in Economic Theory

2.2.1 Introduction

Oppenheimer defines the State as a sociological concept, suggesting that

> *almost completely during the first stages of its existence, is a social institution, forced by a victorious group of men on a defeated group, with the sole purpose of regulating the dominion of the victorious group over the vanquished, and securing itself against revolt from within and attacks from abroad* (Oppenheimer, 1914, p.15).

In history the domination by a foreign, small minority over an existing community within a specific territory is what formally establishes upper and lower classes in that altered society. Laws develop as a consequence of custom, and generally incorporate a social compact whereby the claim of primacy, ownership of the land, and provision of protection by the upper class are accompanied by a duty of obedience and service by the lower class.

At a basic level, the exchange of output from one's own labour for output from another's own labour, is what Oppenheimer defines as "economic means". "Economic means" differ from "political means" whereby output from one's own labour is appropriated by the State, and it is the competition between "economic means" and "political means" that influences the progress of development for the State. Oppenheimer further suggests that the advance of the primitive State occurred through "economic means", usually through a sequence of (a) exchange of fire; (b) the barter of women; and then finally (c) the exchange of goods (Oppenheimer, 1914, pp.279-280).

This process allowed for the State to constantly extend its borders as it afforded protection for marketplaces, and suggests that this desire to barter and trade is a universal human characteristic. Ultimately the enlarged "economic means" surpass the primitive "political means", and cities form to take advantage of massed populations. This proposition is also espoused by Nobel Laureate Theodore Mommsen who argues, in his authoritative works on the History of Rome, that the Greeks founded "all their cities primarily and especially for the sake of trade" (Mommsen, 1854, p.134).

While history focuses on the trade and barter of physical goods, for this trade to occur there must have been either the implicit or explicit provision of services. Even using a simple definition of services, such as the one proposed by the OECD,

> *services are a diverse group of economic activities not directly associated with the manufacture of goods, mining or agriculture... and they typically involve the provision of human value added in the form of labour, advice, managerial skill, entertainment, training, intermediation and the like* (OECD, 2000, p.5).

the exchanges referred to in the definition of "economic means" are also more than likely to have included services as a principle element of the transaction. This could have simply been something like the exchange of a good by Agent A to Agent B for the transportation of the same, or other goods, to market by Agent B on behalf of Agent A.

The history of economic thought shows how the role of services and their impact on exchange, trade, and welfare have evolved over the past five centuries. However, it is important to recognise that what were observed as services historically are different from what we understand services to be today; they differ in how they were produced, how they were used, and the depth and breadth of their applications (Delaunay and Gadrey, 1992, p.5).

2.2.2 Mercantilism to early Neoclassical era (1600 to 1930)

One of the earliest references to services as a defined category of economic activity was presented by Sir William Petty in 1690 (later referred to as "Petty's Law"), where he noted:

> *There is much more to be gained by Manufacture than Husbandry; and by Merchandise than Manufacture. ... Now here we may take notice that as Trades and Curious Arts increase; so the Trade of Husbandry will decrease, or else the wages of Husbandmen must rise and consequently the Bents of Lands must fall* (Clark, 1940, p.176).

According to Petty, employment shifts in the progress of an economy growing from agriculture to manufacturing, then manufacturing to services. This recognition of services and how it develops as an economy expands was particularly insightful given the general economic school of thought at the time, Mercantilism, promoted exports (and importantly the maintenance of a positive trade balance) and the accumulation of gold and silver to help provide monetary stability to a country (Heckscher, 1935).

Mercantilist Thomas Mun divided the economy into two sectors, "natural" and "artificial", with the first sector consisting of agricultural and extractive industries and the second sector comprising "manufactures and industrious trading with foreign commodities" (Mun, 1664, Chapter 3). Mun includes a class of services in this second sector, being those associated with the transport, warehousing, packaging and financing / insurance of manufactures for trade (Alam, 2016, p.5).

It has been proposed that mercantilism, rather than being an homogenous economic theory, is merely a reflection of a period in time where society entertained influential rent-seekers who promoted favoured forms of economic activity, being mining, manufacturing and agriculture, and government implemented preferential laws that enabled these rent-seekers to maximise their own utility (Baysinger, Ekelund and Tollison, 2008). For example, exports were acknowledged by mercantilists as having a positive economic contribution, while imports, particularly of finished goods, were conversely regarded as having a detrimental impact on the wealth of a nation. This philosophical position enabled protectionist trade policies to be enacted, including a ban on importing foreign goods if similar goods were produced domestically.

In addition to limiting free trade, mercantilism also, most likely unwittingly, retarded the development of service industries. For example, the English Laws, *The Navigation Acts*, were enacted between 1651 and 1663, and banned (a) the transportation of goods from outside Europe to England or its colonies by foreign ships, and (b) the transportation of goods from a country elsewhere in Europe to England using third-party countries' ships (Ormond, 2003).

While the practicalities of the *Navigation Acts* were primarily to build up the English merchant naval fleet in peace time so that in the event of a war these vessels could be appropriated by the Crown for conflict, it did however mean that English merchants and traders could not engage the lowest-cost supplier if they were not flagged in England. As mercantilism was also based on a policy framework of economic oppression of the lower classes, the development of some service industries, such as education and healthcare, was unsupported by the upper classes (Malero, 2016).

The French mercantile-era economist, de Boisguilbert, did however recognise that land and agriculture were not the only factors that contribute to a nation's wealth, and that there is an interdependence in an economy between production and the provision of services. De Boisguilbert saw "doctors, lawyers, circuses…, the King, the army, the civil services" needing to work together for the French economy, and that "what happens to any of them affects them all" (Delaunay and Gadrey, 1992, p.9). Such a statement by de Boisguilbert in 1707 meant that he recognised that services paid for by consumers added to a nation's economic value, and that they were in effect the same as outputs from agricultural, mining and industrial production.

Physiocracy followed mercantilism, and given the inconsistencies associated with policy settings advocated by mercantilists, it can be argued that physiocracy was the first properly defined school of economic thought. Physiocracy, which was dominant during the period 1710 and 1764, supported laissez-faire policies and focused on the role of agriculture and the land in formalising the wealth of a nation (Miles, 2002). The main theorists in this school include French laissez-faire economists, Richard Cantillon and François Quesnay, whose respective contributions include the *Essai sur la Nature du Commerce en Général,* which presented a model of the circular flow of income, and *Tableau économique,* which diagrammatically showed the significance of expenditure within the economy, the dependencies between income, expenditure, and output, and the relationship between different sectors of the economy (Murphy, 2008).

Cantillon, in considering the circulatory character of the economic process, identified the size of different cohorts within the French economy. He estimated 25 per cent of the population were employed in agriculture, 33 per cent were dependents not in the labour force, 17 per cent were landowners, entrepreneurs and the sick, and that the remaining 25 per cent of the population were employed in the services sector (including soldiers, domestic servants, etc.), or the manufacturing sector (Spengler, 1945). While Cantillon identified the importance of services as a productive element of the economy in his *Essai*, Brolin notes that Cantillon was a supporter of the *Navigation Acts* of England, and he too advocated the State's use of their own ships for trade (Brolin, 2007, p.27). So, on one hand this early physiocrat recognised the importance of services, but on the other hand he agreed with the State implementing barriers to trade by only allowing domestic transport service providers for the carrying goods for export.

François Quesnay, acclaimed by Schumpeter in 1935 as one of the top four economists of all time (Sameulson, 1962, p.4), is acknowledged as being at the centre of the Physiocrat School, with his *Tableau économique* the foundation for setting out the workings of an economy. Quesnay developed the *Tableau* as a mechanism to explain what policies should be enacted to enable France to recover from successive wars and a (perceived) depopulation of the rural economy.

The central assumptions of the *Tableau,* and the physiocrats, is (a) all tax revenue must come from the agricultural sector, as it is this component of the economy alone that produces a "net product" over costs; (b) the agricultural sector is the primary source for economic growth for a country; and (c) the size of a country's "net product" directly influences the demand for "sterile" products (Eltis, 1975a, p.169). "Sterile" products were considered as representing all non-agricultural sectors of the economy, and from these assumptions it seems Quesnay believed that services can only be demanded if there is a surplus in the agricultural sector, and services themselves produce no taxable surplus and they provide no economic contribution to production. Eltis also suggests that Quesnay prepared the *Tableau* as a mechanism to show that excessive consumption of manufacturers and services, particularly on “luxe de decoration”, was the cause of poverty in France (Eltis, 1975b, p.329). This is clearly outlined in Quesnay’s 3rd edition of the *Tableau* published in 1759, which states (as translated by Meek):

> *It can be seen from the distribution delineated in the Tableau that if the nation’s expenditure went more to the sterile expenditure side than to the productive expenditure side, the revenue would fall proportionately, and that this fall would increase in the same progression from year to year successively. It follows that a high level of expenditure on luxury in the way of ornamentation and conspicuous consumption is ruinous. If on the other hand the nation’s expenditure goes to the productive expenditure side the revenue will rise, and this rise will in the same way increase successively from year to year. Thus, it is not true that the type of expenditure is a matter of indifference* (Eltis, 1975b, pp.334-335).

The Classical School emerged as a contrasting school of economic thought despite it overlapping the physiocrat period during the mid-1700s. Adam Smith, the Scottish economist recognised as being the founder of the Classical School, spent 10 months in Paris during 1765 and 1766, and it is understood that during this time Smith conversed with physiocrat theorists including Quesnay, and this enabled him to form his own ideologies that would later be presented in his seminal work, *An Inquiry into the Nature and Causes of the Wealth of Nations*, in 1776 (Eltis, 1988, p.280). Economic concepts where Smith and Quesnay agreed included (a) the theory that agricultural production adds to aggregate rents whereas industrial production does not; and (b) support for free trade and international competition. Smith did however differ from Quesnay in what he considered to be the composition of profits with industrial production. Smith proposed that within industrial profits was an element of economic surplus and this allowed owners to re-invest and expand their businesses.

While Smith, like Quesnay, had no theoretical interest in services, his focus on differentiating labour into "productive" and "non-productive" categories resulted in Smith establishing a principle that has been often applied since to define a service. In this context Smith says that the labour of a "menial servant",

> *does not fix or realise itself in any particular subject or vendible commodity. His services generally perish in the very instant of their performance, and seldom leave any trace of value behind them for which an equal quantity of service could afterwards be procured* (Smith, 1776, p.330).

Smith then identifies a range of occupations considered to be unproductive, and like the "menial servant", their contributions to the economy does not create an output, but rather their work "perishes in the very instant of its production" (Smith, 1776, p.331). These occupations include "the sovereign, officers of justice and war, the whole army and navy, servants of the public, churchman, lawyers, physicians, men of letters, players, buffoons, musicians, opera-singers, opera-dancers, etc." (Smith, 1776, p.331).

Services were also characterised as a non-productive element of the economy by other leading English economists of that generation, including David Ricardo, Thomas Robert Malthus and James Mill, although such an opinion was not universally held across all economists within the Classical School. Latvian-born, Russian economist Henrich Friedrich von Storch, English economist John Stuart Mill, and French economists Jean Baptiste Say, Jean Charles Simonde de Sismondi, and Henri de Saint-Simon all placed value on the provision of services within the economy of a nation.

Of these economists, von Storch (1815) argued against Smith's propositions that non-industrial work was non-productive (or "sterile"), and that wealth was only a function of external material wealth. He also declared Smith was only interested in "materialism", as opposed to the development of human skills (Zweynert, 2004, p.531). Von Storch proposed, in his six-volume *Cours d'Economie Politique ou exposition des principes qui déterminent la prospérité des nations*, the "Theory of Civilisation" which incorporated the concept of "internal non-material wealth" (Sheptun, 2005, p.351). This concept proposed that "national welfare" is a composite of both "national wealth", which comprises material goods, and "national civilisation", which comprises internal goods. Internal goods were defined by von Storch as being:

all immaterial fruits of nature and labour which man finds useful and which are suitable to become his moral property … the main internal goods consist of our talents and everything that directly serves their development and perfection … [auxiliary internal goods are required for the] prerequisite of the preservation and development of our skills (von Storch, 1815, Vol. 2: p.341).

Zweynert lists the main internal goods as including health, skill, knowledge, aesthetics, morals, religion, and auxiliary internal goods as including security and leisure (Zweynert, 2004, p.531). While von Storch's definition of internal goods aligns with the concept of services, he did however declare that they cannot be sold or bought, and they do not have an exchange value or price, but rather only a value in use (von Storch, 1815). Such an acknowledgment meant von Storch considered services to have only an intrinsic value, rather than a market or tradable value.

Of the other Classical economists named earlier, Jean Baptiste Say is notable regarding his theoretical position on productive employment. Say, in responding to Smith, developed the term "immaterial product" as it related to the proposition of non-productive labour. In his Treatise, Say notes:

The labour productive of immaterial products, like every other labour, is productive so far only as it augments the utility, and thereby the value of a product: beyond this point it is a purely unproductive exertion (Say, 1821, p.121).

Further, Say also recognised that the payment of fees for work undertaken by a physician, lawyer, and musician represents an outlay to recover previous "funds expended" on "capital previously accumulated" through training. Say also defines the results of the work undertaken by those producers as "immaterial products", ascribing a definition similar to Smith's "menial servant" reference in that they are "a product consumed at the time of production itself" (Delauney and Gadrey, 1992, p.17).

Separately, Say is also notable in the context of his antagonistic relationship with von Storch. For example, Say published a new edition of *Cours d'Economie* in 1823 in which he criticised von Storch's theories, and then in 1825 Say wrote to the publisher of *Révue Encyclopédique,* noting of von Storch:

> *Three-quarters of his book is copied textually from the works of Adam Smith (in Garnier's translation), Jeremy Bentham, Sismondi, Destutt de Tracy and myself. He has used my work so freely that I have found in his book whole chapters of my Treatise of Political Economy, from the first to the last word, including the chapter titles!* (Palmer, 1997, p.129)

Von Storch also influenced French economist Claude Frédéric Bastiat, whose *Les Harmonies économiques,* which was initially published in 1850 and then re-published posthumously a year later as an expanded second edition, discusses "services" in a universal sense. Bastiat uses the term "service" in this sense to explain exchange value and price setting, and in a narrow sense in what today is recognised as "human services" (Hülsmann, 2001). He also identifies the terms "public services" and "private services", differentiating these by the arrangements in which they are provided, with public services provided by the government (Bastiat, 1851). Still, while the term services is widely used in *Harmonies*, it is not applied as per today's "modern economic science" in a sectoral meaning (Hülsmann, 2001, p.62).

The ideologies of mid-19th century German economist Karl Marx, who is self-described as a "classical political economist", notably contrasted with the "vulgar economy" teachings of Smith, Ricardo and Say (Lawson, 2013, p.962). In his works, *A Contribution to the Critique of Political Economy* (1859), *Theories of Surplus Value* (1861) and *Capital: A Critique of Political Economy* (Volume I (1867), Volume II (1885), and Volume III (1894)), Marx did not specifically identify a theory for services (Delaunay and Gadrey, 1992, p.31), however his theory of a "circuit of productive capital" implicitly incorporates services as a subset of "commodities".

Marx proposed that the contribution of labour power in the production process increases the end-use value of the commodity compared with its original input value, creating "surplus-value" which is realised when the commodity is sold at its "exchange-value". Treganna (2009) has proposed that Marx's approach to commodities and production should be interpreted as not limited to physical goods or tangible objects, and has noted about *Capital: Volume I*,

> *the commodity form, and the value-relation of the products of labour within which it appears, have absolutely no connection with the physical nature of the commodity and the material relations arising out of this* (Treganna, 2009, p.9).

and

> *If we may take an example from outside the sphere of material production, a schoolmaster is a productive worker when, in addition to belabouring the heads of his pupils, he works himself into the ground to enrich the owner of the school. That the latter has laid out his capital in a teaching factory, instead in a sausage factory, makes no difference to the relation* (Treganna, 2009, pp.11-12).

Treganna (2009) discusses this point further by referencing Marx's characterisation of productive or unproductive labour contained in the *Theories of Surplus Value.* That is, Marx believes what is important is the production of the commodity itself, not whether the commodity itself is characterised as being material or non-material. Further, the reference by Marx that "use-value perishes with the activity of the labour-power itself" (Marx, 1861, pp.160-161) is a direct recognition of the concept of service commodities. While Marx implicitly recognised the economic value of services, he does not discuss them in terms of a services sector per se; although transport and storage are identified as a key specific "cost of circulation". Transport is considered as a continuation of the production process, with its incremental value being added to the commodity. However storage is identified as a special case, in that the surplus-value of the commodities being stored does not increase as a consequence of the storage process but rather allows the surplus-value to be preserved as compared to what would occur in the event that the commodities were left exposed to the external environment.

The German Historical School emerged in the mid-1800s in opposition to Classical School and laissez-faire ideals, with Friedrich List being one of its early founders. List, in *The National System of Political Economy*, dismisses the concept of immaterial goods presented by Smith and Say, discusses services in the context of "productive powers", and suggests that their economic value is not properly captured in national accounting. For example, List remarks:

> *Certainly those who fatten pigs or prepare pills are productive, but the instructors of youths and of adults, virtuosos, musicians, physicians, judges, and administrators, are productive in a much higher degree. The former produce values of exchange, and the latter productive powers … In the doctrine of mere values, these producers of the productive powers can of course only be taken into consideration so far as their services are rewarded by values of exchange; and this manner of regarding*

> *their services may in some instances have its practical use, as e.g. in the doctrine of public taxes, in as much as these have to be satisfied by values of exchange. But whenever our consideration is given to the nation (as a whole and in its international relations) it is utterly insufficient, and leads to a series of narrow-minded and false views* (List, 1841, p.80).

Kenessey (1987) argues that List's scheme describing the progressive stages of economic growth ((i) pastoral, (ii) agricultural, (iii) agricultural and manufacturing, (iv) agricultural, manufacturing and commerce) is an early explanation of a representative economy from a sectoral perspective. The recognition of the economic value of "productive powers", and the disaggregation of an economy into sectors, suggests List was the most progressive of the early economists in understanding the contribution services provide to a country.

At the same time the German Historical School was developing, another set of economic ideologies was being developed in the Neoclassical School. Advocates of this school, which include Marshall, Edgeworth, Pareto, Walras and Fisher, principally believe (a) consumers make rational choices and attach a value to that choice; (b) firms seek to maximise profits, while individuals seek to maximise their own utility; and (c) agents make independent choices based on full information (Preceden, 2017). The Neoclassical School was the dominant school of economic thought for more than 100 years between the mid-1800s and late-1900s.

Despite the existence of List's scheme, neoclassical economists were focused on developing theories relating to market equilibrium under assumptions of constant returns to scale, with capital and labour being the factors of production. However, Léon Walras, in *Éléments d'économie politique pure*, uses the term "services" broadly to define income earned from capital employed, with an initial differentiation between "consumer services" and "producer services". Walras (1874) then introduces the term "services" in the context of "social wealth", where he defines land-services, personal-services and capital-services as income from each respective asset class, namely rent, wages and profit. However, Walras' model was based not on sectors, but rather two distinct markets, a "services market", where the factor products are bought by entrepreneurs for production purposes and households for consumption purposes, and a "products market", where the outputs of the entrepreneur's enterprise are sold as final products for consumption purposes.

Even after the first few decades of the 20th Century, services in the context of economic theories remained defined in terms different from its common application. Over the previous centuries only a handful of economists, such as Mun, Say, Marx and List, recognised services to have value within an economy, and to be classifiable in terms of a common offering. How services are specified and quantified from an economic output perspective was redefined in the 1930s, and is discussed in the following section.

2.2.3 Mid Neoclassical era (1930 to 1950)

Services began to have normative characteristics applied to them from the middle of the 1930s by various scholars through the grouping of same or similar activities into specific categories. The categories tended to represent groups of activities with similar attributes as to how they are consumed, how they are functionally performed, or how they are provided to the market.

In 1935 Alan G.B. Fisher published *The Clash of Progress and Security*, in which he presented a perspective of world economic history describing it in three distinct time periods. These periods, rather than being identified in terms of the Gregorian Calendar, are defined by Fisher in terms of the main economic activity or labour market occupation being undertaken at the time: (i) the primary producing stage, (ii) the manufacturing or industrial or secondary production stage, and (iii) the tertiary stage (Fisher, 1935, pp. 25-28).

Fisher proposes the tertiary stage began in the 20th century and relates it to activities that do not fall neatly into the categories of agriculture and manufacturing, and as such are inadequately captured in a country's economic statistics (Fisher, 1935, p.28). Fisher lists such activities to include:

> *facilities for travel, amusements of various kinds, governmental and other personal and intangible services, flowers, music, art, literature, education, science, philosophy and the like* (Fisher, 1935, p.28).

Linked to the tertiary stage is an increase in the amount of time the consumer allocates to leisure, which must be the case for the consumer to be able to enjoy many of these nominated activities.

Fisher acknowledges that tertiary activities had been engaging a larger proportion of the labour force, and this phenomenon was occurring "everywhere". His explanation for such a phenomenon was:

> *So long as the objective conditions for material progress are present, there will always be a tendency for the relative importance of primary production to diminish, and the relative importance of 'tertiary' production to increase* (Fisher, 1935, p.28).

Colin Clark, independent from Fisher, completed a similar empirical analysis in his book, *The Conditions of Economic Progress*, which was published in 1940 while he was working as the Director of the Bureau of Industry and the Chief Statistician for the Queensland Government. Clark's book, as the title indicates, looks to identify the economic structures necessary for a country to have for its living standards to progress, as measured by real income per capita. In considering this empirical question, Clark divides a country's economic activity into three categories: primary, secondary and tertiary.

The primary sector is defined as all agricultural and livestock farming, trapping, fisheries and forestry, while the secondary sector includes manufacturing production, building and public works construction, mining and electricity production (Clark, 1940, p.337). The tertiary, or services, sector includes commerce, distribution, transport, public administration, personal, domestic and professional services, with Clark also recognising that output from these sub-sectors is not transportable and no international trade is permissible, with the exception of some transport and financial services (Clark, 1940, pp.338-339).

Clark states early in the book that there is a general relationship between real income per capita and the proportion of workers employed in tertiary industries so that where real incomes per capita are high, the proportion of the workforce employed in the tertiary sector is also correspondingly high (Clark, 1940, p.7). He suggests this phenomenon occurs due to demand-side pressures and the fact that the supply of tertiary outputs must be produced locally.

The purpose of Fisher and Clark's analysis was to examine empirically the process of economic development, and their identification of three sectors within an economy was merely a method to classify the "fields of activity" in different countries under uniform categories, albeit that Clark's definition of a service differed slightly from Fisher's in that he incorporated construction and utilities within the secondary sector, and transport, communication, commerce and services within the tertiary sector.

While these important works by Fisher and Clark introduced the concept of services as a separate industry grouping, they did not present a fully formed economic theory, with Clark even acknowledging that “the economics of tertiary industry remains to be written” (Clark, 1940, p.341). Clark does however present some theoretical arguments associated with the economics of services, including his propositions that consumer demand will, over time, become saturated with manufacturing goods and therefore shift to services, resulting in a movement in labour supply from manufacturing industries, which experience high rates of productivity growth, to services, which experience lower rates of productivity growth (Schettkat and Yocarini, 2003, p.7).

French economist Jean Fourastié presented his theory of production sectors in his 1949 publication *Le grand espoir du XX^e siècle*. The basis for this theory is the “Three-sector hypothesis”, which proposes that as a country’s GDP per capita grows, the main economic activity shifts from the primary sector (incorporating agriculture, fishing and quarrying), to the secondary sector (incorporating manufacturing), and then finally to the tertiary sector (incorporating services) (Ambrozova and Fialova, 2014, p.135). Fourastié also differentiated the sectors on the basis of expected productivity growth, with the primary sector incorporating activities that were likely to achieve average productivity growth, the secondary sector incorporating activities likely to achieve higher productivity growth (due to improvements in technology and mechanisation), and the tertiary sector those activities that are likely to experience low or no productivity growth (due to high labour content in generating outputs) (Delaunay and Gadrey, 1992, p.79).

The three-sector hypothesis presents a concept of economic development that describes how a society moves from a “traditional civilisation” through a “transitional period” of industrialisation, mechanisation and automation and finally to a post-industrial service society, the “tertiary civilisation” (Lish, 2014, p.16).

In each of these three periods of development Fourastié suggests the labour force is allocated on the following basis (Table 2.1):

Table 2.1
Fourastie Three-Sector Hypothesis Labour Force Allocation

Development period	Primary	Secondary	Tertiary
Traditional Civilisation	70%	20%	10%
Transitional Period	50%	30%	20%
Tertiary Civilisation	20%	50%	30%

Source: Ambrozova and Fialova, 2014, p.135

2.2.4 Mid Keynesian era (1950 to 1970)

The study of services as a sector of the economy evolved from an emphasis in the 1930s and 1940s on establishing a theory, to a focus in the 1950s and 1960s on testing the theory and understanding its practical consequences.

The three-sector models were formed in the context of describing how, at any given time, the relative proportion of each sector in an economy relates to a specific stage of economic development. Fisher, Clark and Fourastié showed that technology enhancements and improvements in capital productivity enabled the agricultural sector to use less labour to produce the same or more output. During the era of industrial revolution, this allowed the labour force of the primary sector to transition to the manufacturing sector. The continuation of productivity improvements in the primary and secondary sectors results in a rise in incomes such that, as Fourastié argues, human needs reach a “saturation point” and the growth in consumption of food and goods diminishes. However, this “saturation point” is never reached for services, because as consumers become wealthier their relative preference for services, especially those associated with leisure, enjoyment and time-savings, increases (Hospers, 2003, p.12).

The three-sector theory states that the relative size of each sector depends on the inter-relationship between factor productivity and income elasticities for output. As these two variables for each sector adjust over time, the importance of that sector within an economy adjusts relative to the other sectors, resulting in progress from an economic development perspective.

Liebenstein (1957) empirically found an economy’s transition from predominately primary sector production to one that is more weighted towards secondary production was consistent with the three-sector theory, however the evidence associated with the next stage of the theory to a predominately tertiary sector-based economy is less clear (Katouzian, 1970).

Simon Kuznets’ (1957) cross-country study of the three sectors in terms of national product (59 countries for agriculture, 57 countries for manufacturing and services) and total labour force (38 countries excluding unpaid family labour, 47 countries including unpaid family labour) found the relative importance of services diverged less between advanced and less developed countries than did agriculture and manufacturing (Kuznets, 1957). The study also showed (see Tables 3 and 10) that the variation between low-, medium- and high-wealth countries in terms of the relative importance of services from a national product perspective is much less than the variation between the same countries in terms of the relative importance of the service sector from a labour-force perspective (Kuznets, 1957).

William J. Baumol (1967) also investigated the validity of the “three-sector theory” using a two-sector representation of the economy, a “technically progressive” sector (industry) and the “stagnant” sector (services) (Henriques and Kander, 2010). Baumol proposed incremental capital can enhance the productivity of labour in the “technically progressive” sector, however output in the “stagnant” sector is more directly influenced by the volume of labour hours employed. Labour productivity in the “technically progressive” sector will always be higher than that achieved in the “stagnant” sector. This higher labour productivity in the “technically progressive” sector results in increased returns to labour through higher wages, which is then also transferred across to the “stagnant” sector via competitive labour markets even though labour productivity hasn’t improved by the same levels. For profitability in the “stagnant” sector to be maintained, these higher labour costs need to be passed on to consumers, resulting in final prices for output of the “stagnant” sector growing faster than final prices in the “technically progressive” sector. This was referred by Baumol as “cost disease” (Gallouj and Savona, 2009). If consumers continued to purchase services in the same relative proportion to industrial goods, then the labour force will eventually gravitate to the “stagnant” sector and away from the “technically progressive” sector. The combination of higher final prices for services and a greater proportion of the labour force being employed in the services sector results in an “illusion” that output of the services sector as a proportion of GDP has increased (Schettkat and Yocarini, 2003, p.35).

Victor Fuchs’ paper was the second “pathbreaking” study on the services sector in the late 1960s following Baumol’s paper of a year before (François and Hoekman, 2010, p.643). Fuchs’ time-series analysis found that between 1929 and 1965 the services sector share of economic output in the United States, measured in either nominal or real terms, varied only minimally and final demand expenditures for services increased only marginally relative to other purchases, although services sector employment grew from about 40 per cent to about 55 per cent (Ranga Chand, 1983). Fuchs proposed that this outcome was because the income elasticity of demand for services was only slightly higher than the average for the whole of the economy, which was inconsistent with theory at the time (Ranga Chand, 1983, p.360).

2.2.5 New Keynesian era (from 1970)

Of the modern schools of economic thought, being New Classical and New Keynesian, it is the latter that has continued to extend the thinking with respect to the role and importance of the services sector within an economy. New Keynesian theory suggests the existence of rational expectations and imperfect competition within markets and, given these characteristics, it also considers that government intervention using fiscal and monetary policy allows for a more efficient economy compared with the alternative laissez-faire approach. In particular, New Keynesian theory suggests prices and wages are "sticky", causing the economy to transition to equilibrium over a longer time period, if it reaches it at all.

The monopolistic competition model proposed by Avinash Dixit and Joseph Stiglitz ("the Dixit-Stiglitz model") has given new classical economists a supplementary analytical framework in which to empirically assess the structure and performance of the services sector more broadly. The research paper published by Dixit and Stiglitz (1977) was focused on a better understanding of the role of scale economies in production. Foltyn notes with respect to the Dixit-Stiglitz model that

> *aggregate manufacturing output can only increase by increasing the number of varieties* and *equilibrium quantities are constant and depend on the two cost parameters, F* (fixed costs) *and c* (variable costs), *and on one demand parameter, σ* (elasticity of substitution), *all of which are exogenously determined* (Foltyn, 2012, pp.10-11).

However, the Dixit-Stiglitz paper only discusses output in a generic sense and uses the term "commodities" broadly, and in the context of "group or sector or industry" (Dixit and Stiglitz, 1977, p. 297). Examples of how the Dixit-Stiglitz model allowed the role of the service sector in the economy to be better understood is incorporated in research undertaken by Markusen (1989), van Marrewijk, Stiborab, de Vaal, and Viaene (1997), and Pflüger and Tabuchi (2014).

Markusen applies the Dixit-Stiglitz model while analysing trade of producer services (and other specialised intermediate inputs) and finds that "permitting trade in final goods is an imperfect and inferior substitute for permitting trade in specialised services" (Markusen, 1989, p. 95). Markusen's conclusion is based on two arguments, being (i) that countries are "guaranteed" to be better off when input-trade is free compared to where trade is limited to [final] goods trade only (which may not be Pareto improving). This is because trade in input goods guarantees an expansion in the output of the "distorted sector", which ensures welfare improvements when price is greater than marginal cost; and (ii) trade in inputs allows countries to achieve a complementarity between their domestic inputs and any imported inputs via a positive technology externality in final goods production (Markusen, 1989, pp. 85-86).

Markusen's (services-focused) study adapts an earlier (manufacturing-focused) analysis completed by Ethier (1982), who had also adjusted the original Dixit-Stiglitz's (non-sector specific) equations to explicitly allow for differences in substitutability of inputs in production of finished goods.

This adjustment for "product differentiation" was made via the quantity parameter, as defined by Dixit and Stiglitz as being:

$$y = \left\{ \sum_{i=1}^{n} x_i^{\rho} \right\}^{\frac{1}{\rho}}$$

which Ethier proposed as

$$M = n^{\alpha} \left[\left(\sum_{i=1}^{n} \frac{x_i^{\beta}}{n} \right) \right]^{\frac{1}{\beta}}$$

and which Markusen proposed as

$$X = \left[\sum S_j^{\beta} \right]^{\frac{1}{\beta}}$$

(Dixit and Stiglitz, 1977; p.298; Ethier, 1982, p.391; Markusen, 1989, p.86)

Markusen's findings are particularly relevant to trade in producer services. As producer services generally face higher trade barriers than final goods, usually through domestic policies (such as immigration and foreign investment controls) which act as non-tariff barriers, the freeing up of these restrictions in their trade result in improved welfare outcomes for both the supplying country and the purchasing country (Markusen, 1989, pp. 86).

Research by van Marrewijk, Stiborab, de Vaal and Viaene also examines trade in producer services using the Dixit-Stiglitz model of monopolistic competition, where the "service sector is characterised by product differentiation and economies of scale" (van Marrewijk et al., 1994, p. 216). Other important findings in this article include that

> *the welfare effects of trade in goods … are always positive for the country that expands its services sector. The country that faces a contraction of the services sector may, however, lose from trade in final goods only*

and

> *any policy introducing barriers to entry to protect the interest of inefficient service firms or using non-tariff barriers to shelter the service sector from foreign competition might leave the protected country with an unambiguous welfare loss* (van Marrewijk et al., 1994, p. 217).

Pflüger and Tabuchi (2014) apply the total-cost function and price elasticity of demand specification from the Dixit-Stiglitz model in their study on the increase in the relative economic importance of the services sector during the 20th Century, with a key finding of this paper being that the increase in the services sector may have contributed to the observed agglomeration of economic activities (Pflüger and Tabuchi, 2014, pp. 8-9).

The Dixit-Stiglitz model was also applied and adapted by Krugman to enable the development his "new trade theory", which is set out in his three papers, *Increasing returns, monopolistic competition, and international trade* (1979), *Scale Economies, Product Differentiation, and the Pattern of Trade* (1980), and *Intraindustry Specialization and the Gains from Trade* (1981).

Krugman proposed that the Dixit-Stiglitz model assumptions of economies of scale and imperfect competition created the opportunity for trade between countries even in the absence of Ricardian comparative advantage. Krugman suggested a larger economy creates the opportunity for a greater number of product varieties to be produced (compared with a smaller economy) resulting in the presence of increasing returns to scale in that country. These increasing returns to scale result in an increase in the production of each good, reducing the per-unit cost of production in the process. By introducing a second country, and assuming the two countries have the same tastes, technology, and factor endowments, Krugman was able to identify whether there were any welfare gains as a consequence of trade (Krugman, 1979, p.477). This was done by comparing market outcomes of an autarky scenario with a trade scenario, where the size of the economy is equal to the sum of the two individual countries, and assuming there are no costs to trade. Krugman found that allowing for trade between countries, consumers are exposed to an increased variety of products compared with autarky at lower per-unit cost, causing consumer welfare to increase.

Krugman also concluded that international trade promotes intra-industry trade, and where trade is not possible, consumer welfare will be the greater in the country with the larger labour force, which itself causes labour migration, increased agglomeration and greater urbanisation (KVA, 2008).

Krugman extended his model in his second paper on trade by incorporating transportation costs, and he also discussed the "home-market" effects on patterns of world trade (Krugman, 1980, p.955). Krugman proposed that countries with large domestic markets for particular products, which enable scale economies to be achieved, also tend to export those same products, while the majority of intra-industry trade takes place between developed countries in "knowledge intensive" products (KVA, 2008, p.9). Van Welsum (2003) extends this finding by stating that New Trade Theory, especially the components associated with intra-industry trade, applies to many services given that they are produced in industries that exhibit "increasing returns to scale, imperfect or monopolistic competition, and product differentiation" (van Welsum, 2003, p.17)

2.3 The Concept and Characteristics of a Service

To be able to define what a service is, one must be able to describe conceptually what it is, and conversely, what it is not. Conceptually, services are often considered to be non-physical, and are usually described in terms of processes or activities. Barmet and Wehrli argued that services "cannot be seen, felt, tasted or touched in the same manner in goods can be" (Barmet and Wehrli, 2005, p. 134) which Grönroos (1988) recognised as an issue that can create uncertainty from a consumer's perspective as services cannot be viewed prior to their purchase.

As noted in Section 2.1, various classical economists, including Smith, Ricardo and Say, suggested services exhibit the following qualities: they are perishable, instantaneously produced and consumed, un-storable and given these attributes, services also had the inability to be accumulated. The challenge with these early characterisations of services is that they do not hold universally. Some economic activities, which in practice are considered by the market as a service, often include a tangible output or outcome as part of the (bundled) transaction. For example, Victor Fuchs noted the following:

> *a dentist who makes a false tooth and places it in the patient's mouth is certainly delivering a tangible product, but dentistry is invariably classified as a service.* (Fuchs, 1968, p.15)

Other examples are readily identifiable, including the provision of accounting services (the preparation of annual statements of accounts and tax returns for local revenue authorities), medical services (the conduct of medical procedures, such as operations which leave a lasting impact on the patient) and education (the gaining of technical knowledge), and these challenge whether all services are non-durable.

This issue of durability was also considered by classical economists Smith and Say in the context of proximity between the producer of the services and the consumer of those services. It is for this reason that services were historically considered non-tradable with other jurisdictions. However, certainly in today's world of modern communications and transportation (such as air travel), these criteria of physical proximity and immediate production and consumption for a service cannot be universally applied. For example, with the development of video communications, a business consultant in one jurisdiction could be offering real-time process improvement advice to a client without being physically present in the same city, let alone the same country. Further, that business consultant could also complete a video recording for internal training purposes for that same client, which means the consulting advice is able to be absorbed by staff and management at that business on more than one occasion.

Since this early consideration, various academics from different fields, including economists, historians and sociologists, have sought to identify the common characteristics that define a "service".

In the early 20th Century neoclassical economist Alfred Marshall noted:

> *man cannot create material things, all that he can do in the physical world is either re-adjust matter so as to make it more useful* (Marshall, 1920, Book 2, Ch.3, p.45).

This statement implicitly recognises that in addition to adding another tangible good to an intermediate product, it is possible to add a service to that intermediate product and create a value-added output as well. This process of adding a service to an intermediate product implies an action or activity of some description being applied by the producer. It also suggests that a service is usually rendered as an activity, which is important in the context of defining a service, as it is not necessarily an "outcome" but is rather an "action".

More recently academics in the field of supply chain and industrial organisation have considered services in the context of an activity, with services being explored as a process. Balin and Giard (2006) conceptualised the process of providing a service in terms of how it is conducted, what inputs are modified and what type of information is applied. They subsequently differentiated services based on who consumed them, either persons or enterprises, although again applying the lenses of method of production, type of intermediate goods consumed, and form of output.

Hartwell identified three sets of attributes that characterise a service: (i) a lack of durability, inability to hold inventories, producer-consumer intimacy, and intangibility; (ii) produced in discrete units with a high labour-to-capital ratio, limited intermediate inputs, and high gross margin; and (iii) employs a small, but highly skilled pool of labour, with a relatively higher proportion of female, casual and self-employed workers compared with other sectors (Hartwell, 1973, p. 359-360). Singelmann, however, differentiates services from a functionality perspective, classifying services into four categories:

a. Distributive services, which incorporate the distribution of commodities, passengers and information;
b. Producer services, which are those service activities consumed as intermediate inputs by businesses and enterprises;
c. Social services, which are those non-market service activities provided by the government and not-for-profit organisations; and
d. Personal services, which are those market and non-market services that are consumed directly as a final good (Singelmann, 1978, p.1227).

Stern and Hoekman (1987) considered various concepts and principles in defining services in the context of their potential cross-border trade. They recognised that services can be either complementary, substitutes or unrelated to goods, and proposed a typology for categorising services based on whether there is a required movement across borders for either the “provider” or “demander” of the service, which meant services were then able to be considered within broader trade theory. This typology distinguished four types of services:

a. Separated services, which are services that do not require the movement of providers or demanders to cross borders for the trade to occur, and are considered “pure” services in the sense that they can, in principle, be traded like a good;

b. Demander-located services, which are services where physical proximity is a necessary condition for the activity to be undertaken, and therefore requires the movement of labour or capital by the provider to cross a border(s) for the service to be provided;

c. Provider-located services, which are services where physical proximity again is a necessary condition for the activity to be undertaken, although in these instances the services occur in the country in which the provider is located and the demander must travel to that location to consume them; and

d. Foot-loose, non-separated services, which are services undertaken in a third-location independent from the provider and demander, and both actors move to that independent location to supply and consume the service (Stern and Hoekman, 1987, p.40-41).

While useful in understanding how and where services are provided, which better allows for their inclusion within trade statistics, this categorisation does not allow a delineation of activities based on their core elements.

A more modern approach to conceptualising and differentiating services has been proposed by Anderson and Corley (2003). Importantly, services were recognised as tending to be highly heterogeneous, and that they could be considered as material or immaterial objects that are permanently or temporarily transformed. By approaching the classification process in this way, services are then able to be divided into different forms of objects: artefacts (i.e.: food, waste, things such as cars), actors (i.e.: firms, people, animals), nature (i.e.: water, air, energy), and symbolic material (i.e.: information, ownership rights, performing art). These objects can be transformed in four different ways – being physical, biological, social or abstract – and in three different spheres: over time, across space, or instantly (Anderson and Corely, 2003, p.7).

Of the considerations put forward by various scholars over the past few decades, the approach proposed by Hill (1977) for thinking about what is a service (and what is a good) is arguably a good conceptual definition. Prior to considering what characteristics define a service, Hill separately proposed that a good must be a "physical object", and it is specifically this attribute that readily enables its transferability between economic units. Hill then proposed that a service can be defined as a change in the condition of a person, or of a good belonging to some economic unit, which is brought about as the result of the activity of some other economic unit, with the prior agreement of the former person or economic unit (Hill, 1977, pp.336-338).

While esoteric on first reading, on reflection this statement incorporates a layering of necessary conditions which when considered allows services to be defined. A boundary condition of the definition proposed by Hill is that one economic unit "serves", or performs some activity for the benefit of, a different economic unit. Importantly, Hill proposes that services should not be measured as the process of producing the service, but rather from the perspective of the condition of the consumer unit before and after the service is provided. As a service is a flow, and not a stock concept, it cannot be stored or stockpiled, and thereby cannot create inventory.

Hill (1999) revisited his definition of a service some 23 years after his original, formative study on the basis that during the intervening years the development of intangible products had expanded significantly and there was a growing confusion and misclassification between what constitutes a good or a service. In clarifying the taxonomy between tangibles, intangibles and services, Hill again restated the economic characteristics of a good: (a) "an entity that exists independently of its owner and preserves its identity through time"; and (b) "the owner of a good derives some economic benefit from owning it" (Hill, 1999, pp. 437-438). In the context of intangible goods, Hill focused on the notion that different constructs of entities exist, and intangible entities are a form of "original" heterogeneous recordable and storable output generated by persons or enterprises engaged in literary, scientific, engineering, artistic or entertainment activities. In contrast to a good, services entail a relationship between producers and consumers and therefore cannot exist independently as it requires a change to occur in the condition of one economic unit because of the activity of a different economic unit. Again, as services are not entities they cannot be stocked, but they can be traded (resident producers providing a service to a resident consumer) and exported (resident producer providing a service to a non-resident consumer).

Gadrey examined Hill's 1977 and 1999 contributions, and while recognising the "genuine conceptual innovation" (Gadrey, 2000, p.378) within the works associated with the distinction of tangible and intangible goods, he also criticises the esoteric, impractical nature of what characterises a service. Gadrey's primary challenge relates to three aspects of Hill's characterisation: (a) the circularity in the argument of what constitutes an entity and the notion of independent existence; (b) the requirement of a relationship to exist between a person seeking a service and the provider of that service; and (c) the limitation of the definition (and other definitions) to cover appropriately the field of activities and outputs that could genuinely be considered services.

Gadrey instead seeks to redefine services using “demand rationales”, including an “aid or intervention rationale” which involves the provision of assistance on receipt of a request for intervention, and the “provision of maintained technical capacities” which are available for consumption by users, when required, in exchange for a payment. Gadrey’s position of what constitutes a service is:

> *Any purchase of services by an economic Agent B (whether an individual or organisation) would, therefore, be the purchase from organisation A of the right to use, generally for a specified period, a technical and human capacity owned or controlled by A in order to produce useful effects on Agent B or goods C owned by Agent B or which he or she is responsible* (Gadrey, 2000, pp. 382-383).

Gadrey’s definition of a service adds to Hill’s in that it incorporates property rights and excludes the purchase of a salaried workforce. However, Gadrey’s definition still has problems with respect to completeness in that there remain examples of idiosyncratic services that are not readily covered by it, such as where personal services are purchased by households and where services are co-produced.

2.4 Measuring Services

The key element in Hill’s definition of a service is that it involves an action of one economic unit that changes the condition of a person or a good belonging to another economic unit. Gadrey’s important addition to this is the recognition that the “receiver” economic unit purchases that action from the “provider” economic unit, which creates a transfer of property rights between those two economic units, therefore implying the need for an institutional framework to govern the functioning of that transaction.

Boateng defines institutional frameworks as “the various processes groups of people go through to make collective decisions that govern the group” (Boateng, 2006, p.102), while Scully suggests institutional frameworks are “the political, social, legal and economic framework of society [which] defines what resources can be owned, who can own them, and how they can be employed” (Scully, 1988, p.661).

The institutional frameworks associated with the rule of law and property rights are therefore vitally important for being able to measure the “value” of a service that, as Djellal and Gallouj contest, is “unsubstantial, evanescent and perishable” and “not an objective entity embodied in its own technical specification” (Djellal and Gallouj, 2015, pp. 3 - 4). Djellal and Gallouj also propose that a service is a “social construction”, with its value determined by the “output convention that is adopted” (Djellal and Gallouj, 2015, p.5).

Griliches recognises the importance of Hill’s definition of a service in the context of property rights and specifically in relation “to the question of legal ownership of the items being worked on, and the payment format is the price paid for services rendered” (Griliches, 1992, p.5). Griliches also highlights the importance of the purchaser in a service transaction because of their direct involvement in the activity and its output (Griliches, 1992, p.6).

The fundamental challenge of understanding the size and structure of the services sector in an economy, as noted by Djellal and Gallouj and Griliches, as well as many other researchers studying this topic, is that for various services the underlying transaction is ambiguous, the output is not specific, and payments to suppliers may not clearly articulate the value attributed to the action that changed the condition of the person or the good.

Griliches also notes that in “many service sectors output depends on the interaction with the user and thus is more difficult to standardize”, while given the underlying heterogeneity of service transactions there is also a problem of being able to make comparisons between countries and over time (Griliches, 1992, p.7).

Understanding how to value transactions in order to measure aggregate economic output became increasingly important to governments for policy setting following the Great Depression and World War II (Ward, 2006, p.332). The measurement of aggregate economic output is systematically undertaken through the process of national accounting. The first System of National Accounts (SNA) was released in 1953, and while post-WWII the United States adopted its own approach to national accounting (Vanoli, 2005), the SNA provided the institutional framework for countries to apply the same approach to valuing transactions and measuring economic output so that they can understand the consequence of “economic actions or events that take place within a given period of time and the effect of these events on the stocks of assets and liabilities at the beginning and end of that period” (Eurostat, 2017, p.7).

SNA is a system of macroeconomic accounts based on a set of concepts, definitions, classifications and registration rules, and consistent with Hill and Gadrey's definition of a service, the SNA recognises that economic actions are activities that create, transform, exchange, transfer or change the volume, composition or value of assets and liabilities (Eurostat, 2017, p.1). These activities, or economic flows, are differentiated in the SNA as being either (a) transactions or (b) other economic flows. Eurostat defines transactions as an "economic flow that results from interaction between institutional units by mutual agreement [which] can take place within institutional units or between establishments belonging to the same enterprise" (Eurostat, 2017, p.7). Simply, a transaction describes the supply of products and the use of products, where a product can be either a good or a service, and is "valued [in the SNA] at the actual price [being the current market price] agreed upon by the economic agents" (Eurostat, 2017, p.14).

Where a product is supplied in a non-market transaction (such as a government service) the SNA proposes the value of that activity should equal either the total costs incurred in providing the product or be ascribed a value equivalent to the market prices for the same or similar goods or services. Ward, however, suggests that products supplied in non-market transactions are frequently undervalued even though they have a significant influence on personal living standards and communal welfare (Ward, 2006, p.333).

Research by Triplett and Bosworth suggests that the problems associated with measuring the economic size and structure of service industries are "unique to the unique characteristics of services industry output", and that the solution(s) to resolve these measurement problems correspondingly also need to be specific for each industry (Triplett and Bosworth, 2000, p.8).

Mark suggests that such an approach for valuing non-market transactions creates a problem when seeking to measure productivity. That is, if output cannot be quantifiably measured or is dependent on the value of inputs, then a change in productivity cannot be readily determined (Mark, 1982, p.3-4). As with goods, from a measurement perspective, there are also challenges surrounding how to treat a change in the quality of services provided over time, which occur more so in services than goods due to the underlying heterogeneity of outputs and inputs and the ever-expanding range of "new" services that develop to meet a market need or "enhanced" services that apply new technologies (Griliches, 1992, p.7).

Gordon examined this issue of challenges in the valuation of services-sector output and its possible role in influencing productivity measurement in the United States. The study found that in the context of the productivity slowdown being experienced in the US, some, but not all, of that slowdown was due to the intrinsic difficulty in measuring output in those sectors that consume or produce large volumes of services (Gordon, 1996, pp. 2-4).

Griliches has previously noted that various service industries produce intermediate products that have no directly comparable market revealed prices, which means the process of "double deflation"[3] to estimate value added of those sectors becomes problematic (Griliches, 1992, p.6). As productivity is defined by the OECD as "a ratio of a volume measure of output to a volume measure of input use", then being unable to properly deflate either the output associated with final or intermediate usage means any associated productivity measure is unlikely to be reliable (OECD, 2001, p.11). That is, to estimate the output of service industries in constant prices, its turnover should be deflated by "precise" deflators, otherwise if "rough" deflators are applied (or real output is assumed to grow proportionally to some measure of input) then estimates of productivity growth for service industries will be incorrect (Oulton, 1999, pp. 2-11).

This issue of measurement has become more significant as the services sector has grown in relative importance within economies. This growth has occurred from a variety of activities, including (a) changes in business practices (again facilitated and accelerated by improvements in technology) which have seen an increase in the outsourcing of activities, such as information technology support, administrative and finance support functions that have traditionally been provided within organisations; and (b) the process of intermediation has enabled households to purchase domestic activities that historically have been undertaken within a family, such as household cleaning, gardening, washing of clothes and even various forms of entertainment. Importantly, where the institutional unit that supply the service changes from also being the same institutional unit that purchases the service (i.e.: the service moves from being internally provided to externally provided), then from a SNA perspective, the transaction shifts from being non-market to market based and the price for that activity moves from being inferred to being revealed.

[3] The OCED defines "double deflation" as a method whereby gross value added is measured at constant prices by subtracting intermediate consumption at constant prices from output at constant prices. This method is feasible only for constant price estimates which are additive, such as those calculated using a Laspeyres' formula (either fixed-base or for estimates expressed in the previous year's prices).
< https://stats.oecd.org/glossary/detail.asp?ID=674>

To the extent that, as proposed by Ward, products supplied in non-market transactions are frequently undervalued, then the transfer of services provided as internal activities to those now purchased in the market by external providers is also likely to create problems in being able to properly assess movement in productivity between periods for both the purchaser and provider industry sectors.

2.5 Definition of Service Activities for this Thesis

The previous discussion on the history, concept and characteristics of services has shown there remains a diversity of views about how best to classify services. Services have been variously classified according to (a) their function or sphere, such as circulation, consumption, reproduction of productive factors and reproduction of social conditions; (b) type of demand, such as consumer services and producer services; and (c) the producer of the services, such as government, not-for-profit, corporations, small-to-medium enterprises and sole-traders.

It would seem that the researcher chooses a classification of services that is idiosyncratic to the theoretical or empirical issue being considered at the time, although there appears to be a consistency in the use of the United Nations industry classification system, the International Standard Industry Classification of all Economic Activities (ISIC), by researchers in their application of data. For example, Fuchs (1968) did not include the construction, utilities, communication and transportation sectors within his definition of services, although these sectors have been variously included and excluded in other studies, including those (jointly and separately) undertaken by Stanback, Noyelle, Bearse and Karasek (Delaunay, 1992, pp. 109-110). Also, Singelmann utilised an industry-allocation schema initially developed by Browning in 1971 that essentially expanded the Clark-Fisher-Fourastié three-sector model into six sectors, with services differentiated into four sub-categories: distributive, producer, social and personal. Like Fuchs, Singelmann excluded construction and utilities from within the services sector classification in his empirical analysis (Singelmann, 1978, pp.1226-1228).

Contemporary research from the early 1980s onwards appears to include utilities, transportation and communication within the taxonomy of services but continues to exclude construction, which is usually considered to be a “traditional” industry and grouped with manufacturing (US Congress, 1987).

For the purposes of this research the ISIC Rev.4 structure will be applied and the classification of services, as per Table 2.2, will be adopted.

Table 2.2
Classification of Sectors by ISIC Rev.4 Codes

Sector	Section	Division	Description
Primary	A	01-03	Agriculture, forestry and fishing
Primary	B	05-09	Mining and quarrying
Secondary	C	10-33	Manufacturing
Secondary	F	41-43	Construction
Distributive services	D	35	Electricity, gas, steam and air-conditioning supply
Distributive services	F	36-39	Water supply, sewerage, waste management and remediation activities
Distributive services	H	49-53	Transportation and storage
Distributive services	J	58-63	Information and communication
Producer services	G	46	Wholesale trade, except of motor vehicles and motorcycles
Producer services	K	64-66	Finance and insurance activities
Producer services	L	68	Real estate activities
Producer services	M	69-75	Professional, scientific and technical activities
Producer services	N	77-82	Administrative and support service activities
Social services	O	84	Public administration and defence, compulsory social security
Social services	P	85	Education
Social services	Q	86-88	Human health and social work activities
Social services	U	99	Activities of extraterritorial organisations and bodies
Personal services	G	45,47	Retail trade, including sale and repair of motor vehicles and motorcycles
Personal services	I	55-56	Accommodation and food service activities
Personal services	R	90-93	Arts, entertainment and recreation
Personal services	S	94-96	Other service activities
Personal services	T	97-98	Activities of households as employers, undifferentiated goods- and services-producing activities of households for own use

Source: United Nations, 2008, p.43

2.6 Conclusions

As the world economy has become richer the share of services in aggregate output and employment also has grown. This fact has been recognised for some time but the relative growth in services continues to accelerate across many countries as technologies continue to follow the path of Moore’s Law (*The Economist*, 1995). The changing importance of services within the Australian economic landscape can be readily seen by comparing household consumption patterns today with those only 30 years ago. Education, healthcare and social services sectors have been rising in importance in Australia and many other countries and so too has the outsourcing of household support activities, such as cleaning, gardening and clothes washing, which had previously been supplied from within the family.

Research by Hoekman and Mattoo suggests the services sector includes other activities besides domestic and business services, such as transport of goods and people, financial intermediation, communication, distribution, hotels and restaurants, education, healthcare, construction and accounting (Hoekman and Mattoo, 2000, p.283). Trade in these sectors, while originally thought to be non-tradable, is increasingly commonplace as technology enables their provision across distances and time in a more efficient and effective process than had been possible.

The distinction between a good and a service in economics was drawn by Adam Smith in the context of the consumptive life of each. Smith observed that a characteristic of a service is that “they perish in the very instant of their performance” (Smith, 1776, p.331), and they “do not leave any trace or value behind them” (Smith, 1776, p.330). This attribute of intangibility, combined with the fact that it cannot be stored for further use, meant that services were considered to provide no measurable value to the economy.

Since this early consideration, various academics from different fields, including economists, historians and sociologists, have sought to identify the common characteristics that define a “service”. Hartwell identified three sets of attributes that define a service: (i) a lack of durability, inability to hold inventories, producer-consumer intimacy, and intangibility; (ii) are produced in discrete units with a high labour-to-capital ratio, limited intermediate inputs, and high gross margin; and (iii) employs a small, but highly skilled pool of labour, with a relatively higher proportion of female, casual and self-employed workers compared to other sectors (Hartwell, 1973, p. 359-360).

Singelmann however differentiates services using a functionality perspective, classifying services into four categories, being:

a. Distributive services, which incorporate the distribution of commodities, passengers and information;
b. Producer services, which are those service activities consumed as intermediate inputs by businesses and enterprises;
c. Social services, which are those non-market service activities provided by the government and not-for-profit organisations; and
d. Personal services, which are those market and non-market services that are consumed directly as a final good (Singelmann, 1978, pp.1226-1228).

Hill investigated the challenges of defining a service, and in doing so established a common set of elements that he considered were common to all services, including that the condition of a person or good is changed because of a service being applied to it and that the change occurs as a result of the service being applied by some other economic unit (Hill, 1999, pp. 437-438).

Gadrey's important addition to this was the recognition that the "receiver" economic unit purchases that action from the "provider" economic unit and this creates a transfer of property rights between those two economic units, therefore implying the need for an institutional framework to govern the functioning of that transaction (Gadrey, 2000, pp. 382-383).

This issue of property rights is important as it leads to the question of how to measure the proper value of an economy's service sector, which despite the assistance of the framework provided by the SNA, Triplett and Bosworth recognise can be problematic due to the "characteristics of services industry output" (Triplett and Bosworth, 2000, p.8).

The SNA proposes that transactions for the supply and use of products, including services, should be "valued [in the SNA] at the actual price [being the current market price] agreed upon by the economic agents". The challenge with valuing services is that they are (i) often supplied in non-market transactions, which Ward proposes are frequently undervalued (Ward, 2006, p.333), (ii) the quality of services provided changes over time, and (iii) may be produced as intermediate products that have no directly comparable market-revealed prices. If these challenges cannot be adequately resolved, a problem arises in that output cannot be quantifiably measured and changes in productivity therefore cannot be properly assessed (Mark, 1982, p.3-4).

The role of government and other institutional policy makers in a modern economy is to implement initiatives to encourage greater efficiency and productivity in the real sector (Ward, 2006, p.328). If, as Krugman has suggested, “productivity isn’t everything, but in the long run it is almost everything. A country’s ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker” (Krugman, 1992, p.9) then the challenges around being able to properly measure the value of the services sector in a modern, evolving economy become even more important.

Chapter 3 Models of Economic Growth and the Role of Services

3.1 Introduction

The history of economic growth models can be traced from the Classical economists, such as Smith, Riccardo and Malthus, through to modern theories, including those by Schumpeter involving innovation and the diffusion of knowledge.

While history suggests models of economic growth have been considered since the advent of modern economics, the focus on this field became pointed during the period of the Great Depression. Attempting to better understand the determinants of stable economic growth, and by inference, comprehend how to manage economic shocks such as the Depression, were key areas of focus for John Maynard Keynes during the late-1930s and early-1940s.

Formal models of economic growth emerged in the 1940s with the Harrod-Domar model (H-D model), which proposed that growth in the capital stock was dependent on the savings rate and the capital/output ratio, and concluded that growth in the economy does not naturally lead to full employment or that "stable growth" can be achieved.

In the mid-1950s Robert Solow and Trevor Swan proposed the substitutability of labour and capital as a mechanism to overcome the challenges of the H-D model with respect to achieving stable growth. The core of the Solow-Swan model is the Cobb-Douglas production function, and the adoption of three key concepts: (1) constant returns to scale, (2) diminishing returns, and (3) the elasticity of substitution between inputs.

Solow and Swan proposed that growth in an economy is dependent on the continued improvement in technology that is utilised within that same economy. However, this notion of technology advancement could not be explained sufficiently through the concept of diminishing returns, which resulted in this "problem" being resolved by adopting an assumption that technological progress in an economy is exogenous.

The evolution of growth models then focused on the endogenising technical change within a macroeconomic framework. Kenneth Arrow introduced the notion that technology advancement occurs when new capital goods are produced, the so-called “learning-by-doing” phenomenon (Arrow, 1962). “Learning-by-doing” is a positive externality which happens when new knowledge about production activities occurs across the economy due to the adoption of new accumulated capital. In this sense, technological progress is considered external to the firm as it is an accidental by-product of the accumulation of capital by all firms in the economy.

In the 1980s economic growth theories advanced because of work completed by Paul Romer and Robert Lucas, whose principle focus was on being able to explain long-run growth across countries through incorporating research and development activities within an endogenous growth model framework. In essence, economic growth occurs in these models due to increasing returns to scale in output through the application of research and development activities.

These theories were then expanded upon in the 1990s by economists such as Phillipe Aghion and Peter Howitt, who proposed that Joseph Shumpeter’s 1940s concept of “creative destruction” is central to economic growth through the application of research and development activities and innovation. These models also expanded the output function to allow for variety and quality of intermediate goods and recognised that productivity growth at the steady state was a function of research and development activities and total employment.

Full explanations of four growth models – the Solow-Swan model, the AK model, the Romer model and the Aghion and Howitt model – are presented below. This chapter discusses the models and examines how the services sector could be considered in the framework of the Aghion and Howitt model. Several growth models that seek to explain structural change in an economy by incorporating three sectors and two or more factors of production within the model framework are also considered.

3.2 Solow-Swan Exogenous Growth Model

3.2.1 Introduction

The contemporary view of economic growth is largely based on the neoclassical growth model, independently developed by Solow (1956) and Swan (1956). The Solow-Swan model is an exogenous growth model, utilising a neoclassical Cobb-Douglas production function to explain how economic growth is determined by capital accumulation and growth in labour and productivity.

The key assumptions underlying the Solow-Swan model include:

a. There is only one sector within the economy and it produces a single good.

b. That good can be either consumed or invested in the year it is produced.

c. Output is produced using capital and labour according to a neoclassical production function.

d. Perfect competition exists within the markets for the final good and the factors of production.

e. There are no externalities and complete information within the market.

f. There are two forms of economic agents within the market: firms and households.

g. Households save (s) a proportion of their income, which is invested (I) into capital and then rented to firms.

The functional form of the Solow-Swan model is:

$$Y_t = F(K_t, L_t) \tag{1}$$

where:

Y_t = aggregate output in period t

K_t = aggregate stock of capital at the beginning of period t

L_t = the number of households in period t and size of the labour force in period t

A key element of this model is the recognition of MFP within the closed economy. It is identified through the difference between actual and expected growth, after adjusting for capital accumulation, and is also referred to as the Solow residual. This is represented by the term *A* in the following production function underlying the Solow-Swan model:

$$Y_t = A_t L_t^{1-\alpha} K_t^{\alpha} \tag{2}$$

where:

$A_t =$ labour augmenting technology

$\alpha =$ elasticity of output with respect to capital.

For the Solow-Swan model to meet the definition of a neoclassical model, the following properties must be satisfied:

a. The function is continuous (over the specified interval), and at least twice differentiable.

b. K and L exhibit constant returns to scale; i.e.: when K or L are increased by a fixed factor (λ), Y also increases by that same fixed factor. As shown by,

$$F(\lambda \cdot K, \lambda \cdot AL) = \lambda \cdot F(K, AL) = \lambda \cdot Y \quad \forall \ \lambda > 0 \tag{3}$$

c. Diminishing, but positive, marginal products of K and L, as shown by:

$$MPK = \frac{\partial Y}{\partial K} = \alpha A \left(\frac{L}{K}\right)^{1-\alpha} > 0, \text{and } \frac{\partial^2 Y}{\partial K^2} = -\alpha(1-\alpha) A K^{2-\alpha} L^{1-\alpha} < 0$$

and

$$MPL = \frac{\partial Y}{\partial L} = (1-\alpha) A \left(\frac{K}{L}\right)^{1-\alpha} > 0, \text{and } \frac{\partial^2 Y}{\partial L^2} = -\alpha(1-\alpha) A K^{\alpha} L^{-1-\alpha} < 0$$

d. Inada conditions, importantly that the marginal product of capital (or labour) approaches infinity as capital (or labour) goes to 0 and approaches 0 as capital (or labour) goes to infinity, as shown by:

$$\lim_{K\to 0}\frac{\partial Y}{\partial K} = \infty \quad \text{and} \quad \lim_{K\to \infty}\frac{\partial Y}{\partial K} = 0$$

$$\lim_{L\to 0}\frac{\partial Y}{\partial L} = \infty \quad \text{and} \quad \lim_{L\to \infty}\frac{\partial Y}{\partial L} = 0$$

e. All inputs are essential, as shown by:

$$F(0, L) = F(K, 0) = 0$$

The Solow-Swan model proposes that growth in the short run is determined by investment in capital (I_t), growth in the labour force ($\frac{\dot{L}}{L} = n$), and the rate of capital depreciation ($\frac{\dot{A}}{A} = \delta$); whereas growth in the long run is determined solely through technological change (g). Equilibrium, or steady state, in the Solow-Swan model is when the capital intensity of the economy, $\frac{K_t}{Y_t}$, remains constant as the remainder of the variables in the economy grow. For each 0, which reflects the rate of change in output per worker, $\frac{Y_t}{L_t}$.

In addition to the production function, two additional equations are important in enabling the Solow-Swan model to determine a growth equilibrium. These include the capital accumulation formula, $\dot{K}_t = (I_t - \delta K_t)$, the accounting identity, $Y_t = C_t + I_t$, and the household savings formula, $S_t = sY_t$, implying $I_t = S_t$.

3.2.2 Solving the Solow-Swan model

To solve the Solow-Swan model many variables identified above are required to be put into relative units of labour and relative units of effective labour.

a. Output per worker $$y_t = \frac{Y_t}{L_t}$$

b. Consumption per worker $$c_t = \frac{C_t}{L_t}$$

c. Capital per worker $$k_t = \frac{K_t}{L_t}$$

d. Output per effective unit of labour $$\hat{y}_t = \frac{Y_t}{AL_t}$$

e. Consumption per effective unit of labour $$\hat{c}_t = \frac{C_t}{AL_t}$$

f. Capital per effective unit of labour $$\hat{k}_t = \frac{K_t}{AL_t}$$

The production function of the Solow-Swan model,

$$Y_t = A_t L_t^{1-\alpha} K_t^{\alpha}$$

can then be written in a manner consistent with a balanced growth equilibrium:

$$\dot{K}_t = sF(K_t, A_t L_t) - \delta K_t \tag{4}$$

As effective unit of labour does not adjust along the balanced growth path, the above equation can we written as:

$$\frac{\dot{K}_t}{AL_t} = \frac{sF(K_t, A_t L_t)}{AL_t} - \frac{\delta K_t}{AL_t} \tag{5}$$

The first component of the above equation can also be expressed consistently with the constant returns to scale assumption. That is,

$$\frac{sF(K_t, A_t L_t)}{AL_t} = \frac{sF(\lambda K_t, \lambda A_t L_t)}{AL_t} = \frac{s\lambda F(K_t, A_t L_t)}{AL_t} \text{ where } \lambda = 1$$

if

$$\lambda = \frac{1}{AL_t}$$

then

$$\frac{s\lambda F(K_t, A_t L_t)}{AL_t} = sF\left(\frac{K_t}{AL_t}, \frac{A_t L_t}{AL_t}\right)$$

$$\frac{sF(K_t, A_t L_t)}{AL_t} = sF(\hat{k}_t, 1)$$

$$\frac{sF(K_t, A_t L_t)}{AL_t} = sf(\hat{k}_t) \tag{6}$$

To solve for $\frac{K_t}{AL_t}$, or $\hat{k}_t$, it is necessary to take its partial derivative with respect to time and then apply the quotient rule,

$$\frac{d\hat{k}_t}{dt} = \frac{d\left(\frac{\dot{K}_t}{AL_t}\right)}{dt}$$

$$\frac{d\hat{k}_t}{dt} = \frac{\frac{\partial \dot{K}_t}{\partial t} \cdot AL_t - \frac{\partial AL_t}{\partial t} \cdot \dot{K}_t}{(AL_t)^2}$$

as

$$\frac{d\dot{K}_t}{dt} = \dot{K}_t$$

then substituting for $\frac{d\dot{K}_t}{dt}$ and applying the product rule

$$\frac{d\hat{k}_t}{dt} = \frac{\dot{K}_t}{AL_t} \cdot \frac{AL_t}{AL_t} - \frac{K_t}{AL_t} \cdot \frac{A \cdot \frac{dL_t}{dt} - L_t \cdot \frac{dA}{dt}}{AL_t}$$

$$\frac{d\hat{k}_t}{dt} = \frac{\dot{K}_t}{AL_t} \cdot \frac{AL_t}{AL_t} - \frac{K_t}{AL_t} \cdot \left(\left(\frac{A \cdot \dot{L}_t}{AL_t}\right) + \left(\frac{L_t \cdot \dot{A}}{AL_t}\right)\right)$$

$$\frac{d\hat{k}_t}{dt} = \frac{\dot{K}_t}{AL_t} - \hat{k}_t \cdot \left(\left(\frac{\dot{L}_t}{L_t}\right) + \left(\frac{\dot{A}}{A}\right)\right)$$

therefore,

$$\frac{\dot{K}_t}{AL_t} = \frac{d\hat{k}_t}{dt} + \hat{k}_t \cdot \left(\left(\frac{\dot{L}_t}{L_t} \right) + \left(\frac{\dot{A}}{A} \right) \right)$$

$$\frac{\dot{K}_t}{AL_t} = \dot{\hat{k}}_t + \hat{k}_t \cdot (n + g) \tag{7}$$

Returning to equation (5) above, it can now be re-written incorporating the solution at (6) and (7) as:

$$\frac{\dot{K}_t}{AL_t} = \frac{sF(K_t, A_t L_t)}{AL_t} - \frac{\delta K_t}{AL_t}$$

$$\dot{\hat{k}}_t + \hat{k}_t \cdot (n + g) = sf(\hat{k}_t) + \delta \hat{k}_t$$

or

$$\dot{\hat{k}}_t = sf(\hat{k}_t) - (\delta + n + g)\, \hat{k}_t \tag{8}$$

This equation (8) is recognised as the fundamental equation for capital stock accumulation in Solow-Swan model.

The steady state in the economy occurs when the change in capital per unit of output is zero, or $\dot{\hat{k}}_t = 0$. This is found when,

$$\dot{\hat{k}}_t = sf(\hat{k}_t) - (\delta + n + g)\, \hat{k}_t$$

$$0 = sf(\hat{k}_t) - (\delta + n + g)\, \hat{k}_t$$

$$sf(\hat{k}_t) = (\delta + n + g)\, \hat{k}_t \tag{9}$$

then multiplying by cross-product equation (9) becomes:

$$\frac{\hat{k}_t}{f(\hat{k}_t)} = \frac{s}{(\delta + n + g)} \tag{10}$$

In the context of the production function underlying the Solow-Swan model, as given by equation (1), then,

$$f(\hat{k}_t) = \frac{A_t L_t^{1-\alpha} K_t^{\alpha}}{A_t L_t}$$

$$f(\hat{k}_t) = \left(\frac{K_t}{A_t L_t}\right)^{\alpha}$$

$$f(\hat{k}_t) = \hat{k}_t^{\ \alpha} \tag{11}$$

Substituting equation (11) into (10), then

$$\frac{\hat{k}_t}{\hat{k}_t^{\alpha}} = \frac{s}{(\delta + n + g)}$$

$$\hat{k}_t = \left(\frac{s}{(\delta + n + g)}\right)^{\frac{1}{(1-\alpha)}} \tag{12}$$

Equation (12) shows that the steady state level of $\hat{k}$ in the Solow-Swan model can increase with an increase in the savings rate (s), and decrease due to deprecation (δ), growth in the labour force (n), and improvements in technology (g).

3.3 Endogenous Growth Theory

3.3.1 Introduction

The advancement of growth models during the 1960s focused on explaining how growth occurs within an economic system. Technical progress began to be linked to research and development activities within an economy, with “learning” and “knowledge” key components advocated by Arrow to explain how innovation ultimately drives productivity, although Barro and Sala-i-Martin suggest the earliest form of the AK production function type model was by von Neumann in 1937 (Barro and Sala-i-Martin, 2004, p.64).

The AK approach has been able to explain observable growth rates of per capita GDP, whereas the neoclassical model struggles to translate its theoretical framework into empirical settings.

3.3.2 The AK Model

The starting point to consider the transitioning from the Solow-Swan model to the AK model is the Solow-Swan production function,

$$Y_t = A_t L_t^{1-\alpha} K_t^{\alpha} \tag{13}$$

where

$$0 < \alpha < 1$$

Endogenous growth theory omits the neoclassical assumption of diminishing returns to capital, meaning that $\alpha = 1$, which has the effect of collapsing the production function to:

$$Y_t = A_t K_t \tag{14}$$

where

A = technology constant

K = capital

Capital accumulates at the rate consistent with the Solow-Swan model, being:

$$\dot{K}_t = (I_t - \delta K_t)$$

$$\dot{K}_t = (sY_t - \delta K_t)$$

which under the AK model is,

$$\dot{K}_t = (sA_t K_t - \delta K_t)$$

$$\dot{K}_t = K_t(sA_t - \delta) \tag{15}$$

therefore

$$\frac{\dot{K}_t}{K_t} = sA_t - \delta \tag{16}$$

Equation (16) reveals that the rate of growth in capital accumulation is dependent on the savings rate, labour augmenting technology and the rate of capital depreciation. As the growth rate in output under the AK model is given by:

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}_t}{A_t} + \frac{\dot{K}_t}{K_t} \tag{17}$$

and incorporating equation (16) into equation (17), then

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}_t}{A_t} + sA_t \tag{18}$$

Equation (18) shows that the rate of growth in output under the AK model is determined by both the rate of growth of technical change and the level of technology operating within the economy.

A steady state in the AK model can therefore only be achieved when

$$\frac{\dot{A}_t}{A_t} = 0$$

such that

$$\left(\frac{\dot{Y}_t}{Y_t}\right)^* = sA_t - \delta \tag{19}$$

Equation (19) reveals that relaxing the assumption of diminishing returns to capital as compared to the Solow-Swan model, the steady state of the AK model is only determined by the savings rate, the level of technology augmentation and the rate of depreciation.

3.3.3 The AK Model with Human Capital

The simple AK model allows for the disaggregation of capital into two forms of capital, physical and human. The production function of the AK model with human capital (the AKHC Model) is:

$$Y_t = A_t K_t^{\alpha} H_t^{1-\alpha} \tag{20}$$

where

A_t= technology constant

K_t= physical capital

H_t= human capital

$\alpha =$ elasticity of output with respect to capital, and $0 < \alpha < 1$

Consistent with the AK model, by taking the log of equation (20), the rate of growth rate in output under the AKHC model is given by:

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}_t}{A_t} + \alpha\left(\frac{\dot{K}_t}{K_t}\right) + (1-\alpha)\left(\frac{\dot{H}_t}{H_t}\right) \tag{21}$$

Under the AKHC model the capital-output ratio can be disaggregated into its component parts, being:

$$\omega_K = \frac{Y_t}{K_t} \tag{22}$$

$$\omega_H = \frac{Y_t}{H_t} \tag{23}$$

If we assume capital accumulates within the AKHC model at the rate consistent with the Solow-Swan model and AK model, being:

$$\dot{K}_t = (s_K Y_t - \delta K_t)$$

$$\dot{H}_t = (s_K Y_t - \delta H_t)$$

or they can be expressed as a function of their capital-output ratios,

$$\frac{\dot{K}_t}{K_t} = \frac{s_K}{\omega_K} - \delta \tag{24}$$

$$\frac{\dot{H}_t}{H_t} = \frac{s_H}{\omega_H} - \delta \tag{25}$$

The first step in establishing the steady state of the AKHC model requires substituting equations (22) and (23) into the AKHC production function (20),

$$Y_t = A_t \omega_K Y_t^{\alpha} \omega_H Y_t^{1-\alpha} \tag{26}$$

and if $Y_t$is divided across by sides, then equation (26) becomes:

$$1 = A_t {\omega_K}^{\alpha} {\omega_H}^{1-\alpha} \tag{27}$$

Taking the log of equation (27), it then becomes:

$$0 = \frac{\dot{A}_t}{A_t} + \alpha \log(\omega_k) + (1-\alpha) \log(\omega_H) \tag{28}$$

and

$$\frac{\dot{A}_t}{A_t} = -\alpha \frac{\dot{\omega}_K}{\omega_K} - (1-\alpha) \frac{\dot{\omega}_H}{\omega_H}$$

This equation reveals that the steady state in the AKHC model can only be positive if the values of the capital-output ratios are negative. The challenge with this scenario is that for this to occur, growth rates in physical and human capital must be increasing, which by definition does not indicate the situation of a steady state. Rather, it would seem more appropriate that a steady state is one where the rate of growth in both physical and human capital is equal. This would be where:

$$\frac{\dot{K}_t}{K_t} = \frac{\dot{H}_t}{H_t}$$

or substituting in equations (24) and (25)

$$\frac{s_K}{\omega_K} - \delta = \frac{s_H}{\omega_H} - \delta$$

$$\frac{s_K}{\omega_K} = \frac{s_H}{\omega_H}$$

$$\frac{\omega_K}{\omega_H} = \frac{s_K}{s_H}$$

$$\frac{\frac{Y_t}{K_t}}{\frac{Y_t}{H_t}} = \frac{s_K}{s_H}$$

$$\frac{K_t}{H_t} = \frac{s_K}{s_H}$$

$$H_t = \frac{s_K}{s_H} K_t \tag{29}$$

Substituting (29) into the AKHC production function (20) allows the level of the steady state to be determined. That is,

$$Y_t = A_t K_t^{\alpha} H_t^{1-\alpha}$$

$$Y_t = A_t K_t^{\alpha} \left(\frac{s_K}{s_H} K_t\right)^{1-\alpha}$$

$$Y_t = A_t \left(\frac{s_K}{s_H}\right)^{1-\alpha} K_t \tag{30}$$

Utilising equation (17) again we can establish the growth rate for output in the AKHC model:

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}_t}{A_t} + \frac{\dot{K}_t}{K_t}$$

and where again

$$\frac{\dot{A}_t}{A_t} = 0$$

such that

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{K}_t}{K_t}$$

$$\frac{\dot{Y}_t}{Y_t} = \frac{(s_K Y_t - \delta K_t)}{K_t}$$

$$\frac{\dot{Y}_t}{Y_t} = \frac{s_K Y_t}{K_t} - \frac{\delta K_t}{K_t}$$

$$\frac{\dot{Y}_t}{Y_t} = \frac{s_K Y_t}{K_t} - \delta \tag{31}$$

Substitution in equation (30) into (31), then

$$\frac{\dot{Y}_t}{Y_t} = \frac{s_K A_t \left(\frac{s_K}{s_H}\right)^{1-\alpha} K_t}{K_t} - \delta$$

$$\frac{\dot{Y}_t}{Y_t} = A_t s_k^{\alpha} s_h^{(1-\alpha)} - \delta \tag{32}$$

Equation (32) reveals similarities to the steady state growth equation of the basic AK model (19), with the exception being that it is determined by the average of the savings rates for physical and human capital.

3.4 New Growth Theories

3.4.1 The Romer Model

Paul Romer (1990) proposed an endogenous growth model where technical change, A, is also endogenous. This occurs where profit maximising economic agents undertake research and development (R&D) activities, which impacts the incentives for those same agents to conduct further R&D activities. This principle requires two of the underlying assumptions of the Solow-Swan model to be relaxed: (1) perfect competition exists within the markets for the final good and the factors of production; and (2) there are no externalities and complete information within the market. The maintenance of these assumptions within the Romer model would result in the owners of the R&D selling their intellectual property at its marginal cost, which would result in negative returns, eventually resulting in no R&D activities occurring within the market (Romer, D., 1990).

The Romer model proposes an alternative form of production function as compared to both the Solow-Swan model and the AK models, being:

$$Y_t = L_x^{(1-\alpha)} (x_1^{\alpha} + x_2^{\alpha} + \cdots + x_A^{\alpha})$$

$$Y_t = L_x^{(1-\alpha)} \sum_i^A (x_i^{\alpha}) \tag{33}$$

where:

Y_t = aggregate output in period t

L_x = the size of the labour force (i.e.: the number of workers) producing inputs in period t

x_i = the different type of capital goods available to the labour force.

A = the number of capital goods utilised by the labour force to produce aggregate output

α = elasticity of output with respect to capital, and $0 < \alpha < 1$

In the Romer model, n is not fixed, but rather varies depending on the number of workers engaged in R&D activities, which in turn leads to the creation of new capital goods for use in the production process. Romer proposes the change in the number of capital goods is calculated by:

$$\dot{A} = \gamma \, L_x^{\lambda} A^{\Phi} \tag{34}$$

where:

$\gamma =$ rate at which new ideas emerge

λ = rate of diminishing marginal productivity for those employed in R&D activities

A = the number of capital goods utilised by the labour force to produce aggregate output

$\Phi =$ represents the "stepping on shoulders effect", which means new R&D builds on previous R&D (i.e.: stepping up), and is usually <1

Equation (34) shows that the change in the number of capital goods is a function of both the number of researchers developing new capital goods and the starting number of capital goods. This means that the total labour supply is equal to the sum of the labour supply in equations (33) and (34), given by:

$$L_T = L_x + L_A$$

where

$$L_A = s_A L \tag{35}$$

and

s_A= the proportion of total labour engaged in developing new capital goods.

Other key assumptions and principles applied in the Romer model include:

a. Growth in labour force is given by: $$\dot{n} = \frac{\dot{L}}{L}$$

b. Aggregate stock of capital equals: $$K = \sum_{i}^{A} (x_i^{\alpha})$$

c. Savings is exogenous and is defined as: s_K

d. Change in capital stock is given by: $$\dot{K} = s_K Y$$

e. Demand for each capital good is identical, as shown by: $$x_i = \bar{x}$$

The production function, as described in equation (33), can now be written as:

$$Y_t = L_x^{(1-\alpha)} \sum_{i}^{A} (x_i^{\alpha})$$

$$Y_t = L_x^{(1-\alpha)} \bar{x}^{\alpha} \tag{36}$$

From assumptions (ii) and (v) above,

$$K = A\bar{x}$$

so

$$\bar{x} = \frac{K}{A} \tag{37}$$

Substituting equation (37) in the production function equation (36), output is then determined by:

$$Y_t = L_x^{(1-\alpha)} \left(\frac{K}{A}\right)^{\alpha}$$

$$Y_t = (AL_x)^{(1-\alpha)} K^{\alpha} \tag{38}$$

The steady state in the Romer model is derived in the same manner as previous models, being the point where capital and output grow at the same rate. This point can be found using the same approach outlined previously, starting with the redefined production function presented in equation (38).

$$Y_t = (AL_x)^{(1-\alpha)}K^{\alpha}$$

Adding in a discrete term for the proportion of labour associated with input production (i.e.: this allows non-input producing labour to be excluded from the production function), being:

$$s_Y + s_L = 1 \tag{39}$$

then,

$$Y_t = \left(As_yL_x\right)^{(1-\alpha)}K^{\alpha} \tag{40}$$

Taking the log form of equation (40),

$$\dot{Y}_t = (1-\alpha)\left(\dot{A} + \dot{s}_Y + \dot{L}_x\right) + \alpha\dot{K}$$

and then its derivative,

$$\frac{\dot{Y}_t}{Y_t} = (1-\alpha)\left(\frac{\dot{A}}{A} + \frac{\dot{s}_Y}{s_y} + \frac{\dot{L}}{L}\right) + \alpha\frac{\dot{K}}{K} \tag{41}$$

As noted above at the steady state, growth in output equals growth in capital, such that:

$$\frac{\dot{Y}_t^{\,*}}{Y_t} = \frac{\dot{K}^*}{K}$$

so

$$\frac{\dot{Y}_t^{\,*}}{Y_t} = (1-\alpha)\left(\frac{\dot{A}}{A} + \frac{\dot{s}_Y}{s_y} + \frac{\dot{L}}{L}\right) + \alpha\frac{\dot{Y}_t^{\,*}}{Y_t} \tag{42}$$

Given a feature of the Romer model is the allocation of separate labour resources to utilising inputs in the production process and the development of new capital goods, this allocation is required to be maintained along the balanced growth path for the steady state to be achieved. This is described by:

$$\frac{\dot{Y}_t}{Y_t}^* - \frac{\dot{L}}{L}^* = \frac{\dot{A}}{A} \tag{43}$$

Equation (43) shows that the steady state growth rate of output per unit of labour equals the steady state growth rate of A. The steady state growth rate of A can be found by taking the derivative of equation (34), being:

$$\dot{A} = \gamma \, L_x^{\lambda} A^{\Phi}$$

So, substituting in equation (35), then

$$\frac{\dot{A}}{A} = \gamma \, (s_A L)^{\lambda} \, A^{\Phi - 1}$$

and

$$0 = \gamma \, (s_A L)^{\lambda} \, A^{\Phi - 1} \tag{44}$$

Presenting equation (44) in logarithmic form,

$$0 = \gamma \, \lambda \, (s_A + L) \; - (1 - \theta) A \tag{45}$$

Consistent with equation (43), γ, the rate at which new ideas emerge must equal 0, as the stock of individuals working on new capital goods is fixed. Taking the derivate of equation (45), adjusting for γ, then

$$0 = \lambda \left(\frac{\dot{s}_A}{s_A} + \frac{\dot{L}}{L} \right) - (1 - \theta) \frac{\dot{A}}{A} \tag{46}$$

At the steady state, the rate of growth in the proportion of total labour engaged in developing new capital goods must also be zero. Adopting this solution for $\frac{\dot{s}_A}{s_A}$, and substituting assumption (i) into equation (46), then

$$\frac{\dot{A}}{A} = \frac{\dot{n}\lambda}{1-\theta} \tag{47}$$

Equation (47) shows that the long-run growth in output per worker is dependent on three factors:

a. The growth rate of the labour force, $\dot{n}$.
b. The marginal productivity of researchers, λ.
c. The strength of the "standing-on-shoulders" effect, θ.

Simply, the Romer equation proposes that as the labour force increases, so does the number of researchers working within it, causing growth in the number of capital goods available, adjusting for diminishing marginal productivity (negative impact) and the "standing-on-shoulders" effect (positive impact), or the production process.

3.4.2 Model of Growth through Creative Destruction

The Romer model provided the basis for the development of a class of growth models referred to as neo-Schumpeterian. These models incorporate the assumption that market power exists for firms and individuals, albeit it temporarily, and during this time they can earn monopoly rents on R&D discoveries. This occurs due to (i) the relative improvement in product quality achieved through the R&D process that generates higher product demand and higher profitability; (ii) the development of a new product that earns excess returns until competitive products enter the market; and (iii) the cost of production is reduced through process transformation identified by the R&D activity – either on existing processes or the development of new processes – which results in higher net profit at the same price level.

Aghion and Howitt (1992) developed a growth model incorporating Schumpeter's concept of creative destruction. Schumpeter said of this idea

> *The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, ... [it] incessantly revolutionises the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism.* (Schumpeter, 1942, pp. 82-83)

Assumptions within the Creative Destruction (CD) growth model include:

a. There are three kinds of externalities in existence, firstly those associated with innovations displacing existing products (i.e.: obsolescence), secondly the monopoly rents associated with the innovations are smaller than its associated consumer surplus (i.e.: the economy is better off due to the innovations), and thirdly, previous innovations enable new innovations to occur (i.e.: the "standing-on-shoulders" effect as per the Romer model).
b. There is no accumulation of capital.
c. Individuals within the economy seek to maximise their utility in a manner consistent with the following function

$$U(Y) = \int_0^\infty Y_t \, e^{-rt} \, dt \tag{48}$$

where

$Y_t =$ aggregate output in period t

$r =$ the rate-of-time preference, usually proxied by the rate of interest

Following the same naming convention for variables as per the Romer model description above, the production function of the CD model is given as

$$Y_t = A_t x_t^a \tag{49}$$

where

$A_t =$ productivity parameter

x_t= the amount of intermediate goods used to produce the final good

$a =$ elasticity of output with respect to capital, where $0 < a < 1$

Consistent with the Romer model, the total labour force is made up of workers associated with producing outputs using intermediate goods using technology on a 1-to-1 basis, L_x, and the labour force dedicated to innovation and R&D activities, L_A. If we denote,

$$L_x = x$$

$$L_A = n$$

then

$$L = x + n \tag{50}$$

The CD model treats the number of workers involved in innovation and R&D activities slightly differently from the Romer model, where n is fixed. In the CD model, the number of workers engaged in R&D activities adjusts to the following conditions,

$$w_i = \lambda V_{i+1} \tag{51}$$

where

$w_i =$ wage rate

$\lambda =$ marginal productivity of researchers (akin to the probability of R&D success)

$V_{i+1} =$ the present value of the benefits associated with the ($i+1$)-th innovation

Further, the productivity adjusted wage rate is found by dividing the wage rate by the productivity factor. That is,

$$\omega_i = \frac{w_i}{A} \tag{52}$$

Profit maximisation occurs when the marginal revenue product of the intermediate good, x_i, equals its unit price and is determined by

$$p_t = \frac{\partial Y_t}{\partial x_t}$$

$$p_t = \alpha A x_i^{(a-1)} \tag{53}$$

In this context profit maximisation occurs where

$$\pi_t = p_t x_t - w_t L_x \tag{54}$$

Substituting equation (53) and equation (54) into the above equation, then

$$\pi_t = \alpha A x_t^{(a-1)} x_t - w_t x_t$$

$$\pi_t = x_t \left(\alpha A x_i^{(a-1)} - w_t \right)$$

If we take the first derivative of the above equation with respect to the intermediate good, and then set this to zero, then the first order condition for profit maximisation can be found.

$$\frac{\partial \pi_t}{\partial x_t} = \alpha^2 A x_t^{(a-1)} - w_t = 0$$

so

$$w_t = \alpha^2 A x_t^{(a-1)}$$

$$\frac{w_t}{A} = \alpha^2 x_t^{(a-1)}$$

$$\omega_t = \alpha^2 x_t^{(a-1)} \tag{55}$$

which can be written as

$$\omega_t = \tilde{\omega}(x_t) \tag{56}$$

Solving equation (55) for the optimal level of goods to be produced at equilibrium, then

$$x_t^* = \left(\frac{\alpha^2}{\omega_t}\right)^{\frac{1}{(1-\alpha)}} \tag{57}$$

This equation also represents the demand for labour in the intermediate goods sector. It shows that the productivity-adjusted wage rate, ω_t, results in labour demand being a decreasing function. Consistent with the convention of equation (56), equation (57) can be written as

$$x_t = \tilde{x}(\omega_t) \tag{58}$$

This solution also has an implication for the functioning of the labour force. Equation (50) showed,

$$L = x + n$$

therefore, substituting in equation (58) into the equation above, then

$$L = \tilde{x}(\omega_t) + n_t \tag{59}$$

Equation (59) shows that at equilibrium the productivity adjusted wage rate, ω_t, is a function of the equilibrium labour market.

Optimal pricing for the intermediate goods sector can be found by substituting equation (57) into equation (53). That is,

$$p_t = \alpha A x_i^{(1-a)}$$

so that

$$p_t = \alpha A \left(\frac{\alpha^2}{\omega_t}\right)^{\frac{(a-1)}{(1-\alpha)}}$$

$$p_t = \alpha A \left(\frac{\alpha^2}{\omega_t}\right)^{-1}$$

$$p_t = \frac{\alpha A}{\left(\frac{\alpha^2}{\omega_t}\right)}$$

$$p_t = \frac{\alpha A \omega_t}{\alpha^2}$$

$$p_t = \frac{A\omega_t}{\alpha}$$

$$p_t = \frac{w_t}{\alpha}$$

From equation (54), profit for the intermediate goods sector can be found using the above price solution. That is:

$$\pi_t = p_t x_t - w_t L_x$$

$$\pi_t = \frac{w_t}{\alpha} x_t - w_t x_t$$

$$\pi_t = \left(\frac{1}{\alpha} - 1\right) w_t x_t$$

$$\pi_t = A_t \left(\frac{1}{\alpha} - 1\right) \omega_t x_t$$

and substituting in ω_t from equation (55), then

$$\pi_t = A_t \left(\frac{1}{\alpha} - 1\right) \alpha^2 x_t^{(a-1)} x_t$$

$$\pi_t = A_t \left(\frac{1}{\alpha} - 1\right) \alpha^2 x_t^{a}$$

$$\pi_t = A_t \left(\frac{\alpha^2}{\alpha} - \alpha^2\right) x_t^{a}$$

$$\pi_t = A_t \, (1-\alpha) a \left(\left(\frac{\alpha^2}{\omega_t}\right)^{\frac{\alpha}{(1-\alpha)}}\right) \tag{60}$$

Again, adopting the same convention as earlier, equation (60) may also be written as

$$\pi_t = A_t \, \tilde{\pi}(\omega_t) \tag{61}$$

The CD model proposes that the development of new capital goods through R&D and innovation in practice makes existing capital goods obsolete. Equation (62) shows that the take-up of the new capital goods lifts existing productivity by a factor of γ, which is always greater than one (i.e.: productivity increases from one period to the next as a direct consequence of the use of new, innovative capital goods).

$$A_{t+1} = A_t \gamma^t \tag{62}$$

The CD model defines the term, γL_A, as representing the number of innovations that occur within the economy, arriving within the marketplace in a random fashion. To determine the optimal number of innovations and R&D activity, the marginal revenue associated with the R&D activities should equal the marginal cost associated with that activity, which equals the wage rate, w_i. As presented in equation (63),

$$w_i = \lambda \, V_{i+1} \tag{63}$$

The return on the present value of the R&D activities is given by the equation, $r\ V_{i+1}$, and is equal to:

$$r\ V_{i+1} = \pi_{i+1} - \lambda n_{i+1} V_{i+1} \qquad (64)$$

where

$r =$ rate of interest

π_{i+1} = profit earned by the producer of innovative product (*i+1*)

The term, $\lambda n_{i+1} V_{i+1}$, reflects the expected loss associated with the production of the next innovative product beyond *i+1*; in effect *i+2*. As described by the term, this equals the probability of innovation occurring multiplied by the number of workers associated with creating that innovation multiplied by the value lost by making product *i+1* obsolete.

From equation (64) it is possible to determine the value of V_{i+1}, being

$$r\ V_{i+1} = \pi_{i+1} - \lambda n_{i+1} V_{i+1}$$

$$r\ V_{i+1} + \lambda n_{i+1} V_{i+1} = \pi_{i+1}$$

$$V_{i+1}(r + \lambda n_{i+1}) = \pi_{i+1}$$

$$V_{i+1} = \frac{\pi_{i+1}}{(r + \lambda n_{i+1})} \qquad (65)$$

Equation (65) is the core element of the CD model as it describes Schumpeter's process of "creative destruction". This process was described by Aghion and Howitt as,

> *The producer of an innovation captures (some of) the rents from that productivity gain, but only during one interval. After that the rents are captured by other innovators, building upon the basis of the present innovation, but without compensating the present innovator … The model also embodies Schumpeter's idea of "creative destruction". Each innovation is an act of creation aimed at capturing monopoly rents. But it also destroys the monopoly rents that motivated the previous creation. Creative destruction accounts for the term λn_{i+1} in the denominator of V_{t+1}. More research reduces the expected tenure of the current monopolist, and hence*

reduces the expected present value of its flow of rents (Aghion and Howitt, 1992, pp. 330-331).

In terms of value of the benefits associated with the (*i+1*)-th innovation, V_{i+1}, equations (60) and (62) are substituted into equation (65) to reveal

$$V_{i+1} = \frac{A_{t+1}\,\tilde{\pi}(\omega_{t+1})}{(r + \lambda n_{i+1})}$$

$$V_{i+1} = \frac{A_t \gamma^t\,\tilde{\pi}(\omega_{t+1})}{(r + \lambda n_{i+1})}$$

as shown by equation (a63),

$$w_i = \lambda\, V_{i+1}$$

then

$$w_i = \lambda\, \frac{A_t \gamma^t\,\tilde{\pi}(\omega_{t+1})}{(r + \lambda n_{i+1})}$$

and

$$\omega_i = \frac{w_i}{A}$$

then

$$\omega_i = \lambda\, \frac{\gamma^t\,\tilde{\pi}(\omega_{t+1})}{(r + \lambda n_{i+1})} \qquad (66)$$

Equation (66) shows that the allocation of labour between the production of intermediate goods and undertaking R&D activities is dependent on the productivity adjusted wage, ω_i.

In terms of solving for equilibrium in the CD model, Aghion and Howitt noted

There is only one decision for society to make; namely, how to allocate the fixed flow N of skilled labour between manufacturing and research. (Aghion and Howitt, 1992, p. 331)

To solve for equilibrium, then equation (66) and equation (55) should equate. That is,

$$\alpha^2 x_t^{(a-1)} = \lambda \frac{\gamma^t \tilde{\pi}(\omega_{t+1})}{(r + \lambda n_{i+1})}$$

Substituting in from equation (61), then

$$\alpha^2 x_t^{(a-1)} = \lambda \frac{\gamma^t \frac{\pi_{t+1}}{A_{t+1}}}{(r + \lambda n_{i+1})}$$

Dividing both sides by λ, and substituting in from equation (60), then

$$\frac{\alpha^2 x_t^{(a-1)}}{\lambda} = \frac{\gamma^t \frac{A_{t+1}\,(1-\alpha)a\left(\left(\frac{\alpha^2}{\omega_{t+1}}\right)^{\frac{\alpha}{(1-\alpha)}}\right)}{A_{t+1}}}{(r + \lambda n_{i+1})}$$

Substituting in from equation (57), then

$$\frac{\alpha^2 x_t^{(a-1)}}{\lambda} = \frac{\gamma^t\,(1-\alpha)a\left(\left(\frac{\alpha^2}{\omega_{t+1}}\right)^{\frac{\alpha}{(1-\alpha)}}\right)}{(r + \lambda n_{i+1})}$$

And then substituting in from equations (55), then

$$\frac{\alpha^2 x_t^{(a-1)}}{\lambda} = \frac{\gamma^t\,(1-\alpha)a\left(\left(\frac{\alpha^2}{\alpha^2 x_{t+1}^{(a-1)}}\right)^{\frac{\alpha}{(1-\alpha)}}\right)}{(r + \lambda n_{i+1})}$$

which reduces to

$$\frac{\alpha^2 x_t^{(a-1)}}{\lambda} = \frac{\gamma^t\,(1-\alpha)a(x_{t+1}^{1-a})^{\frac{a}{1-a}}}{(r + \lambda n_{i+1})}$$

$$\frac{\alpha^2 x_t^{(a-1)}}{\lambda} = \frac{\gamma^t\,(1-\alpha)a\,x_{t+1}^{a}}{(r + \lambda n_{i+1})}$$

And then substituting in from equation (50), then

$$\frac{\alpha^2 (L - n_t)^{(a-1)}}{\lambda} = \frac{\gamma^t a\,(1-\alpha)\,(L - n_{t+1})^a}{(r + \lambda n_{i+1})} \tag{67}$$

Equation (67) can be thought of as showing equilibrium as the point where the marginal cost of innovation and R&D equals the marginal benefit of innovation and R&D. Aghion and Howitt (1992) defined these terms as the following:

a. Marginal cost of innovation and R&D activities = $c(n_t)$; and
b. Marginal benefit of innovation and R&D activities = $b(n_{t+1})$

These definitions allow the equilibrium equation (67) to be re-written as:

$$c(n_t) = b(n_{t+1})$$

Equation (67) also suggests that the volume of innovation and R&D activities will change over time. This assumption can be illustrated through further adjustments to equation (67). That is,

$$\frac{\alpha^2 (L - n_t)^{(a-1)}}{\lambda} = \frac{\gamma^t a\,(1-\alpha)\,(L - n_{t+1})^a}{(r + \lambda n_{i+1})}$$

and multiplying both sides of the equation by $\frac{\lambda}{a^2}$, then

$$(L - n_t)^{(a-1)} = \frac{\lambda \gamma^t a^{-1}\,(1-\alpha)\,(L - n_{t+1})^a}{(r + \lambda n_{i+1})}$$

and taking both sides to the power of $\frac{1}{a-1}$, then

$$(L - n_t) = \left(\frac{\lambda \gamma^t a^{-1}\,(1-\alpha)\,(L - n_{t+1})^a}{(r + \lambda n_{i+1})}\right)^{\frac{1}{a-1}}$$

$$n_t = L - \left(\frac{\lambda \gamma^t a^{-1}\,(1-\alpha)\,(L - n_{t+1})^a}{(r + \lambda n_{i+1})}\right)^{\frac{1}{a-1}} \tag{68}$$

The denominator in equation (68) contains the term n_{i+1}, which means the amount of innovation and R&D activities in the current period is a decreasing function of the amount of innovation and R&D activities expected to be undertaken in the next period. This practically occurs for two reasons,

a. an expectation of higher wages in the future wages, reducing future profits associated with the next innovation; and
b. an expectation that the monopoly rents achieved by the next innovation will be less than those achieved by the current products.

Although this outcome is expected for the general case, Aghion and Howitt also proposed there should also be a case where there "exists a unique stationary equilibrium" (Aghion and Howitt, 1992, p. 333). This steady state point would be where the allocation of labour to innovation and R&D activities and production activities remains unchanged, i.e.: stationary. This point should also correspond to the point where the wage rate between workers employed in the production side of the economy equals the wage rate for workers employed in the R&D side of the economy.

The following sequence presents the solution to identifying the volume of labour allocated to innovation and R&D activities in the steady state. As shown above in equation (68), then

$$n_t = L - \left(\frac{\lambda \gamma^t a^{-1} (1-\alpha) (L - n_{t+1})^a}{(r + \lambda n_{i+1})} \right)^{\frac{1}{a-1}}$$

$$L - n_t = \left(\frac{\lambda \gamma^t \frac{(1-\alpha)}{\alpha} (L - n_{t+1})^a}{(r + \lambda n_{i+1})} \right)^{\frac{1}{\alpha-1}}$$

$$(L - n_t)^{a-1} = \frac{\lambda \gamma^t \frac{(1-\alpha)}{\alpha} (L - n_{t+1})^a}{(r + \lambda n_{i+1})}$$

$$(r + \lambda n_{i+1}) = \frac{\lambda \gamma^t \frac{(1-\alpha)}{\alpha} (L - n_{t+1})^a}{(L - n_t)^{a-1}}$$

$$(r + \lambda n_{i+1}) = \lambda \gamma^t \frac{(1-\alpha)}{\alpha} (L - n_t)$$

$$n\left(\lambda + \lambda\gamma^t \frac{(1-\alpha)}{\alpha}\right) = \lambda\gamma^t \frac{(1-\alpha)}{\alpha} L - r$$

$$n^* = \frac{\lambda\gamma^t \frac{(1-\alpha)}{\alpha} L - r}{\lambda\left(1 + \gamma^t \frac{(1-\alpha)}{\alpha}\right)}$$

This steady state solution for n^* then allows the equilibrium rate of growth for the steady state to also be determined. Equation (49) reminds us

$$Y_t = A_t x_t^{\alpha}$$

so

$$Y_t = A_t (L - n^*)^{\alpha}$$

and at the steady state it must also be true that

$$Y_{t+1} = A_{t+1} (L - n^*)^{\alpha}$$

so

$$\frac{Y_{t+1}}{Y_t} = \frac{A_{t+1}}{A_t}$$

As equation (62) noted previously

$$A_{t+1} = A_t \gamma^t$$

then

$$\frac{A_{t+1}}{A_t} = \gamma^t$$

so

$$\frac{Y_{t+1}}{Y_t} = \frac{A_{t+1}}{A_t} = \gamma^t$$

As discussed previously, the outcomes of innovation and R&D are uncertain, and therefore it is necessary to adopt a probability of success and failure in considering how an economy will grow from one period to the next within the CD model.

Aghion and Howitt recognised that the growth rate of the economy depends on the probability of innovation being successful, λn^*, and the volume of innovation activities, ln λ. The growth rate of the steady state is therefore given by

$$\log Y_{t+1} = \log Y_t + \log(\gamma^t) + \varepsilon(\tau) \tag{69}$$

where

$\varepsilon(\tau)$ = the number of innovations that occur between periods t and $t+1$

$\varepsilon(\tau)$ also reflects Poisson distribution with respect to λn^* such that equation (69) can be written as

$$\log Y_{t+1} - \log Y_t = \lambda n^*. \log(\gamma^t)$$

$$g_Y = \lambda n^*. \log(\gamma^t) \tag{70}$$

where

g_Y = average growth rate of output.

The CD model proposes that economic growth is determined by

a. the number of workers engaged in innovation and R&D activities at the steady state, n^*;
b. the absolute number of workers engaged in the labour force, L;
c. the marginal productivity of researchers, λ; and
d. indirectly through the calculation of n^*, the cost of interest, r, and the elasticity of output with respect to capital, a.

3.4.3 Extending the Aghion-Howitt model to incorporate services

The "new growth" theory models of Romer (1990) and Aghion and Howitt (1992) remain highly stylised, with limited-to-no discussion on how the different sectors within the economy interact with each other, and the relationship which the primary, secondary and tertiary sectors have individually with the size and growth rates of an economy.

It is possible however, to take these models and decompose aggregate output (or aggregate economic growth) into sectors of the economy.

Equation (70) in the detailed presentation of the Aghion and Howitt model analysis presented previously is reproduced below.

$$g_Y = \lambda n^* . \log(\gamma^t)$$

This states that economic growth between two periods, g_Y, is determined by

a. the marginal productivity of researchers, λ; and
b. the number of workers engaged in innovation and R&D activities at the steady state, n^*;
c. γ, which reflects the lift in existing productivity from one period to the next (by a factor of which is always greater than one) as a direct consequence of the use of new, innovative capital goods.

Empirically, economic growth between two periods can also be defined by equation (71),

$$g_Y = \sum_{i=1}^{n} \left(\frac{y_{i\,t+1} - y_{i\,t}}{Y_t} + \cdots + \frac{y_{n\,t+1} - y_{n\,t}}{Y_t} \right) \tag{71}$$

where:

y_i = output of defined sector i in the economy

n = total number of sectors in the economy

$y_i \subseteq Y$

Y = output of total economy

Equation (71) states that the growth in aggregate output between two periods is the sum of the weighted average output growth of the sectors within the economy. That is, the increase in output for each sector from period *t* to period *t+1* is divided by total increase in output for the economy and then summed.

Equation (72) below presents equation (71) in terms of a three-sector economy as per the Clark-Fisher model, being primary (P), secondary (S) and tertiary (T).

$$g_Y = \sum\left(\frac{y_{P\,t+1} - y_{P\,t}}{Y_t} + \frac{y_{S\,t+1} - y_{S\,t}}{Y_t} + \frac{y_{T\,t+1} - y_{T\,t}}{Y_t}\right) \tag{72}$$

By rearranging equation (72), then

$$\frac{y_{T\,t+1} - y_{T\,t}}{Y_t} = g_Y - \left(\frac{y_{P\,t+1} - y_{P\,t}}{Y_t} + \frac{y_{S\,t+1} - y_{S\,t}}{Y_t}\right)$$

Multiplying both sides by Y_t, then

$$\dot{y}_T = Y_t g_Y - \dot{y}_P - \dot{y}_S$$

and dividing both sides by y_{Tt}, then

$$\frac{\dot{y}_T}{y_{Tt}} = \left(\frac{Y_t g_Y - \dot{y}_P - \dot{y}_S}{y_{Tt}}\right)$$

Equation (73) below defines the growth rate of a sector of the economy in terms of aggregate output, growth in the remaining sectors, and the size of sector under consideration.

$$g_{y_T} = \left(\frac{Y_t g_Y - \dot{y}_P - \dot{y}_S}{y_{Tt}}\right) \tag{73}$$

if

$$g_{y_T} \subseteq g_Y$$

then,

$$\lambda n^*_{yT}.\log(\gamma^t_T) = \left(\frac{Y_t g_Y - \dot{y}_P - \dot{y}_S}{y_{Tt}}\right) \tag{74}$$

Equation (74) explicitly links sectoral R&D and innovation activities, the marginal productivity associated with those activities in that sector, and the proportion of workers engaged in R&D activities relative to the total sectoral workforce to the level of sectoral economic growth, which is equal to the residual between aggregate growth and growth achieved in the other defined sectors of the economy.

This equation therefore allows the concepts of sectoral "creative destruction" to be explicitly identified through empirically modelling the aggregate economy and individual sectors and isolating the unobservable terms, such as marginal productivity, within the equation.

3.5 Reflections on Post-Keynesian Growth Theories

Muzhani (2014) suggests it's necessary to ask the following questions to properly assess any theoretical model that describes the process of economic growth:

a. What are the reasons for, and factors that affect, economic growth?
b. Is it possible for an economy to have stable growth, such that:
    i. all markets are constantly adjusting towards equilibrium; and
    ii. development happens in a way to create no sectoral disequilibrium and inflationary pressures?
c. Why do real economies develop unsteadily, such that development is contingent on fluctuations correlated with accelerated growth alternated with stagnation and recession?

These qualitative questions augment the well-known "stylised facts" that Kaldor (1957) suggested represent the statistical qualities associated with long-term economic growth, being:

a. The shares of national income received by labour and capital are roughly constant over long periods of time.
b. The rate of growth of the capital stock per worker is roughly constant over long periods of time.
c. The rate of growth of output per worker is roughly constant over long periods of time.
d. The capital/output ratio is roughly constant over long periods of time.
e. The rate of return on investment is roughly constant over long periods of time.

f. There are appreciable variations (2% - 5%) in the rate of growth of labour productivity and of total output among countries.

It is on this framework that growth models can be critiqued. The following sections present arguments surrounding the veracity of these models in being able to properly explain economic growth.

3.5.1 Critique of the Neoclassical Solow-Swan Growth Model

Solow extended the Harrod-Domar model by, among other assumptions, adopting the hypothesis that the capital-output ratio varies to reflect the availability of labour and capital, with savings adjusting consequently. Solow also incorporated the concept of technological progress, which allows labour to become more productive over time as workers accumulate knowledge.

Neoclassical economists focused growth theories towards the concept of a steady state and considered how and why an economy would transition to this point if it is in an existing position of disequilibrium. This concept of steady state was defined by neoclassical economists where an economy experienced:

a. The rate of growth in real output per capita at a broadly constant rate over the long run;
b. The rate of growth in capital stock at, again, broadly a constant rate, but in excess of the rate of growth of labour input;
c. The rate of growth in real output broadly consistent with the rate of growth in the capital stock;
d. Consistent returns on capital, except where effective demand varies.
e. Profits as a proportion of total income also remains broadly consistent over the long run.

The Solow-Swan growth model has been challenged by various economists in terms of both theoretical underpinnings and consistency with empirical data. A failing of the model is the fact that the Solow residual does not properly explain productivity growth within an economy. Other arguments against the strength of the model have included:

a. Barro (1996) and Barro and Sala-i-Martin (2004) suggesting that the neoclassical model proposes that per capita growth should eventually stop if there is a lack of ongoing improvements in technology, despite long-run empirical data that many countries show continuous growth and the fact that meaningful investment in technical change cannot be maintained if technology is non-excludable and non-rivalrous.
b. The Cambridge School economists, particularly Robinson, Kaldor and Pasinetti, (Muzhani, 2014) raised several key issues, including:
    i. there is no investment function incorporating a required rate of return;
    ii. technical progress is not explained well, either in terms of its speed or direction;
    iii. externalities are ignored;
    iv. the assumption of diminishing returns to reproducible capital;
    v. the marginal productivity theory of distribution is “all nonsense”;
    vi. the capital-labour ratio is assumed to vary, despite in a practical sense it being normally bounded by interactions with technology; and
    vii. technical progress and capital deepening are interdependent, not independent of each other.
c. Sato, Ramachandran and Ping Lian (1999) believe the capital-labour ratio is not open to adjustment, but rather operates within a narrow range.
d. Eisner (1958) suggests that various theoretical difficulties associated Keynesian growth models remain within the Solow-Swan model, which makes its ability to work empirically limited.

In general, the development of neoclassical growth models, including the Solow-Swan model, attempted to explain the role technological innovation and advancement played in increasing per capita output. Technical progress was not defined in terms of skills development, learning-by-doing and product development, but rather presented as a fixed factor of production: that is, set exogenously. By having this element set outside of the model, these cohorts of models fail to properly explain the rate of growth of an economy.

3.5.2 Critique of the Endogenous Growth Models

The advancement of growth models during the 1960s focused on explaining how growth occurs within an economic system. Technical progress began to be linked to research and development activities within an economy, with "learning" and "knowledge" key components advocated by Arrow to explain how innovation ultimately drives productivity.

The AK approach has been able to explain observable growth rates of per capita GDP, whereas the neoclassical model struggles to translate its theoretical framework into empirical settings. Although empirically stronger, critics of the AK model say it cannot explain cross-country or cross-regional convergence. For example, Benhabib and Spiegel (1994) argue, based on cross-country panel data, that the countries that achieved the greatest growth in human capital in the 20 years between 1965 and 1985 did not achieve correspondingly high levels of economic growth. They also found from the panel data that the long-run growth for an individual country appears to be strongly related to the base level of human capital.

Other challenges within the AK model include its assumption regarding (a) factors of production being additive when in the real world some factors are fixed, such as land, and (b) the consistent treatment of human capital and physical capital, when there are distinct differences between these two forms of assets.

3.5.3 Critique of 'New Growth' Theories

The re-emergence of growth models as an area of research occurred during the 1980s. Romer (1990) presented a new model of economic growth that incorporated knowledge, which has the characteristic of increasing marginal productivity, as an input into the production process. The model includes concepts, backed by empirical analysis, including (a) increasing growth rates over time, (b) the role of private agents in the economy, and (c) differential growth rates between small and large countries.

Romer's model also incorporated positive spillover effects because of knowledge accumulation and ideas diffusing through the economy as workers move between positions. Zweynert notes that Romer's new growth theory model is closer to the concept proposed by Classical economist von Storch as it incorporates knowledge and skills as key factors influencing long-term development (Zweynert, 2004, p.545). However, Romer's model only incorporates "economically utilizable assets", while von Storch's internal goods include intangibles like health, aesthetics, morals and religion, which cannot fit into the new growth theory framework.

The innovation associated with Romer's model lies in how R&D activities promote growth within the economy via its ability to earn "guaranteed" monopoly rents for their inventor. Also, as knowledge is additive, new R&D builds on from previous innovations, which is reflected in the fact that the marginal cost of new innovation is a declining function.

Aghion and Howitt (1992) broadened this analysis by incorporating concepts that allow for the breadth and quality of goods to be extended through meaningful R&D and innovation activities. Through allowing for the concept of "creative destruction", Aghion and Howitt (1992) incorporated the real-world scenarios where new technology makes old technology obsolete, reducing the value of the capital associated with that told technology, eventually making it – and the companies that produce goods that utilise only that now dated technology – worthless.

These "new growth" theories recognise that R&D occurs as a profit maximising activity of private firms that can earn temporary rents from their inventions until their innovation becomes obsolete. This means that R&D is a discrete factor of production, and it is not undertaken unless there is the potential for a market return to be achieved on its expenditure.

Critics of these models have argued, not necessarily on various factors identified within them, but rather how these factors materialise themselves in practice. For example, Romer properly identified the diffusion of new knowledge generated in a firm from innovation creates positive spillover benefits throughout the economy, but not necessarily how this occurs. As knowledge diffusion and innovation spillovers are a core element of the Romer model, its lack of a detailed explanation leaves the model exposed, to some degree, to being empirically tested.

Further, the Aghion and Howitt (1992) model has been characterised as a "pure" endogenous growth model, and while it incorporates many elements that theoretically drive growth, it is not practical in the sense that it does not easily allow for specific policy recommendations. Rather, only broad policy directions such as enabling free trade, minimising taxation on income derived from capital goods, promoting education and directing government expenditure towards whole-of-economy infrastructure assets, can be inferred from these growth models.

In summary, it seems that as growth theories developed over the past 60 years the differences between exogenous and endogenous models appear to have diminished, with Muzhani (2014) suggesting that the latest versions of "new growth" models apply neoclassical frameworks but incorporate an explicit link between research and development activities and technology progress.

3.6 Models of Economic Growth and Structural Change

3.6.1 Introduction

Herrendorf, Rogerson and Valentinyi argue the one-sector growth model, regardless of the variation, is the "workhorse of modern macroeconomics" (Herrendorf, Rogerson and Valentinyi, 2014, p.855). Despite its clear importance to macroeconomic theory, the one-sector growth model abstracts the process of structural transformation[4], being the reallocation of economic activity across the three key sectors – agriculture, manufacturing, and services (or primary, secondary and tertiary) – that Herrendorf, Rogerson and Valentinyi highlight as being identified by Kuzents as "one of the six main features of modern economic growth" (Herrendorf, Rogerson and Valentinyi, 2014, p.855).

The one-sector growth models presented previously were primarily focused on achieving constant growth, or a constant value, in endogenous variables. This "balanced growth" outcome, by definition, is too narrow for a growth model to explain structural change. To overcome this problem researchers have proposed multi-sector growth models that seek a solution which only requires the real interest rate to remain constant, a so-called "generalised balanced growth path".

A review of literature reveals a number of examples of where researchers have sought to explain structural change by proposing economic growth models incorporating three goods and two (or more) factors of production. The following section presents several of these models, including those proposed by Kongsamut, Rebelo and Xie and Ngai and Pissardies, which are considered as representing two "extreme scenario[s]" along the spectrum of possible solutions (Herrendorf, Rogerson and Valentinyi, 2014, p.888, 890).

[4] Used interchangeably with the term 'structural change'

3.6.2 Three-Sector Economic Growth Models

Sonis, Azzoni and Hewings (2008a, 2008b) present a three-sector deterministic Euler-Malthus dynamic growth model and apply it to analysing the economy of Brazil in two studies, between 1985 and 2020 and 1947 and 2027 respectively. The basis of this model is a "classical population growth model", which calculates growth using simple average linear growth calculations between periods, and where the value for each sector is equal to the residual value between aggregate output and the sum of output of the remaining two sectors. It provides little explanation for the drivers of sectoral growth, and does not include elements common to the growth models examined previously in this chapter, including factors of production, productivity, profitability, technical change and innovation.

Kongsamut, Rebelo, and Xie (1997, 2001) presents a balanced growth model that seeks to allow for both Kaldor Facts and sectoral reallocation. This is discussed in the context on the empirical basis that "the US economy is often described as following a balanced growth path, that is, a trajectory along which all the relevant variables grow at a constant rate" (Kongsamut, Rebelo, and Xie, 1997, p.2).

The structural changes are allowed for in the model through the inclusion of three sectors of activity: agriculture, manufacturing and services. The key assumptions underlying the sectoral balanced growth ("SBG") model include:

a. It is a closed economy, with no international trade.
b. There are two factors of production, capital (K_t) and labour (L_t), and they are freely mobile across sectors.
c. The proportion of capital allocated to each sector is given by

$$\emptyset_t^A + \emptyset_t^M + \emptyset_t^S = 1$$

d. The proportion of labour allocated to each sector is given by

$$N_t^A + N_t^M + N_t^S = 1$$

e. Technical progress is labour augmenting, and is represented by the term X_t, and the rate of change of technical progress is constant, $\dot{X}_t = X_t g$

f. Given (b) above, the marginal rate of transformation for all three sectors equals one, and is given by

$$\frac{\emptyset_t^A}{N_t^A} = \frac{\emptyset_t^M}{N_t^M} = \frac{\emptyset_t^S}{N_t^S} = 1$$

g. Output of the agriculture (A_t) and services (S_t) sectors can be used for consumption, while the output of the manufacturing sector can be either consumed (M_t) or invested ($\dot{K}_t + \delta K_t$).

h. Individuals within the economy seek to maximise their utility in a manner consistent with the following function

$$U(Y) = \int_0^\infty e^{-\rho t} \frac{\left[(A_t - \bar{A})^\beta M_t^\gamma (S_t + \bar{S})^\theta\right]^{1-\sigma} - 1}{1 - \sigma} dt$$

Where

$\sigma, \beta, \gamma, \rho, \bar{A}, \bar{S} > 0$

$\beta + \gamma + \theta = 1$

$\bar{A}, \bar{S} =$ minimum output levels in agricultural (i.e.: subsistence consumption of agricultural output) and service sectors (i.e.: home production of services)

i. The utility preferences imply the income elasticity of demand, η_I, for each sector is

$\eta_{I\,A} < 1$

$\eta_{I\,M} = 1$

$\eta_{I\,S} > 1$

Which means, as income rises, households spend proportionally less on food, the same on manufactured products and more on services.

The production functions for the three sectors is given by:

$$A_t = B_A F(\emptyset_t^A K_t, N_t^A X_t)$$

$$M_t + (\dot{K}_t + \delta K_t) = B_M F(\emptyset_t^M K_t, N_t^M X_t) \tag{75}$$

$$S_t = B_S F(\emptyset_t^S K_t, N_t^S X_t)$$

where

B_A= (constant) returns to scale in the agriculture sector

B_M= (constant) returns to scale in the manufacturing sector

B_S= (constant) returns to scale in the services sector.

The price of each unit of output produced for the agriculture and services sector relative to the manufacturing sector is given by:

$$P_A = \frac{B_m}{B_A} \tag{76}$$

$$P_S = \frac{B_m}{B_S} \tag{77}$$

From equations (76) and (77), and explicitly allowing for the marginal rate of transformation assumption (i.e.: assumption (vi)), then equation 75 can be re-written as an economy-wide resource constraint

$$M_t + \left(\dot{K}_t + \delta K_t\right) + P_A A_t + P_S S_t = B_M F(K_t, X_t) \tag{78}$$

The real interest rate in the economy is determined by

$$r = B_M F_1(k, 1) - \delta \tag{79}$$

where

$$k = \frac{K}{X}$$

Competitive equilibrium in the economy is reached when equation 78 is maximised subject to the utility function, with the optimal consumption of agricultural and services output given, respectively, by

$$\frac{P_A(A_t - \bar{A})}{\beta} = \frac{M_t}{\gamma} \tag{80}$$

$$\frac{P_S(S_t + \bar{S})}{\theta} = \frac{M_t}{\gamma} \tag{81}$$

While the optimal path for the consumption of manufacturing products is given by

$$\frac{\dot{M}}{M} = \frac{r - \rho}{\sigma} \tag{82}$$

On the assumption that $\bar{A} = \bar{S} = 0$, which means economic production can be fully allocated to $M_t + (\dot{K}_t + \delta K_t)$, then, based on equation 78, balanced growth can be found when M_t, A_t, S_t and K_t expand at the rate of change of technical progress, g.

The steady state value of capital can be determined when equations 79 and 82 equate. That is, from equation 82,

$$\frac{\dot{M}}{M} = \frac{r - \rho}{\sigma}$$

$$g = \frac{r - \rho}{\sigma}$$

$$r = \sigma g + \rho$$

therefore

$$B_M F_1(k, 1) - \delta = \sigma g + \rho \tag{83}$$

Equation 83 reaffirms the position that for the economy to maintain a balanced growth path its rate of economic growth must be equal to the rate of change of technical growth, g.

However, Kongsamut, Rebelo and Xie recognise the conditions of the balanced growth path above, being $\bar{A} = \bar{S} = 0$ is unlikely, and that a solution for a generalised balanced growth path should also be identified. In considering a solution to this, Kongsamut, Rebelo and Xie started with the proposition that, based on equation 79, *k* must be constant if the real interest rate, *r*, is also to be constant. This proposition means an economy's resource constraint (equation 78) can be re-described as

$$M_t + \left(\dot{K}_t + \delta K_t\right) + P_A A_t + P_S S_t = B_M F(k,1) X_t \tag{84}$$

where

$$\frac{(B_M F(k,1) X_{t+1} - B_M F(k,1) X_t)}{B_M F(k,1) X_t} = g$$

and

$$\frac{M_{t+1} - M_t}{M_t} = \frac{\dot{K}_{t+1} - \dot{K}_t}{\dot{K}_t} = \frac{\delta K_{t+1} - \delta K_t}{\delta K_t} = g$$

but

$$\frac{\dot{A}_t}{A} \text{ and } \frac{\dot{S}_t}{S} \neq g$$

This suggests that expecting the real interest rate to be constant in situations of competitive equilibrium is not viable. However, to overcome this theoretical problem, Kongsamut, Rebelo, and Xie also imposed the following constraint, in order to achieve a generalised balanced growth path,

$$\bar{A} B_S = \bar{S} B_A$$

which implies

$$P_S \bar{S} - P_A \bar{A} = 0 \tag{85}$$

Equation 85 can be interpreted that each agent in the economy has an endowment of agricultural products and services of -$\bar{A}$ and $\bar{S}$ respectively, and that the market value of these endowments at prices P_A and P_S is equal.

Given this assumption, the economy's overall resource constraint (equation 84) can be re-written as

$$M_t + \left(\dot{K}_t + \delta K_t\right) + P_A(A_t - \bar{A}) + P_S(S_t + \bar{S}) = B_M F(k,1) X_t \tag{86}$$

The rate of growth in agricultural and services output can therefore be defined by

$$\frac{\dot{A}_t}{A} = g\ \frac{(A_t - \bar{A})}{A_t}$$

$$\frac{\dot{S}_t}{S} = g\ \frac{(S_t + \bar{S})}{S_t}$$

with the associated annual change in labour for each sector, subject to the maintenance of assumption vi), given by

$$\dot{N}_t^A = -g \frac{\bar{A}}{B_A F(k,1) X_t}$$

$$\dot{N}_t^M = 0$$

$$\dot{N}_t^S = g \frac{\bar{S}}{B_S F(k,1) X_t}$$

In summary, the purpose of this model is to explain how differing sectoral growth outcomes can still result in the economy achieving an overall balanced growth path consistent with Kaldor Facts.

A key insight in the model is the explicit assumption that income elasticity of demand for agriculture is below one ($\eta_{I\,A} < 1$) and for services is above one ($\eta_{I\,S} > 1$); which has implications for sectoral resource allocation, particularly at low income levels. However, with rising income, and fixed (positive) values for $\bar{S}$ and $\bar{A}$, the resource allocation effects become muted. This results in the aggregate economy converging to a standard balanced growth path, with constant (i) relative prices, (ii) aggregate labour share of income, (iii) growth rate for capital and (iv) aggregate output; and variable (i) growth rates and (ii) employment shares across the three sectors, consistent with Kuznets Facts.

Ngai and Pissardies (2007) present a multisector growth model that contrasts with the one proposed by Kongsamut, Rebvelo and Xie (2001), and in doing so they challenge the appropriateness of some of the restrictions imposed on preferences and technologies associated with parameters of the utility function in the SBG model. Those restrictions are relaxed within Ngai and Pissardies' multisector growth model (MGM), with the results suggesting that where there is low (below one) elasticity of substitution across final goods employment shifts to those sectors where there is low MFP growth (Ngai and Pissardies, 2007, p.429).

The key assumptions in the MGM model include:

a. There are m number of sectors within the economy.

b. Individuals within the economy seek to maximise their utility in a manner consistent with the following function

$$U(Y) = \int_0^\infty e^{-\rho t}\, \upsilon(c_1, \dots, c_m) dt \qquad (87)$$

where

$\rho > 0$

$c_i \geq 0$ (per capita consumption)

$\upsilon\,(\cdot) =$ is concave, satisfies the Inada conditions and has constant elasticities across goods and over time, as described by

$$\upsilon(c_1, \dots, c_m) = \frac{\phi(\cdot)^{1-\theta} - 1}{1 - \theta} \qquad (88)$$

and

$$\emptyset(\cdot) = \left(\sum_{i=1}^{m} \omega_i c_i^{(\varepsilon-1)}\right)^{\frac{\varepsilon}{\varepsilon-1}} \qquad (89)$$

where

$\theta, \varepsilon, \omega_i > 0$

$\sum \omega_i = 1$ = income elasticity of demand

ε = (constant) price elasticity of demand

c. The labour force, N, is exogenous and grows at rate v.

d. The aggregate capital stock, k, is endogenous and reflects the relative strength of the economy.

e. Labour and capital are freely mobile between sectors, with allocations of labour and capital between sectors governed by

$$\sum_{i=1}^{m} n_i = 1 \tag{90}$$

and

$$\sum_{i=1}^{m} n_i k_i = k \tag{91}$$

where

$n_i \geq 0$ (share of employment in sector i)

$k_i \geq 0$ (capital-labour ratio in sector i)

f. Sectors i= 1, … , m-1 produce consumption goods only, and the final sector m produces both final consumption and capital goods, so

$$c_i = \beta_i F^i(n_i k_i, n_i) \qquad \forall\, i \neq m \tag{92}$$

$$\dot{k} = \beta_m F^m(n_m k_m, n_m) - c_m - (\delta + v)k \tag{93}$$

where

$\delta =$ depreciation rate

β_i = (constant) returns to scale for industry i

β_m = (constant) returns to scale for industry m

g. Factors n_i and k_i are allocated across sectors under the following static efficiency conditions, which also results in the rates of return to labour and capital being equal across sectors

$$\frac{v_i}{v_m} = \frac{F_K^m}{F_K^i} = \frac{F_N^m}{F_N^i} \; \forall \; i \tag{94}$$

where

F_N^i= marginal product of labour in sector *i*

F_K^i= marginal product of capital in sector *i*

h. Output is allocated for either consumption or capital accumulation through a dynamic efficiency condition

$$-\frac{\dot{v}_m}{v_m} = F_k^m - (\delta + \rho + v) \tag{95}$$

i. Production functions are identical across sectors, with the exception of multifactor productivity (MFP) growth rates.

$$F^i = A_i F(n_i k_i, n_i) \forall \; i \tag{96}$$

where

$$\frac{\dot{A}}{A} = \gamma_i$$

It can be shown that if

$$f(k) = F(k, 1) \tag{97}$$

then from equation 96

$$F_K = A_i f(k) \tag{98}$$

and

$$F_N = A_i[f(k) - kf'(k)] \tag{99}$$

so

$$\frac{F_N}{F_K} = \frac{f(k)}{f'(k) - k} \tag{100}$$

Therefore, from equation 94

$$k_i = k_m \qquad\qquad \forall\ i\ \neq m \tag{101}$$

and given equations 90 and 91, then

$$k_i = k \tag{102}$$

and

$$\frac{p_i}{p_m} = \frac{v_i}{v_m} = \frac{A_m}{A_i} \tag{103}$$

where

p_i = price of good *i*

From all the assumptions above, Ngai and Pissardies show

$$\frac{p_i c_i}{p_m c_m} = \left(\frac{\omega_i}{\omega_m}\right)^{\varepsilon} \left(\frac{A_m}{A_i}\right)^{1-\varepsilon} \equiv x_i\ \forall i \tag{104}$$

which states that the ratio of consumption expenditure of good *i* to consumption expenditure on the manufacturing good is equal to the weighted average of the ratio of the weight of each good in the utility function and their relative prices (Ngai and Pissardies, 2007, p.431). Also, a higher price ratio $\frac{p_i}{p_m}$ will increase the expenditure on good *i* relative to good *m* by an amount equal to one minus the common price elasticity of demand, 1-ε.

It is also possible to define aggregate consumption expenditure and output per capita in terms of the manufacturing sector, being

$$c \equiv \sum_{i=1}^{m} \frac{p_i}{p_m} c_i \tag{105}$$

and

$$y \equiv \sum_{i=1}^{m} \frac{p_i}{p_m} F^i \tag{106}$$

and given the static efficiency conditions, as per equation (94), then

$$c = c_m X \tag{107}$$

and

$$y = A_m F(k, 1) \tag{108}$$

where

$$X \equiv \sum_{i=1}^{m} x_i \tag{109}$$

Ngai and Pissarides (2007) then explain how structural change, defined as the state in which some of the labour shares are changing over time for some sectors, can be evaluated under the MGM (Ngai and Pissarides, 2007, p.431). Labour shares for each industry are defined by

$$n_i = \frac{x_i}{X}\left(\frac{c}{y}\right) \tag{110}$$

and

$$n_m = \frac{x_m}{X}\left(\frac{c}{y}\right) + \left(1 - \frac{c}{y}\right) \tag{111}$$

These two equations show that the employment share to produce all the consumption goods and capital goods demanded within the economy is given by $\frac{c}{y}$ and $\left(1-\frac{c}{y}\right)$ respectively. From equations 104, 106, 107 and 108, the share of employment allocated to produce consumption good *i* reflects good *i*'s share of overall consumption multiplied by the share of total employment allocated to produce consumption goods. This calculation is also equal to the average propensity to consume good *i*, which is given by

$$n_i = \frac{p_i c_i}{p_m y} \tag{112}$$

From equation 110 it can also be shown that the relative difference in employment growth between sectors is due to the different MFP growth rates and the elasticity of substitution between the two goods. That is,

$$\frac{\dot{n}_i}{n_i} - \frac{\dot{n}_j}{n_j} = (1-\varepsilon)\left(\gamma_j - \gamma_i\right) \ \forall\, i,j \neq m \tag{113}$$

However, from equations 96 and 103,

$$\frac{\dot{p}_i}{p_i} - \frac{\dot{p}_j}{p_j} = \left(\gamma_j - \gamma_i\right) \ \forall\, i \tag{114}$$

so equation 113 then becomes

$$\frac{\dot{n}_i}{n_i} - \frac{\dot{n}_j}{n_j} = (1-\varepsilon)\left(\frac{\dot{p}_i}{p_i} - \frac{\dot{p}_j}{p_j}\right) \ \forall\, i,j \neq m \tag{115}$$

Equation 115 proposes the rate of change of the relative price of good *i* to good *j* is equal to the difference between the MFP growth rates of sector *j* and *i*, and in sectors producing only consumption goods, relative employment shares grow in proportion to relative prices, with the factor of proportionality given by one minus the elasticity of substitution between goods (Ngai and Pissarides, 2007, p.432).

For manufacturing, this relationship between prices, MFP and the elasticity of substitution is more complex as its allocation of employment shares is split between the production of consumption goods and capital goods. To account for this difference, Ngai and Pissarides proposed equation 116 to calculate structural change within the manufacturing sector.

$$\frac{\dot{n}_m}{n_m} = \left[\frac{\bar{c}/y}{c/y} + (1 - \varepsilon)(\gamma \quad - \gamma_m)\right] \times \frac{(c/y)(x_m/X)}{n_m} + \left(\frac{-\bar{c}/y}{1 - c/y}\right)\left(\frac{1 - c/y}{n_m}\right) \tag{116}$$

where $\bar{\gamma}$ represents the economy-wide weighted average MFP growth rate, with weights given by each consumption good's share of total consumption. Formally, it is identified by

$$\bar{\gamma} \equiv \sum_{i=1}^{m} \frac{x_i}{X} \gamma_i \tag{117}$$

The combination of equations 115 and 116 allow Ngai and Pissarides to suggest the following:

a. If MFP is the same for the consumption good sector and the manufacturing good sector, a necessary and sufficient condition for structural change is that the rate of change in consumption expenditure is different from the rate of change in output per capita; and

b. If the rate of change in consumption expenditure is the same as the rate of change in output per capita, a necessary and sufficient condition for structural change is a non-unitary elasticity of substitution for sectors *i* = (1, …, *m*-1). On a sector pairs basis, if $\varepsilon < 1$, then employment moves from the sector with high MFP to the sector with low MFP, or if $\varepsilon > 1$, then employment moves from the sector with low MFP to the sector with high MFP (Ngai and Pissarides, 2007, p.433).

While an economy may be experiencing structural change, its ultimate goal of achieving a steady state requires it to follow a balanced growth path, consistent with Kaldor Facts, which necessitates aggregate output, consumption and capital to grow at the same rate (Ngai and Pissarides, 2007, pp. 433-434). To evaluate this, it is necessary to redefine the production function previously presented in equation 92 in the form of a Cobb-Douglas production function,

$$F(n_i k_i, n_i) = k^{\alpha} n_i \tag{118}$$

where

$$\alpha \in (0,1)$$

With the above redefined production function, the path to equilibrium for *c* and *k* within the aggregate economy is one which satisfies the following two differential equations, 119 and 120.

$$\frac{\dot{k}}{k} = A_m k^{\alpha-1} - \frac{c}{k} - (\delta + v) \tag{119}$$

$$\theta \frac{\dot{c}}{c} = (\theta - 1)(\gamma_m - \bar{\gamma}) + \alpha A_m k^{\alpha-1} - (\delta + \rho + v) \tag{120}$$

For a balanced growth path $(\theta - 1)(\gamma_m - \bar{\gamma})$ is required to be constant. So, if

$$(\theta - 1)(\gamma_m - \bar{\gamma}) = \psi \tag{121}$$

and aggregate consumption and capital-labour ratio is defined in terms of efficiency units, such as

$$c_e \equiv c A_m^{-\frac{1}{(1-\alpha)}} \tag{122}$$

$$k_e \equiv k A_m^{-\frac{1}{(1-\alpha)}} \tag{123}$$

and the rate of labour-augmenting technological growth in the capital producing sector is given by

$$g_m \equiv \frac{\gamma_m}{(1-\alpha)} \tag{124}$$

then equations 119 and 120 become

$$\dot{k}_e = k_e^{\alpha} - c_e - (g_m + \delta + v)k_e \tag{125}$$

$$\frac{\dot{c}_e}{c_e} = \frac{[\alpha A_m k^{\alpha-1} + \psi - (\delta + \rho + v)]}{\theta} - g_m \tag{126}$$

Equations 125 and 126 reveal that, different from each sector's employment shares, once the economy is on the aggregate balanced growth path, output and consumption in each consumption sector grow according to

$$\frac{\dot{F}^i}{F^i} = \frac{\dot{A}_i}{A_i} + \alpha \frac{\dot{k}_i}{k_i} + \frac{\dot{n}_i}{n_i} \tag{127}$$

which equals

$$\frac{\dot{F}^i}{F^i} = \varepsilon\gamma_i + \alpha g_m + \ (1-\varepsilon)\bar{\gamma} \tag{128}$$

From equation 128 it can be shown that if the elasticity of substitution is equal to or less than one, $\varepsilon \ \leq 1$, then the rate of growth of consumption and output of each sector is positive, which means the sector never ceases to exist, even though their employment shares reduce to something close to zero (Ngai and Pissarides, 2007, pp. 435-436).

Ngai and Pissarides conclude their model exhibits characteristics consistent with empirical analysis produced by Kuznets (1966) and Maddison (1982) which revealed a decline in agriculture's employment share, the rise and then fall of the manufacturing sector, and the rise of the services sector (Ngai and Pissarides, 2007, p. 438). That is, the MGM model proposes that sectoral employment changes reflect different MFP growth rates across sectors, given that the substitutability of final goods between sectors is low. Further, employment tends to shift away from sectors with high rates of technological progress to sectors with low rates of technological progress (Ngai and Pissarides, 2007, p.438).

3.6.3 Critique of Three-Sector Growth Models

The recognition that economic activity and employment growth have been evolving consistent with the three-sector growth model theory originally proposed by Fisher, Clark and Fourastié and empirically tested by Kuznets has led researchers to propose growth models that seek to explain the dynamic behaviour of an economy with more than one sector. However, any multisector growth model needs to marry Kaldor's and Kuznet's facts so that sector prices, economic growth and structural change are framed together dynamically.

Kongsamut, Rebelo, and Xie (1997, 2001) put forward a three-sector model where structural change occurs due to non-homothetic consumer preferences (Muro, 2017, p.407). The model includes a constraint that each agent in the economy has an endowment of agricultural products and services whose market value is equal, which creates the potential for a balanced growth path along which the real interest rate remains constant. Muro (2017) suggests this balanced growth path condition involves an unstable "knife-edge" condition which diminishes the explanatory value of the proposed model, and that a price-unit cost equalisation condition does not allow individual prices for agriculture goods and services. Herrendorf, Rogerson and Valentinyi also note that the model can approximate the decrease and increase in shares of value-added activity for agriculture and services respectively, but it cannot formulate a "hump-shape" for the economic measures associated with the manufacturing sector (Herrendorf, Rogerson and Valentinyi, 2014, p.892). Other problems include a difficulty in accounting for variances in nominal and real measures, and an implied expectation that economies with very low income households will consume little or no services and employ few or no workers in the services sector (Herrendorf, Rogerson and Valentinyi, 2014, p.893).

In contrast to this income-elasticity explanation, Ngai and Pissarides (2007) proposed a structural change model based on differences in MFP growth rates between sectors and the elasticity of substitution of products (Mao and Yao, 2012, p.30). The model proposed by Ngai and Pissarides mimics Baumol's (1967) "cost disease" findings, being factors move to those sectors with the slowest productivity growth given a low elasticity of substitution across products. Herrendorf, Rogerson and Valentinyi recognise that the Ngai and Pissarides model can account for shifts in the nominal relative importance of the agriculture and services sector, and while not producing a "hump-shape" result for employment and value-added shares for manufacturing, it can do so (albeit not guaranteed) for nominal consumption-based measures (Herrendorf, Rogerson and Valentinyi, 2014, p.893). However, a problem was still found to exist for the use of this model in estimating behaviour using real measures (Herrendorf, Rogerson and Valentinyi, 2014, p.893).

While the theory underpinning multisector economic growth models has continued to improve and develop since Kongsamut, Rebelo, and Xie's (relatively) early works, it appears that most models find it challenging to replicate the "hump-shaped" structural change associated with the evolution of the manufacturing or secondary sector.

3.7 Conclusions

Theoretical models seeking to explain the forces behind economic growth have been proposed by various academic thinkers for centuries, although the modern constructs that try to better understand the basis of macroeconomic shocks and the determinants of stable economic growth emerged following the Great Depression.

A discussion on the progression of growth theory and the formal models that mathematically explain those theories has been presented in this chapter. The rate of savings, technical change, increasing returns to scale, the elasticity of substitution between inputs, the elasticity of output with respect to capital, and the volume of research and development activities and employment are but a few of the key elements theorists such as Harrod, Domar, Solow, Swan, Romer, Aghion and Howitt have identified as playing a pivotal role in explaining how and why growth occurs within an economy.

Growth theories have been extended by some economists to try to explain not only how the aggregate economy expands and contracts, but also what drives different sectors within the economy to expand and contract at different rates. Of the sectoral growth models presented in this thesis the Multi-Sector Growth Model (MGM) proposed by Ngai and Pissarides appears to be able to reach conclusions that are consistent with theories proposed by other leading economists, including Baumol's "cost disease" hypothesis.

The MGM model proposes that sectoral employment changes reflect different MFP growth rates across sectors, given the substitutability of final goods between sectors is low. Also, employment tends to shift away from sectors with high rates of technological progress to sectors with low rates of technological progress (Ngai and Pissarides, 2007, p.438).

The significance of this conclusion should not be understated. It is consistent with the body of theory presented in Chapter 2 of this thesis and reinforces Krugman's message about the importance of productivity for an economy's long-run growth outcomes. Further, the measurement challenges surrounding the proper valuation of services sector output, and hence the ability to correctly calculate sectoral productivity, becomes a practical issue in being able to empirically test the MGM model with accurate, actual macroeconomic data.

Chapter 4 The Role of the Services Sector in the Australian Economy since Post-European Settlement

4.1 Introduction

The Australian economy has evolved in the period of post-European settlement to be a diverse modern economy. The services sector in Australia has grown in importance in recent decades due to a combination of demand and supply factors, consistent with the so-called "tertiarisation" of many other western economies (OECD, 2015, p.10).

Before comparing the services sector in Australia with that in other jurisdictions it is important to understand how the structure of the Australian economy has evolved over time, the relative importance of the different sectors within the economy and why those relativities have changed. The purpose of this chapter is to provide a background on the structure of the Australian economy for the period 1795 onwards.

4.1.1 Sources of Data

4.1.1.1 Introduction

The statistical data presented in this chapter have come from various sources, including the Australian Bureau of Statistics (ABS), the Reserve Bank of Australia (RBA) and various economic historians including Angus Maddison, Noel Butlin, William Sinclair, Matthew Butlin, Brian Haig, Diane Hutchinson and Florian Ploeckl, who have researched the performance of the Australian economy since European settlement.

Despite a breadth of information sources available, "there is no strictly comparable and continuous set of national accounts for Australia before and after 1949 published by the ABS" (McLean, 2005, p.418). As there is no reliable information source for the period between 1949 and 1963, data on industry gross value added for each sector has been interpolated based on data on the number of people employed by sector and estimates of sectoral real gross value added per employee[5].

[5] $GDP_{iYr\,(1939+n)} = \frac{rGVApEmp_{i\,Yr1963} - rGVApEmp_{i\,Yr1939}}{1963-1939} \times Emp_{i\,Yr1939+n}$

The purpose of the analysis shown in Section 4.2 is to present trends in the composition of economic output in Australia since European settlement. In order to enable a consistent comparison of the structure of the Australian economy, the author has developed a composite time series for the period 1795 to 2016. Given the challenges each economic historian has documented in their own studies regarding access to, and inclusion of, direct data, individual data points utilised in this analysis (specifically prior to 1975) should be considered as approximations. In order to manage any imprecision associated with the linking of discontinuous datasets, shares of output by sector are presented as 5-year moving averages in Figures 4.2 to 4.6. A full explanation of the information sources utilised by the author for each period in the estimation of a continuous timeseries dataset is presented in section 4.1.2 below.

4.1.1.2 Treatment of Dwelling Services in GDP for this Thesis

The ABS calculates GDP using three different methods: by expenditure, by income and by production. In theory each of these methods should estimate the same value for GDP. In practice, however, there are differences in the value of GDP estimated under each approach, reflecting calculation errors, timing differences in estimation of inventories, etc. (ABS, 2013).

In the production approach for calculating GDP, gross value added (GVA) for businesses, households, government and not-for-profit organisations is estimated through the use of surveys. An imputed value for dwelling services is also added to enable the services provided by dwellings to owner-occupier households to be treated consistently with the marketed services provided by rented dwellings to their tenants (ABS, 2013). Industry gross value added (IGVA) represents the value of output produced within each industry sector minus the value of intermediate inputs consumed during the production process.

It appears that different researchers have taken different approaches in analysing the relative importance of the services sector in the Australian economy through their treatment of dwelling services, taxes less subsidies and the statistical discrepancy in calculating GDP. Since

$$GDP(P) = IGVA + Dwelling\ Services + Taxes\ less\ subsidies + Statistical\ discrepancy$$

some researchers have included dwelling services in estimating the value of the services sector in the Australian economy, while some have not, but most appear to exclude taxes less subsidies and the statistical discrepancy (McCredie et al., 2010).

The Commonwealth Government excludes dwelling services in their definition of the services sector, while the peak industry body for the services sector in Australia, the Australian Service Roundtable (ACIL Tasman and Australian Services Roundtable, 2010), includes dwelling services in their estimates of the value of the sector in the domestic economy.

In the historical analysis section of this Chapter (section 4.2), the services sector will implicitly include dwelling services, taxes less subsidies and the statistical discrepancy as the value of this sector is calculated as the residual of aggregate GDP less the combined value of the primary and secondary sector. This approach has been adopted due to data availability and the fact that the purpose of this part of the thesis is to discuss the influences impacting sectoral growth in the Australian economy rather than interrogating the veracity of any individual data point.

In the next section (4.3), a more precise approach to estimating the value of the services sector is adopted, consistent with the methodology employed by the Commonwealth Government, as the statistical data from the ABS allows IGVA to be calculated and dwelling services, taxes less subsidies and the statistical discrepancy to be excluded. This approach also allows a consistency in comparing data in Chapter 6, which is also based on an IGVA approach.

4.1.2 Summary of Data Sets

The following datasets were utilised in establishing a composite timeseries of GDP by sector.

Title: Australian National Accounts, 1788 – 1983, Source Paper No.6, November 1985, The Australian National University *Author: Noel Butlin*			
1788	-	1860	*Table 1* Australian Total Gross Domestic Product 1788 to 1860 (Pounds Thousands), Current Prices
1861	-	1938/39	*Table 9* Industrial Subdivision, Gross Domestic Product, 1861 to 1938/39, Constant 1910/11 Prices (Pounds Millions)
1962/63	-	1981/82	*Table 35* Gross Domestic Product at Constant Prices by Industry, 1962/63 to 1981/82

Title: Annual Estimates of Gross Domestic Product, Australian Colonies/States, 1861-1976/77 *Author: W.A Sinclair*			
1861	-	1938/39	Annual estimates of GDP in current prices and GDP in constant prices by industrial sector and shares of industrial sectors in GDP in current prices.
1939/40	-	1948/49	
1948/49	-	1976/77	

Title: Historical Statistics of the World Economy: 1 – 2008AD *http://www.ggdc.net/maddison/oriindex.htm* *Author: Angus Maddison*			
1820	-	2008	Real GDP in 1990 International GK$

Title: What Was the Australian GDP or CPI Then? 2017 *https://www.measuringworth.com/datasets/australiadata/* *Author: Diane Hutchinson and Florian Ploeckl*			
1828	-	2016	Real GDP in $2010

Title: Australian Economic Statistics, 1949-50 to 1996-97 *Author: Reserve Bank of Australia*			
1974/75	-	1995/96	*Table 5.10* Gross Domestic Product at Constant Prices by Industry ($millions at average 1989/90 prices)

Title: Australian System of National Accounts, Catalogue No. 5204.0 *Author: Australian Bureau of Statistics*			
1974/75	-	2016/17	*Table 5* Gross Value Added by Industry, Chain Volume Measures

Title: Australian Historical Population Statistics, 2014, Catalogue No. 3105.0.65.001 *Author: Australian Bureau of Statistics*			
1788	-	2010	*Table 1.1* Population by Sex, State and Territories, 31 December

Title: Australian Demographic Statistics, March 2017 edn, Catalogue No. 3101.0 *Author: Australian Bureau of Statistics*			
1981	-	2017	*Table 4* Estimated Resident Population, States and Territories (number)

4.2 A Brief Economic History of Australia since European Settlement

4.2.1 Introduction

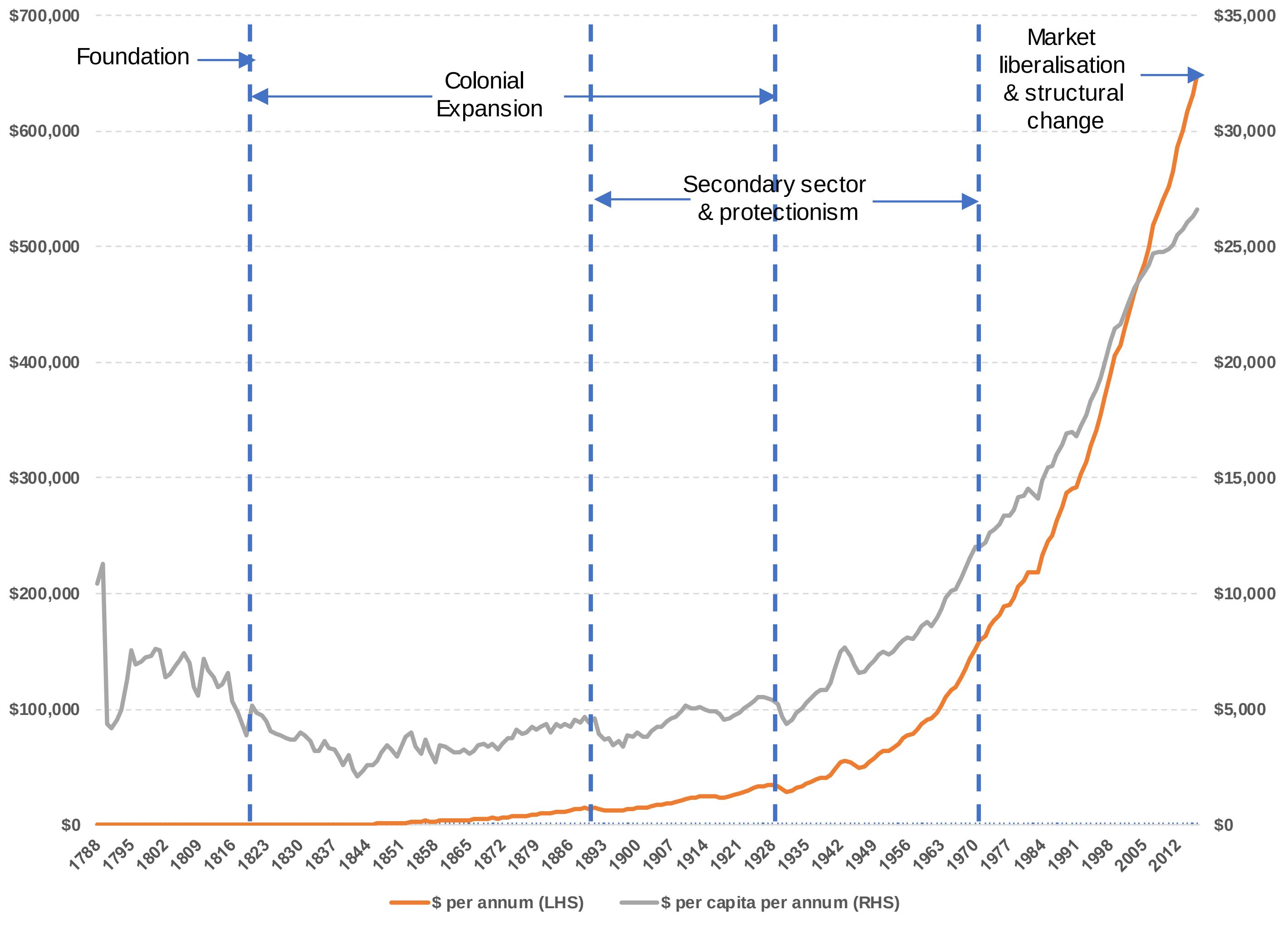
The history of European settlement in Australia presents a strong picture of economic development. It enjoyed the highest standard of living in the world in 1852, as measured on a GDP per capita basis (Greasley, 2015, p.159). Unfortunately, its fortunes reversed over the next century, experiencing the lowest rates of growth in real per capita GDP in the developed world between 1870 and 1990, due in part to high levels of debt and low productivity in the manufacturing sector (Greasley and Oxley, 1997, p.39; Madsen, 2015, p.33).

The *Clark-Fisher-Fourastié* three sector model of economic development, as presented in Chapter 2, shows economies follow a pattern of growth in which the primary sector's shares of GDP and employment decline at the same time the industrial sector grows, while eventually the services sector rises to represent the largest part of the economy. Anderson (2017) shows these "normal" patterns of development have been disturbed when Australia has experienced extraordinary international Terms of Trade and "booms" in natural resource markets, although government's intervention through protectionism policies associated with imports also influenced the natural sectoral balance in the domestic economy (Anderson, 2017, p.4).

Attard (2008) presents a useful way of considering Australia's economic history since European settlement by separating it into four distinct time periods: (i) the foundation period up to 1820, (ii) the colonial economy period between 1820 and 1930, (iii) the rise of the secondary sector and protectionism between 1890 and 1972, and (iv) the period of market liberalisation and structural change since 1973 (Attard, 2008, p.1). The following analysis adopts these same time periods and discusses major themes and influences driving the Australian economy during each of these intervals.

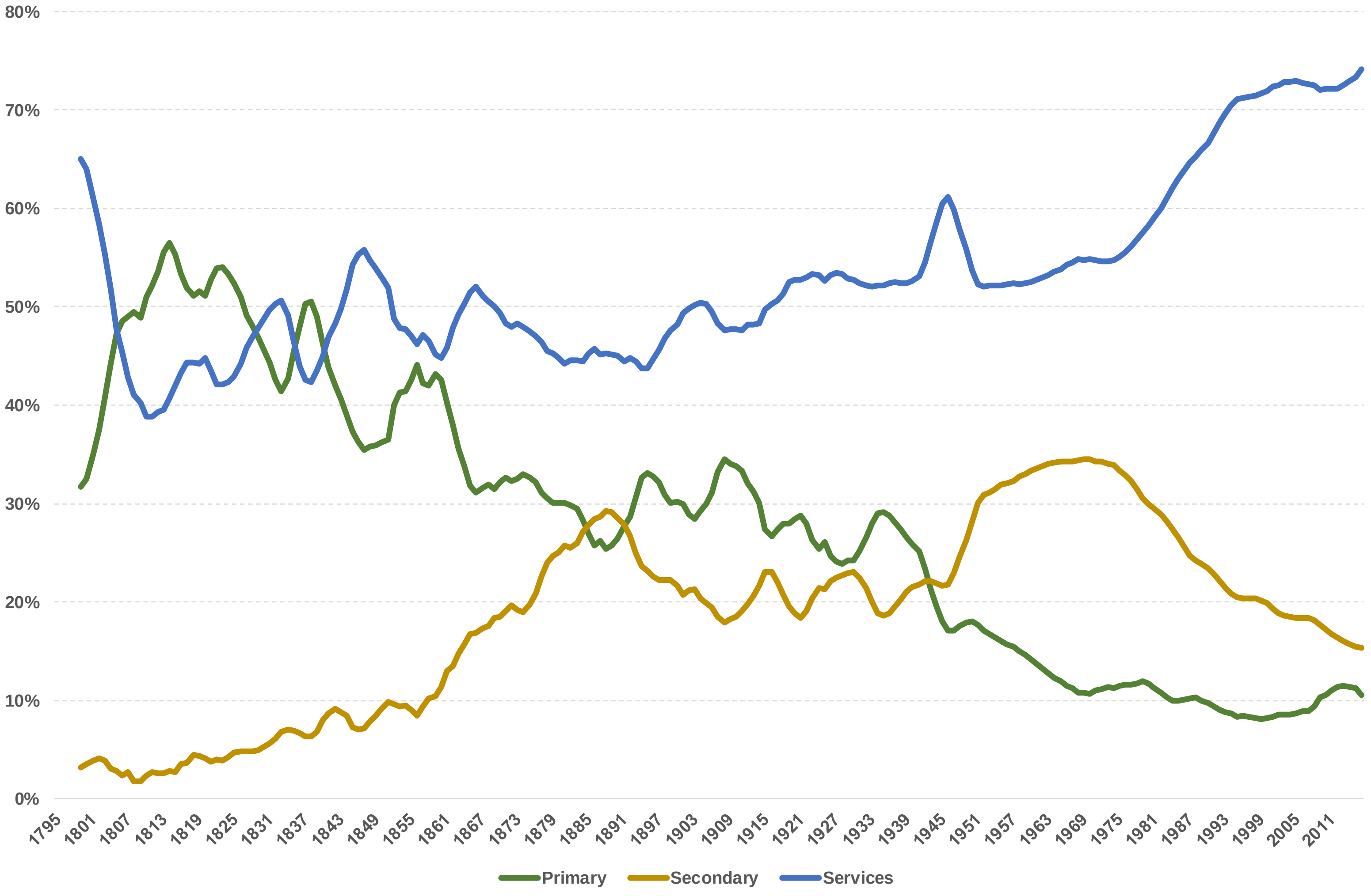
Figures 4.1 and 4.2 present, as a continuous time series, Australia's real GDP over this period, both in aggregate terms and on a per-capita basis and the distribution of economic activity by three sectors, primary, secondary and services on a five-year moving average basis.   Appendix B contains the dataset for these charts.

Figure 4.1
Australian Real GDP, Total and Per Capita (1990, Int. GK$)



Source: Author's calculations

Figure 4.2
Proportion of GDP by Sector, Five-Year Moving Average, Australia, 1795-2016



Source: Author's calculations

4.2.2 The Foundation Years, 1788 - 1820

Meredith and Oxley argue the *Transportation Act 1718* facilitated the equivalent of "Britain's 'offshore solution' '' (Meredith and Oxley, 2015, p.98). The Act incorporated provisions for "royal mercy" which allowed the death sentence, which was in place in Britain's justice system as punishment for committing a felony, to be commuted to penal exile for a fixed period of time.

Transportation of convicts to British colonial settlements in North America ceased with the commencement of the American War of Independence (Emesley, Hitchcock and Shoemaker, 2015; Jackson, 1998, p.9). This cessation of transportation of convicts prompted the convening of a Parliamentary Inquiry to determine where to transport offenders, with Lord Sydney suggesting during the Inquiry the establishment of a convict colony in a settlement in New South Wales (Egerton, 1897, p.262).

Butlin (1987, p.221) argued the establishment of the penal settlement at Botany Bay was a "project at least as risky as modern efforts to send a man to the moon". From the outset the production of fresh food was the highest priority for the new settlement (Anderson, 2017, p.9; Greasley, 2015, p.152) given the alternative, being the continued importing of food supplies, would have been a prohibitive expensive that the British Government could not have sustained (Jackson, 1998, p.4).

Despite the risks and logistical challenges, the settlement at Sydney Cove began to prosper, aided by large payments from the British Government. The post-European settlement of Australia was developed initially as a "command economy", but a "parallel market economy" emerged quickly with activity occurring in the farming, manufacturing, fishing (including whaling and sealing) and services sectors (Maddock, 2015, p.267; Boot, 1998, p.74; Maddock and McLean, 1987, p.8).

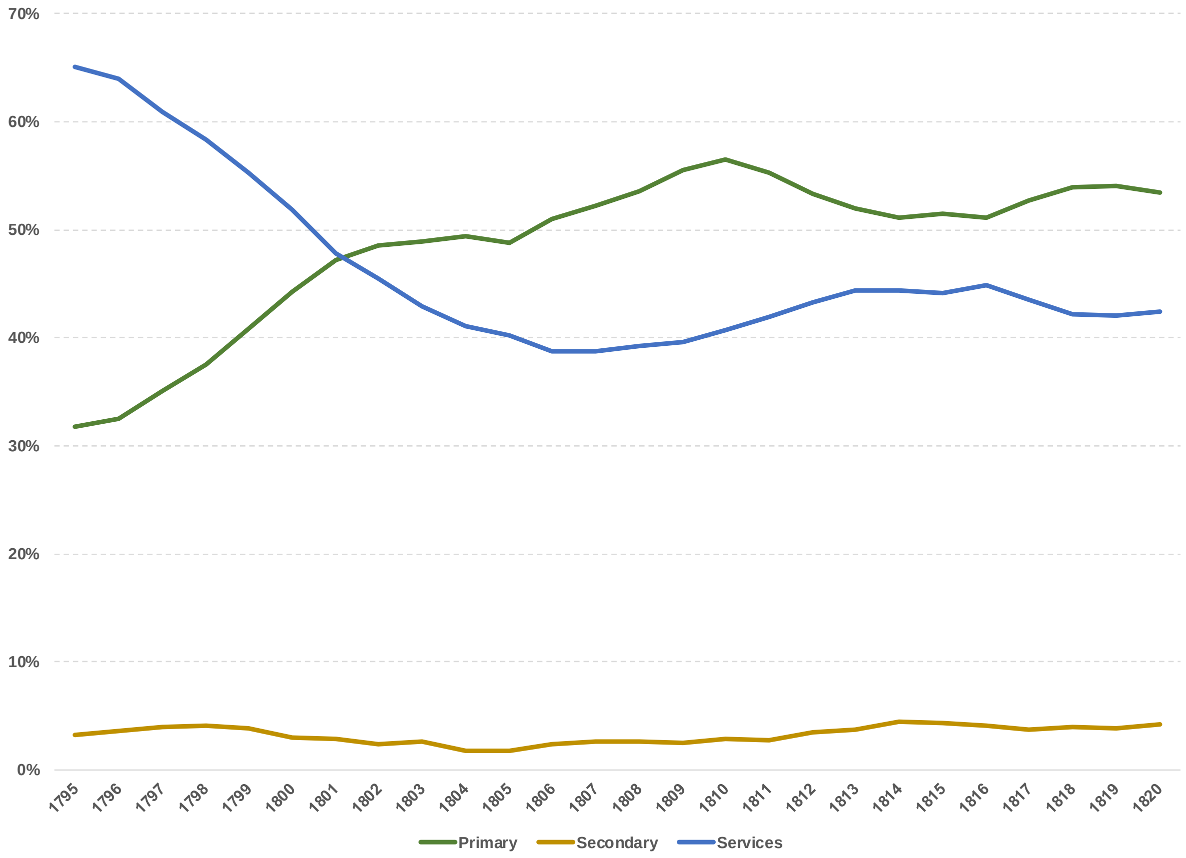
While in these early years of economic development society relied on the Government Commissariat to provide goods and currency, the recognition of property rights (consistent with the legal system in the United Kingdom) facilitated the establishment and functioning of markets for labour, goods and services (Attard, 2008, p.1; Jackson, 1998, p.11). Jackson also notes that throughout the early period of post-European settlement, government policies on the conditions of access to land, capital spending, and assisted immigration had a dominant influence on how the local economy developed (Jackson, 1998, p.10).

The arrival of Lachlan Macquarie as Governor of New South Wales in late 1809 coincided with an increase in the number of convicts being transported to the colony from England, which resulted in a rise in the relative share of spending and employment by the public sector in the local economy. Macquarie also focused on town planning, the provision of social services, including roads, schools, hospitals, churches, and accommodation for convicts, and to the administration of the law (Boot, 1998, p81).

In the period before the discovery of mineral resources, there was an absence of a staple export commodity despite efforts to develop trading industries in sealing, whaling, pork and sandalwood. This lack of export industry also created a balance of payments problem for the colony through the shortage of sterling for internal trading and importing. Anderson suggests that at this early stage of the development of the colony its international competitiveness would have been strong in non-perishable agricultural products that were not labour-intensive in their production and which also had a high price per tonne (given the high cost of transport to European markets in Europe) (Anderson, 2017, p.8). Wool production, which would have met these two criteria proposed by Anderson, did not develop as an industry until grazing lands were "discovered" away from the coastal area following the crossing of the Blue Mountains in 1813 (Jackson, 1998, p.3-4) and it did not emerge as a permanent staple export until the 1830s (Ville, 1998, p. 25; Frost, 2015, p.248).

It was not until the end of the Napoleonic Wars that the British Government started to pay greater attention to the new colony in Australia and this coincided with an increasing crime rate in Britain and a corresponding increase in the number of convicts transported to Australia (Meredith and Oxley, 2015, p.99). Funding the new colony was the responsibility of a number of different government departments, and it was only after 1815 that Treasury and the British Parliament focused attention on the revenues and expenditures of the colony (Young, 1961, p.12).

Figure 4.3
Proportion of GDP by Sector, Five-Year Moving Average, Australia, 1795-1820



Source: Author's calculations

Figure 4.3 shows annual GDP by sector as a proportion of aggregate GDP for Australia as identified by Butlin and Sinclair (1986). Consistent with the commentary above, this analysis shows that as the new settlement established itself, economic activity expanded from the initial public service activities (associated with founding the penal settlement) to a more diverse, albeit still insecure, economy. Estimates of national economic activity compiled by Butlin and Sinclair (1986) show the primary sector played a dominant role in the domestic economy for much of the 19^{th} and 20^{th} centuries, with data indicating it represented about one-third of GDP in 1795, rising to about 60 per cent of national output in 1810.

The economic contribution of the secondary sector to the early Australian economy was negligible for the first three decades, with key industries in the sector being manufacturing, ship building and construction, and these were dependent on inefficient and inconsistent supply chains, which limited their ability to deliver output in a reliable and timely manner.

Even from the earliest period of European settlement in Australia the services sector played a significant role in the structure of the domestic economy. Value added associated with commercial, personal and real estate services amounted to about £26,900 in 1795, representing about one-third of Australia's GDP for that year.

GDP per capita in the foundation period has highly volatile, swinging from a peak in the first two years of settlement, and then halving the following year. The cause of these swings was not an economic collapse of the early settlement, but rather the change in the population as a consequence of new arrivals to the colony. For example, the Second Fleet arrived in 1790 and the Third Fleet arrived a year later, which resulted in an annual population increase of about 220 per cent and 90 per cent respectively for those two years. This population growth effect on real GDP per capita was even more pronounced during the period 1810 and 1820, when the Australian colony grew from 11,500 to 33,500 residents.

At the end of the Napoleonic Wars there were few prospects for officers and soldiers to stay within the British Army as its personnel were being shed and wages were being applied at "half pay", while the prospect of finding employment in the private sector was also remote as the British economy was in a depression from which it would not emerge until 1821. These factors made the thought of migration to New South Wales appealing, and as such, a significant proportion of this population growth of this period was former British soldiers (Wright, 2011).

Madsen also suggests the volatility in per-capita income was due to limited factor and product markets, and a lack of an ability to achieve economies of scale in any productive processes (Madsen, 2015, p.32).

4.2.3 The Colonial Expansion Years, 1820-1930

In 1820 the Australian colony, from an economic perspective, was limited to a "narrow coastal strip of New South Wales" (Greasley, 2015, p.152). It then expanded to include settlements in Van Diemen's Land in 1825 (renamed Tasmania in 1856), Western Australia in 1829, South Australia in 1836, Victoria in 1851 and Queensland in 1859 (Attard, 1998, p.4).

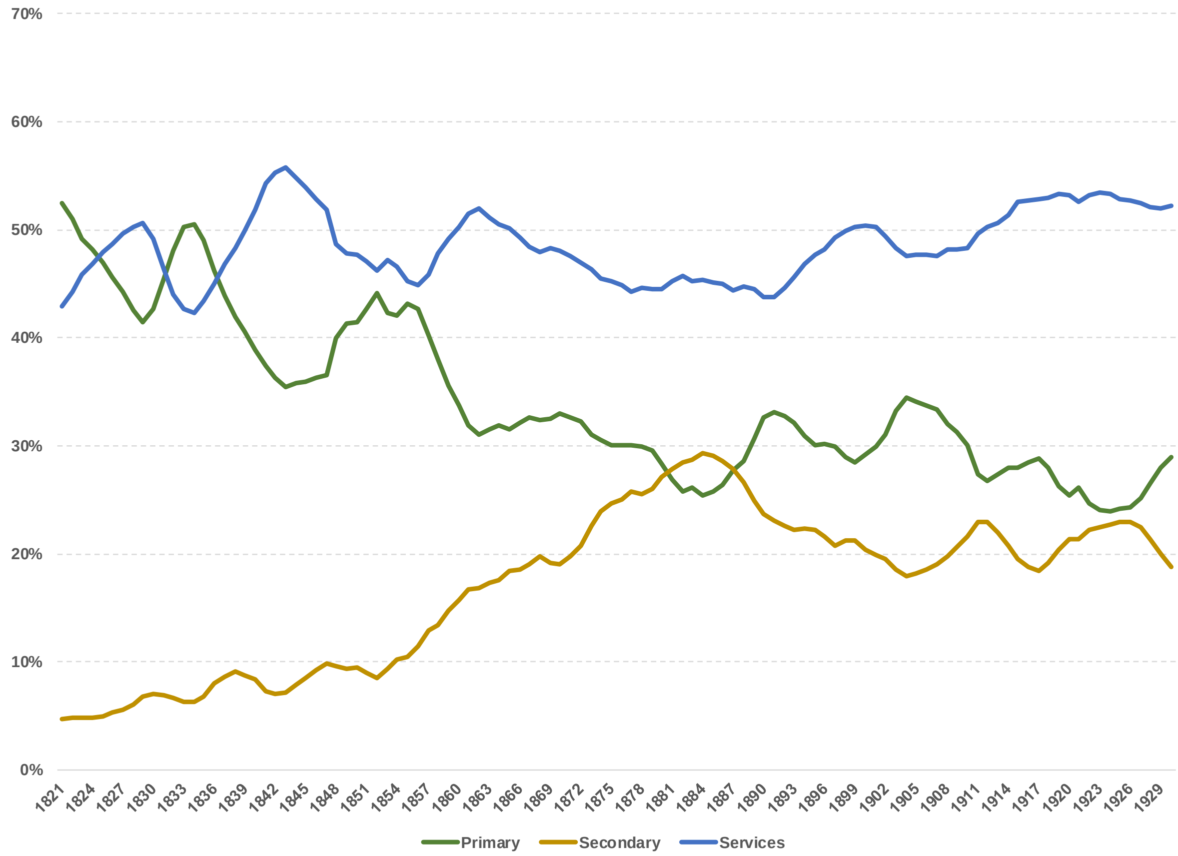
This expansion, particularly through the middle decades of the century, was the catalyst for change in Australian enterprise. The 1830s pastoral boom and the 1850s gold boom saw the evolution of export markets, development of marketing, finance, and technical support industries, increased population, national income, and urbanisation, and improvements in transportation systems (Ville, 1998, p. 24).

This deepening in the structure of the Australian economy, which resulted in an expanded, more highly skilled workforce, also made it more attractive for overseas investors, enabling credit to be sourced more easily. These factors combined to enable existing colonial businesses to become larger, meaning the colonies started to shift focus in this period from one concentrating on achieving economies of scope to one now looking to achieve economies of scale (Ville, 1998, p. 25).

The level of financial support provided by Britain to the Australian colonies began to fall from 1823, and by 1833 New South Wales only received Commissariat expenditures for the support of penal and defence activities (Boot, 1998, p83). Government policies implemented during this time were aimed at reducing the reliance on British financial support and underpinning the development of the "new" pastoral industry. Such policies included the (i) assigning of convicts to private-sector employers for labour, (ii) granting of land for pastoral activities in 1820, and (iii) swapping of land grants to land sales by the Crown in 1831. The consequence of these policies was the attraction of a larger number of free settlers to Australia and the establishment of a domestic finance and banking sector, which caused producer services (including rental income) to grow dramatically over this period (Attard, 1998, pp. 2-3; Seltzer, 2015, p.182; Ville, 2015, p.206).

By the 1830s nearly 90 per cent of the male labour force were convicts or ex-convicts, and by 1840 two-thirds of the male labour force were still convicts or ex-convicts. Jackson notes, while the composition of the labour force is not surprising, what is extraordinary is that labour productivity in Australia during that period was about two-thirds of that in Britain, then the most productive economy in the world (Jackson, 1998, p.11). At the same time public opinion in Britain was starting to sway from the assigning of convicts for labour to private enterprise on the basis it was considered a form of slavery (Jackson, 1998, p.12; Meredith and Oxley, 2015, p.101).

Figure 4.4
Proportion of GDP by Sector, Five-Year Moving Average, Australia, 1821-1930



Source: Author's calculations

The self-sustainment of the colony became more pointed following the cessation of convict transportation to the eastern mainland states in 1840. As shown in Figure 4.1, this was also the timing of a turnaround in GDP per capita, reflecting a switching in population growth dominated by non-productive residents (i.e. convicts) to productive residents. Unfortunately, this change in policy also coincided with the first of two major recessions during the period, caused in part by the demand for Australian wool contracting dramatically because of the collapse of the British textile industry (Madsen, 2015, pp.34-35). Consequently, non-pastoral agricultural production declined by nearly two-thirds between 1840 and 1844, and manufacturing output also fell by 60 per cent during those five years.

After the 1840 recession, it took seven years for the economy to recover to the same pre-downturn level of nominal GDP, by which time the relative importance of producer services had increased at the expense of the agricultural and manufacturing sectors. Britain's last major administrative initiative, the making of *Orders-in-Council* in 1847, occurred around the time the domestic economy regained its pre-recessionary standard of living. These *Orders-in-Council* ensured settlement rights to squatters but also maintained the Crown's rights over unalienated colonial land (Boot, 1998, p82).

The *Australian Colonial Government Act* of 1850 was the legislative instrument that allowed Victoria to separate from New South Wales in 1851, and later for Queensland to separate from New South Wales in 1859. Following the adoption of self-government, the colonial economy experienced a significant expansion during the 1850s with the discovery of gold in central Victoria, resulting in a "gold rush" population surge. Between 1851 and 1852, gold production increased Australia's GDP by slightly more than one-third, and consequently increased the relative importance of the primary sector in the overall economic makeup of the country (Butlin, 1986; Greasley and Oxley, 1997; Boot, 1998). Ville also recognised that by the middle of the 19th century the Australian population had risen and urbanised to a point that domestic markets became larger and deeper, with some firms expanding to have a presence across several colonies, while the transport systems had improved, which allowed increased trade between colonies and with Pacific Islands and New Zealand (Ville, 2015, p.205; Ville, 2015, p.211).

Mainly European migrants were drawn to Australia in the 19th century due to its high wages and its relatively superior working conditions, and while the non-white population of the colony remained low during the 19th century, a large number of Chinese migrants arrived to work in the Victorian goldfields from the mid-1800s and Pacific Islander migrants came to work in the Queensland sugar plantations as "indentured servants" between 1870 and 1890 (Seltzer, 2015, p.178, pp.183-185, pp.187-188).

While Australia's population grew by 160 per cent in the decade to 1861, demand for producer services and personal services grew at even faster rates over this same period, increasing by about 400 per cent and 260 per cent respectively. Reasons for this sharp increase in services sector demand include (i) the transition of gold mining from surface to below-ground operations required more sophisticated financial services support; and (ii) agricultural activities shifting from wool production for export markets to meat and tallow production for domestic consumption resulted in a deepening in markets associated with retail trade and food-related activities (Attard, 1998; Keneley, 2015, p.385).

Each colony experienced different rates of economic growth and social change. For example, the Victorian gold rush supported the development and expansion of Melbourne at a much faster rate than that experienced by Sydney (Ville, 1998, p. 26). Madsen also recognised that the gold rush redistributed labour initially away from the wool industry, but once the mining boom faded, labour was then spread throughout the broader economy (Madsen, 2015, p.33). Closely associated with the development of the mining sector at this time was the opening of stock exchanges in the various colonies during the 1860s (Merrett, 1997, p.183).

While industry development differed across each colony, government expenditure on infrastructure, especially roads, railways and the telegraph, dominated all colonial budgets by 1860. Despite Queensland and New South Wales initially preferring the private sector to supply rail infrastructure and operations, these endeavours eventually failed which resulted in those governments stepping in and taking over the industry (Ergas and Pincus, 2015, p.226). From the 1860s railways became the largest single item of public capital spending, taking more than half of all government capital expenditure for the next four decades. The development of the railways was an impetus for programs of assisted immigration and also a key reason why colonial governments accessed the London capital market for debt (Boot, 1998, p.91).

During the latter half of the 19th century colonial governments adopted a policy of "closer settlement" which involved the (i) compulsory acquisition and sub-division of private freehold, (ii) resumption of leasehold, and (iii) sale of Crown land. The increased access to smaller blocks of land, combined with innovative production practices, particularly associated with the use of irrigation, and in the wheat and dairy farming industries, resulted in the primary sector becoming relatively more important to the Australian economy during this period (Merrett, 1997, p.189).

This combination of strong public-sector capital spending and an implicit industry policy that was biased towards the primary sector has been argued by Butlin as a reason why the structure of the colonial economy in the mid- to late-1800s was distorted (Butlin, N., 1962). Butlin suggests that excessive investment occurred in grazing, banking, and commerce sectors at the expense of areas like manufacturing and other agriculture (Boot, 1998, p94), and this imbalance in the Australian economy would exacerbate the next economic downturn.

The depression of the 1890s was triggered by the cessation of lending from the British banks to Australian borrowers. The build up to that trigger followed the "classic" pattern of a financial crisis: increased credit, rise in speculative activity in stock and property markets, and materialisation of asset bubble(s) (Madsen, 2015, p.35; Maddock, 2015, p.271). This decision to stop lending by British banks was not specific to the risk profile of the Australian colonies, but rather a general response to the near collapse of Baring's Bank in London which occurred as a result of poor investments made by it in Argentina (Shann (1930), Fitzpatrick (1949), Greasley and Oxley, 1997, p.40).

Between 1890 and 1895 the Australian economy contracted by about one-third due to a combination of factors, including severe drought conditions (which reduced economic output in the primary sector by nearly 50 per cent in the first five years of the decade) and labour market disruptions (due to striking dockworkers, miners and shearers). During this time the domestic banking system also nearly collapsed. Four trading banks failed between 1890 and 1893 and a further 12 suspended their operations during 1893 (RBA, 1999, pp. 3-4), while of the 64 deposit-taking institutions operating in 1891, within two years 34 were closed permanently and a further 20 were temporarily closed (Maddock, 2015, p.274).

The Reserve Bank of Australia described the economic downturn of the 1890s as "substantially deeper and more prolonged than the depression of the 1930s" (RBA, 1999, pp. 3-4), and it was not until the 1940s that there was a return to per-capita growth rates similar to those achieved before the onset of that depression (McLean, 2006, p.216).

The colonial expansion period continued into the new century, with the gross value added of the pastoral industry improving as a consequence of technical innovations, including the creation of drought-resistant grain varieties and the development of cold storage enabling foreign trade in meat, dairy products and fruit (Attard, 1998, p.4). These examples reinforce the view presented by Magee who suggested that the "technology adopted, developed and diffused" in the early settlement period of Australia was aligned to the factor endowments of the country at that time, being abundant land but scarce labour and capital (Magee, 2015, p.127; Seltzer, 2015, p.178). These technology improvements positively impacted farming productivity, which consequently reduced the cost of food in the cities. Frost notes that the wholesale price index for groceries fell by nearly 50 per cent over the 30 years from 1861 to 1891 (Frost, 2015, p.250).

The end of this defined economic period coincided with the onset of the Great Depression. The closure of world capital markets and declining world trade was transmitted into the domestic economy through reduced investment activity, falling output demand and rising unemployment. While the pastoral and agricultural products continued to be a key export for Australia, their relative importance fell from representing above 50 per cent of total exports in 1821 to around 30 per cent in 1929 (Butlin, 1985).

4.2.4 The Rise of the Secondary Sector and Protectionism, 1890 - 1972

The overlap in time between the second and third defined economic growth phases in Australia's history reflects the diverse policy objectives being targeted during this period. The closing stages of the pastoral expansion cycle intersected with the opening stages of a new economic cycle that was characterised by government adopting an interventionist regulatory philosophy.

By 1891 approximately one-third of Australia's population resided in the capital cities, with a further 15 per cent living in major regional and rural towns (Jackson, 1998, p.8). Various commercial and other service activities developed to support the primary sector in particular, and transport, legal and financial service sectors grew as a consequence of international and domestic trade. Demand for social and personal services also grew as the domestic population increased (Jackson, 1998, p.8-9). Jackson argues that the services sector represented at least 50 per cent of total economic output for the colonies for the majority of the 19th century (Jackson, 1998, p.8-9), and in particular the services sector enjoyed growth from the 1880s onwards as new industries emerged to provide leisure activities to the middle-class (Keneley, 2015, p.377).

Despite the economic recovery beginning in 1895, the last decade of the 19th century is seen as the start of a 50-year low-growth phase in the Australian economy (Greasley and Oxley, 1997, p.51). McLean argues that after the depression of the 1890s there was a major need for a period of monetary and real adjustments in the Australian economy to bring about a reduction in, or an absorption of, excess capacity and the liquidation of weak companies (McLean, 2006, p.219).

During this period Australia experienced a structural change in its economic makeup: the banking and financial sectors were "shaken-out"; there was a halving of the size of the domestic sheep-flock; manufacturing and mixed-farming grew as a proportion of economic output (Greasley and Oxley, 1997, p.45); and there was a dampening of demand for new large-scale investment activity for nearly two decades (Merrett, 1997, p.182). Such was the adjustment in the Australia economy post the 1890s depression, real incomes were only 14 per cent above their pre-depression peak in 1889 at the outbreak of World War I (McLean, 2006, p.216).

The interventionist regulatory philosophy of government was more influential in this phase of economic growth due to a change in the structure of governments operating at the time, moving from a system of Colonial Parliaments to a system of Federalism, with the Commonwealth of Australia created on 1 January 1901 through the adoption of the *Commonwealth of Australia Constitution Act 1900* by the parliament of the United Kingdom. The creation of a Federal Government allowed for the implementation of a new national approach to various existing regulatory arrangements (Jones, 2002, p.314). Examples of where the change in governance arrangements resulted in materially altered regulatory and/or statutory measures include: (i) the abolition of tariffs on trade between colonies; (ii) the establishment of the Commonwealth Court of Conciliation and Arbitration; and (iii) the implementation of a Commonwealth grants scheme providing funding to states (Sheldon, 2007, p.250).

Clark argued in the opening sentence of his contemporaneous study on the challenges facing the Australian economy: "the principal motive for forming a federation in Australia, as in America, was to secure free trade among the states" (Clark, 1908, p. 576). Hutchinson suggests that Federation created the institutional settings necessary to promote greater industrialisation of the Australian economy, although the relative economic importance of manufacturing took the next few decades to strengthen (Hutchinson, 2015, p.287). Uniform tariff rates were implemented by the Commonwealth Government post-Federation at rates lower than what some individual colonies had previously applied. These import tariffs were initially employed as a revenue measure for the Federal government, rather than for the primary purpose of protectionism (Horridge, 1988, p.66), although domestic producers continued to benefit from non-tariff barriers such as the "tyranny of distance" and high sea transport costs (Wilson, 2015, p.334).

The adoption of tariffs to assist the local manufacturing industry occurred following the Sunshine Harvester Case in 1907, where the courts refused assistance to a company on the grounds it was not paying “reasonable wages”, and therefore no tariff protection was warranted to offset a higher cost of domestic production compared with imported products (Hatton and Withers, 2015, p.362). This judgement, “New Province for Law and Order”, established the concept of a “basic wage”, initially linking the wage-setting process in Australia to its tariff regime (Horridge, 1988, p.66), and from 1914 to 1953 to changes in the retail price index (Hatton and Withers, 2015, p.362).

World War I was detrimental to the Australian economy for a variety of reasons, the most significant being the loss of some 60,000 men. The direct financial cost of the war on Australia was substantial, however, the indirect cost from the loss of tax receipts due to declining economic activity was equally burdensome, with the net effect being a rise in public debt equivalent to nearly 120 per cent of GDP between 1915 and 1918 (Wilson, 2015, p.338).

Australia would experience a Terms of Trade shock between 1920 and 1925, the first of three that would occur during the next 100 years (Gillitzer and Kearns, 2005, p.2). Frost argues the Australia economy was “reshaped” during the years between the World Wars through a progression of demand-side and supply-side shocks that saw the mining and agriculture sectors decline in relative importance and manufacturing rise (Frost, 2015, p.251-252). For example, the export price boom in the 1920s was driven solely by wool prices, while manufacturers, who were benefiting from import protection mechanisms, increased their borrowings to construct new factories and upgrade their equipment (Merrett, 1997, p.194). These two factors drove strong average real GDP growth of 6.5 per cent per annum during the first five years of that decade (Butlin, N., 1962). The agriculture sector in Australia also followed the international trend of declining relative contribution to aggregate economic output because: (i) the demand for food rises at a slower rate than the demand for other goods and services, and (ii) advancements in technology have positively impacted agricultural productivity (Anderson, 1987, p.195; Anderson, 2000, p.7).

Merrett suggests that Australia faced a complex set of economic problems at the beginning of the 1930s depression, including a wage-tariff spiral, collapse of commodity prices, the closure of international capital markets, high levels of government debt and the onset of a significant Balance of Payments crisis (Merrett, 1997, p.195; Maddock, 2015, p.276; Wilson, 2015, p.341). Schedvin proposes that these problems were compounded by an inability of the politicians of the day to reach a cohesive solution (Schedvin, 1970; Merrett, 1997, p.195) although ultimately a series of interventions, including a reduction in real wages, introduction of tariffs, devaluation of the Australian currency, and the signing of multilateral trade agreements with other Commonwealth countries, helped stabilise the domestic economy (Wilson, 2015, p.344).

By 1932 private-sector investment started to rebound, again with a bias towards manufacturing and housing construction, and this investment was maintained at high levels until the commencement of World War II in 1939 (Butlin, N., 1962). Different from previous housing booms however, investment in this cycle was driven by demand for higher quality housing and new residences that were away from the “run-down” inner-city (Merrett, 1997, p.198).

In 1938 British and Australian ministers determined that there was benefit to both countries, and the British Empire, if the Australian population was substantially increased. It was also recognised that if this migration policy was to be successful the size of Australia’s secondary sector would need to correspondingly increase as the primary sector would not be able to “soak-up” the incremental labour force that would accompany an enlarged population (Robertson, 1997, p.93).

The post-depression recovery of the Australian economy was not yet complete by the commencement of World War II (Wilson, 2015, p.345). Manufacturing had grown significantly since the turn of the new century, the manufacturing sector’s share of the nation’s labour force had increased from 15 per cent to 24 per cent, and its share of national output had grown from 12 per cent to 19 per cent. Merrett and Ville note that this expansion of the manufacturing sector in Australia was correspondingly matched by a contraction in the country’s primary sector, which saw its share of employment decline from 33 per cent to 23 per cent and its share of output fall from 30 per cent to 23 per cent. On the other hand, the services sector continued to be the “cornerstone of the economy”, with employment and output for the sector staying above 50 per cent for the first four decades of the 20th century (Merrett and Ville, 2011, p.48).

While the manufacturing sector achieved strong growth during this period, the view of various economists, including Butlin, Banard, Pincus, Merrett and Ville, is that many industries had high levels of seller concentration which facilitated collusive behaviour, particularly with regard to price agreements (Butlin, Barnard and Pincus, 1982, Chapter 4; Merrett and Ville, 2011, p.53).

Three years after the commencement of World War II, and coinciding with a worsening of hostilities in Europe and the Pacific, the Commonwealth Government enacted a range of controls over nearly every element of the Australian economy and society. Conscription of labour for military and civilian duties reduced production efforts for “non-essential” industries and the redirection of inputs from those activities into war production, the fixing of wages, prices and rents and the direction of public investment towards military related assets, such as aerodromes and roads (Merrett, 1997, p.199) were just some of the measures implemented to ensure the country embraced a “total war” mentality.

In contrast with World War I, the majority of additional revenues required for spending on the war effort by the Commonwealth Government was generated via increased taxation. This was made easier through the enactment of the *Income Tax Act* in June 1942, which gave sole responsibility to the Commonwealth Government for the collection of personal and company income taxes (Merrett, 1997, p.199).

Genuine concerns regarding the threat of invasion by the Japanese had largely dissipated by the middle of 1943, which meant Government policy started to focus beyond the war effort. This was practically shown by the fact that government spending associated with the war effort peaked in 1942/43 at ₤562 million (Mann, 2015, p.40), with the number of personnel in the Army and military production starting to reduce from October 1943.

While World War II ended with the surrender of Japan in August 1945, the Commonwealth Government maintained a large number of regulatory controls for several years after this date in order to oversee shortages in US dollars and in domestic input materials and labour (Jones, 2002, p.315). In addition to these policies, the Commonwealth Government was resolved to expand the manufacturing capabilities of the country as the politicians and senior government advisers recognised that: (i) the domestic economy experienced a more severe downturn than it would have if it had been more diverse and not so dependent on the export of primary products; (ii) its geographic remoteness meant that Australia could not rely on its allies for its defence; and (iii) there were more than 700,000 people engaged in the Australian armed forces who needed to be re-absorbed into the domestic labour force (Robertson, 1997, p.93; Wilson, 2015, p.348). Following the end of the war the Australian economy was transformed through growth in "advanced" industrial manufacturing, including the expansion of the automobile, chemical and petrochemical sectors, which was supported by continued urbanisation and significant migration (Jones, 2002, p.332).

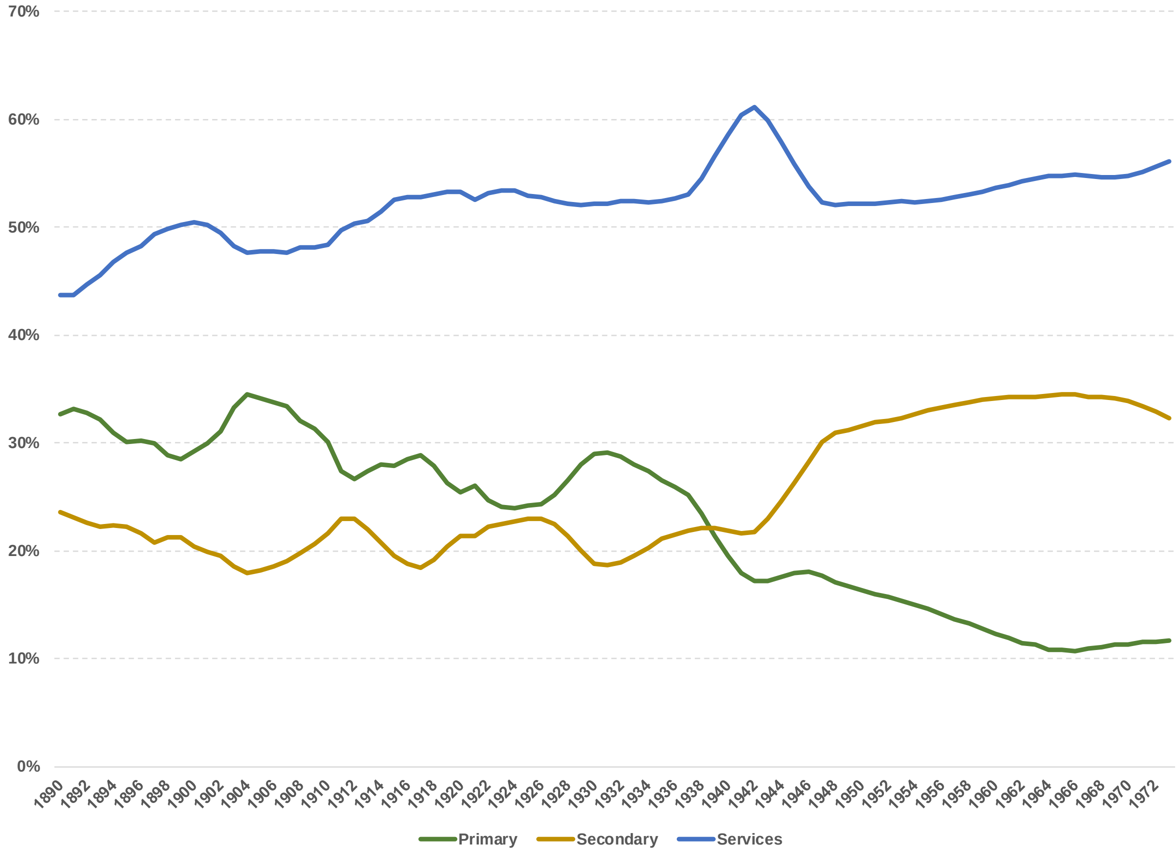
Government policy following World War II in effect closed the domestic economy to global competition on the premise it facilitated better conditions for economic development to occur (Wilson, 2015, p.335; Keating, 2015, p.439). That is, an inwards focus was adopted, with development occurring on the basis of restricted markets, arbitrated wages and protection through import tariffs (Jones, 2002, p.313). Such an approach meant economic efficiency and innovation were "second-order" considerations. Moreover, the link between the adoption of protective measures, such as tariffs and subsidies, and growth in the Australian manufacturing sector is presented by Benham, who showed that labour and resources were deliberately diverted away from non-protected industries (the primary sector) towards protected industries (manufacturing) (Benham, 1930, p.138; Merrett and Ville, 2011, p.53). Anderson, Lloyd and MacLaren argue that these factors, as well as an anti-primary sector bias in the Australian government's industry assistance policies, were the key reasons why the domestic economy underperformed for the four decades following the end of World War II (Anderson, Lloyd, MacLearn, 2007, p.462).

The second major Terms of Trade shock occurred during the time of the Korean War, from the late 1940s to the early 1950s, and was caused by a spike in the prices of wool, mining products and other agriculture products. Bhattacharyya and Williamson suggest this Terms of Trade shock was unusual for two reasons: (i) the price spike for all product groups was significant; and (ii) the co-movement of all three product groups was unique (Bhattacharyya and Williamson, 2011, p.156).

Australia's post-war tariff regime was supplemented with the introduction of binding import quotas in 1952, which remained until early 1960. These support mechanisms were particularly significant in sectors producing labour-intensive goods, such as textiles, clothing and footwear. It was not only import restrictions that were part of Australia's protectionist trade policy; the export of iron ore was also banned between April 1938 and

May 1966, while an array of regulations raised intermediate input costs for export-producing industries (Anderson, 2017, p.8). Anderson also notes that for most of the time that tariffs were in place to support the domestic manufacturing industry there was also considerable direct assistance given to the farming sector (Anderson, 2009, p. 32).

Figure 4.5
Proportion of GDP by Sector, Five-Year Moving Average, Australia, 1890-1973



Source: Author's calculations

Hutchinson contends that just as the manufacturing sector reached its peak in terms of structural economic importance, it immediately started to "deindustrialize" (Hutchinson, 2015, p.287); although McLean believes that this post-war period of industrial growth was vitally important to the Australian economy as it contributed economic value at a time when our primary sector was struggling (McLean, 2013, p.9).

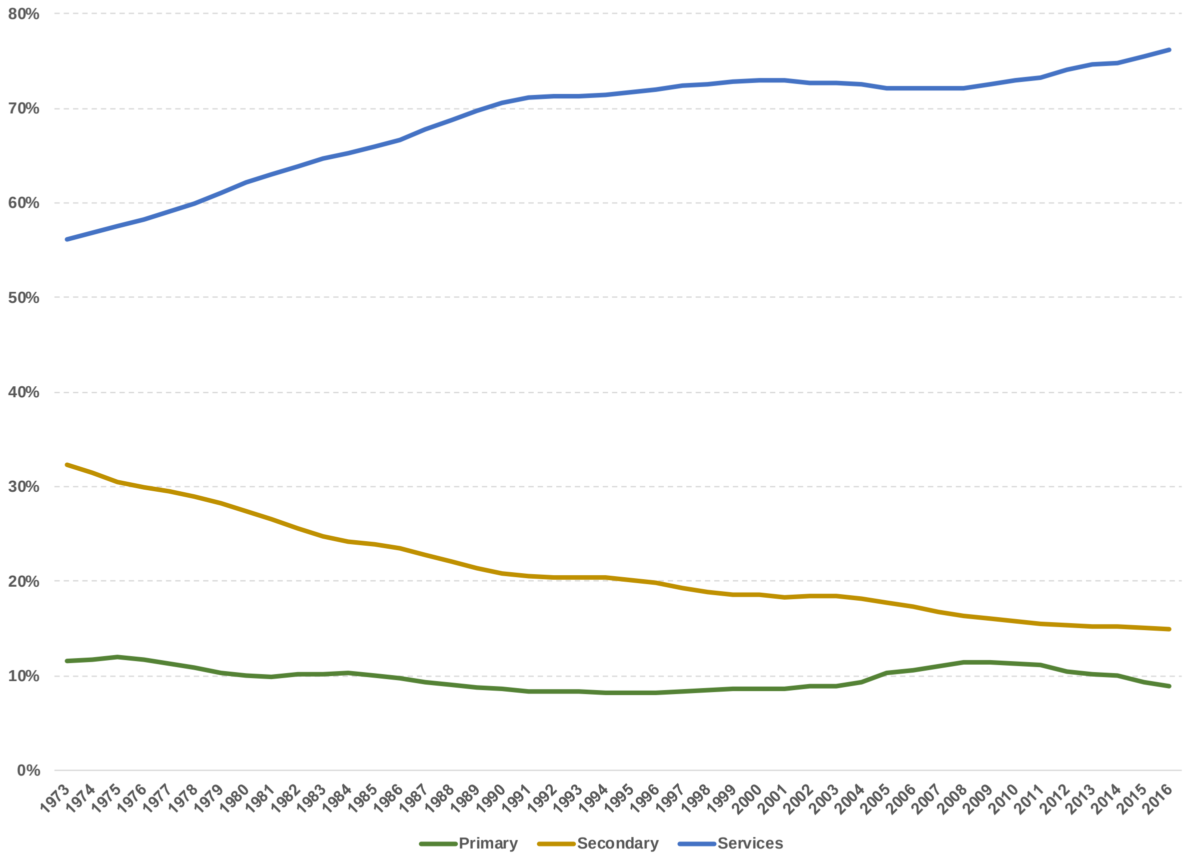
4.2.5 Market Liberalisation and Structural Change, 1973 - 2016

Anderson notes that decades of inward-focused trade policy meant that Australia's commercial engagement with the rest-of-the-world, as measured by the ratio of merchandise exports plus imports to GDP, was barely 20 per cent during the period from 1930 to 1970 (Anderson, 2017, p.9). Maddock also argues that domestic policymakers failed to set Australia's exchange rate properly, which further contributed to our poor engagement with trading partners (Maddock, 2015, p.282; Pomfret, 2015, p.398).

The governance arrangements associated with protectionist trade policies in Australia changed in 1973 with the creation of the Industries Assistance Commission (IAC). The IAC was given wider responsibilities compared with the previous Tariff Board, including the ability to review tariff arrangements beyond the manufacturing sector and non-tariff arrangements more broadly (Horridge, 1988; Anderson and Garnaut, 1987, p.83).

The middle of 1973 also saw the implementation of a 25 per cent across-the-board tariff cut, which kick-started a period of structural change in the Australian economy. The response by the Australian economy to these trade reforms has been one of steady change, with the ratio of merchandise exports to GDP gradually increasing from 21 per cent at the start of the 1970s to 25 per cent in the 1980s, 28 per cent in the 1990s, and 32 per cent in the first 16 years of the present century (or 41 per cent when services are included) (Anderson, 2017, p.9).

Figure 4.6
Proportion of GDP by Sector, Five-Year Moving Average, Australia, 1973-2016



Source: Author's calculations

Australia's comparative advantage in bulk commodities, including coal, natural gas and iron ore, did not emerge until the 1970s when commodity producers could access higher international prices and lower bulk shipping costs (Anderson, 2017, p.8). That is, not until the first Organisation of the Petroleum Exporting Countries (OPEC) oil shock of 1973/74, followed by the second OPEC oil shock of 1979/80, did it become financially feasible for thermal coal, and then natural gas, to be exported from Australia to East Asia (Anderson, 2017, p.15).

While reforms were progressing, the continuation of an overall protectionist industrial policy by the government sector through the 1970s meant the domestic economy evolved slowly during this decade, with the consequence being persistently high unemployment and a rising (and now structural) current account deficit. The Commonwealth Government also adopted various reforms based on findings from a series of Committee investigations, including the 1976 *Jackson Report*, which proposed that the adoption of an import-replacement policy would not revive the domestic manufacturing sector, and the 1979 *Crawford Report*, which proposed the (continual) phased reduction in tariffs, with industry assistance replaced with export incentive grants (Borland, 2015, pp.426-427)

The Australian economy entered a recession during 1982/83 and real GDP declined by 2.2 per cent during that financial year. This event was a key impetus for the introduction of major economic reforms, including slowing the growth in real wages through the Accord process, opening up domestic capital markets by relaxing restrictions on foreign banks, and increasing global competition in the domestic marketplace through the floating of the Australian dollar and continued removal of protectionist trade policies (Productivity Commission, 2015, p.29; Hatton and Withers, 2015, p.363; Pomfret, 2015, p.404, p.411).

A range of microeconomic reforms was implemented during the late 1980s and 1990s on the basis that the Australian economy had been underperforming during the 1970s and the early- to mid-1980s (Borland, 2015, p.421). The introduction of a National Competition Policy following the *Hilmer Review* in the early 1990s saw the drive for economic efficiency "trickle down" from the Commonwealth Government to State and Local Governments (Hilmer, 1993). Other major reforms progressively implemented through the 1990s and 2000s included: (i) the privatisation of numerous Government Business Enterprises, including Qantas, Telecom (now Telstra), Medibank Private and various infrastructure assets, such as airports, ports, rail, electricity networks (and some electricity generation), gas transmission and distribution pipelines; (ii) the deregulation of institutional barriers to competition, such as agricultural marketing boards; (iii) the introduction of competition within sectors which traditionally were sheltered from such behaviour; and (iv) an acceleration towards decentralised wage bargaining (Productivity Commission, 2005; Hatton and Withers, 2015, p.363).

Australia also (re)engaged at an international level by promoting competition essentially from the Uruguay Round of negotiations of the General Agreement on Tariff and Trade (GATT), and by more actively participating in various bilateral and multilateral trade agreements (Lloyd, 2008, p.110). In May 1988 the Government further liberalised trading arrangements with the announcement of a four-year phased reduction of most tariffs above 15 per cent to that level, and tariffs between 10 per cent and 15 per cent would also be reduced to that lower bound. This was further expanded in May 1991 and most tariffs were lowered again to 5 per cent by 1996, and tariffs on private motor vehicles and textiles, clothing and footwear were reduced to 15 per cent and 25 per cent respectively (Borland, 2015, p.427).

The Australian economy experienced another "mild" recession in 1990/91, with real GDP contracting by 0.2 per cent year-to-year. Over the next 15 years Australia experienced "more or less full employment", and while Australia experienced four separate quarters of negative economic growth, the country has not, to date, been in a technical recession since the end of the September quarter 1991, making it the longest period of uninterrupted economic growth since Federation (Pomfret, 2015, p.413; Keating, 2015, p.452). Much of this economic success was due to the program of microeconomic reforms and the flexibility in the domestic labour market, but also because Australia significantly benefited from the commodities boom of the mid-2000s. Given Australia's mining consumption is a relatively small share of total mining production (Freebairn, 2014, p.535) the excess between domestic supply and domestic consumption of mining output was exported to (i) various Asian countries that were experiencing significant economic growth, most notably China, and/or (ii) various countries, such as Japan, that were transforming those raw materials (mainly iron ore and coal) into intermediate inputs that would later be consumed by those expanding Asian economies.

The third major Terms of Trade shock began in 2003 as a consequence of the mining "commodities boom" associated with the Asian economic expansion. Bhattacharyya and Williamson have indicated the magnitude of the recent boom in the price of mining products was greater than the shocks experienced by wool in the early 1920s but were well below the price spikes for minerals associated with the Korean War boom (Bhattacharyya and Williamson, 2011, pp., 156). Anderson also notes that the latest Terms of Trade shock resulted in considerable de-industrialisation of the Australian economy, but relatively little de-agriculturalisation as agricultural commodity prices increased between 2005 and 2012 by nearly as much as the corresponding increase in mineral prices (Anderson, 2017, p.15).

This finding is consistent with Auty's argument that resource-rich countries need to diversify their economies otherwise they suffer from destructive boom-bust cycles (Auty, 1993, p.158), and with the Corden and Neary model, often referred to as "Dutch Disease"[6], which says a booming commodity sector may alter the composition of

[6] First used by *The Economist* in November 1977 to describe the adverse effects on Dutch manufacturing on the natural gas discoveries of the 1960s because of the appreciation of the Dutch real exchange rate.

production in the economy (Corden, 1984, p. 359). The non-booming tradable sector, usually assumed to be manufacturing (but often tourism and education are also affected), becomes globally less competitive due to an appreciation in the real exchange rate as a consequence of the commodity boom (Robinson et al., 2017, p.29).

While Australia has enjoyed sustained and substantial economic growth since the early 1990s, the policy reforms implemented through that decade and the decade before have also contributed to a significant adjustment to the country's tradable sectors. For example, the adjustment to the relative importance of the domestic manufacturing sector has been severe, impacted by the double effect of de-industrialisation associated with the Terms of Trade shock and the near withdrawal of all protectionist support by government. At the turn of the new century, manufacturing's share of GDP had declined to 13 per cent, although by 2014 it had nearly halved again to represent 7 per cent (Andersen, 2017, p10). The decline in the domestic manufacturing sector has been greatest in the Other Manufacturing and Petroleum, Coal, Chemical and Rubber Manufacturing sub-sectors, with real industry gross value added (IGVA) falling 18.0 per cent and 12.6 per cent respectively between 2000 and 2016, which compares with manufacturing sector and GDP growth of 1.8 per cent and 59.0 per cent respectively over the same time period (ABS, 2017b).

In contrast, the services sector in Australian experienced a marginal decline as a proportion of GDP over the 100 years to 1960, even though the sector's share rarely moved out of the 50 per cent to 60 per cent range during those 10 decades. Australia's services sector has since risen rapidly over the past 50 years to represent around 80 per cent of GDP today (on a current price basis), a level consistent with many other high-income countries (Andersen, 2017, p13, Fig.5a).

4.3 Conclusion

This section of the thesis presents a brief history of the Australian economy and traces its evolution, which Anderson suggests has been different from the path of development of other high-income countries while still consistent with economic theory (Anderson, 2017, p.9).

This analysis reveals a number of distinct features of how different sectors of the Australian economy since post-European settlement have evolved. The primary sector has been on a path of long-run decline since the 1800s, although sporadic booms in both agricultural and mining sectors have helped to lift its share of GDP and exports at specific times. The secondary sector grew in relative importance as a consequence of protectionist trade policies, and once these were wound back, manufacturing's share of national output correspondingly declined.

The services sector represented around half of Australia's GDP from about 1840 for nearly the next 130 years (excluding the period of World War II), however, since the adoption of wholesale economic reforms the sector has experienced a strong rise in its importance to the domestic economy.

Chapter 5 The Importance of the Services Sector in the Modern Australian Economy

5.1 Introduction

The previous chapter provides a brief overview of the factors influencing sectoral economic performance in Australia since European settlement. However, of more importance to this study is understanding the contribution the services sector makes to the contemporary Australian economy.

5.2 Structure, conduct and performance of the services sector in Australia between 1975 and 2016

Australia's real GDP grew from $470 billion in 1975 to just under $1,660 billion in 2016, a compound average annual growth rate (CAAG) of 3.1 per cent over the 42-year period. Over this same period GVA for the services sector in Australia increased from about $250 billion to just over $1,000 billion, a CAAG rate of 3.5 per cent. The marginally higher annual growth rate achieved by the services sector over aggregate GDP has meant the relative importance of this sector increased from representing 53 per cent of all economic activity in Australia in 1975 to 62 per cent in 2016[7].

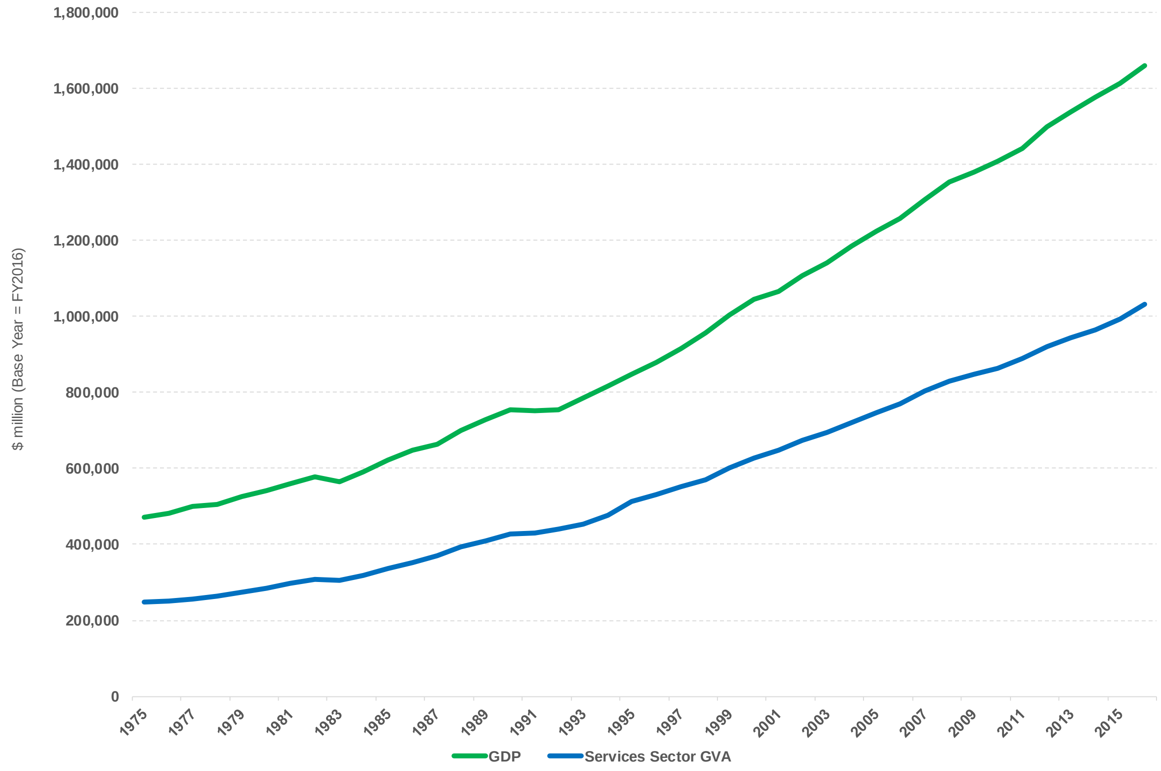
Table 5.1
Compound Average Annual Rate of Growth in Real Industry GVA by Sector[1]

Period	Primary Sector	Secondary Sector	Services Sector	Distributive Services	Producer Services	Social Services	Personal Services
1975-1985	2.76%	1.44%	3.10%	3.84%	2.71%	3.61%	2.24%
1985-1995	3.11%	2.15%	4.36%	4.01%	6.19%	3.30%	2.95%
1995-2005	3.91%	3.35%	3.79%	3.55%	4.33%	2.98%	4.19%
2005-2016	4.04%	1.43%	2.99%	2.50%	3.31%	3.19%	2.32%
1975-2016	3.52%	1.95%	3.53%	3.41%	4.10%	3.26%	2.86%

1. Base Year = FY2016
Source: ABS, Cat. No. 5204.0, Table 5; Author's Calculations

[7] Real IGVA for services in FY16 was $1,031Bn and Real GDP in FY16 was $1,660Bn. Real IGVA – equal to Real GDP *less* ownership of dwellings, taxes and statistical discrepancy was $1,399Bn. Real IGVA for Services as a percentage Total Real IGVA in FY16 was 73.7%

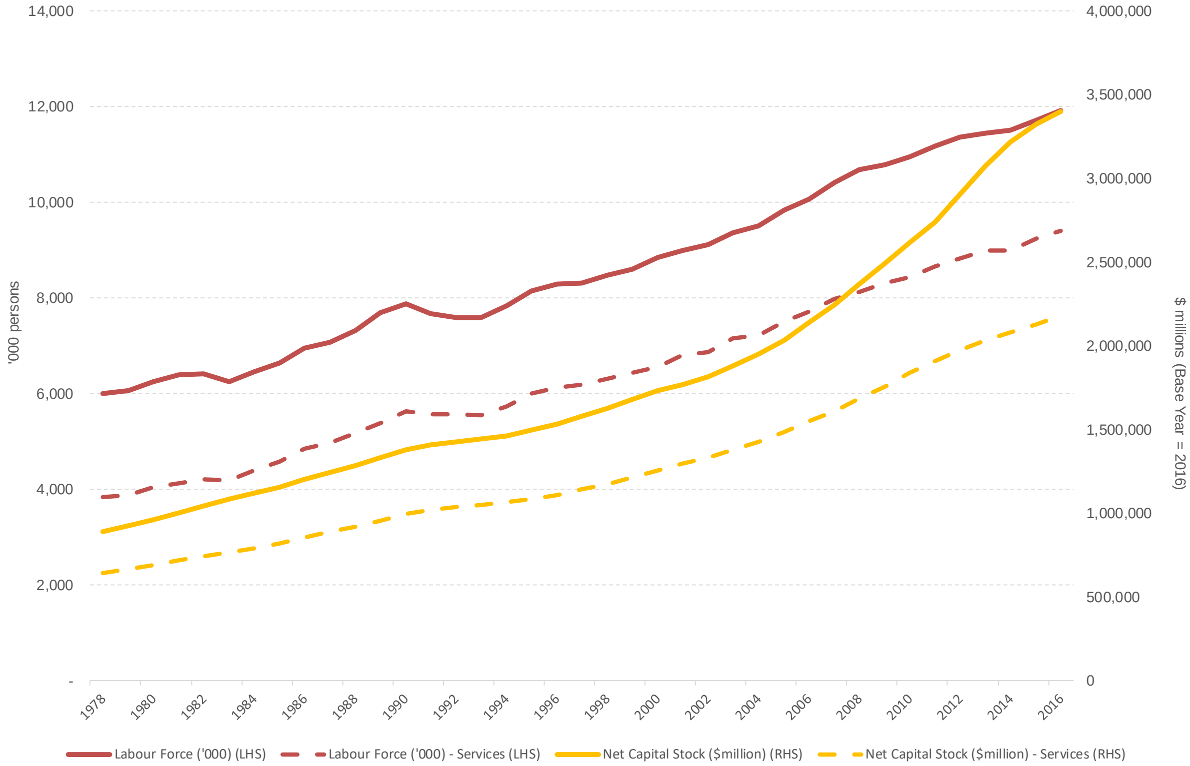
Figure 5.1
Real GDP and IGVA for the services sector, Australia, 1975-2016, ($ million)



Source: ABS Cat 5204.0 Table 5. GVA by Industry, Author's Calculations

Australia's labour force and capital stock have increased significantly over this period as well, with the labour force doubling in size from about 6 million in 1978 to nearly 12 million in 2016, while the domestic capital stock grew by nearly 400 per cent during this time. The services sector recorded stronger employment growth than did the economy as a whole over this period (CAAG of 2.4 per cent compared with 1.8 per cent), however, the proportion of the nation's capital stock employed by the services sector has declined from 72 per cent in 1978 to 64 per cent in 2016, reflecting the intense investment made in the mining sector during the "commodities boom" of the early- to- mid-2000s.

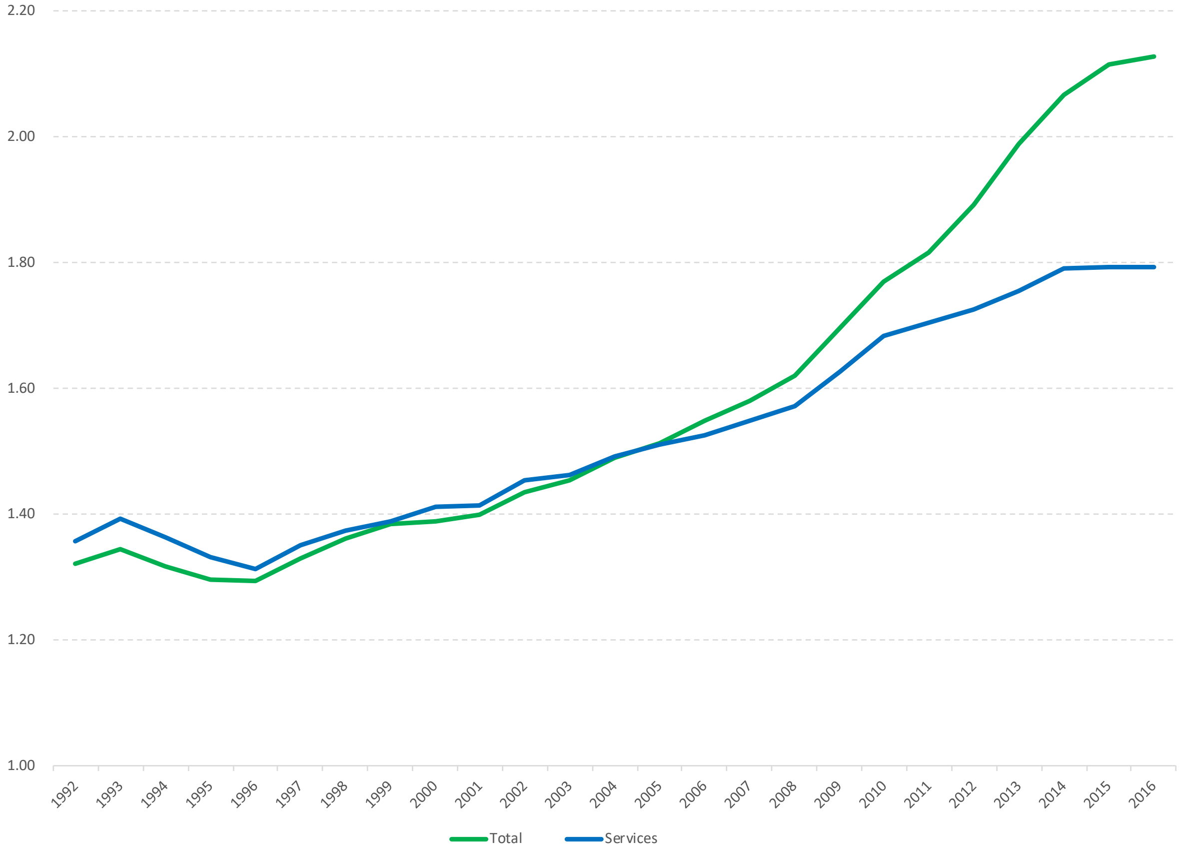
Figure 5.2
Labour Force and Net Capital Stock (at 30 June), Australia, 1978-2016



Source: ABS Cat 6291.0.55.003, Table 04. Employed persons by Industry division of main job (ANZSIC) - Trend, Seasonally adjusted and Original, ABS Cat 5204.0, Table 63. Net Capital Stock, by Industry by type of asset, Author's Calculations

This profile in the application of labour and capital in the Australian economy can also be seen in the Capital/Labour (K/L) ratio for Australia as a whole and the services sector specifically. For the period 1992 to 2006 the K/L ratio for the services sector mirrored the aggregate economy but then started to diverge as capital expenditure within the mining sector began to surge in response to the rise in global demand for (predominately) iron ore, coal and natural gas. For example, the mining sector captured a disproportionately higher amount of all Gross Fixed Capital Formation in Australia during the past two decades (1997-2006 and 2007-2016) at 15.9 per cent and 29.6 per cent respectively, which resulted in the sector's K/L ratio rising dramatically from 12.8 at the start of the period to 21.6 by the end.

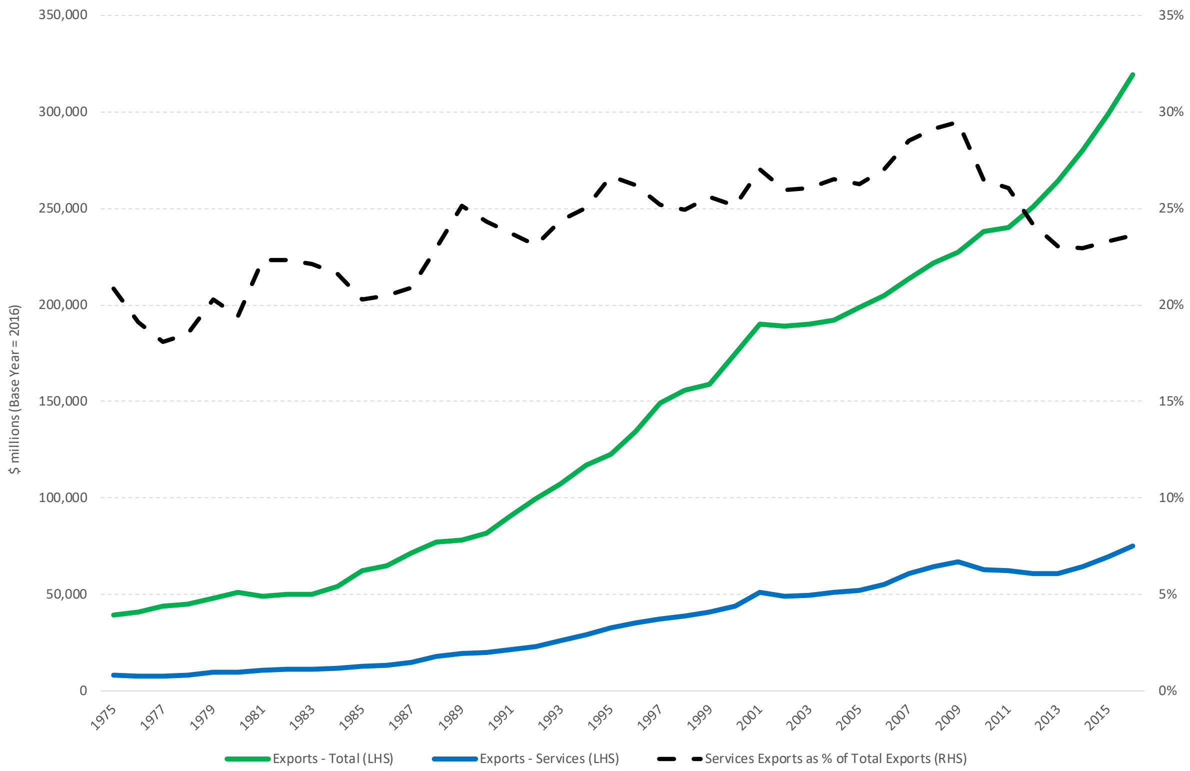
Figure 5.3
Capital / Labour Ratio, Australia and Services sector, 1992-2016



Source: ABS Cat 6291.0.55.003, Table 04. Employed persons by Industry division of main job (ANZSIC) - Trend, Seasonally adjusted and Original, ABS Cat 5204.0, Table 63. Net Capital Stock, by Industry by type of asset, Author's Calculations

Australia is a small, open economy and as such is dependent on international trade to maintain and enhance its standard of living. Since the beginning of the "Market Liberalisation" phase of the economy, (gross) exports have become an increasingly larger contributor to national GDP, rising from 8.4 per cent of GDP in 1975 to 19.3 per cent of GDP in 2016. Over this period the services sector has consistently contributed between 20 per cent and 30 per cent of total Australian exports, although there had been a noticeable decline between 2009 and 2013. This reflected a number of factors, including the impact of the global financial crisis on world trade more generally, and the effect of a significant currency appreciation in the Australian dollar, reducing the competitiveness of services sector exports, particularly in education and tourism.

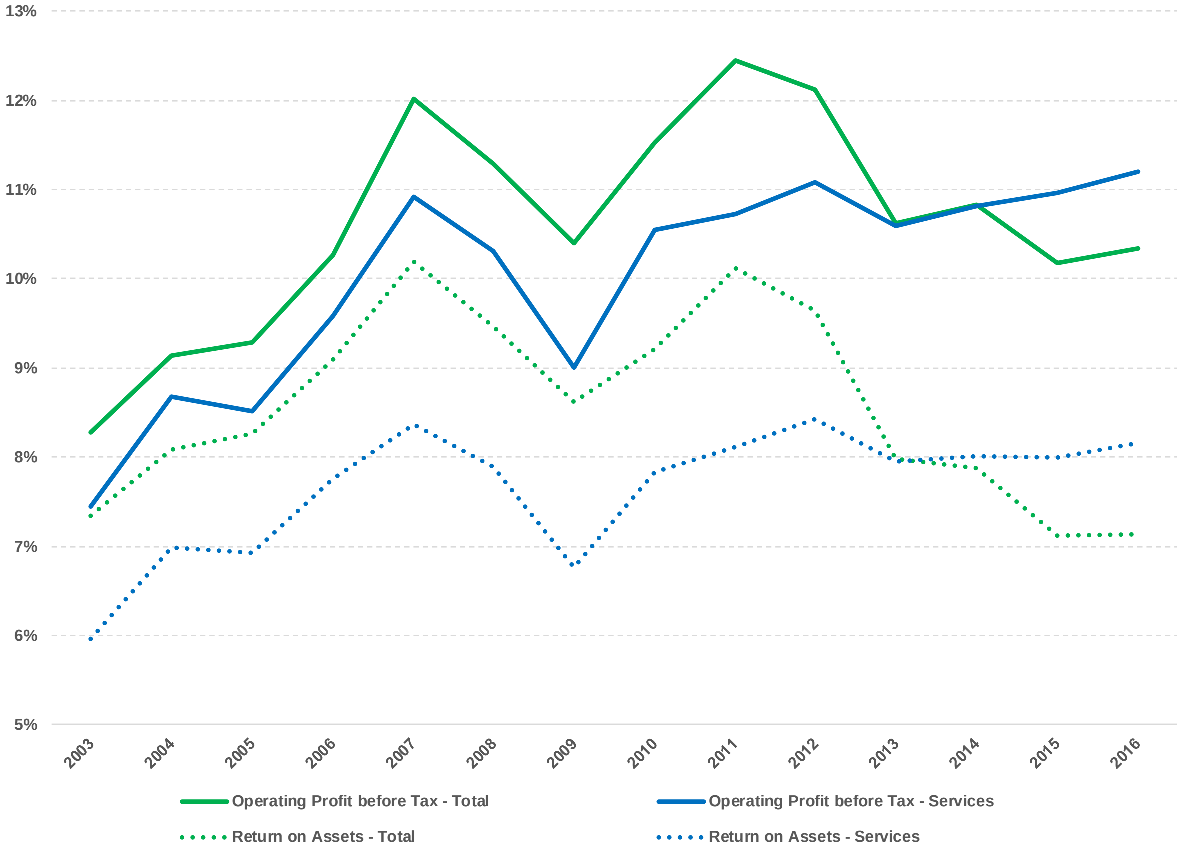
Figure 5.4
Exports ($million), Australia and Services sector, 1975-2016



Source: ABS Cat 5302.0, Table 5. Goods and services: chain volume measures and indexes – quarter, Author's Calculations

Data on business profitability and Return on Assets by sector is only available from the ABS for the period from 2003. This information reveals average annual Operating Profit before Tax (equal to Total Income less Total Expenses) across all industry sectors has ranged between 8.3 per cent and 12.4 per cent, while annual Return on Assets (equal to Net Profit after Tax divided by Current Net Capital Stock) has ranged between 7.1 per cent and 10.2 per cent. There is a large variation in both Operating Profit before Tax and Return on Assets between industry sectors, however, in general the services sector achieves below-average results for both of these business performance measures. As shown in Figure 5.5, average profitability declined markedly in 2015 and 2016, due to poor profitability within the mining sector in those years as a consequence of significant declines in market prices, driven both by softer demand in developing economies for commodities, and the bringing "on-line" of new supply that had been previously under construction (Department of Industry, Innovation and Science, 2017).

Figure 5.5
Operating Profit before Tax and Return on Assets, Australia and Services sector, 2003-2016



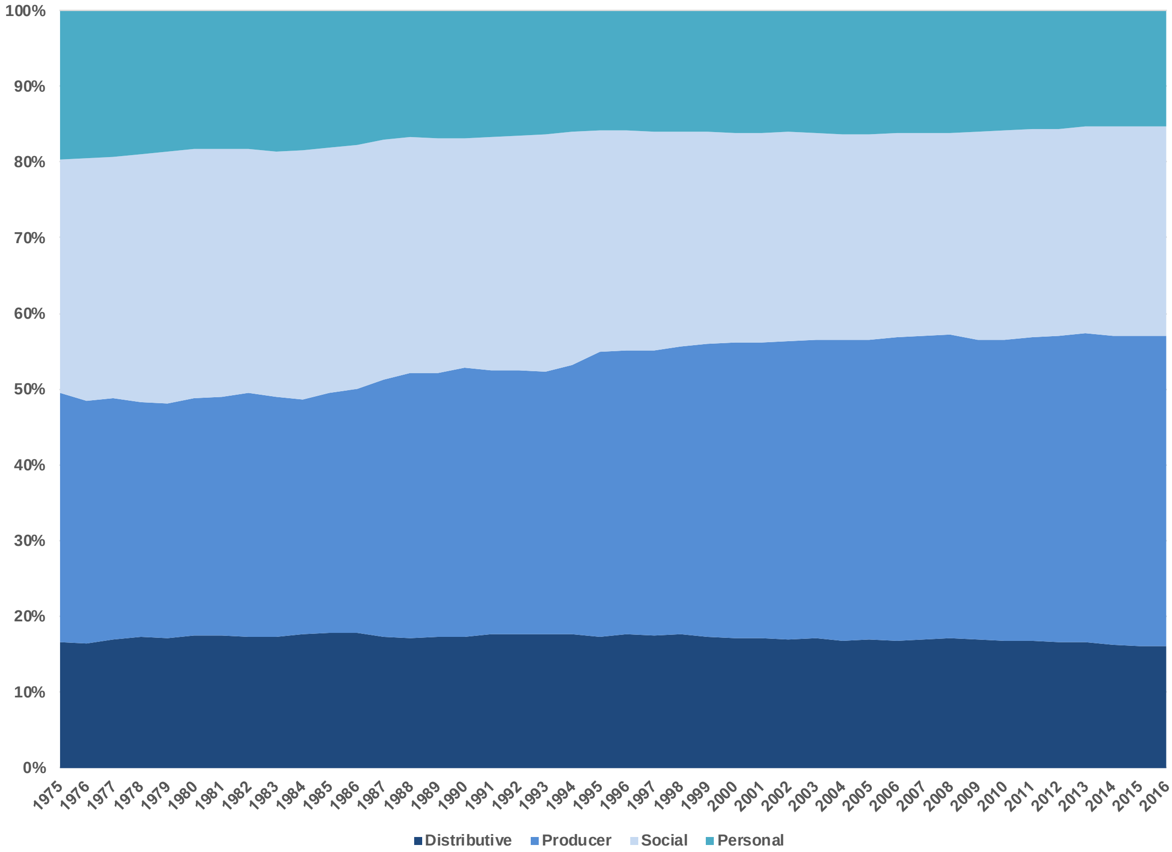
Source: ABS Cat 81550DO001_201516, Table 1 Key Data by Industry Division, ABS Cat 5204.0, Table 63. Net Capital Stock, by Industry by type of asset, Author's Calculations

5.2.1 Distribution, Producer, Social and Personal Services in Australia

The disaggregation of the services sector into four sub-sectors as per Section 2.3, being distributive services, producer services, social services and personal services, allows for a more granular analysis of its structure, conduct and performance. In this section, the four sub-sectors will be compared with the aggregate services sector to identify the relative contribution and performance of each individual sub-sector.

Figure 5.6 shows the relative importance of each services sub-sector as measured by real IGVA over the period 1975 to 2016. Producer services now represent 41 per cent of total services in Australia, which primarily reflects an increased significance of the financial services sector in the domestic economy. The growth in the financial services sector over the past four decades has occurred as a consequence of numerous regulatory and market reforms, including those recommended by the Australian Financial System Inquiry (referred to as the "Campbell Committee") of 1979, such as floating the Australian dollar, removing barriers to entry to the financial system, and a strengthening of prudential measures to preserve the system (Hanratty, 1997; Pomfret, 2015, p.411, Borland, 2015, p.424).

Figure 5.6
Proportion of Real IGVA by Services Sub-Sector, Australia, 1975-2016

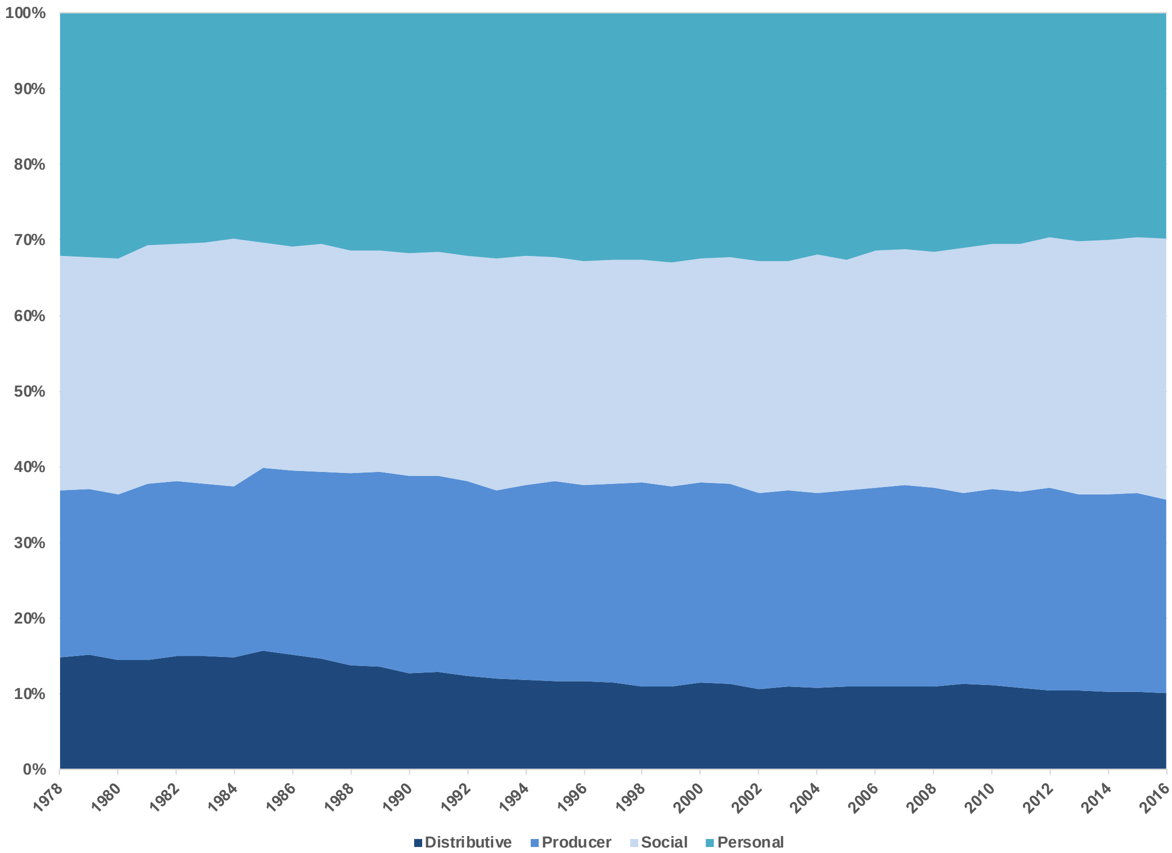


Source: ABS Cat 5204.0 Table 5. GVA by Industry, Author's Calculations

Social services and personal services have grown at real average CAAG rates of 3.3 per cent and 2.9 per cent respectively between 1975 and 2016, which while still positive, are below the services sector as a whole. Low growth in the Accommodation and Food Services and Other Services industries drove the below-average growth in personal services, while growth in IGVA for social services was moderated due to lower growth in Public Administration and Safety and Education and Training. Declining real prices for food, especially with takeaway food, the privatisation of various government functions and services, and the reduction in government expenditures on higher education and vocational training, are contributing factors for why these industries experienced relatively softer growth in GVA during this period.

Labour force data shows social services and personal services employ the largest number of workers within the services sector, while employment within distributive services has been declining as a proportion of total employment in the services sector. The privatisation of Commonwealth-owned airports and railway networks, and state-owned electricity and gas distribution assets and water and sewerage reticulation assets, resulted in significant labour efficiencies within distributive services from the mid-1990s (Productivity Commission, 2005).

Figure 5.7
Proportion of Labour Force by Services Sub-Sector, Australia, 1978-2016

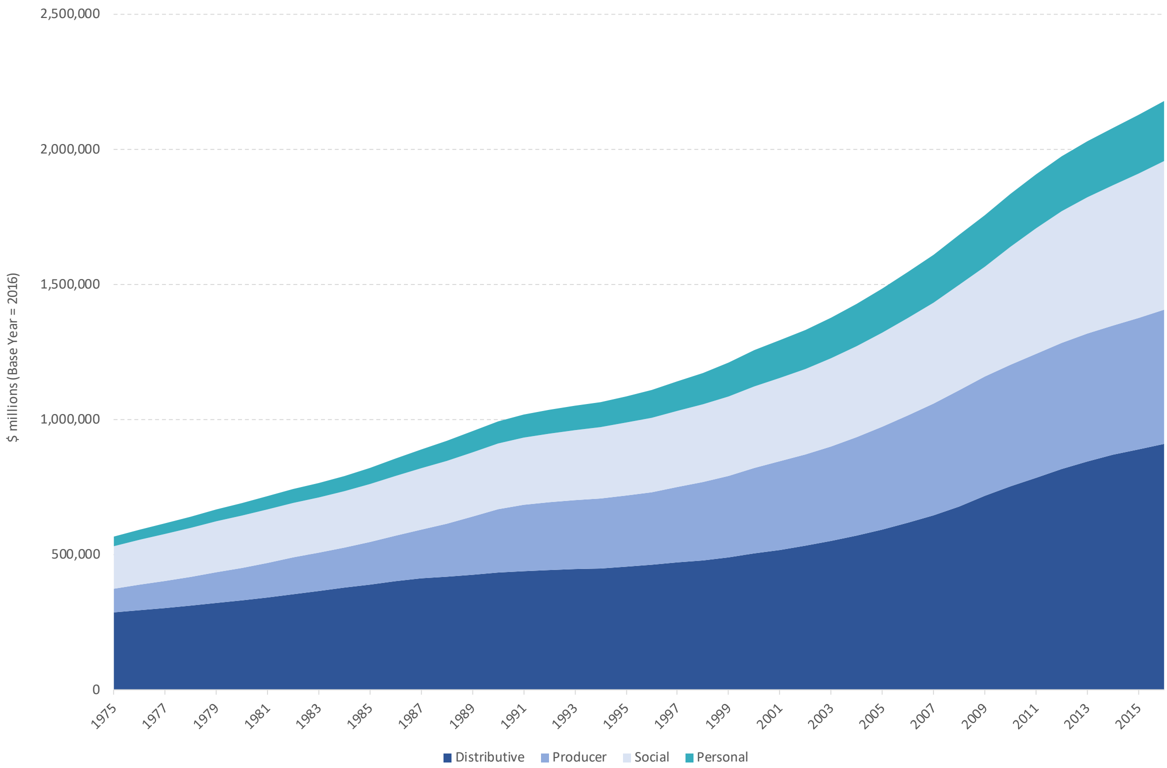


Source: ABS Cat 6291.0.55.003, Table 04. Employed persons by Industry division of main job (ANZSIC) - Trend, Seasonally adjusted and Original, Author's Calculations

These privatisation events also altered capital usage within the distribution services sub-sector as the regulatory framework, employed to govern the management of monopoly infrastructure by the private sector, encouraged new investment (Quiggin, 2014). The "rate of return" based regime created an incentive to increase the asset base as long as the regulator was persuaded there was an underlying need to do so, due to either an expectation of increasing demand, and/or the requirement to replace run-down assets, and/or the requirement to provide enhanced system security/system reliability to the electricity grid.

This is evidenced by the rate of growth in the real asset base in both the Electricity, gas, water and waste services and Transport, postal and warehousing industry sectors, which grew by 1.9 per cent and 2.3 per cent respectively between 1975 and 1995, and 2.8 per cent and 3.5 per cent respectively between 1995 and 2016. This result for the Transport, postal and warehousing industry sector is also likely to have been influenced by changes in consumer behaviour over this period, specifically with the advent of internet shopping and increased reliance on imports for goods no longer manufactured in significant volumes in Australia (such as textiles, clothing and footwear).

Figure 5.8
Capital Stock by Services Sub-Sector ($ million real), Australia, 1978-2016



Source: ABS Cat 6291.0.55.003, Table 04. Employed persons by Industry division of main job (ANZSIC) - Trend, Seasonally adjusted and Original, Author’s Calculations

Considering both capital and labour inputs together it can be seen (as per Table 5.2 below) that producer services, social services and personal services all have K/L ratios below the national average, indicating these sub-sectors have a relatively higher reliance on labour in their production processes compared with the all-industries average.

Notably, personal services has a K/L ratio of 0.68, which means that in 2016 for one unit of capital employed in the sub-sector there were about one-and-a-half units of labour employed. This compares with 1992, where for every one unit of capital employed in the sector, there were about three units of labour employed. This suggests that while personal services remains biased towards the use of labour in its production process, capital has been employed in this sub-sector more rapidly than virtually any other sub-sector (except for the primary sector), most likely through factors such as the increasing use of internet shopping, production efficiencies in food services, and the development of the "pampering" industry.

Table 5.2
Capital-Labour Ratio[1] by Services Sub-sector, Australia

Year ended 30 June	Distributive	Producer	Social	Personal	Total - All Industries
1992	4.30	1.20	1.15	0.38	1.32
1993	4.54	1.24	1.17	0.39	1.34
1994	4.43	1.20	1.15	0.39	1.32
1995	4.30	1.15	1.19	0.38	1.30
1996	4.26	1.13	1.14	0.40	1.29
1997	4.36	1.16	1.17	0.42	1.33
1998	4.53	1.17	1.20	0.45	1.36
1999	4.57	1.19	1.19	0.48	1.38
2000	4.52	1.22	1.21	0.50	1.39
2001	4.38	1.24	1.19	0.51	1.40
2002	4.72	1.31	1.18	0.52	1.43
2003	4.76	1.32	1.17	0.53	1.45
2004	4.84	1.35	1.18	0.55	1.49
2005	4.80	1.38	1.20	0.56	1.51
2006	4.92	1.38	1.18	0.58	1.55
2007	5.01	1.38	1.20	0.59	1.58
2008	5.05	1.42	1.22	0.59	1.62
2009	5.15	1.47	1.22	0.62	1.70
2010	5.55	1.43	1.29	0.65	1.77
2011	5.65	1.44	1.32	0.65	1.82
2012	5.88	1.41	1.33	0.66	1.89
2013	6.03	1.42	1.36	0.67	1.99
2014	6.28	1.45	1.36	0.68	2.07
2015	6.25	1.43	1.39	0.68	2.12
2016	6.32	1.44	1.37	0.68	2.13

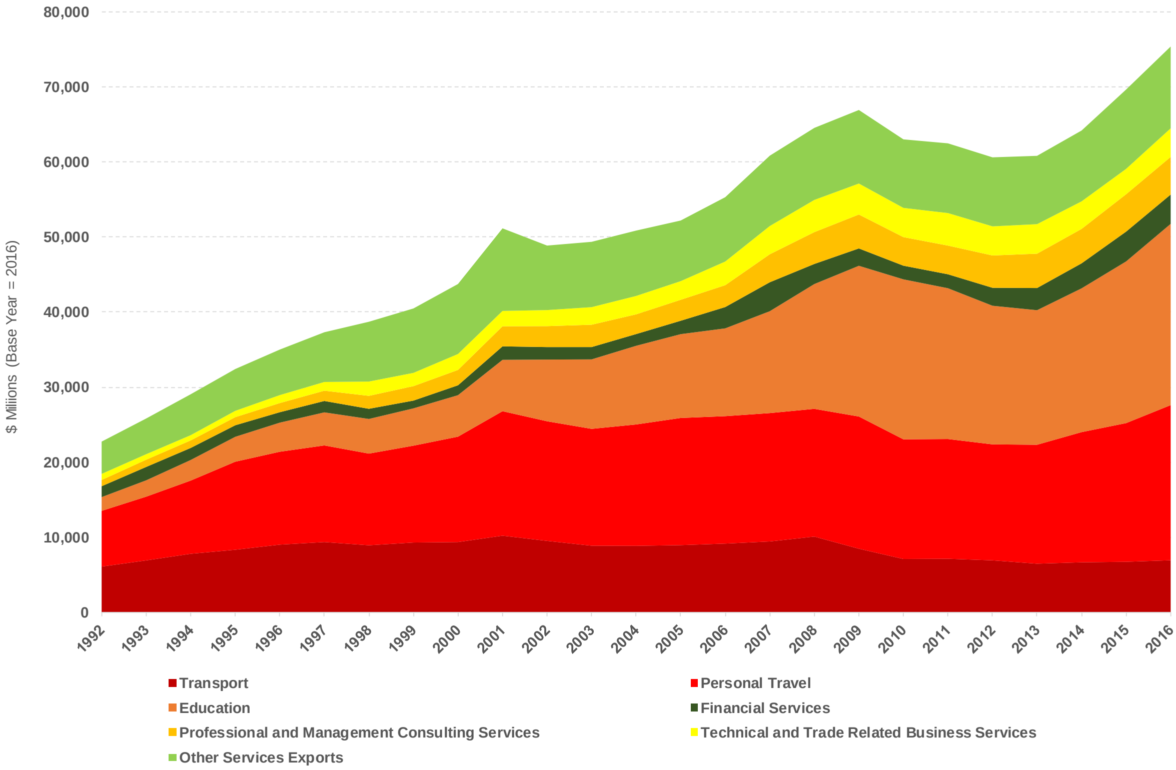
1. Calculated as Net Capital Stock: Chain volume measures ($ millions) divided by Number of hours actually worked in all jobs ('000 hours)

Source: ABS Cat. No. 5204.0, Table 58. Capital Stock, by Industry; ABS Cat. No. 6291.0.55.003, Table 11. Employed persons by Industry division of main job (ANZSIC) and Hours actually worked in all jobs, Author's Calculations

The two dominant categories of services sector exports for Australia are Personal Travel (in-bound international tourism) and Education (foreign students studying full-time in Australian schools and higher education institutions). Australia's attractiveness as a destination for international tourists remains high, with about 7.85 million short-term overseas arrivals visiting Australia during 2016 compared with 2.69 million arrivals during 1992 (ABS, 2017h).

The ABS has estimated the international visitors have, on average, contributed 0.9 per cent of national GDP during 1998 and 2016, although the Sydney Olympics and the Rugby World Cup during 2000 and 2003 respectively helped push tourism exports to represent 1 per cent of GDP during those years (ABS, 2017i).

Figure 5.9
Services Exports by Main Category ($ million real), Australia, 1992-2016



Source: ABS Cat 5302.0, Table 08. Service Credits; Author's Calculations

As shown in Table 5.3, profitability for each services sub-sector differs reflecting the nature of the activities undertaken, the marginal price point for the services offered and the level of competition for those activities within the economy. The profitability analysis is presented over three-time periods: (i) between the start of the series and 2009, reflecting a period leading up to and including the initial years of the Global Financial Crisis

(“GFC”); (ii) between 2010 and 2016, reflecting the post-GFC recovery period; and (iii) the complete period between 2003 and 2016.

Table 5.3
Services Sub-Sectors Profitability and Volatility[1] Measures, Australia
FY03 - FY16

	Avg. Op. Profit before Tax	Standard Deviation	Avg. Return on Asset	Standard Deviation
Distributive services				
FY2003 - FY2009	10.6%	1.3%	3.5%	0.5%
FY2010 - FY2016	10.9%	0.7%	3.5%	0.2%
FY2003 - FY2016	10.8%	1.0%	3.5%	0.4%
Producer services				
FY2003 - FY2009	10.4%	1.4%	14.1%	2.1%
FY2010 - FY2016	12.4%	0.8%	17.1%	1.5%
FY2003 - FY2016	11.4%	1.5%	15.9%	2.6%
Social services				
FY2003 - FY2009	13.6%	1.4%	2.7%	0.3%
FY2010 - FY2016	16.6%	0.5%	3.6%	0.2%
FY2003 - FY2016	15.1%	1.9%	3.1%	0.5%
Personal services				
FY2003 - FY2009	5.9%	0.9%	12.8%	1.1%
FY2010 - FY2016	6.9%	0.5%	14.3%	1.3%
FY2003 - FY2016	6.4%	0.9%	13.6%	1.4%
Services sector – Total				
FY2003 - FY2009	9.2%	1.2%	7.2%	0.8%
FY2010 - FY2016	10.8%	0.2%	8.1%	0.2%
FY2003 - FY2016	10.0%	1.2%	7.7%	0.7%
All Industries – Total				
FY2003 - FY2009	10.1%	1.3%	8.7%	0.9%
FY2010 - FY2016	11.1%	0.9%	8.4%	1.2%
FY2003 - FY2016	10.6%	1.2%	8.6%	1.1%

1. Volatility of profitability is measured as the standard deviation of the annual operating profit before tax by sector; volatility of return on asset is measured as the standard deviation of the annual return on asset by sector.

Source: ABS Cat 81550DO001_201516, Table 1 Key Data by Industry Division, ABS Cat 5204.0, Table 63. Net Capital Stock, by Industry by type of asset, Author’s Calculations

This analysis shows social services has had the strongest operating profit of all the services sub-sectors, due to high margins in the private health care industry. Despite the strong operating profit for this sub-sector, it consistently achieves the lowest return on assets, indicating the sub-sector has a significant asset base, of which a large proportion are long-lived assets (such as hospital buildings and education facilities).

This analysis also reveals a broader distinction in industry profitability between the pre-GFC and post-GFC time periods, with returns generally stronger and less volatile in the later period compared with the former. This is likely to reflect a number of factors, including: (i) three main GFC “events” occurring in this first period, which were the announcement by BNP Paribus Investment Partners of cessation of three hedge funds on 9 August 2007, the collapse of Lehman Brothers on 8 September 2008, and the release of the G20 US$5 trillion stimulus package on 2 April 2009, which resulted in greater volatility in profitability during this time (KPMG, 2017); and (ii) given a tightening of prudential lending requirements in the period post-GFC, businesses became more selective in the opportunities they would invest in, thereby directing their equity into those opportunities with higher returns and lower risk.

In summary, the services sub-sectors in Australia exhibit a range of idiosyncratic characteristics reflecting the nature and function of their underlying activities. The distributive services sub-sector is highly capital intensive, increasingly less reliant on labour, and moderately profitable. Producer services is the dominant services sub-sector in the Australian economy, employing marginally greater amounts of capital compared with labour, with growth also being achieved through international trade. Social services employs the largest number of workers in Australia and generates an increasing amount of its revenues through the export of education services to foreign students, but also earns the lowest Return on Assets of all the service sub-sectors. Personal services is a low-wage, low-profit, labour intensive sub-sector, but one whose volatility has declined as Australian consumers change their spending habits in this sector from being highly discretionary to being a more staple expense.

5.3 Sectoral backward and forward linkages within the Australian economy

5.3.1 Introduction

Hirschman introduced the concepts of backwards and forward linkages in his research into the patterns of industrial interdependence within an economy (Drejer, 2002, p.2). Hirschman recognised that production by a given industry (or sector) generates two types of economic effects on other sectors within the economy. "Backward linkages" show the connection an industry has with its suppliers; while "Forward linkages" show the connection an industry has with its clients (Gorska, 2015, p.31).

Backward linkages show the direction of causation in the demand-side component of the economy, and measures the impact on the demands of other sectors whose goods are used as inputs to production in industry *j* when it increases its output. Forward linkages show the direction of causation on the supply side model, such that when industry *j* increases its output, additional volumes of its product are then available to be used as inputs to other sectors for their own production (Gorska, 2015, p.31)

Aydin (2007) calculates linkages by estimating the Leontief and Ghosian weighted inverse coefficients for backwards and forwards linkages respectively (Aydin, 2007, p.7). These coefficient calculations are similar in the sense that they represent the total inputs a specific industry absorbs within its own production processes; although the technical difference between the two measures is that the denominator in the Leontief coefficient calculation incorporates final demands while the denominator in the Ghosian coefficient calculation incorporates other primary inputs (equal to value added).

5.3.2 Empirical results

The linkage measures for Australia have been calculated using the National Input-Output (I-O) and Supply and Use Tables for FY01 and FY14 as prepared by the ABS. The linkage measures have been calculated using the Chenery-Watanabe approach[8] for primary, secondary and services sectors, as well as the distributive, producer, social and personal services sub-sectors.

Table 5.4 shows the normalised values of backwards and forward linkages of sectors in the Australian economy for FY01 and FY14; and Figure 5.10 presents how the linkages in each sector have evolved between the two time periods.

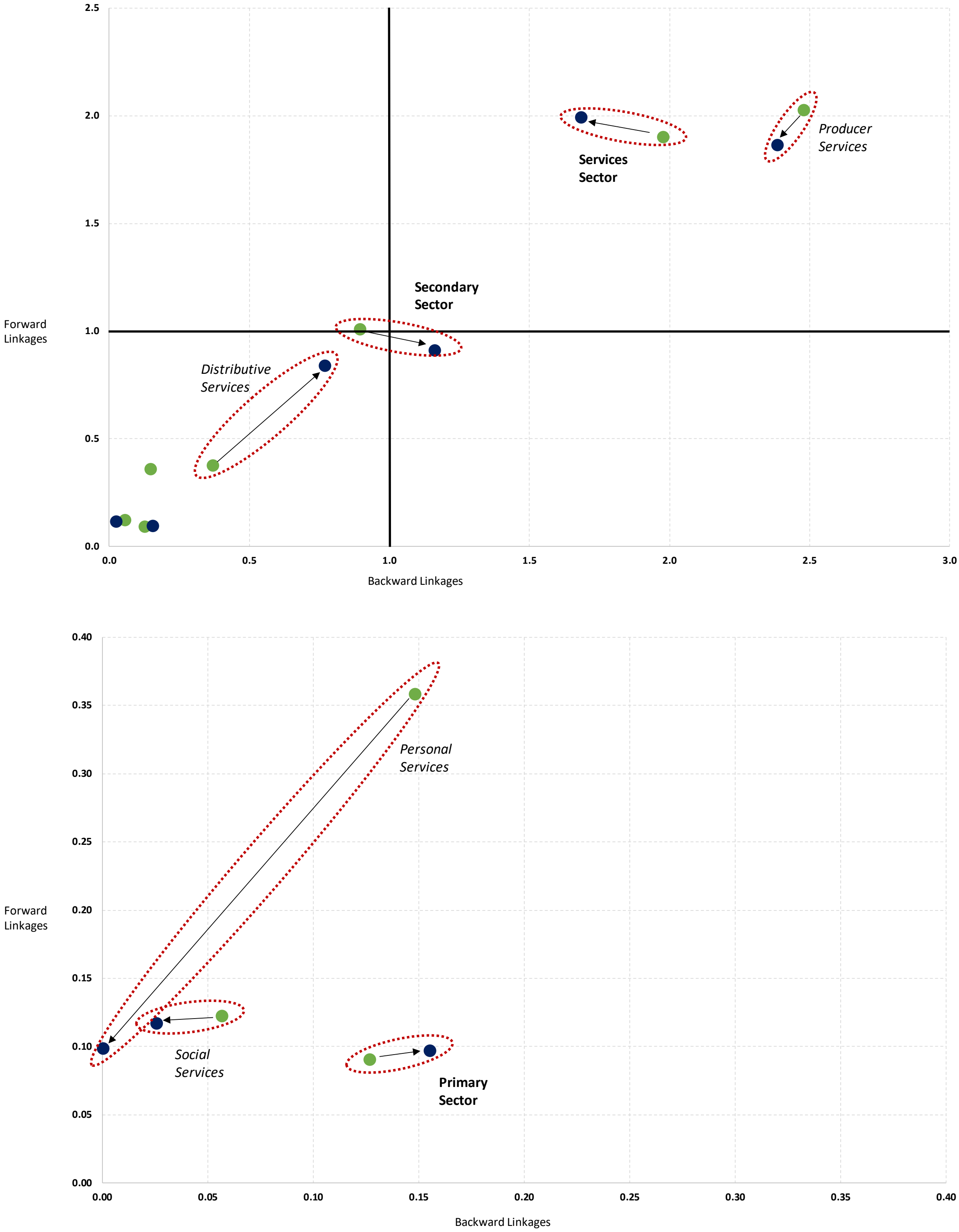
Table 5.4
Backward and forward linkages in the Australian economy by sector, FY01 and FY14

	2000-01		2013-14	
	Weighted Leontief Backward Linkages	Weighted Ghosian Forward Linkages	Weighted Leontief Backward Linkages	Weighted Ghosian Forward Linkages
Primary	0.1267	0.0910	0.1551	0.0975
Secondary	0.8954	1.0082	1.1612	0.9113
Services	1.9779	1.9008	1.6837	1.9912
Distributive services	0.3703	0.3753	0.7697	0.8413
Producer services	2.4788	2.0253	2.3848	1.8631
Social services	0.0565	0.1227	(0.0006)	0.0988
Personal services	0.1481	0.3586	0.0253	0.1173

Source: Author's calculations

[8] The Chenery-Watanabe approach measures only the first round effects generated by the inter-relationships between sectors (Aydin, 2007, p8)

Figure 5.10
Backwards and Forwards Linkages by Sector and Sub-Sector, Australia, FY01 and FY14



Source: Author's Calculations

The secondary and services sectors, and the distributive and producer services sub-sectors, exhibit the strongest linkages in the Australian economy. During the 13 years between the two datasets the secondary sector and the producer services subsector consolidated their backward linkages within the economy; the services sector increased its forward linkages in the economy; while the distributive services subsector improved both its forward and backward linkages. The personal services sub-sector experienced a marked decline in the strength of its linkages within the domestic economy, while the backward linkages of the social services sub-sector also declined markedly, albeit from a low base.

Overall, the services sector in aggregate has stronger forward and backward linkages than either the secondary sector or the primary sector. This is caused by the strong forward and backward linkages exhibited by producer services, which in fact is the only component of the services sector that has stronger linkages than the primary or secondary sectors.

5.3.3 Additional Supply-Use analysis by sector

The examination of the I-O tables for the linkage analysis also provides information on how the composition of intermediate inputs required for the production of goods and services created in Australia has changed over recent time. Table 5.5 presents the use of intermediate inputs by sector in FY01 and FY14.

Table 5.5
Use of Intermediate Inputs by Type by Sector, FY01 and FY14

Supply of inputs by Sector	Use of inputs by Sector					
	Primary		Secondary		Services	
	2001	2014	2001	2014	2001	2014
Primary	12.2%	9.6%	11.3%	11.3%	0.9%	0.7%
Secondary	13.3%	13.5%	36.2%	37.0%	11.5%	7.4%
Services	14.5%	22.8%	22.3%	21.4%	35.9%	36.7%
Distribution	*4.4%*	*4.9%*	*5.8%*	*6.0%*	*7.2%*	*9.2%*
Producer	*8.6%*	*13.6%*	*14.2%*	*13.0%*	*23.6%*	*23.6%*
Social	*0.3%*	*0.5%*	*0.5%*	*0.5%*	*1.1%*	*1.1%*
Personal	*1.2%*	*3.7%*	*1.7%*	*1.9%*	*4.1%*	*2.8%*
Total Uses	40.0%	45.9%	69.8%	69.7%	48.4%	44.8%
Services as % of Intermediate Uses	36.3%	49.6%	31.9%	30.8%	74.3%	81.9%

Source: ABS, Cat. No. 5209.0.55.001; Author's calculations

The analysis in Table 5.5 shows services have become more important as an input into the production process in Australia during the past 14 years, representing 55.6 per cent of all intermediate inputs in FY01 to 60.1 per cent in FY14. This increase in usage as an intermediate input has been most pronounced within the primary sector, where services as a proportion of intermediate uses increased from representing just over one-third to nearly one-half of all inputs used in the sector.

Of the different types of services produced in Australia, producer services significantly increased its importance as an intermediate input in the production process for the primary sector during this period. This increase in usage of producer services was as a result of the significant growth in capital spending by the mining industry, which included increased spending on financial services (associated with the funding of the capital projects) and professional and technical services (associated with the technical planning and development of the capital projects). Also, the services sector itself increased its consumption of services as an intermediate input in the production of its output; while the secondary sector saw a decline in the relative use of services as an input.

This analysis also shows that Australia, contrary to the experience in many other countries, has not experienced a "servicification" of its secondary sector; rather the secondary sector experienced a slight decline in its relative use of services as an intermediate input in its production process. Lodefalk (2013), Pilat (2005), Pilat et al (2008), Boddin and Henze (2014), Crozet and Milet (2014), Kelle (2013) and Kelle and Kleinert (2010) and Thangavelu, Wenxiao and Oum (2017) are just a number of studies which show manufacturing industries across developed and developing countries have increasingly been using services in their production processes, as well as selling services as a final product to consumers. This phenomenon of "servicification of manufacturing" has been attributed to a number of factors, including the rise in importance of Global Value Chains (GVCs) (Thangavelu, Wenxiao and Oum, 2017), use of services (such as logistics, management consulting, engineering) to improve productivity within the sector (Nordas, 2010), and competitive differentiation (Lodefalk, 2015). Australia's lack of participation within multinational corporations (MNCs) GVC network and the consequential decline of the manufacturing sector following the "commodities boom" are factors that may partially explain this result.

Rather, this analysis suggests Australia has experienced a “servicification of the primary sector” since the turn of the century. Given most of this increased “servicification” effect in the primary sector has been associated with increased usage of producer services it is reasonable to question whether this outcome may be temporary (reflecting the recent capital development phase in the mining sector, which may return to previous levels once the operational phase of the new capital assets becomes dominant) or will be permanent (meaning there will be a continual purchase of financial, professional and property services by the primary sector as intermediate inputs in future years).

5.3.4 Summary

The linkage analysis presented above reaffirms the strength the services sector has in its backwards and forwards linkages within the Australian economy. The analysis shows that while Australia’s secondary sector increased its backwards linkages in the economy, its forwards linkages fell, suggesting an erosion of the sector’s importance in supporting downstream value-added activities within the economy over this period considered. Conversely, Australia’s services sector lifted its strength in forward linkages, and marginally declined its strength in backwards linkages, driven predominately by the decline in both linkages from the personal services sub-sector. This result shows there has been a significant disconnection in the personal services sub-sector over the 13 years spanning the datasets, most likely as a result of the “disruption” experienced in the retail, accommodation and food and beverage industries from innovative on-line market participants such as Amazon, Air BnB and Deliveroo who have altered the traditional business model in these industries significantly.

The I-O analysis has also shown that services have become more important as an input into the production of final goods and services in Australia. Importantly, this analysis also shows that, contrary to the experience in many other countries, Australia has not experienced a “servicification” of its secondary sector, but rather has experienced a “servicification” of its primary sector.

5.4 Productivity and the Australian services sector

5.4.1 Introduction

The previous sections provide an overview of the individual roles played by capital and labour in each of the services sectors during the most recent few decades in Australian economy. This section now seeks to combine the growth theory discussed in Chapter 3 and the empirical data presented previously in this chapter to better understand the role that capital, labour and productivity have collectively played more recently in promoting growth within the services sector in Australia.

Understanding the role of productivity in driving economic growth is a fundamental issue for any policy maker to comprehend. However, measuring productivity can be problematic, and given there are different approaches and methodologies that can be applied to estimate productivity, comparisons across time and jurisdictions can be difficult even if it appears the same principles are broadly employed by differing researchers and in differing studies.

Multifactor productivity in Australia has been calculated by numerous economists over the past few decades using various techniques including the Cobb-Douglas Production Function (Pagan (1997), Otto (1999), Otto and Voss (1996), Narayan (2007), Shahiduzzaman, Layton and Alam (2015), Kennedy et al (2017)), a Translog function (Paul and Marks (2009), Fox and Kohli (1998)) the Growth Accounting Framework (Parham, Roberts and Hill (2001), Ewing et al (2007)), and the OECD "bottom-up, non-parametric approach based on production economics" (OECD (2001)) (Zheng, 2005, pp.2-3). Each of these methods is discussed below and estimates of MFP are calculated for the primary and secondary sectors, and the distributive, producer and personal services sub-sectors.

Despite the ABS improving their data collection and analysis techniques to estimate gross value added (on a chain volume basis) within Australia's national accounts[9] for other service industries considered to be non-market, the ABS also notes that the improvements are not sufficient to enable the creation of reliable productivity estimates for the education and training sector (ABS, 2001, p.13, 19). Also, given the well-known problems of estimating MFP for government services that are provided at non-market prices

[9] From the June quarter 2001

(Productivity Commission, 2017b, p.3), the whole social services sub-sector has been excluded from the productivity calculations contained within this section, with the services sector productivity measurements only being presented for the ABS defined market sectors. (ABS, 2001, p.19).

5.4.2 Measuring Australian MFP by Sector

As noted above, given the challenges surrounding the accurate measuring of productivity, four alternative approaches to calculating MFP for Australia are discussed below, with estimates of productivity by each different approach presented in the following section.

5.4.2.1 Cobb-Douglas Production Function

A production function defines how much potential output can be produced for a given level of combined inputs at a set level of technology. Miller (2008) notes that the Cobb-Douglas production function "is a special case in a general class of production functions with constant elasticity of substitution" and that its "major strengths are its ease of use and its seemingly good empirical fit across many data sets" (Miller, 2008, p.i, p.7).

The traditional Cobb-Douglas production function takes the form:

$$Y_t = A_t(L_t)^{\alpha}(K_t)^{(1-\alpha)} \tag{129}$$

where

Y_t = output;

L_t = labour;

K_t = capital;

A_t = constant term representing MFP; and

$\alpha, (1-\alpha)$ = labour and capital's share of output[10].

[10] Under the assumption of competitive markets and factors of production are paid their marginal product

Miller's assessment recognised the use of the Cobb-Douglas production function within macroeconomic analysis is not without its limitations, including endogeneity problems when a monetary value is used instead of a quantity index for capital (Cohen and Harcourt, 2003), inconsistency issues between studies when technical progress is misspecified, and aggregation of unlike industries or sectors within the Cobb-Douglas functional form can create interpretation challenges given its strong flexibility to fit data well.

Mahadevan (2002) explains that MFP growth comprises both technological progress and improvements in technical efficiency (Mahadevan, 2002, p.171). The difference between these two concepts is technical progress represents improvements in technology that is "embodied in capital" which enables the production frontier to shift outwards, while technical efficiency represents those situations where existing technology and inputs are utilized more efficiently as a consequence of improvements in knowledge due to "learning-by-doing", "managerial practice", and "technology diffusion" which enable output to move closer to the best-practice frontier (Mahadevan, 2002, p.171).

The OECD describes this distinction of the components of MFP growth in terms of "embodied" and "disembodied" technical change. Embodied technical change is defined by the OECD as those "advances in the design and quality if new vintages of capital and intermediate inputs, and its effects are attributed to the respective factor as long as the factor is remunerated accordingly"; while disembodied technical change are costless spillovers from other factors of production, such as "better management and organizational change" (OECD, 2001, p.20).

The traditional Cobb-Douglas function, which can be redefined to include an explicit measure of technical progress, is also included by adding an exponential time trend to the regression (Felipe and Adams, 2004, p.5; Ewing et al, 2007, p.11) which results in the constant term representing a Hicks-neutral measure of technical efficiency. This second form of the Cobb-Douglas equation (referred to as the "time trend" Cobb-Douglas equation) is given by

$$Y_t = A_t e^{\lambda T} (L_t)^{\alpha} (K_t)^{(1-\alpha)} \tag{130}$$

where

A_t = constant term representing technical efficiency; and

λ = exogenous rate of technical change.

This functional form of the Cobb-Douglas Production Function will be tested using empirical data in the following section, with the results presented in Table 5.8.

5.4.2.2 Transcendental Logarithmic Production Function

The transcendental logarithmic ("translog") production function was introduced by Christensen, Jorgensen and Lau (1972) in response to the recognition that "the empirical observation that the value added per unit rate of labour used within a given industry varies across countries with the wage rate" (Arrow et al, 1961, p.225), which results in varying substitutability between capital and labour at different price ratios (Boisvert, 1982, pp.1-3).

The translog production function is considered more flexible than the Cobb-Douglas production function as it lets more than two inputs to be considered and allows for the estimation of "other types of substitution elasticities that do not embody inherent behavior assumptions" (Matuschke, Mishra, and Qaim, 2007, p.1428; Boisvert, 1982, p.5).

The functional form of the translog production function, where output (Y) is a function of inputs (x_n) is given by

$$Y = f(x_1, \ldots, x_n)$$

$$Y = \alpha_0 \prod_{i=1}^{n} x_i^{\alpha^i} \prod_{i=1}^{n} x_i^{\frac{1}{2}\left(\sum_{j=1}^{n} \beta_{ij} \ln x_j\right)} \tag{131}$$

Taking the natural logs of both sides equation 131 becomes

$$\ln Y = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln(x_i) + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \beta_{ij} \ln(x_i) \ln(x_j) \tag{132}$$

and introducing labour (L) and capital (K) as inputs, then equation 132 becomes

$$\text{Ln}\, Y_t = \alpha_0 + \alpha_L \ln L_t + \alpha_K \ln K_t + \tfrac{1}{2}\alpha_{LL} \ln L_t^2 + \tfrac{1}{2}\alpha_{KK} \ln K_t^2 \qquad (133)$$

$$+ \alpha_{LK} lnL_t lnK_t + \mu_t$$

To ensure the MFP analysis using the translog functional form is comparable to the analysis using the Cobb Douglas function form, equation 133 can be amended to include a constant to returns to scale assumption and explicitly incorporating a Hicks-neutral technical change variable (Kuan et al, 1998, p.577). This is achieved by the following equation

$$\text{Ln}\, Y_t = \alpha_0 + g_t + \alpha_L \ln L_t + \alpha_K \ln K_t + \tfrac{1}{2}\alpha_{LL} \ln L_t^2 + \tfrac{1}{2}\alpha_{KK} \ln K_t^2 \qquad (134)$$

$$+ \alpha_{LK} lnL_t lnK_t + \mu_t$$

where

g_t = exponential rate of Hicks-neutral technical change

$\alpha_L + \alpha_K = 1$

$\alpha_{LL} + \alpha_{LK} = 0$

$\alpha_{KK} + \alpha_{LK} = 0$

From equation 132 it can also be shown that the translog production function can reduce down to a Cobb-Douglas production function in those situations where (i) output does not monotonically increase with all inputs and (ii) isoquants are not convex; which can be expressed in the equation as $\beta_{ij} = 0$.

The output elasticities for labour (S_{Lt}) and capital (S_{Kt}) can be also calculated from equation 134 (Kuan et al, 1988, p.578), being

$$\frac{\partial \ln Y_t}{\partial \ln L_t} = \frac{\partial\, Y_t}{\partial\, K_t}\frac{L_t}{Y_t} = S_{Lt} = \alpha_L + \alpha_{LL} \ln L_t + \alpha_{KL} \ln K_t$$

$$\frac{\partial \ln Y_t}{\partial \ln K_t} = \frac{\partial\, Y_t}{\partial\, L_t}\frac{K_t}{Y_t} = S_{Kt} = \alpha_K + \alpha_{KK} \ln K_t + \alpha_{KL} \ln L_t$$

Which then allows MFP growth to be estimated as per the conventional Solow residual calculation (Zheng and Bloch, 2014, p.212), being

$$\hat{A} = \hat{Y} - S_L\hat{L} - S_K\hat{K} \tag{135}$$

Paul and Marks (2009) apply a translog function in assessing the link between trade openness and productivity. In their specification of the translog model they note that "translog functional form often faces a serious problem of multicollinearity amongst variables, and reduces the degrees of freedom" (Paul and Marks, 2009, p.109). Boisvert (1982) acknowledges this concern with multicollinearity with the translog production function, but also raises concerns about the use of this method from a computational complexity and data availability perspective, and suggests using this approach one must have a compelling "a priori reason for believing such flexibility is necessary to represent the production technology accurately" (Boisvert, 1982, p.32).

5.4.2.3 Growth Accounting Framework

The growth accounting framework decomposes growth in output as a consequence of variations in growth of labour, capital and MFP. Parham, Roberts and Sun (2001) discuss the growth accounting framework for measuring productivity, and note the approach, which is a statistical accounting methodology, cannot "necessarily provide an indication of the total causal effect of the growth of inputs on the growth of output or productivity" (Parham, Roberts and Sun, 2001, p.23).

MFP is calculated under the growth accounting framework from the following formula

$$\frac{\Delta Y}{Y} = \frac{\Delta I}{I} + \frac{\Delta MFP}{MFP} \tag{136}$$

where

$\frac{\Delta Y}{Y} =$ growth in output

$\frac{\Delta I}{I} =$ growth in inputs

$\frac{\Delta MFP}{MFP} =$ growth in multifactor productivity

When output is assumed to reflect constant returns to scale and competitive equilibrium (meaning price is equal to marginal cost and capital and labour are paid the value of their marginal product), then the growth rate in MFP from equation 136 can estimated by the following equation (Verma, 2012, p.165; Zheng, 2005, p.7)

$$\frac{dA_j/dt}{A_j} = \frac{dY_j/dt}{Y_j} - v_j\left(\frac{dL_j/dt}{L_j}\right) - \gamma_j\left(\frac{dK_j/dt}{K_j}\right) \tag{137}$$

where

v_j = share of labour in total payments to factors of production;

γ_j = share capital in total payments to factors of production; and

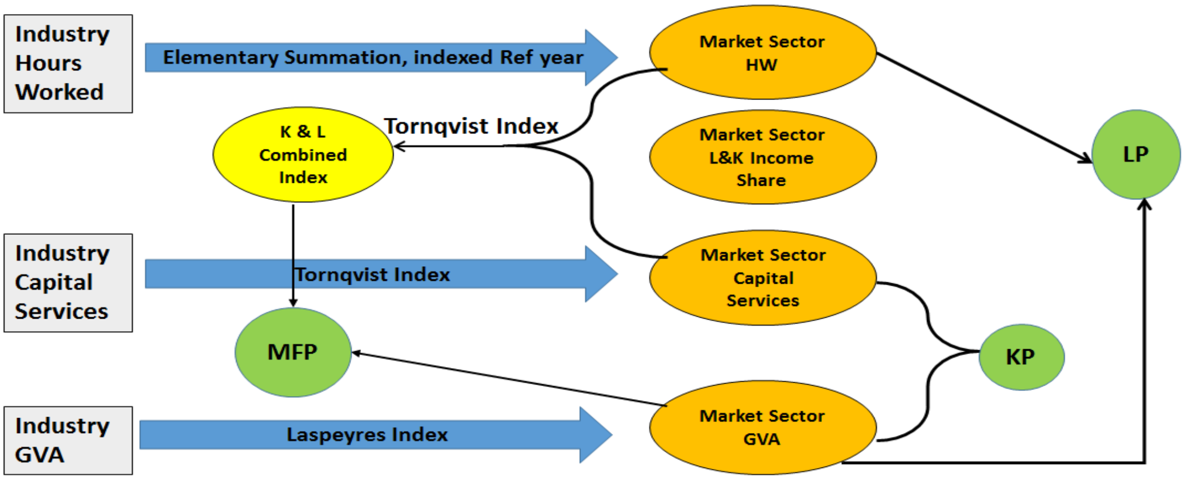
$v_j + \gamma_j = 1$

5.4.2.4 Index Number Approach in a Production Theoretic Framework

The Cobb-Douglas and Translog production function techniques are econometric approaches to measuring MFP, while the growth accounting framework discussed above is a statistical decomposition approach. The OECD notes that these techniques are suited to "academically orientated, single studies of productivity growth", but index number methods are more appropriate as a tool to estimate productivity statistics on a periodic basis (OECD, 2001, p.19).

Statistical agencies, like the OECD and the ABS, argue productivity is better measured through an index number approach as "simply adding up units of different types of commodities" ignores the heterogeneity of goods and services across the economy (OECD, 2001, p.83). The methodology employed by the ABS to calculate labour productivity, capital productivity and MFP on an industry-by-industry basis is shown in the following diagram.

Figure 5.11
Productivity Measurement using the Index Number Approach applied by the ABS



Source: ABS, 2018

MFP is measured empirically using the index number approach by the following equation

$$\bar{\tau}_v^i = [\ln V^i(t) - \ln V^i(t-1)] - \bar{s}_K^i[\ln K^i(t) - \ln K^i(t-1)] - \bar{s}_L^i[\ln L^i(t) - \ln L^i(t-1)] \quad (138)$$

where

$$\bar{s}_q^i = \frac{1}{2}\left[s_q^i(t) + s_q^i(t-1)\right], (q = K, L)$$

$\bar{\tau}_v^i$ = MFP growth

$V^i(t)$ = value added for industry *i* in period *t*

s^i = factor income shares for industry *i* (Zheng, 2005, p.15)

As shown above, the index number approach also requires similar data on an industry-by-industry basis to the previous productivity measures, including gross value added, labour hours worked and net capital stock. However, different to previous methods, capital input is measured in terms of capital services, which is derived applying a rental price to the productive stock of capital for each asset type. Further, while labour hours worked is also utilised, it is converted into an index and partially adjusted for quality change through weighting hours worked by each industry's proportional share of total labour compensation (Zheng, 2005, pp.25-26).

5.4.3 Summary of Empirical Analysis

5.4.3.1 Introduction

Carmichael and Dews stated that the Australian experience, consistent with the international experience, of calculating empirical production functions has historically been poor, primarily due to a lack of reliable data on the value of capital stock within the economy (Carmichael and Dews, 1986, p.17). Consistent with this theme is the opening quote presented in the recent study by Collard-Wexler and de Loecker on estimating production functions:

> *the measurement of capital is one of the nastiest jobs that economists have set to statisticians* (Hicks, 1981, p.204).

Since Hicks made that statement, and also since the Carmichael and Dews study into the role of investment in Australian economic growth between 1967 and 1986, the ABS has improved its data collection and statistical analysis techniques, improving the quality, timeliness, and breadth of information surrounding the value, type, application and industry use of the capital stock in Australia. This improved dataset, including annual information on the value of real output, actual hours worked by the labour force and value of the real net capital stock by services sub-sector, is presented in Table 4.5.

It is recognised that there is sometimes a delay between the commissioning and installation of new capital assets and equipment and the maximising of their contribution to output. These delays in new assets becoming fully operational to "boiler plate" specifications relate to the "bedding in" of new processes, systems and/or skills, and in terms of the production function equations above, suggest a need to incorporate a lag(s) in the data to reflect this "bedding in" process.

To test this, the value of net capital stock for each sub-sector has been lagged by up to three years, with the optimal model chosen for each sub-sector being the one with the minimum Akaike Information Criteria (AIC) value (Snipes and Taylor, 2014, p.4). The AIC value is estimated as per the following equation

$$AIC = n\,log\left(\frac{RSS}{n}\right) + 2K \tag{139}$$

where

n = number of observations in the dataset

RSS = residual sum of squares

K = number of parameters in the model.

However, given that the size of the dataset to be used in the calculation of the production function is relatively small (n=25), the following adjusted AIC equation proposed by Hurvich and Tsai (1989) has been applied to compare the impact of different lag effects in the Cobb-Douglas model (Snipes and Taylor, 2014, p.5).

$$AIC_c = AIC + \frac{2K(K+1)}{n-K-1} \tag{140}$$

Table 5.6 presents the AIC values calculated using equation 140 for each of the different lagged models.

Table 5.6
Adjusted Akaike Information Criteria Values[1] for Proposed Cobb-Douglas Production Functions by Services Sub-Sectors with lagged Net Capital Stock

	Lag in Net Capital Stock			
	t-0	t-1	t-2	t-3
Equation 122 - $Y_t = A_t e^{\lambda T}(L_t)^{\alpha}(K_t)^{\beta}$				
Primary	-152.19	**-156.47**	-154.29	-143.17
Secondary	**-164.64**	-157.98	-153.05	-149.06
Services – Market Sectors[2]	-197.82	**-204.23**	-146.64	-196.48
Distributive services	-191.34	**-196.64**	-195.50	-187.86
Producer services	**-177.06**	-176.13	-169.94	-163.92
Personal services	**-213.49**	-207.35	-196.61	-191.94

1. Bolded values are the lowest calculated AIC_c and represents the 'best-fit' model
2. includes all services except social services
Source: Author's Calculations

This analysis reveals that the contemporaneous value of net capital stock should be applied in the production function calculations with the exception of the primary sector, aggregate services (market sectors) sector and distributive services, where net capital stock should be lagged by one year. These findings are consistent with the study completed by Zheng and Bloch (2014) into Australia's declining productivity in the mining sector, which also found that "in order to take account of the long lead time from the investment in capital goods to their use in production…it is appropriate to lag both capital values by one year" (Zheng and Bloch, 2014, p.209).

These findings also make intuitive sense given that: (i) annual data is being utilised in these calculations, meaning there are up to four quarters for new assets to be "bedded down" into the production process; and (ii) the nature of the capital investment undertaken within the primary sector and distributive services sub-sector. These are often long-lived physical assets such as mining infrastructure, gas distribution and transmission pipelines, warehouses and telecommunication networks, which usually require a "ramp-up" period that can take longer than four quarters from when the asset has been commissioned.

Table 5.7
Values of Output, Labour and Capital by Industry Sector, Australia, FY92 – FY16

	Primary				Secondary			Services		
	Output[1]	Labour[2]	Capital-Land[3]	Capital-Other	Output	Labour	Capital	Output	Labour	Capital
FY92	58,163	81,879	117,507	142,540	124,209	232,891	128,673	440,044	763,691	1,036,308
FY93	60,206	80,770	117,475	144,118	128,770	237,772	130,388	452,188	754,978	1,051,418
FY94	61,895	82,418	117,815	146,003	136,051	245,682	133,534	475,103	780,699	1,064,507
FY95	60,785	80,816	119,347	150,171	141,819	257,516	138,803	513,812	814,564	1,085,673
FY96	69,235	82,156	121,264	156,284	144,823	255,451	144,562	530,253	845,442	1,109,694
FY97	71,908	83,829	123,809	163,493	147,629	255,695	147,960	552,234	845,400	1,141,714
FY98	73,557	86,097	128,141	174,008	156,093	256,557	152,647	570,985	852,945	1,172,341
FY99	76,491	84,108	131,201	181,592	164,232	255,980	154,295	601,987	872,183	1,211,107
FY00	80,464	87,275	131,649	183,979	170,284	268,321	157,493	625,984	890,414	1,257,067
FY01	85,460	85,126	131,882	185,746	162,793	265,852	158,492	647,313	914,264	1,293,940
FY02	87,047	87,392	133,220	191,342	172,490	262,834	159,538	674,501	915,271	1,331,540
FY03	78,967	77,539	136,065	199,407	187,259	272,322	165,389	695,146	940,924	1,377,058
FY04	84,705	77,016	139,337	209,794	193,826	275,251	173,357	721,547	957,515	1,428,274
FY05	89,223	76,693	143,069	221,487	197,252	285,161	184,012	745,529	982,773	1,484,968
FY06	91,247	77,507	149,878	241,945	202,087	286,386	197,413	768,613	1,014,036	1,546,382
FY07	90,281	81,546	157,773	268,187	207,875	297,164	205,805	802,677	1,038,998	1,609,599
FY08	95,050	82,494	166,996	300,413	218,471	306,767	216,158	830,298	1,071,437	1,683,707
FY09	103,218	88,080	177,237	337,845	216,191	301,863	221,842	847,821	1,079,326	1,756,158
FY10	107,090	88,617	184,318	366,098	217,220	297,961	227,268	864,168	1,090,003	1,834,956
FY11	109,444	91,663	193,805	405,266	219,633	298,925	232,697	888,277	1,118,219	1,907,362
FY12	115,004	97,101	211,483	480,144	233,256	293,907	238,971	919,188	1,144,159	1,974,100
FY13	120,992	96,617	231,113	570,940	234,386	291,948	240,329	942,774	1,156,120	2,029,650
FY14	129,138	98,779	246,225	648,726	238,934	295,221	239,313	964,087	1,160,922	2,078,876
FY15	135,422	89,655	254,719	700,576	234,170	293,813	237,992	993,422	1,186,269	2,127,410
FY16	137,993	92,130	257,598	726,311	230,598	288,697	234,931	1,030,579	1,215,324	2,178,680

1. Output values equal real (chain volume measures) of IGVA ($million); Base Year = FY16
2. Labour values equal number of actual hours worked in all jobs by industry (‘000 hours)
3. Capital values equal real (chain volume measures) net capital stock by industry as at 30 June ($million); Base Year = FY16

Source: ABS Cat 5204.0 Table 5. GVA by Industry; ABS Cat. No. 5204.0, Table 58. Capital Stock, by Industry; ABS Cat. No. 6291.0.55.003, Table 11. Employed persons by Industry division of main job (ANZSIC) and Hours actually worked in all jobs,

Table 5.7 (cont)
Values of Output, Labour and Capital by Services Sub-Sector, Australia, FY1992 – FY2016

	Distributive services			Producer services			Social services			Personal services		
	Output[1]	Labour[2]	Capital[3]	Output	Labour	Capital	Output	Labour	Capital	Output	Labour	Capital
FY92	77,355	103,060	443,331	153,510	209,650	251,055	136,370	219,639	253,639	72,809	231,341	88,283
FY93	79,518	98,556	447,007	157,161	205,805	255,028	141,807	220,646	258,901	73,702	229,972	90,482
FY94	83,755	101,351	449,069	168,966	215,647	259,043	145,987	228,978	264,140	76,395	234,723	92,255
FY95	88,866	106,052	455,859	193,359	228,813	263,273	150,391	227,907	270,166	81,196	251,791	96,375
FY96	93,239	108,648	463,066	199,396	237,312	268,026	154,040	241,863	275,567	83,578	257,619	103,035
FY97	96,209	108,294	471,807	208,306	239,525	278,887	159,737	240,080	281,643	87,982	257,502	109,377
FY98	100,262	105,831	478,936	217,072	247,576	290,175	162,534	239,994	287,650	91,117	259,545	115,580
FY99	103,980	107,316	490,266	232,543	253,757	301,344	168,828	247,530	294,015	96,636	263,580	125,482
FY00	107,089	111,723	505,070	244,412	258,898	315,960	173,795	248,530	301,685	100,688	271,262	134,352
FY01	110,363	118,275	517,463	253,101	264,570	328,661	178,997	259,669	308,068	104,852	271,751	139,748
FY02	113,651	112,979	533,629	266,200	258,028	337,491	186,693	267,023	316,077	107,957	277,241	144,343
FY03	118,261	115,902	551,171	274,345	264,049	349,357	190,025	278,433	326,614	112,515	282,539	149,916
FY04	121,431	118,078	570,929	286,588	269,330	364,194	195,335	285,513	336,639	118,193	284,593	156,512
FY05	125,958	123,623	593,137	295,339	276,337	380,623	201,818	288,902	348,070	122,414	293,911	163,138
FY06	129,325	125,799	618,604	308,145	288,397	396,940	207,221	304,393	360,536	123,922	295,446	170,302
FY07	135,626	128,844	645,753	322,210	300,383	413,499	215,080	311,305	373,299	129,761	298,467	177,048
FY08	141,412	134,260	678,266	333,817	303,375	430,394	220,755	319,747	390,137	134,314	314,055	184,910
FY09	142,913	139,335	717,987	336,878	301,006	441,367	232,709	332,016	406,035	135,321	306,969	190,769
FY10	145,363	135,696	753,013	343,290	314,835	449,747	239,413	338,658	436,509	136,102	300,814	195,687
FY11	149,545	138,938	784,456	355,173	319,353	458,661	244,720	352,222	464,546	138,839	307,705	199,699
FY12	152,982	139,023	817,131	371,291	329,962	466,540	251,089	367,075	487,288	143,826	308,100	203,141
FY13	155,780	140,140	844,871	384,762	334,047	473,437	257,473	370,917	504,137	144,759	311,017	207,205
FY14	155,933	138,594	870,068	393,325	329,000	477,742	266,874	381,422	519,136	147,955	311,907	211,930
FY15	159,806	142,279	889,707	405,908	338,822	486,201	275,059	383,877	534,147	152,649	321,290	217,355
FY16	165,305	143,942	910,062	422,642	344,074	496,564	285,064	401,229	549,945	157,568	326,079	222,109

4. Output values equal real (chain volume measures) of IGVA ($million); Base Year = FY16
5. Labour values equal number of actual hours worked in all jobs by industry (‘000 hours)
6. Capital values equal real (chain volume measures) net capital stock by industry as at 30 June ($million); Base Year = FY16

Source: ABS Cat 5204.0 Table 5. GVA by Industry; ABS Cat. No. 5204.0, Table 58. Capital Stock, by Industry; ABS Cat. No. 6291.0.55.003, Table 11. Employed persons by Industry division of main job (ANZSIC) and Hours actually worked in all jobs, 5.4.3.2 Production function and growth accounting estimates

The estimation results for the production functions presented above are shown in the following tables.

Table 5.8
Estimated Parameters[1] of the 'Time-Trend' Cobb-Douglas Production Function with constant returns to scale by Industry and Services Sub-Sector
FY93-FY16

Parameter	Primary Sector	Secondary Sector	Services (Market) Sector[2]	Distributive Services	Producer Services	Personal Services
A	-0.756 (-20.91)***	-0.464 (-5.67)***	0.743 (17.97)***	-0.550 (-9.27)***	-0.468 (-30.98)***	-0.514 (-8.21)***
λ	0.168 (7.86)***	0.099 (5.15)***	0.146 (20.99)***	0.125 (14.89)***	0.151 (12.95)***	0.008 (0.58)
α	0.743 (17.97)***	0.590 (6.52)***	0.682 (17.78)***	0.845 (18.27)***	0.593 (6.39)**	0.327 (6.76)***
β	0.257	0.410	0.318	0.155	0.407	0.673
R^2	0.977	0.982	0.998	0.994	0.995	0.998
DW	1.165	0.963	0.965	1.423	1.031	1.232

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. t-statistic in parenthesis
2. includes all services except social services
Source: Author's Calculations

Table 5.9
Estimated Parameters[1] of the 'Hicks-neutral technical change' Translog Production Function with constant returns to scale by Industry and Services Sub-Sector
FY93-FY16

Parameter	Primary Sector	Secondary Sector	Services (Market) Sector[2]	Distributive Services	Producer Services	Personal Services
α_0	-0.713 (-2.56)**	-0.473 (-5.62)***	0.714 (0.78)	1.170 (3.16)***	-0.258 (-0.38)	-1.764 (-2.27)**
g_t	0.172 (5.14)***	0.114 (3.80)***	0.175 (9.06)***	0.168 (15.15)***	0.158 (6.52)***	-0.014 (-0.74)
α_L	0.802 (2.09)**	0.347 (0.91)	0.489 (3.95)***	0.583 (8.96)***	0.564 (4.30)***	0.455 (4.93)***
α_K	0.198	0.653	0.511	0.417	0.436	0.545
$\frac{1}{2}\alpha_{LL}$	0.016 (0.156)	0.386 (0.66)	0.009 (1.64)	0.015 (4.67)***	0.15 (0.31)	-0.008 (-1.62)
$\frac{1}{2}\alpha_{KK}$	0.016 (0.156)	0.386 (0.66)	0.009 (1.64)	0.015 (4.67)***	0.15 (0.31)	-0.008 (1.62)
α_{LK}	0.031 (0.156)	0.773 (0.66)	0.018 (1.64)	0.029 (4.67)***	0.029 (0.31)	-0.016 (1.62)
R^2	0.977	0.982	0.998	0.997	0.996	0.998
DW	1.165	1.006	1.171	1.144	1.016	1.638

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. t-statistic in parenthesis
2. includes all services except social services
Source: Author's Calculations

Table 5.10 Growth Accounting Analysis by Industry and Services Sub-Sector, FY92 – FY16						
	Primary Sector	**Secondary Sector**	**Services (Market) Sector[1]**	**Distributive Services**	**Producer Services**	**Personal Services**
Average annual Factor Share – Labour[2]	29.7%	63.1%	53.0%	47.5%	50.7%	75.7%
Average annual Factor Share - Capital	70.3%	36.9%	47.0%	52.5%	49.3%	24.3%
Average annual Growth in Real IGVA	3.75%	2.65%	3.83%	3.22%	4.34%	3.28%
Due to Labour	0.12%	0.56%	0.91%	0.67%	1.07%	1.12%
Due to Capital	4.20%	0.98%	1.46%	1.61%	1.41%	0.92%
Due to MFP	-0.57%	1.11%	1.47%	0.94%	1.86%	1.24%

1. includes all services except social services
2. Source: ABS, 5260.0.55.002 Estimates of Industry Multifactor Productivity, Australia, Table 14
Source: Author's Calculations

These results indicate the Cobb-Douglas production function exhibits characteristics consistent with theoretical expectations, and has better statistical qualities, as shown by the greater number of parameters showing statistical significance at the 1% and 5% levels, than the Translog production function. The "time trend" analysis reveals the following insights with respect to the performance of the services sub-sectors in Australia between FY92 and FY16:

i. Technological progress has played an important role in three of the four services sub-sectors in Australia over the past two-and-a-half decades, particularly in distributive services where between 13 per cent and 17 per cent of output growth has been due to innovation and technology improvements within the sub-sector. Examples of such technologies include (a) the development of improved welding techniques to allow for higher capacity and pressures for gas pipelines; (b) the increasing automation of freight distribution centres and container ports; and (c) the ability of "older" telecommunication infrastructure to be upgraded to allow for higher bandwidths and increased internet speeds.

ii. Output of the personal services sub-sector has not been positively influenced by technological progress. This result is understandable in the sense that, by their nature, many of the activities undertaken within this sector involve personal interaction between the supplier and the purchaser, and while technology might assist the supplier to perform its activities, they may not necessarily create any incremental output above what they would have done without the use of that new technology. For example, a new LED lighting system may have been installed in a performing arts complex and this improves the viewing experience for the patrons of the theatrical performance. However, it is unlikely the new lighting system will induce incremental demand sufficient to require additional performances to be scheduled.

5.4.3.3 Estimates of Multifactor Productivity

Estimates of annual multifactor productivity from FY97 for each of the different methodologies presented in this section are shown in the following tables and charts. While annual estimates for MFP can be calculated using the Cobb-Douglas, Translog and Growth Accounting methodologies for the period prior to FY97, disaggregated capital stock data necessary to calculate the capital services index applied in the OECD and ABS preferred Index Number Approach in a Production Theoretic Framework is not available prior to this date.

Table 5.11 Annual Estimates of MFP for the Primary Sector by Methodology				
Year ending 30 June	**Cobb-Douglas**	**Translog**	**Growth Accounting**	**Index Number Approach**
1998	-3.14%	-3.18%	-1.94%	-2.37%
1999	2.13%	2.23%	2.55%	2.17%
2000	-0.55%	-0.60%	3.36%	2.87%
2001	6.05%	6.08%	6.49%	6.53%
2002	-1.86%	-1.93%	-0.46%	-0.84%
2003	-2.83%	-2.64%	-8.24%	-9.05%
2004	5.47%	5.49%	4.64%	4.62%
2005	3.29%	3.32%	2.26%	2.78%
2006	-0.81%	-0.80%	-3.57%	-3.27%
2007	-7.48%	-7.48%	-8.82%	-8.22%
2008	1.13%	1.17%	-2.18%	-1.64%
2009	0.03%	0.03%	-0.81%	-0.22%
2010	-0.17%	-0.15%	-1.54%	-1.43%
2011	-2.86%	-2.87%	-5.42%	-4.36%
2012	-2.30%	-2.31%	-8.14%	-6.19%
2013	0.97%	0.95%	-6.37%	-4.51%
2014	0.32%	0.24%	-2.47%	-1.53%
2015	8.78%	8.54%	2.92%	2.01%
2016	-2.47%	-2.54%	-1.02%	-1.14%
Source: Author's Calculations				

Table 5.12 Annual Estimates of MFP for the Secondary Sector by Methodology				
Year ending 30 June	**Cobb-Douglas**	**Translog**	**Growth Accounting**	**Index Number Approach**
1998	1.96%	2.85%	4.33%	3.69%
1999	2.77%	3.51%	4.96%	4.25%
2000	-2.35%	-1.75%	-0.07%	-0.49%
2001	-5.58%	-5.03%	-4.05%	-4.61%
2002	4.99%	5.52%	6.42%	6.32%
2003	3.25%	3.73%	4.93%	5.35%
2004	0.10%	0.44%	0.89%	1.21%
2005	-3.59%	-3.31%	-2.83%	-2.52%
2006	-0.86%	-1.03%	-0.70%	-0.11%
2007	-2.05%	-1.76%	-1.09%	-1.04%
2008	0.33%	0.45%	1.18%	1.13%
2009	-1.47%	-1.75%	-1.02%	-1.00%
2010	-0.09%	-0.44%	0.33%	0.19%
2011	-0.60%	-0.72%	0.04%	-0.15%
2012	5.94%	5.21%	6.38%	7.20%
2013	0.05%	0.01%	0.75%	0.51%
2014	0.46%	1.07%	1.32%	1.41%
2015	-2.21%	-1.96%	-1.49%	-2.04%
2016	-0.58%	-0.47%	0.07%	-0.07%
Source: Author's Calculations				

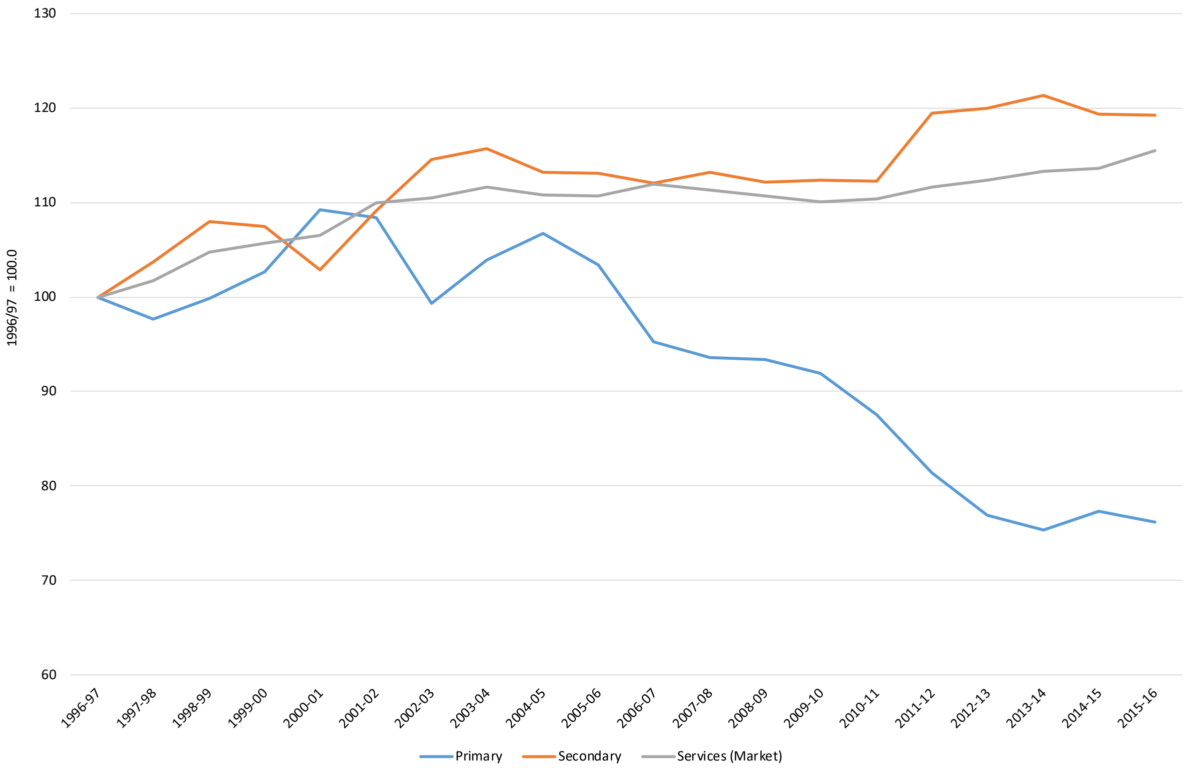
Table 5.13 Annual Estimates of MFP for the Services (Market) Sector by Methodology				
Year ending 30 June	**Cobb-Douglas**	**Translog**	**Growth Accounting**	**Index Number Approach**
1998	-0.32%	-0.39%	2.06%	1.69%
1999	1.51%	1.74%	3.33%	3.06%
2000	-0.62%	-0.18%	0.97%	0.99%
2001	-0.77%	-0.67%	1.02%	0.80%
2002	2.42%	1.53%	3.29%	3.39%
2003	-0.35%	0.00%	0.77%	0.50%
2004	0.82%	0.83%	1.56%	1.19%
2005	-1.33%	-0.70%	-0.34%	-0.82%
2006	-0.67%	-0.43%	0.06%	-0.14%
2007	0.53%	0.86%	1.33%	1.30%
2008	-0.83%	-0.21%	-0.18%	-0.61%
2009	-0.78%	-1.66%	-0.81%	-0.71%
2010	-0.85%	-1.27%	-0.42%	-0.57%
2011	-0.23%	-0.02%	0.48%	0.24%
2012	1.06%	1.14%	1.59%	1.34%
2013	0.22%	0.17%	0.76%	0.65%
2014	0.86%	0.19%	1.03%	0.95%
2015	-0.45%	0.33%	0.48%	0.32%
2016	1.41%	1.65%	1.95%	1.88%
Source: Author's Calculations				

Table 5.14 Annual Estimates of MFP for the Distribution Services Sub-sector by Methodology				
Year ending 30 June	**Cobb-Douglas**	**Translog**	**Growth Accounting**	**Index Number Approach**
1998	2.81%	1.90%	4.48%	4.09%
1999	-0.02%	0.47%	1.79%	1.04%
2000	-2.59%	-1.16%	-0.54%	-1.51%
2001	-3.68%	-1.67%	-1.02%	-1.92%
2002	4.20%	2.40%	3.50%	3.16%
2003	-0.17%	0.74%	1.10%	0.68%
2004	-0.91%	-0.26%	-0.13%	-0.55%
2005	-1.88%	-0.23%	-0.54%	-0.83%
2006	-0.79%	-0.19%	-0.38%	-0.59%
2007	0.82%	1.67%	1.39%	1.23%
2008	-1.00%	0.49%	-0.38%	-0.84%
2009	-3.85%	-2.55%	-3.82%	-3.57%
2010	1.30%	0.22%	0.37%	0.77%
2011	-1.00%	-0.17%	-0.47%	-0.61%
2012	0.36%	0.32%	0.03%	-0.05%
2013	-0.61%	-0.36%	-0.40%	-0.25%
2014	-0.68%	-1.15%	-0.96%	-0.84%
2015	-0.96%	0.00%	0.04%	0.11%
2016	1.27%	1.69%	1.67%	1.55%
Source: Author's Calculations				

Table 5.15 Annual Estimates of MFP for the Producer Services Sub-sector by Methodology				
Year ending 30 June	**Cobb-Douglas**	**Translog**	**Growth Accounting**	**Index Number Approach**
1998	-1.92%	-1.76%	0.52%	0.08%
1999	1.86%	1.87%	3.99%	3.76%
2000	0.29%	0.05%	1.70%	1.93%
2001	-0.89%	-0.99%	0.47%	0.51%
2002	4.73%	3.87%	5.08%	5.42%
2003	-1.04%	-1.06%	0.13%	-0.19%
2004	0.48%	0.29%	1.38%	1.14%
2005	-1.27%	-1.40%	-0.45%	-0.86%
2006	-1.16%	-0.92%	0.01%	-0.01%
2007	-0.69%	-0.48%	0.40%	0.49%
2008	0.76%	0.37%	1.17%	1.07%
2009	-0.11%	-0.61%	0.13%	0.57%
2010	-2.80%	-2.18%	-1.36%	-2.16%
2011	0.98%	1.00%	1.76%	1.59%
2012	0.76%	1.18%	2.03%	1.55%
2013	1.50%	1.56%	2.27%	2.26%
2014	2.38%	1.97%	2.49%	2.53%
2015	-0.20%	0.14%	0.84%	0.55%
2016	1.68%	1.69%	2.28%	2.22%
Source: Author's Calculations				

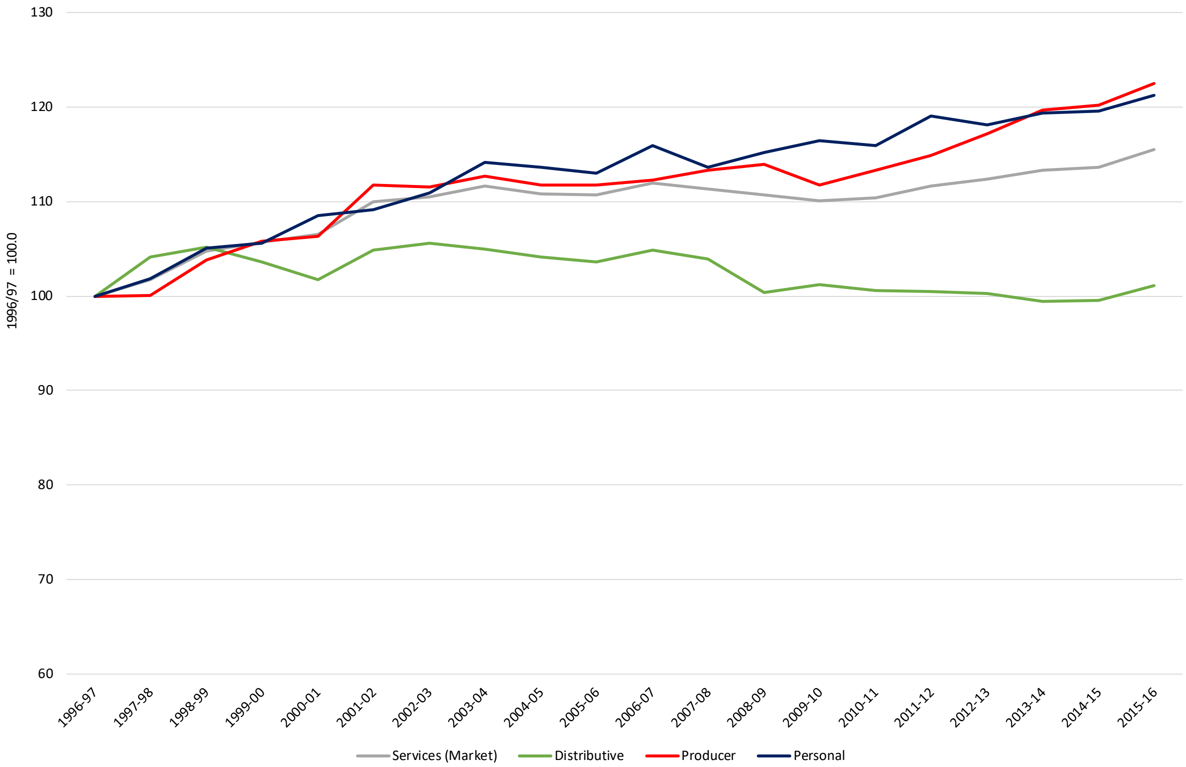
Table 5.16 Annual Estimates of MFP for the Personal Services Sub-sector by Methodology				
Year ending 30 June	**Cobb-Douglas**	**Translog**	**Growth Accounting**	**Index Number Approach**
1998	-1.09%	-0.31%	1.83%	1.85%
1999	0.38%	-0.14%	3.00%	3.18%
2000	-1.74%	-1.74%	0.35%	0.59%
2001	1.14%	1.54%	3.05%	2.93%
2002	-0.99%	-0.15%	0.65%	0.61%
2003	0.30%	0.75%	1.89%	1.69%
2004	1.95%	1.85%	3.43%	3.28%
2005	-1.19%	-0.85%	0.07%	-0.55%
2006	-1.42%	-1.75%	-0.31%	-0.64%
2007	1.78%	1.62%	2.91%	2.92%
2008	-2.44%	-2.08%	-1.51%	-2.26%
2009	0.68%	0.05%	1.55%	1.55%
2010	0.52%	0.11%	1.29%	1.27%
2011	-1.07%	-0.51%	-0.22%	-0.54%
2012	2.20%	2.44%	3.00%	3.16%
2013	-1.33%	-1.09%	-0.60%	-1.01%
2014	0.65%	0.62%	1.38%	1.31%
2015	-0.44%	-0.10%	0.28%	0.15%
2016	0.83%	1.01%	1.56%	1.74%
Source: Author's Calculations				

Figure 5.12
MFP Index by Sector using the Index Number Approach



Source: Author's Calculations

Figure 5.13
MFP Index by Services Sub-Sector using the Index Number Approach



Source: Author's Calculations

The analysis presented in Table 5.13 and Figures 5.12 and 5.13 shows the services (market) sector in Australia has recorded comparatively strong MFP growth since the mid-1990s. While the secondary sector has achieved marginally stronger MFP growth in comparison, annual movements in MFP in the secondary sector are more volatile than that experienced in the services sector. This suggests that productivity in the services sector, while it has been more gradual than the secondary sector, has also been more consistent.

The analysis also shows the services sector has been considerably more productive than the primary sector, with MFP achieving a negative growth rate in 13 of the 19 years considered in this analysis. This outcome is likely to be as a result of the significant investment which occurred within the mining industry during this period; with Dolman and Gruen (2012) arguing that while measured productivity in the mining industry has been estimated as negative there has not been “any real decline in productive efficiency within the industry” (Shahiduzzaman, Layton and Alam, 2015, p.285). Rather, measured productivity within the mining industry has been negative “because of the massive capital spending by mining companies during that time in response to the huge upswing in Australia’s terms of trade (resulting in more mining projects becoming economically viable due to higher world minerals’ prices), along with the necessarily considerable lags between capital spending and subsequent actual increases in mining production” (Shahiduzzaman, Layton and Alam, 2015, p.285).

Of the services sub-sectors, producer services and personal services recorded the strongest MFP growth. Consistent with the rationale discussed above for the primary sector, the distributive services sub-sector also experienced a significant increase in its capital stock during the analysis period, primarily associated with electricity distribution and transmission infrastructure. As infrastructure assets are usually commissioned with considerable excess capacity, capital productivity within the distributive services sub-sector has been (on average) negative during the past two decades, pushing MFP for the sector lower as a consequence.

The above MFP results for Australia are also consistent with the assertions made by Verma[11], and supported by research by Echevarria into growth factors of the Solow residual between sectors[12], that most advanced economies exhibit lower MFP growth in the services sector compared with the industrial sector (Verma, 2012, p.167; Echevarria, 1997, p.442)[13].

5.5 Conclusion

The Australian economy has evolved significantly since European settlement in the late-1700s, having withstood natural disasters, booms-and-busts and fluctuations in government policy towards openness in trade with external markets. Throughout this time services has been the dominant industry sector, with the only exception being a short period in Australia's early economic history when the pastoral industry expanded following the opening up of inland grazing areas. This dominance has strengthened further since the early 1970s after government trade protectionist policies were wound back and the services sector now represents around three-quarters of Australia's aggregate IGVA.

MFP has played a (statistically) significant role in driving economic growth in Australia since the early 1990s, with its greatest effect on the secondary and services sectors, while on a services sub-sector basis, producer services and personal services gained the most from productivity improvements.

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[11] Verma's study into MFP and growth in value added in services for India sees a higher proportion of *Services sector* growth in IGVA due to growth in MFP (45.5 per cent) during the period 1980-2005.

[12] Echevarria's sectoral analysis comprised Sector 1 = agriculture; Sector 2 = mining and quarrying, electricity, gas and water; manufacturing; and construction; Sector 3 = wholesale, retail trade, restaurants and hotels, transport, storage and communication, finance, insurance and real estate, and community, social and personal services.

[13] Noting there is a different industry allocation being applied in this study compared with that used in the Enchevarria study, and each study applies to two different time periods (i.e.: 1997 to 2016 and 1970 to 1985)

The services sector in Australia has grown at nearly the same average annual compound growth rate as the primary sector over 24 years from 1992, despite it being about 7½ times larger than the primary sector in absolute terms. Gradual and consistent productivity improvements, whether measured as increasing returns to scale, technical progress, or MFP coefficients, have directly supported the achievement of this outcome. This is a significant finding and empirically reinforces the message about the importance of productivity to an economy's long run growth outcomes.

Chapter 6 Cross-Country Empirical Analysis

6.1 Introduction

This chapter examines whether a country's living standards and its institutional governance arrangements influence the size and structure of the services sector within that country.

The relationship between real GDP per capita, a composite Governance Indicator and the relative economic importance of the services sector (and sub-sectors) is initially modelled using panel data (time series and cross-country information). The structure of the regression analysis is then extended to a fixed effects econometric model to test for structural differences for country and time (Miller, 1996).

Cross-country panel studies can be very useful as a mechanism to assess global trends and country-specific idiosyncrasies. However, the validity of the output of such studies can be open to debate on the basis that the results of cross-country panel studies have the potential to vary considerably depending on the countries included in the dataset (Maddala, 1999, p.434). Levine and Zervos (1993) and Harberger (1987) note that it is very important which countries are included in the panel study, and that it is not necessarily appropriate to have countries with significantly different social, economic and demographic characteristics in the same panel dataset (e.g.: Bolivia, Thailand, Greece and the Dominican Republic) (Levine and Zervos, 1993, p. 426; Harberger, 1987, p.256).

This chapter presents further information on the data utilised in this analysis, the modelling framework applied to conduct the empirical analysis, the results of the regression modelling, and a discussion of the findings.

6.2 Data sources used in the analysis

Maddala has observed the conduct of any cross-country analysis can be fraught with problems associated with data reliability (Maddala, 1999, p.431) and as such it is important to source information from reputable providers, and where possible, to utilise quantitative, referenceable data as opposed to third-party subjective indicators.

With this in mind, the data for this component of the study has been sourced from the World Bank, the European Commission and the International Monetary Fund. A discussion on each of the data sources is presented below.

6.2.1 World Input-Output Database

The World Input-Output Database (WIOD)[14] is an outcome of a project that was funded by the European Commission, Research Directorate General from 2009 to 2012 as part of the 7th Framework Programme, Theme 8: Socio-Economic Sciences and Humanities, grant Agreement No. 225 281 (Timmer, et al., 2015, p.575).

The project was carried out by a consortium of research institutes, including:

i. the University of Groningen, The Netherlands;

ii. the Institute for Prospective Technological Studies (IPTS), Seville, Spain;

iii. the Vienna Institute for International Economic Studies (wiiw), Vienna, Austria;

iv. Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim, Germany;

v. Österreichisches Institut für Wirtschaftsforschung (Wifo), Vienna, Austria;

vi. Hochschule Konstanz, Germany;

vii. The Conference Board (TCB) Europe, Brussels, Belgium;

viii. CPB Netherlands Bureau for Economic Policy Analysis, The Hague, The Netherlands;

ix. Institute of Communication and Computer Systems (ICCS), Athens, Greece;

x. Central Recherche SA, Paris, France; and

xi. the Organisation for Economic Co-operation and Development (OECD), Paris, France (Timmer, et al., 2015, p.575).

The input-output tables of the WIOD have been constructed using the United Nations System of National Accounts (SNA) framework and are based on published input-output tables and national account data from each country's national statistics agency, as well as

[14] www.WIOD.org

data from the OECD and UN National Accounts, UN COMTRADE and IMF trade statistics. (Timmer, et al., 2015, pp.576, 578, 596).

The WIOD presents annual input-output tables for the global economy from 1995 onwards, with the first release (in 2013) presenting information for the period 1995 to 2011 for 40 individual countries, including all 27 members of the European Union (as at 1 January 2007) and 13 other major economies, including Australia, Brazil, Canada, China, India, Indonesia, Japan, Mexico, Russia, South Korea, Taiwan, Turkey and the United States of America. The 2013 release presents data on 35 sectors, including agriculture, mining, construction, utilities, 14 manufacturing industries, telecom, finance, two business services, two personal services, eight trade and transport services industries and three public services industries (Timmer, et al., 2015, p.577-578).

A second version of the WIOD was released in 2016 and provides annual input-output tables between 2000 to 2014 for 43 countries (with the additional three countries in the 2016 version being Switzerland, Norway, and Croatia) split by 56 sectors (with the greater disaggregation in the number of sectors predominately in manufacturing and business services) (Timmer et al., 2016, p.17).

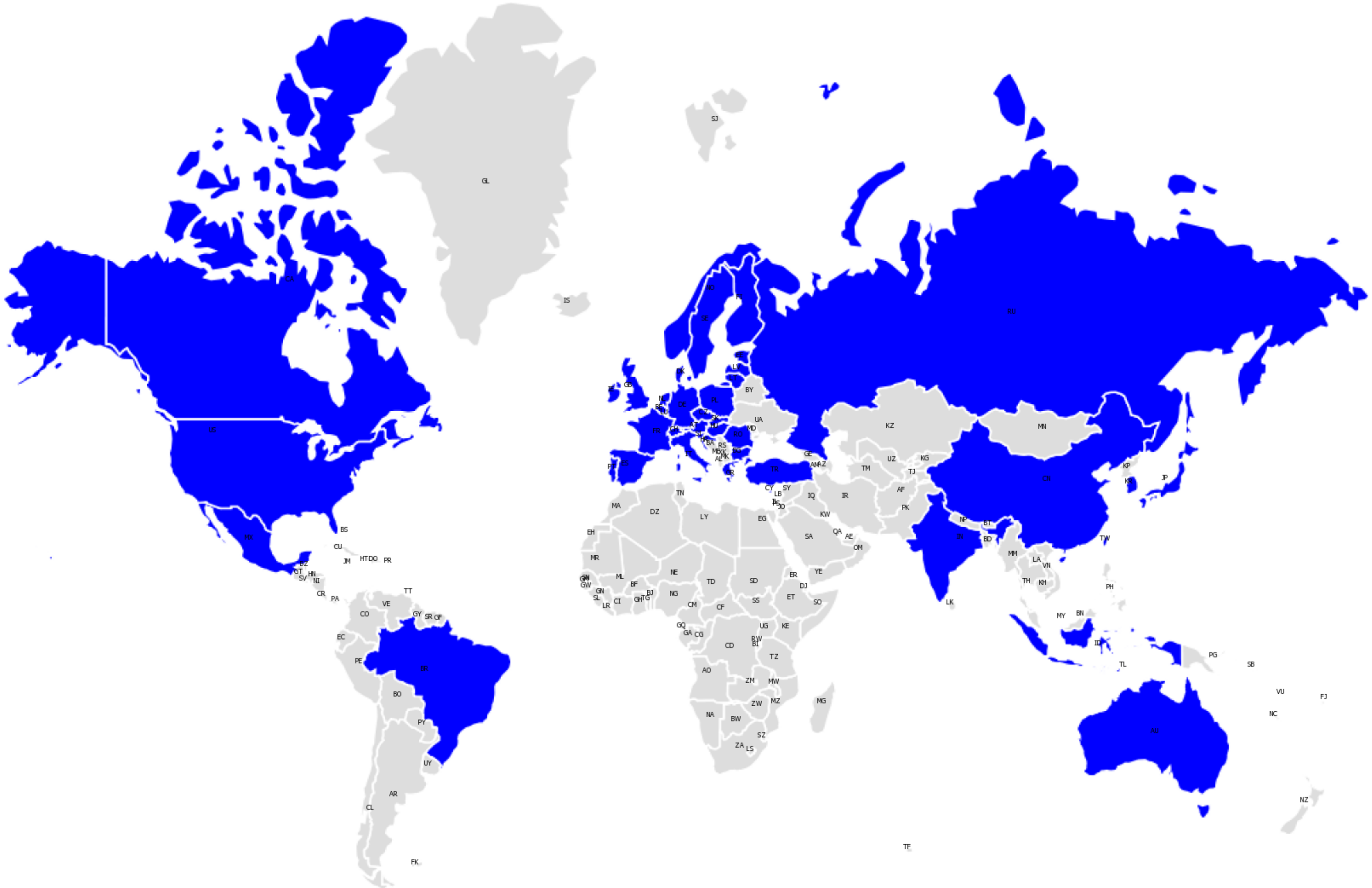
Importantly, the input-output tables in the first and second versions are not comparable as the 2013 WIOD is based on the 1993 classification of the SNA, while the 2016 WIOD is based on the 2008 classification of the SNA. Further, the first version of the WIOD is based on the International Standard Classification (ISIC) revision 3, while the second version of the WIOD is based on ISIC revision 4 (Timmer et al., 2016, p.17). These differences mean it is not possible to link the two versions and create a continuous timeseries of input-output data between 1995 and 2014. Rather, either the periods between 1995 to 2011 or 2000 to 2014 can be utilised for the cross-country analysis in this thesis. The more recent period has been chosen for this analysis.

Lists of the individual countries and sectors contained within the 2016 WIOD, which combined represent about 85 per cent of world GDP (Timmer et al., 2016, p.17) are presented in Tables 6.1 and Table 6.2 respectively.

Table 6.1 **Countries within the 2016 World Input-Output Database**			
Australia	Denmark	Ireland	Poland
Austria	Spain	Italy	Portugal
Belgium	Estonia	Japan	Romania
Bulgaria	Finland	Korea	Russia
Brazil	France	Lithuania	Slovak Republic
Canada	United Kingdom	Luxembourg	Slovenia
Switzerland	Greece	Latvia	Sweden
China	Croatia	Mexico	Turkey
Cyprus	Hungary	Malta	Taiwan
Czech Republic	Indonesia	Netherlands	United States
Germany	India	Norway	Rest of the World
Source: WIOD, <http://www.wiod.org/database/wiots16>			

Table 6.2 **Industry Sectors within the 2016 World Input-Output Database**	
Crop and animal production, hunting and related service activities	Electricity, gas, steam and air-conditioning supply
Forestry and logging	Water collection, treatment and supply
Fishing and aquaculture	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
Mining and quarrying	Construction
Manufacture of food products, beverages and tobacco products	Wholesale and retail trade and repair of motor vehicles and motorcycles
Manufacture of textiles, wearing apparel and leather products	Wholesale trade, except of motor vehicles and motorcycles
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Retail trade, except of motor vehicles and motorcycles
Manufacture of paper and paper products	Land transport and transport via pipelines
Printing and reproduction of recorded media	Water transport
Manufacture of coke and refined petroleum products	Air transport
Manufacture of chemicals and chemical products	Warehousing and support activities for transportation
Manufacture of basic pharmaceutical products and pharmaceutical preparations	Postal and courier activities
Manufacture of rubber and plastic products	Accommodation and food service activities
Manufacture of other non-metallic mineral products	Publishing activities
Manufacture of basic metals	Motion picture, video and television program production, sound recording and music publishing activities; programming and broadcasting activities
Manufacture of fabricated metal products, except machinery and equipment	Telecommunications
Manufacture of computer, electronic and optical products	Computer programming, consultancy and related activities; information service activities
Manufacture of electrical equipment	Financial service activities, except insurance and pension funding
Manufacture of machinery and equipment n.e.c.	Insurance, reinsurance and pension funding, except compulsory social security
Manufacture of motor vehicles, trailers and semitrailers	Activities auxiliary to financial services and insurance activities
Manufacture of other transport equipment	Real estate activities
Manufacture of furniture; other manufacturing	Legal and accounting activities; activities of head offices; management consultancy activities
Repair and installation of machinery and equipment	Architectural and engineering activities; technical testing and analysis
Source: WIOD, <http://www.wiod.org/database/wiots16>	

Figure 6.1
Map of Countries included in the 2016 World Input-Output Database



6.2.2 International Monetary Fund World Economic Outlook database

The World Economic Outlook (WEO) database contains macroeconomic data presented in the Statistical Appendix of the *IMF World Economic Outlook* report. The WEO, which is released biannually, presents historical data (from 1980) and medium-term forecasts on a range of indicators, including information on national accounts, inflation, unemployment rates, balance of payments, fiscal indicators, trade for countries and country groups, and commodity prices.

The following information has been sourced from the WEO database for each country contained in the 2016 version of the WIOD,

i. Gross Domestic Product, constant prices, national currency;

ii. Gross Domestic Product, current prices, national currency;

iii. Gross Domestic Product, current prices, US Dollars (USD); and

iv. Population (persons).

6.2.3 Institutional Indicators

Repucci (2015) found growth in the services sector can be linked to two of the World Governance Indicators (WGI): the rule of law and the quality of regulatory environment. Findlay and Pangestu (2016) argue that as services are often highly regulated, it is the efficiency with which these regulations are managed that is likely to be a greater influence on the rate of growth of services as a sector within an economy (Findlay and Pangestu, 2016, p.43).

To test this hypothesis Findlay and Pangestu utilised the OECD and World Bank measures of the quality of regulatory frameworks supporting the services sectors, the Services Trade Restrictiveness Index (STRI) and they found that this measure explained a greater proportion of variation in services exports by country than any other measure (Findlay and Pangestu, 2016, p.45). However, the STRI is not able to be applied in this cross-country analysis as data is only available for the period 2014 to 2017, although the WGI is available over the full analysis period of this study.

The WGIs measure governance across six difference dimensions: (i) voice and accountability, (ii) political stability and absence of violence, (iii) government effectiveness, (iv) regulatory quality, (v) rule of law, and (vi) control of corruption. They are calculated annually for 200 countries and presented as both standard normal units (ranging between -2.5 to 2.5) and in percentile rank terms from 0 to 100 (with higher values corresponding to better outcomes) (World Bank, 2018).

Al-Marhubi (2004) and de Barros Leal Pinheiro Marino et al. (2016) define governance as

> *the traditions and institutions through which authority is exercised in a country*

and argue that it is: an important component in the efficient functioning of a market economy; vital for the growth prospects of a country; and that it better enables equity to be achieved for a country's population (Al-Marubi, 2004, p. 394; de Barros Leal Pinheiro Marino et al., 2016, p.726). Global institutions which analyse the role and influence of governance present it in terms of the relationship between government, business and civil society and include concepts such as authority, leadership, decision-making processes, representation and mechanisms for conflict resolution (Al-Marubi, 2004, p. 394).

Numerous academic studies have sought to understand whether governance impacts on the economic, social and physical wellbeing of a nation. Kaufman, Kraay and Zoido-Lobaton (1999) found a strong positive correlation between governance and per capita income, literacy and infant mortality, while Gaygisiz (2013) similarly concluded that the strength of a nation's institutional governance arrangements strongly influences economic development (de Barros Leal Pinheiro Marino et al., 2016, p.723-726).

Malik identified more than 150 governance indicators developed by international bodies, research institutes and private organisations (Malik, 2002, p.3) although the WGIs have more widespread acceptance within the academic community (Jacques, Vicente and Ensslin, 2013).

Eichengreen and Gupta (2011) included an aggregate WGI as a variable within their analysis of services sector growth "waves" across countries between 1951 and 2005, with data being included as standard normal units. The evaluation concluded governance was not a statistically significant driver of growth in the services sector between and across the designated "wave" time periods although the analysis also suggests that governance was strongly correlated with other variables, including per capita incomes, GDP, urban population and democracy, all of which were found to be statistically significant (Eichengreen and Gupta, 2011, p. 106, 108-109).

Analysis by Repucci and Eichengreen and Gupta shows a statistical relationship exists between either some WGI measures or other correlated independent variables and services sector outputs, which suggests that some (or a combination of some) WGI measures may incorporate the same governance dimensions that are reflected in the STRI.

To test this, the STRI for each country in the WIOD sample for 2014 – the first year of the STRI and the last year of the WIOD dataset – was correlated against several aggregated percentile rank WGI indicators.   As STRI and WGI are measured in opposite directions to each other (ie. STRI is measured on a "downwards" scale between 0 and 1, where 0 = complete openness to trade and investment and 1 = total market closure to foreign service providers; and WGI indicators are measured on an "upwards" scale between 0 and 100, with higher values corresponding to better outcomes), an inverse STRI measure (ie. 1-STRI) was applied in the *Pearson r* correlation analysis, which is presented in Table 6.3.

Table 6.3
Correlation coefficient (*Pearson's r*) between STRI and WGI measures, 2014

	All	**Reg Qual + Rule of Law**	**Govt Effect + Reg Qual + Rule of Law**
Correlation coefficient	0.693	0.732	0.753
Source: Author's Calculations			

The above analysis shows that the three different percentile rank WGI measures are well correlated with the STRI, and in effect any of the measures could be applied as an STRI equivalent proxy, although the correlation between the STRI and the WGI index containing measures of government effectiveness, regulatory quality and rule of law reveals marginally stronger statistical qualities.

Given these results, and the fact that the STRI is not available for the complete time period of this analysis, the aggregate three-measure percentile rank WGI is included as an explanatory variable within the cross-country regression modelling.

6.3 Empirical analysis

6.3.1 Empirical specification and econometric approach

6.3.1.1 Introduction

The conventional technique for answering the question being posed in this study involves applying time series econometric analysis using an ordinary least squares (OLS) approach to the cross-country dataset.

As the dataset available for this evaluation incorporates information with dimensions of both time and space, an alternative to the conventional time series regression techniques can be applied, being a panel data model.

Hsiao (2003) highlights a number of advantages of using panel data compared with standard cross-sectional data or time series data in econometrics research, including: (i) the datasets usually contain many more observations, thereby reducing the potential for collinearity among the independent variables; (ii) the ability to complete a recursive structure analysis where there is a requirement to have sequential data to be able to properly evaluate a policy issue on a pre- and post-impact basis; (iii) the availability of multiple observations with panel data creates a higher likelihood for a researcher to properly specify a model that otherwise could have been unidentifiable due to measurement error in the cross-section or time series dataset; (iv) the potential for a better predictive model as panel data models incorporate information on the behaviour of multiple agents compared with time series data models where just one agent can be represented; and (iv) a better ability to control for correlation between the independent variable and (potentially) omitted variables (Hsiao, 2003, pp.1 – 7).

An issue to consider in using the WIOD is whether it is potentially skewed by the fact that 30 of the 43 countries in the database are within the European Union (EU) or are geographically located within Europe (but are not EU member states).

Elhorst (2003) notes that when locational data is included within a panel dataset there is the potential for spatial dependence between observations over time and heterogeneity of parameter data over space (Elhorst, 2003, pp.244 – 245). With regard to these issues identified by Elhorst (2003), the potential problem of heterogeneous locational data is minimised in this study by the fact that the information is sourced from the WIOD project, which in turn has applied a rigorous approach to ensuring data consistency between countries. However, the first issue of spatial dependence will be explicitly considered in this evaluation given the high number of observations within the dataset from European countries.

Spatial dependence, or spatial autocorrelation, occurs because distance has the ability to impact on the behaviour of economic agents such that the value of an observation in one location may be dependent on an observation at (an)other location(s). That is, economic agents may adjust their behaviour once they consider the relative market conditions between their "home" region and other region(s) and the distance between those two locations (Elhorst, 2003, p.244).

Paelinck and Klaassen (1979) outlined this technique as a method to resolve problems of spatial dependency when applying econometric models to regional and multiregional spatial data (Anselin and Bera, 1998, p.237). "Spatial econometrics", the term coined by Paelinck in the early 1970s, has been defined by Anselin as "the collection of techniques that deal with the peculiarities caused by space in the statistical analysis of regional science models" (Anselin, 1988, p.7). These peculiarities present themselves through three different types of interaction effects: (i) endogenous interaction effects among the dependent variable; (ii) exogenous interaction effects among the independent variable(s); and/or (iii) interaction effects among the error terms (Elhorst, 2014a, p.1638). That is, endogenous interaction effects occur when the dependent variable for one economic agent is determined mutually through an interaction with a neighbouring economic agent, whereas exogeneous interactions effects occur where a decision made by one economic agent is influenced by the decision made by another independent economic agent(s). Interaction effects among error terms occur in situations where omitted dependent variables in a model are spatially autocorrelated, and where unobserved shocks occur in a spatial pattern (Elhorst, 2014a, p.1639 - 40).

6.3.1.2 Testing for spatial dependence

Cheng and Pu and Voss et al. suggest *Moran's I* is the most common statistical technique used to test for spatial autocorrelation, and is defined by the following equation (Cheng and Pu, 2017, pp.73-97; Voss et al., 2006, pp.369-391)

$$I = \left(\frac{n}{\sum_i \sum_j w_{ij}}\right)\left(\frac{\sum_i \sum_j w_{ij}\,(x_i - \bar{x})(x_j - \bar{x})}{\sum_i (x_j - \bar{x})^2}\right) \tag{141}$$

where

n = number of spatial units

x_i = data associated with spatial unit *i*

x_j = data associated with spatial unit *j*

w_{ij} = an element of a *n* x *n* spatial weight matrix, W, defining the contiguity relationship between spatial units *i* and *j*.

The spatial weight matrix, *W*, has been applied as a distance-based spatial weights matrix on a border sharing basis, which is consistent with the approach adopted by Baltagi and Li (1999, 2006) in their spatial analysis studies concerning predicting demand for cigarettes and alcohol by state in the United States of America. The spatial weight matrix has been constructed on the following basis: the value of 1 is applied to a country in the WIOD sample that has a common border with another country in the WIOD sample, and a value of zero if there is no common border between the two countries. That is:

$$W\{\begin{array}{l} w_{i,j} = 1, if\ w_i = w_j \\ w_{i,j} = 0, if\ w_i \neq w_j \end{array}$$

where

$w_i = w_j$ represents a country pair with a shared border

$w_i \neq w_j$ represents a country pair without a shared border.

Consistent with the approach applied within the Baltagi and Li studies, the rows of the matrix are also standardised such that they aggregate to one (Baltagi and Li, 2006, p.2). Each country pair weighting is calculated as $\frac{w_{i,j}}{\sum_{y} w_{i,j}}$ (Özyurt and Dees, 2015, p. 18). Table 6.4 is a summary of the *W* spatial weight matrix applied in this study.

Moran's I value is similar to the Pearsonian product-moment correlation coefficient (Voss et al., 2006, p.377), with the values for the statistic ranging from -1 to +1. Where $I > I_0$ then the data shows positive spatial dependency, while the data shows negative autocorrelation where $I < I_0$. When the *Moran's I* equals zero, then the data is "ungrouped" (Kusrini and Mukhtasor, 2015, p.86).

Table 6.5 below summarises the *Moran's I* statistics for the ratio of valued added for the services sector to total value-added for all economic activities in country *j* in year *t* for all countries within the WIOD.

Table 6.5
***Moran's I* Statistic by Year**[1]

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
-0.10 (-2.3)**	-0.06 (-0.7)	-0.07 (-0.8)	-0.06 (-0.6)	-0.06 (-0.9)	-0.07 (-0.9)	-0.04 (0.2)	-0.02 (1.1)	-0.01 (1.4)	-0.01 (1.4)	-0.02 (0.9)	-0.04 (0.2)	-0.03 (0.7)	-0.04 (0.2)	-0.04 (0.1)

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are standard errors
Source: Author's Calculations

This analysis suggests there does not appear to be any positive spatial autocorrelation with respect to the relative economic performance of the services sector in countries contained within the WIOD. This finding suggests that a standard OLS regression framework can be applied to the complete WIOD dataset without the need to specifically address spatial dependency within the design of the regression model.

Table 6.4
Spatial Weights Matrix, *W*

	AUS	AUT	BEL	BRA	BGR	CAN	CHE	CHN	CYP	CZE	DNK	EST	FIN	FRA	DEU	GRC	HRV	HUN	IND	IDN	IRL	ITA
AUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AUT	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0
BEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BGR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
CAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHE	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
CYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CZE	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DNK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FRA	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
DEU	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HRV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
HUN	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
IND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IDN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IRL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ITA	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
JPN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LVA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LUX	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MLT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NLD	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PRT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ROU	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
RUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SVK	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
SVN	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.3
ESP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SWE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TWN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TUR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
GBR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
USA	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Author's calculations

Table 6.4 (cont.)
Spatial Weights Matrix, *W*

	JPN	KOR	LVA	LTU	LUX	MLT	MEX	NLD	NOR	POL	PRT	ROU	RUS	SVK	SVN	ESP	SWE	TWN	TUR	GBR	USA	Total
AUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AUT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.0
BEL	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
BRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BGR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
CAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
CHE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.0
CHN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
CYP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CZE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
DNK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
EST	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
FIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.0
FRA	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	1.0
DEU	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
GRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0
HRV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0
HUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.0
IND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
IDN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IRL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
ITA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
JPN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LVA	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
LTU	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
LUX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
MLT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
NLD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
NOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.0
POL	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
PRT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
ROU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
RUS	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
SVK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
SVN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
ESP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
SWE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
TWN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TUR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
GBR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
USA	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0

Source: Author's calculations

6.3.1.3 Model specification

Empirical analysis using a spatial econometrics framework starts with mathematically defining the problem initially in terms of a standard OLS linear regression model, such as

$$y = \alpha i_n + X\beta + \varepsilon \quad (142)$$

where

y = N x 1 matrix consisting of one observation of dependent variables for every unit in the sample, i = 1,…,N

X = N x K matrix of exogenous explanatory variables

α = constant term

i_n= N x 1 matrix of ones associated with the constant term, α

β = K x 1 matrix of parameter values

ε = matrix of disturbance terms, being $\varepsilon_1, \ldots, \varepsilon_N$, that are identically distributed for all i with zero mean and σ^2 variance.

As noted above, one of the primary advantages of utilising panel data in an experiment compared with either time series or cross-sectional data is the fact that it allows researchers the opportunity to deal more effectively with the possible problem of omitted variables from the regression model that are correlated to a dependent variable (Hsiao, 2003, p.5).

Hsiao (2003) explains that introducing a unit and/or time-specific variable into the panel data regression model can assist in reducing, or possibly avoiding, omitted variable bias (Hsiao, 2003, p.29). That is, the introduction of a dummy variable into the regression equation provides the mechanism to capture (i) the effects of an omitted variable(s) which are specific to individual cross-sectional units and do not vary over time, and (ii) period specific effects that vary over time but that remain constant across cross-sectional units (Hsiao, 2003, p.30).

In equation 142, the error term, ε, represents the impact of the omitted variables, which, given the equation is specified for panel data, incorporates components for time-specific error, spatial error and residual error, which is assumed to be independent and identically distributed (i.i.d.).

Özyurt and Dees (2015) suggest that a solution to deal with space-specific omitted variables is to include an additional intercept term into the model specification, while introducing a time-specific effect allows for the control of spatial-invariant time effects (Özyurt and Dees, 2015, p.13).

Equation 142 can be re-written to allow for spatial effects and time effects:

$$y_t = \alpha i_n + X_t \beta + \mu + \xi_t i_n + u_t \tag{143}$$

where

μ = spatial effects

$\xi_t i_n$ = time period effects

u_t = stochastic error term which is assumed to be i.i.d.

Elhorst (2014a) note the spatial and time period specific effects, μ and $\xi_t i_n$, respectively are able to be treated as either fixed effects or random effects (Elhorst, 2014a, p.1642). Introducing a dummy variable for N-1 spatial units and T-1 time units enables fixed effects to be calculated in the regression model while μ and $\xi_t i_n$ are treated as random variables (which are i.i.d.) in a random effects model (Elhorst, 2014a, p.1642 - 1643).

Özyurt and Dees (2015) note that the majority of empirical spatial economics literature applies a random effects specification in their regression model for three reasons: (i) it provides a compromise solution to the "all-or-nothing" fixed-effects approach; (ii) it reduces the loss of degrees of freedom; and (iii) it avoids potential problems with estimating coefficients for variables that may be time-invariant or have little variation (Özyurt and Dees, 2015, p.14).

While the use of random effects may be a popular choice in related academic research, Elhorst (2014b) identifies three conditions that need to be met to warrant the use of random effects rather than fixed effects in a spatial econometrics evaluation. These conditions are: (i) the number of units should potentially be able to go to infinity; (ii) the units of observation should be representative of a larger population; and (iii) the assumption of zero correlation between the random effects of μ (which again represents the effect of the omitted variables that are peculiar to each spatial unit considered) and the explanatory variables needs to be made (Elhorst, 2014b, pp. 38, 54-55).

With regard to the first condition, Beenstock and Felsenstein (2007) proposes that if the sample of units being analysed is the population, then fixed effects should be applied as each spatial unit represents itself and has not been randomly sampled (Beenstock and Felsenstein, 2007, p. 178). This is confirmed by Hsiao (2003) where it is proposed that when inferences are to be made about a population from data taken from a random sample, then the effects should be considered random (Hsiao, 2003, p.43). Elhorst (2014b) also notes that where the space-time data is from adjacent spatial units located in contiguous study areas then the fixed effects model is generally more appropriate than the random effects model (Elhorst, 2014b, p. 56).

In the context of this evaluation, the 43 countries individually specified within the WIOD (see Figure 5.1 for a map of the countries included in the WIOD) represent about 85% of world GDP (Timmer et al., 2016, p.17) and of the 40 countries that make-up Europe (excluding countries like Andorra, the Holy See, Liechtenstein and Monaco, which have an aggregate population of fewer than 150,000 residents) 30 are included within the WIOD. The 10 European countries not included in the WIOD are Albania, Belarus, Bosnia and Herzegovina, FYR Macedonia, Iceland, Moldova, Montenegro, San Marino, Serbia and Ukraine, which in 2014 represented approximately 9.9 per cent of the European population and 1.5 per cent of European GDP.

The combination of high-aggregate world GDP representation within the WIOD, and even higher representation of European GDP, suggests the empirical analysis is not based on a sample of random data, but rather the independent variable in the model specification will nearly represent global GDP per capita and will virtually represent European GDP per capita.

By using the WIOD in this study, conditions 1 and 2 of Elhorst's three-condition framework for the use of random effects cannot be met. That is, there is a defined number of units in the population (i.e. countries) and the number of observations does not represent a sample of the population, but rather nearly represents the population.

On this basis, it appears the most appropriate specification for the specific effects elements of equation 142 should be fixed effects rather than random effects.

6.3.2 Data

The 2016 WIOD presents value-added (in current US dollar terms) by ISIC rev.4 industry classification for each individual country for the 15-year period 2000 to 2014. For this study the industry value-added data has then been aggregated into six broad sectors consistent with the Clark-Fisher-Fourastié three sector model of economic development and the (contemporary) Singelmann services sub-sector definition as presented in Section 2.3 of this thesis. The mapping of WIOD sectors to the service sector classifications is shown in Table 6.6 below.

Each of the WIOD value-added aggregates for the four service sub-sectors and total services, equating to 3,225 observations, is then transformed into ratios of relative economic importance:

$$r_{ij}^{t} = \frac{S_{ij}^{t}}{VA_{i}^{t}} \tag{144}$$

where

r = ratio valued-added by sector i to total value-added economic activities

S = aggregated value-added of industries in sector classification i

VA = value-added

t = year

i = sector classification

j = country

GDP for each of the countries and over the time period of the 2016 WIOD has been sourced from the IMF WEO database (version dated 10 October 2017). This information has been transformed using the following equation to estimate real GDP per capita (in USD).

$$rGDPC(USD)_i^t = \frac{\frac{rGDP(LCU)_i^t}{nGDP(LCU)_i^t}\ x\ nGDP(USD)_i^t}{Pop_i^t} \tag{145}$$

where

$rGDP(LCU)_i^t$ = GDP in constant prices, *Local Currency Unit* (WEO Code *NGDP_R*)

$nGDP(LCU)_i^t$ = GDP in current prices, *Local Currency Unit* (WEO Code *NGDP*)

$rGDP(USD)_i^t$ = GDP in current prices, *US Dollars* (WEO Code *NGDPD*)

Pop_i^t = Population, *Persons* (WEO Code *LP*)

A summary of the complete dataset used in this analysis is presented in Tables 6.7 to 6.13 below. Prior to presenting the regression modelling results, the first step in this analysis has been to plot r_{ij}^t and $rGDPC(USD)_i^t$ to visually identify whether there appears to be any relationship between the two variables. These scatter plot graphs are presented in Figures 6.2 to 6.6 below.

Table 6.6
Mapping of WIOD Industry Sectors into Sector Classifications

Primary	Secondary	Distribution Services	Producer Services	Social Services	Personal Services
Crop and animal production, hunting and related service activities	Manufacture of food products, beverages and tobacco products	Air transport	Activities auxiliary to financial services and insurance activities	Activities of extraterritorial organisations and bodies	Accommodation and food service activities
Forestry and logging	Manufacture of textiles, wearing apparel and leather products	Electricity, gas, steam and air-conditioning supply	Administrative and support service activities	Education	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
Fishing and aquaculture	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Land transport and transport via pipelines	Advertising and market research	Human health and social work activities	Other service activities
Mining and quarrying	Manufacture of paper and paper products	Motion picture, video and television program production, sound recording and music publishing activities; programming and broadcasting activities	Architectural and engineering activities; technical testing and analysis	Public administration and defence; compulsory social security	Retail trade, except of motor vehicles and motorcycles
	Printing and reproduction of recorded media	Postal and courier activities	Computer programming, consultancy and related activities; information service activities		Wholesale and retail trade and repair of motor vehicles and motorcycles
	Manufacture of coke and refined petroleum products	Publishing activities	Financial service activities, except insurance and pension funding		

Table 6.6 (cont.) Mapping of WIOD Industry Sectors into Sector Classifications					
Primary	**Secondary**	**Distribution Services**	**Producer Services**	**Social Services**	**Personal Services**
	Manufacture of chemicals and chemical products	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	Insurance, reinsurance and pension funding, except compulsory social security		
	Manufacture of basic pharmaceutical products and pharmaceutical preparations	Telecommunications	Legal and accounting activities; activities of head offices; management consultancy activities		
	Manufacture of rubber and plastic products	Warehousing and support activities for transportation	Other professional, scientific and technical activities; veterinary activities		
	Manufacture of other non-metallic mineral products	Water collection, treatment and supply	Real estate activities		
	Manufacture of basic metals	Water transport	Scientific research and development		
	Manufacture of fabricated metal products, except machinery and equipment		Wholesale trade, except of motor vehicles and motorcycles		
	Manufacture of computer, electronic and optical products				
	Manufacture of electrical equipment				
	Manufacture of machinery and equipment n.e.c.				
	Manufacture of motor vehicles, trailers and semitrailers				

Table 6.6 (cont.)
Mapping of WIOD Industry Sectors into Sector Classifications

Primary	Secondary	Distribution Services	Producer Services	Social Services	Personal Services
	Manufacture of other transport equipment				
	Manufacture of furniture; other manufacturing				
	Repair and installation of machinery and equipment				
	Construction				

Source: WIOD 2016, Singelmann (1978), Author's Analysis

Table 6.7

Ratio of Value Added of *Distributive Services* as a Proportion of Total Value Added by Country, 2000 - 2014

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AUS	11.2%	11.1%	11.1%	11.2%	11.2%	10.8%	10.9%	10.7%	10.3%	10.6%	10.4%	10.5%	10.9%	10.5%	10.2%
AUT	11.1%	11.2%	11.4%	11.4%	11.2%	11.1%	10.9%	10.7%	10.6%	10.7%	10.4%	10.1%	10.1%	10.1%	9.9%
BEL	11.6%	11.5%	11.1%	11.3%	11.1%	11.2%	11.3%	11.2%	11.3%	11.5%	11.3%	11.2%	10.8%	10.5%	10.3%
BGR	16.5%	18.2%	19.0%	19.1%	18.6%	14.9%	15.5%	14.8%	15.3%	14.9%	14.8%	14.1%	14.2%	14.7%	14.2%
BRA	10.3%	9.9%	9.9%	9.9%	10.5%	10.6%	10.5%	10.1%	9.8%	9.5%	9.6%	9.3%	9.1%	8.5%	8.3%
CAN	9.4%	9.6%	9.5%	9.4%	9.2%	9.4%	9.3%	9.2%	9.2%	9.2%	9.3%	9.0%	8.9%	8.9%	8.9%
CHE	9.2%	9.2%	8.9%	8.7%	8.5%	8.4%	8.1%	7.9%	8.0%	8.1%	8.0%	7.9%	7.9%	7.7%	7.5%
CHN	10.7%	11.1%	11.5%	11.3%	11.7%	11.7%	11.6%	11.4%	9.8%	9.3%	8.8%	8.6%	8.6%	8.7%	8.9%
CYP	14.7%	14.3%	14.0%	13.4%	12.9%	12.2%	11.7%	11.6%	11.1%	12.1%	12.5%	11.9%	12.3%	13.4%	13.5%
CZE	13.9%	14.3%	14.7%	14.8%	14.5%	14.1%	14.4%	14.3%	14.6%	15.1%	14.3%	13.7%	13.6%	13.6%	13.2%
DEU	9.7%	9.9%	10.1%	9.8%	10.1%	10.2%	10.4%	10.4%	10.7%	10.9%	10.5%	10.0%	10.2%	10.0%	9.9%
DNK	11.9%	11.9%	11.7%	12.2%	12.2%	12.2%	11.2%	11.0%	10.7%	9.8%	11.0%	10.1%	10.0%	10.4%	10.6%
ESP	10.6%	10.5%	10.5%	10.5%	10.4%	10.3%	10.0%	10.0%	10.1%	10.3%	10.9%	11.0%	11.2%	11.1%	11.1%
EST	18.4%	17.6%	17.1%	17.5%	17.2%	15.7%	15.2%	14.3%	14.3%	16.1%	17.2%	16.1%	15.9%	16.2%	15.3%
FIN	11.5%	12.0%	12.4%	12.2%	12.1%	11.1%	10.8%	10.6%	10.5%	11.2%	11.5%	10.9%	11.0%	10.9%	10.8%
FRA	9.9%	10.1%	10.5%	10.4%	10.5%	10.4%	10.2%	9.8%	9.7%	9.7%	9.8%	9.6%	9.7%	9.6%	9.6%
GBR	11.7%	11.4%	11.4%	11.4%	10.9%	10.6%	10.3%	10.3%	10.2%	10.6%	10.1%	10.0%	10.3%	10.6%	10.3%
GRC	13.1%	12.5%	12.7%	13.2%	13.8%	14.7%	14.3%	14.7%	14.4%	14.0%	13.2%	12.9%	12.9%	13.0%	13.1%
HRV	13.2%	13.0%	13.0%	12.7%	13.4%	13.1%	12.2%	11.3%	11.5%	11.6%	12.1%	11.5%	11.5%	11.9%	11.7%
HUN	13.7%	13.0%	12.8%	12.5%	12.8%	12.6%	12.4%	13.6%	13.0%	13.8%	13.4%	13.1%	13.1%	12.6%	12.2%
IDN	5.9%	6.0%	7.0%	7.8%	8.2%	8.4%	8.8%	8.6%	8.1%	8.2%	8.4%	8.3%	8.4%	8.6%	9.0%
IND	9.8%	9.7%	10.1%	10.2%	10.3%	10.1%	9.9%	9.6%	9.3%	9.4%	8.8%	8.7%	8.9%	8.8%	9.0%
IRL	11.1%	10.1%	9.1%	9.5%	10.1%	9.6%	9.3%	9.8%	10.4%	12.1%	12.4%	12.8%	13.7%	13.4%	13.5%
ITA	10.1%	10.5%	10.7%	10.5%	10.6%	10.5%	10.3%	10.4%	10.5%	10.8%	10.6%	10.2%	10.1%	10.1%	10.1%
JPN	9.9%	10.0%	10.0%	9.9%	9.8%	9.5%	9.3%	9.0%	8.9%	9.6%	9.6%	9.1%	9.1%	9.2%	9.2%
KOR	10.3%	10.4%	10.5%	10.5%	10.3%	10.2%	10.2%	10.1%	9.1%	9.2%	9.2%	8.6%	8.7%	9.1%	9.6%
LTU	16.9%	17.3%	18.0%	18.9%	17.9%	17.3%	16.9%	16.6%	15.6%	17.9%	18.8%	18.1%	18.1%	18.2%	17.9%
LUX	11.9%	12.4%	12.1%	12.0%	12.1%	11.9%	11.0%	10.7%	10.4%	10.6%	10.7%	10.6%	10.3%	9.8%	10.8%
LVA	21.0%	22.4%	21.6%	21.5%	20.9%	19.0%	15.9%	13.9%	15.4%	17.9%	18.4%	17.7%	17.1%	16.5%	16.2%
MEX	10.9%	11.1%	10.9%	10.6%	10.6%	10.8%	10.8%	10.9%	10.7%	11.2%	11.1%	10.4%	10.2%	10.5%	10.7%
MLT	14.6%	15.1%	13.8%	12.9%	13.3%	12.2%	13.0%	13.4%	12.4%	12.4%	11.8%	11.0%	11.1%	11.4%	13.5%
NLD	9.6%	9.5%	9.8%	10.0%	9.8%	9.9%	9.8%	9.6%	9.2%	9.3%	9.2%	9.0%	9.0%	9.0%	8.9%
NOR	11.9%	12.6%	12.8%	12.7%	12.0%	11.8%	11.5%	10.8%	10.5%	11.1%	11.1%	10.3%	9.9%	10.2%	10.2%
POL	11.8%	12.5%	13.4%	13.8%	13.5%	13.4%	13.3%	12.9%	12.7%	13.0%	12.8%	12.6%	13.3%	13.2%	12.8%
PRT	9.6%	9.7%	9.7%	10.1%	10.2%	9.9%	10.2%	10.4%	9.9%	10.5%	10.5%	10.5%	10.8%	10.6%	10.5%
ROU	14.0%	13.9%	14.7%	14.8%	14.6%	14.7%	14.5%	14.4%	13.6%	15.0%	16.2%	15.6%	14.8%	15.2%	14.5%
ROW	13.3%	13.2%	13.7%	14.3%	14.9%	15.2%	15.4%	15.4%	14.2%	14.1%	13.9%	13.4%	13.3%	13.1%	13.2%
RUS	13.6%	13.8%	13.9%	14.3%	14.7%	13.5%	12.9%	12.7%	12.0%	12.7%	12.4%	11.6%	11.4%	11.2%	11.0%
SVK	14.7%	14.6%	14.6%	15.8%	15.5%	14.7%	15.0%	14.3%	13.6%	14.1%	13.0%	13.2%	13.2%	12.5%	12.9%
SVN	11.1%	11.3%	11.0%	11.1%	11.5%	11.6%	11.8%	11.7%	11.7%	11.4%	11.6%	11.8%	12.2%	12.4%	12.3%
SWE	11.4%	11.8%	11.8%	11.9%	12.0%	12.0%	11.7%	11.5%	12.1%	11.9%	11.8%	11.5%	11.9%	11.5%	11.1%
TUR	15.0%	16.5%	17.8%	17.8%	17.3%	17.5%	17.5%	17.6%	18.1%	17.4%	17.3%	17.7%	18.2%	18.2%	17.9%
TWN	9.7%	10.0%	9.7%	9.3%	8.8%	8.4%	7.8%	7.5%	6.7%	7.8%	7.6%	6.9%	7.0%	7.2%	7.3%
USA	9.3%	9.3%	9.2%	9.0%	9.2%	9.0%	8.9%	9.1%	9.2%	9.2%	9.3%	9.1%	8.9%	9.0%	9.0%
World	10.3%	10.4%	10.4%	10.5%	10.7%	10.6%	10.6%	10.7%	10.5%	10.5%	10.4%	10.1%	10.1%	10.1%	10.1%

Source: 2016 version WIOD, author's calculations

Table 6.8

Ratio of Value Added of *Producer Services* as a Proportion of Total Value Added by Country, 2000 - 2014

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AUS	34.7%	34.6%	35.3%	34.8%	34.9%	34.7%	35.5%	36.1%	34.8%	35.3%	34.3%	34.6%	35.5%	35.5%	36.2%
AUT	28.0%	28.2%	28.8%	28.8%	29.1%	30.0%	30.4%	30.5%	30.6%	30.5%	30.6%	31.2%	31.0%	31.5%	31.8%
BEL	33.6%	34.1%	34.0%	33.8%	34.3%	34.5%	34.7%	35.1%	35.2%	35.5%	35.6%	36.0%	36.1%	36.2%	36.5%
BGR	23.1%	22.8%	23.5%	23.1%	24.6%	26.1%	26.8%	30.0%	28.8%	30.0%	32.6%	33.1%	33.6%	34.1%	32.7%
BRA	29.0%	29.5%	29.7%	28.8%	26.9%	28.6%	28.9%	29.2%	28.3%	28.7%	28.4%	28.5%	29.0%	29.4%	30.2%
CAN	31.4%	32.0%	32.1%	32.0%	31.8%	31.7%	32.0%	32.4%	32.4%	32.4%	32.3%	31.8%	31.9%	32.0%	31.9%
CHE	38.4%	37.1%	36.0%	36.3%	36.8%	37.5%	38.6%	39.7%	39.0%	38.9%	39.1%	38.8%	39.0%	39.3%	39.3%
CHN	17.4%	17.7%	18.0%	18.2%	17.9%	17.8%	18.6%	20.1%	20.2%	21.9%	22.6%	22.7%	23.3%	24.1%	24.5%
CYP	28.2%	28.8%	28.6%	28.9%	29.9%	30.9%	32.1%	32.7%	32.6%	33.9%	32.0%	33.1%	34.2%	35.0%	35.2%
CZE	24.5%	24.2%	24.3%	24.7%	24.4%	25.1%	25.1%	25.9%	27.0%	27.4%	27.6%	27.5%	27.4%	27.9%	27.2%
DEU	31.7%	32.5%	32.9%	33.1%	33.0%	33.5%	33.3%	33.8%	34.1%	34.4%	33.4%	33.4%	33.3%	33.4%	33.4%
DNK	29.1%	29.5%	29.8%	30.2%	30.2%	30.8%	31.3%	31.8%	32.5%	33.9%	33.7%	34.0%	33.9%	34.2%	34.5%
ESP	22.4%	23.3%	23.9%	24.3%	24.7%	25.2%	26.2%	27.6%	27.9%	28.1%	28.0%	28.8%	30.1%	30.2%	30.6%
EST	27.7%	27.9%	28.9%	28.5%	29.1%	30.0%	30.3%	30.4%	31.5%	31.9%	30.8%	30.6%	31.0%	31.2%	31.9%
FIN	24.5%	25.0%	25.1%	25.3%	25.6%	26.1%	26.2%	26.5%	27.4%	28.6%	28.0%	29.0%	30.0%	30.1%	31.1%
FRA	35.0%	35.2%	34.8%	35.2%	35.4%	36.0%	36.8%	37.1%	37.5%	36.9%	37.0%	36.9%	36.9%	37.1%	37.2%
GBR	31.5%	32.2%	32.3%	33.1%	34.0%	34.5%	35.2%	36.2%	36.1%	36.7%	36.6%	37.1%	37.3%	37.2%	37.7%
GRC	26.1%	25.2%	26.9%	26.9%	27.3%	28.0%	27.4%	29.1%	30.7%	31.2%	33.3%	33.8%	35.5%	34.7%	33.8%
HRV	24.5%	25.7%	26.5%	27.8%	27.1%	28.4%	29.5%	31.3%	31.1%	31.0%	31.4%	32.0%	32.1%	31.9%	32.1%
HUN	25.1%	25.5%	26.0%	26.0%	25.7%	26.5%	27.3%	27.1%	28.0%	29.1%	29.5%	29.3%	29.2%	29.0%	28.1%
IDN	17.3%	17.3%	17.5%	17.6%	17.2%	16.9%	16.4%	16.2%	15.5%	15.0%	15.3%	15.2%	15.2%	15.4%	15.6%
IND	17.7%	18.7%	19.5%	19.6%	19.2%	19.5%	19.9%	20.1%	21.0%	20.8%	21.4%	21.9%	22.5%	23.4%	24.1%
IRL	28.2%	27.3%	27.4%	29.7%	29.8%	31.2%	31.7%	32.2%	33.5%	31.2%	33.8%	33.0%	33.9%	34.9%	35.8%
ITA	32.0%	32.2%	32.5%	33.3%	33.3%	33.6%	33.6%	33.8%	34.1%	34.5%	34.6%	35.2%	35.7%	35.9%	36.1%
JPN	32.0%	32.8%	33.0%	33.0%	33.1%	34.0%	34.2%	34.1%	34.3%	33.7%	32.9%	33.4%	33.1%	32.9%	32.7%
KOR	25.4%	25.8%	26.7%	26.5%	25.5%	25.9%	26.0%	26.0%	26.3%	25.9%	25.5%	25.7%	25.7%	25.3%	25.3%
LTU	20.3%	20.8%	20.8%	20.6%	20.6%	21.5%	22.2%	23.9%	24.2%	24.6%	24.0%	23.4%	23.6%	24.3%	24.4%
LUX	48.2%	47.6%	47.7%	47.4%	47.8%	49.9%	52.8%	52.7%	53.4%	53.9%	54.4%	54.5%	54.5%	56.0%	54.6%
LVA	23.0%	23.5%	24.8%	26.1%	26.5%	29.2%	31.2%	32.3%	31.5%	30.1%	29.4%	31.6%	32.7%	33.4%	33.7%
MEX	28.1%	28.4%	29.6%	30.4%	29.7%	30.1%	29.4%	29.5%	29.5%	30.4%	29.7%	29.1%	28.8%	29.7%	29.7%
MLT	24.3%	24.7%	24.9%	25.7%	27.3%	29.5%	30.7%	29.9%	28.4%	29.5%	29.7%	31.2%	32.4%	32.2%	31.4%
NLD	36.9%	36.0%	35.6%	35.4%	36.0%	36.1%	36.6%	37.4%	37.6%	37.3%	37.7%	37.8%	37.7%	37.5%	38.1%
NOR	21.0%	21.8%	22.3%	22.8%	22.7%	21.6%	21.0%	22.8%	21.8%	23.9%	23.4%	22.5%	23.3%	23.8%	24.3%
POL	26.6%	25.8%	25.6%	25.3%	24.1%	24.3%	24.1%	24.7%	25.3%	24.4%	25.0%	24.7%	25.4%	25.2%	25.7%
PRT	27.5%	27.7%	27.9%	28.5%	28.7%	29.2%	30.1%	31.1%	32.1%	31.8%	32.0%	33.0%	33.6%	33.5%	33.7%
ROU	22.6%	20.5%	20.8%	19.2%	19.2%	20.8%	21.1%	24.7%	23.7%	23.8%	21.9%	22.8%	25.6%	27.2%	28.2%
ROW	23.3%	23.8%	23.0%	22.9%	22.5%	21.9%	21.9%	22.6%	22.0%	24.0%	23.6%	23.3%	23.9%	24.7%	25.0%
RUS	26.0%	27.0%	27.3%	28.5%	24.8%	25.2%	26.3%	26.9%	27.8%	28.7%	28.8%	28.1%	28.7%	29.3%	29.8%
SVK	25.3%	23.7%	24.6%	24.0%	25.6%	25.5%	24.7%	25.6%	26.4%	28.1%	27.9%	27.4%	25.5%	28.8%	25.9%
SVN	25.4%	25.6%	26.6%	27.0%	27.1%	27.2%	27.5%	27.9%	28.9%	30.2%	30.0%	29.4%	28.4%	28.1%	28.0%
SWE	29.6%	29.8%	29.5%	29.4%	29.5%	29.9%	29.8%	29.9%	30.7%	31.8%	30.7%	31.6%	32.0%	32.7%	32.7%
TUR	25.6%	27.4%	23.7%	23.1%	23.8%	24.1%	25.0%	26.5%	27.2%	29.1%	27.5%	26.0%	26.2%	26.5%	26.2%
TWN	30.0%	30.4%	29.3%	28.8%	28.9%	29.5%	30.2%	30.5%	31.4%	30.8%	30.1%	30.5%	30.5%	30.6%	30.1%
USA	36.2%	37.2%	37.3%	37.0%	36.7%	37.3%	37.4%	37.5%	37.2%	37.4%	37.2%	37.4%	38.0%	37.7%	38.1%
World	31.2%	31.8%	31.8%	31.7%	31.4%	31.5%	31.4%	31.5%	31.1%	31.5%	30.9%	30.8%	31.0%	31.1%	31.4%

Source: 2016 version WIOD, author's calculations

Table 6.9

Ratio of Value Added of *Social Services* as a Proportion of Total Value Added by Country, 2000 - 2014

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AUS	16.4%	16.3%	16.3%	16.4%	16.2%	16.2%	15.9%	15.6%	15.9%	16.9%	16.8%	16.9%	17.3%	17.4%	17.9%
AUT	17.4%	17.4%	17.3%	17.5%	17.3%	17.0%	16.8%	16.4%	16.8%	17.9%	17.8%	17.4%	17.4%	17.4%	17.4%
BEL	19.7%	19.9%	20.3%	20.5%	20.2%	20.4%	20.4%	20.2%	20.9%	22.0%	21.6%	21.8%	22.3%	22.6%	22.6%
BGR	17.1%	15.7%	16.0%	15.4%	15.2%	15.5%	14.0%	13.2%	12.9%	13.0%	12.7%	12.1%	12.5%	13.6%	14.9%
BRA	18.8%	19.4%	19.3%	18.6%	18.1%	18.4%	19.0%	18.9%	19.0%	19.6%	19.3%	19.1%	19.2%	19.7%	20.3%
CAN	20.8%	21.0%	21.4%	21.6%	21.2%	20.9%	21.0%	21.5%	21.5%	21.5%	21.1%	20.7%	20.7%	20.7%	20.7%
CHE	17.2%	17.7%	18.3%	18.6%	18.4%	18.0%	17.4%	16.9%	17.1%	18.1%	17.9%	18.2%	18.6%	18.8%	18.9%
CHN	8.1%	8.5%	9.1%	8.8%	8.5%	8.7%	8.6%	8.5%	8.7%	9.0%	8.5%	8.4%	8.6%	8.9%	9.2%
CYP	17.3%	17.0%	17.7%	19.5%	19.3%	19.2%	19.0%	18.2%	18.8%	20.1%	19.9%	20.5%	20.6%	20.5%	20.4%
CZE	13.8%	14.0%	15.1%	15.4%	14.8%	15.0%	14.6%	14.1%	14.2%	15.2%	15.2%	14.9%	15.0%	15.1%	14.8%
DEU	17.1%	17.0%	17.4%	17.5%	17.3%	17.3%	16.8%	16.4%	16.6%	18.1%	17.8%	17.7%	17.9%	18.2%	18.2%
DNK	21.9%	22.2%	22.6%	22.7%	22.6%	22.1%	21.8%	21.6%	22.1%	24.5%	24.2%	23.5%	23.3%	23.3%	23.2%
ESP	16.1%	15.8%	15.7%	16.0%	16.1%	16.2%	16.2%	16.3%	16.9%	18.2%	18.7%	18.7%	18.6%	19.0%	18.8%
EST	14.5%	13.9%	13.8%	13.7%	13.7%	13.3%	12.7%	13.0%	14.8%	17.5%	16.2%	14.7%	14.3%	14.5%	14.7%
FIN	18.3%	18.3%	18.7%	19.3%	19.3%	19.6%	19.4%	18.8%	19.3%	21.5%	21.4%	21.4%	22.1%	22.3%	22.1%
FRA	20.8%	20.7%	21.1%	21.3%	21.3%	21.5%	21.4%	21.2%	21.3%	22.6%	22.5%	22.5%	22.8%	22.9%	23.2%
GBR	17.1%	17.6%	18.1%	18.4%	18.7%	18.9%	18.9%	18.7%	18.9%	20.1%	20.0%	19.5%	19.2%	18.5%	18.1%
GRC	17.1%	18.0%	18.5%	18.1%	18.8%	19.5%	19.5%	19.7%	20.6%	22.0%	21.7%	22.2%	21.3%	20.7%	20.6%
HRV	18.5%	16.7%	15.8%	15.0%	14.6%	14.5%	13.9%	13.9%	13.9%	15.1%	15.5%	15.5%	15.4%	15.3%	15.3%
HUN	17.4%	17.3%	18.1%	19.4%	18.6%	18.5%	18.0%	17.5%	17.9%	18.2%	17.8%	17.0%	17.2%	17.2%	17.4%
IDN	6.6%	6.6%	6.2%	6.9%	7.3%	6.8%	7.0%	7.3%	7.3%	8.0%	7.9%	8.0%	8.3%	8.3%	8.3%
IND	14.5%	14.4%	14.2%	13.6%	13.6%	13.2%	12.5%	12.3%	12.9%	13.9%	13.4%	13.2%	12.9%	12.4%	12.7%
IRL	13.3%	13.6%	14.0%	14.7%	15.3%	15.3%	15.4%	15.6%	17.7%	19.4%	18.2%	17.2%	17.2%	16.8%	16.3%
ITA	15.9%	15.9%	16.1%	16.4%	16.5%	16.8%	16.9%	16.4%	16.7%	17.7%	17.5%	17.1%	17.2%	17.2%	17.3%
JPN	15.2%	15.9%	16.3%	16.4%	16.5%	16.6%	16.7%	16.8%	17.3%	18.7%	18.4%	19.0%	18.9%	18.6%	18.5%
KOR	13.4%	14.4%	14.3%	14.8%	15.0%	15.6%	16.1%	16.2%	16.8%	17.1%	16.3%	16.2%	16.6%	16.7%	17.0%
LTU	17.5%	17.0%	16.4%	15.5%	15.2%	14.3%	14.4%	13.7%	14.6%	17.5%	15.7%	14.6%	14.1%	14.0%	14.0%
LUX	12.7%	13.4%	13.8%	14.3%	14.8%	14.7%	13.8%	13.5%	14.0%	15.6%	15.1%	15.1%	15.8%	15.5%	15.8%
LVA	17.1%	16.4%	15.4%	16.1%	15.6%	15.1%	15.3%	15.6%	16.9%	16.9%	15.9%	15.4%	15.0%	15.2%	15.3%
MEX	9.3%	10.1%	10.5%	10.8%	10.1%	10.0%	9.7%	9.8%	9.8%	10.9%	10.6%	10.3%	10.5%	10.9%	11.0%
MLT	15.7%	17.6%	17.7%	17.7%	18.6%	18.1%	17.9%	17.5%	17.5%	18.8%	18.5%	18.5%	18.5%	18.6%	18.8%
NLD	17.8%	18.4%	19.5%	20.2%	20.2%	20.0%	19.6%	19.3%	19.7%	21.6%	21.8%	21.7%	22.0%	22.3%	22.2%
NOR	18.4%	19.0%	20.2%	20.5%	19.6%	18.4%	17.6%	18.2%	17.7%	20.6%	20.4%	20.1%	20.2%	20.5%	21.1%
POL	14.5%	15.7%	16.4%	16.4%	15.7%	15.5%	15.3%	14.9%	15.3%	15.3%	15.4%	15.0%	14.8%	14.8%	14.7%
PRT	20.2%	20.6%	21.1%	21.6%	21.7%	22.4%	21.7%	20.9%	21.0%	21.9%	21.6%	21.0%	20.0%	20.6%	20.2%
ROU	10.4%	9.8%	10.5%	13.3%	11.8%	12.5%	11.6%	11.3%	12.0%	12.2%	11.9%	11.2%	11.6%	11.4%	11.6%
ROW	12.1%	12.4%	11.8%	11.6%	11.5%	11.1%	10.8%	10.8%	10.6%	11.6%	11.0%	10.7%	10.8%	10.9%	11.0%
RUS	9.0%	10.3%	11.9%	11.6%	11.3%	10.9%	11.2%	11.2%	11.4%	12.9%	11.8%	11.6%	12.3%	13.0%	13.8%
SVK	14.8%	14.8%	15.1%	15.2%	14.0%	13.7%	13.3%	12.9%	12.7%	14.8%	14.7%	14.0%	13.8%	14.3%	13.6%
SVN	16.3%	16.8%	16.6%	16.8%	16.7%	16.7%	16.2%	15.3%	15.6%	17.3%	17.8%	17.6%	17.9%	17.5%	16.7%
SWE	20.5%	20.5%	21.1%	21.5%	21.0%	21.0%	20.5%	20.2%	20.4%	21.7%	20.9%	20.8%	21.3%	21.6%	21.7%
TUR	8.7%	9.1%	9.6%	9.9%	9.7%	9.5%	9.4%	9.5%	9.3%	10.3%	10.3%	9.9%	10.5%	10.5%	10.7%
TWN	15.0%	16.2%	16.1%	16.2%	15.7%	15.7%	15.5%	15.0%	15.7%	16.2%	15.2%	15.4%	15.5%	14.9%	14.4%
USA	19.5%	20.1%	20.7%	20.9%	20.8%	20.4%	20.4%	20.5%	21.4%	22.7%	22.6%	22.3%	21.9%	21.6%	21.3%
World	16.6%	17.0%	17.4%	17.5%	17.3%	17.0%	16.8%	16.5%	16.6%	17.7%	17.1%	16.7%	16.5%	16.4%	16.4%

Source: 2016 version WIOD, author's calculations

Table 6.10

Ratio of Value Added of *Personal Services* as a Proportion of Total Value Added by Country, 2000 - 2014

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AUS	10.6%	10.6%	10.5%	10.7%	10.4%	10.0%	9.8%	9.7%	9.7%	10.0%	9.9%	10.1%	10.1%	10.0%	10.4%
AUT	13.2%	13.2%	13.3%	13.3%	13.4%	13.4%	13.1%	13.0%	13.3%	13.8%	14.1%	14.0%	14.0%	14.1%	14.2%
BEL	9.0%	9.1%	9.8%	10.2%	10.3%	10.4%	10.3%	10.2%	10.1%	10.2%	10.2%	10.2%	10.1%	10.3%	10.3%
BGR	10.2%	9.8%	9.3%	10.1%	10.5%	11.2%	11.4%	10.3%	10.5%	11.1%	12.1%	10.7%	10.2%	10.4%	10.6%
BRA	12.9%	12.7%	11.8%	11.4%	11.6%	12.1%	12.7%	12.9%	13.1%	13.3%	13.3%	13.4%	14.1%	14.2%	13.9%
CAN	9.4%	9.6%	9.9%	9.9%	10.0%	9.9%	9.9%	10.0%	10.0%	10.0%	9.8%	9.5%	9.6%	9.7%	9.6%
CHE	10.6%	10.7%	10.9%	10.8%	10.6%	10.4%	10.0%	9.7%	9.8%	10.1%	10.0%	9.7%	9.5%	9.3%	9.4%
CHN	5.9%	6.3%	6.4%	6.4%	5.8%	6.0%	5.8%	5.6%	5.6%	5.7%	5.7%	5.7%	5.8%	5.8%	5.9%
CYP	19.0%	19.5%	18.5%	17.4%	17.2%	17.1%	16.9%	17.0%	16.8%	16.0%	19.2%	19.6%	19.9%	20.0%	20.7%
CZE	10.8%	10.7%	11.1%	10.9%	10.4%	10.0%	10.0%	9.7%	9.6%	9.6%	9.6%	9.6%	9.5%	9.2%	9.1%
DEU	12.1%	11.9%	12.0%	12.1%	11.9%	11.7%	11.6%	11.1%	11.0%	11.6%	10.8%	10.6%	10.3%	10.4%	10.3%
DNK	9.8%	9.8%	10.0%	9.9%	9.9%	9.9%	9.9%	10.0%	9.7%	9.9%	9.5%	9.7%	9.5%	9.5%	9.4%
ESP	18.6%	18.1%	18.0%	17.7%	17.8%	17.7%	17.3%	16.7%	16.7%	17.0%	17.4%	17.6%	17.9%	17.9%	18.1%
EST	10.2%	11.0%	11.0%	10.9%	11.1%	11.3%	11.6%	11.3%	10.6%	9.7%	9.6%	9.8%	10.4%	10.5%	10.7%
FIN	8.2%	8.6%	8.8%	9.1%	9.3%	9.5%	9.3%	9.1%	9.4%	9.9%	10.0%	10.2%	10.3%	10.0%	9.9%
FRA	11.2%	11.2%	11.5%	11.6%	11.5%	11.4%	11.2%	11.2%	11.2%	11.5%	11.5%	11.5%	11.5%	11.4%	11.3%
GBR	14.1%	14.6%	14.6%	14.6%	14.6%	14.3%	14.0%	13.9%	14.1%	13.9%	14.2%	14.0%	14.4%	14.5%	14.8%
GRC	19.5%	19.8%	17.7%	16.7%	16.0%	16.7%	15.9%	15.8%	16.2%	15.8%	15.6%	14.9%	13.8%	14.9%	16.1%
HRV	11.6%	12.3%	13.4%	13.6%	13.0%	13.2%	13.4%	13.0%	13.1%	12.6%	12.6%	12.7%	13.0%	14.0%	14.2%
HUN	10.2%	10.6%	10.9%	10.4%	10.3%	10.1%	10.0%	10.4%	10.5%	9.9%	9.5%	9.5%	9.4%	9.8%	9.7%
IDN	12.7%	12.5%	13.6%	13.4%	13.0%	12.7%	12.4%	12.2%	11.4%	11.0%	11.3%	11.2%	11.2%	11.4%	11.6%
IND	12.6%	12.6%	12.9%	12.9%	13.1%	13.3%	13.5%	13.5%	13.3%	13.2%	13.7%	13.7%	14.2%	15.0%	15.4%
IRL	11.0%	10.3%	9.7%	10.0%	10.1%	10.1%	10.4%	11.2%	10.9%	10.9%	10.3%	9.7%	9.7%	10.0%	10.0%
ITA	14.2%	14.2%	13.7%	13.5%	13.4%	13.4%	13.3%	13.2%	13.2%	13.6%	13.6%	13.6%	13.6%	13.5%	13.5%
JPN	12.5%	12.4%	12.4%	12.3%	11.9%	11.4%	11.5%	11.8%	12.0%	12.7%	12.6%	12.5%	12.7%	12.8%	12.7%
KOR	11.2%	11.3%	11.2%	10.8%	10.3%	10.3%	10.5%	10.4%	10.7%	10.6%	10.5%	10.6%	10.6%	10.5%	10.3%
LTU	13.4%	13.4%	14.2%	14.0%	13.7%	13.6%	12.8%	12.6%	12.8%	13.6%	13.2%	12.8%	12.7%	13.1%	13.1%
LUX	9.6%	9.4%	9.2%	9.3%	8.7%	8.2%	8.4%	7.7%	8.1%	8.4%	8.1%	8.0%	8.0%	7.8%	7.9%
LVA	11.3%	11.2%	11.4%	11.5%	11.7%	12.4%	13.0%	12.6%	11.9%	12.3%	13.0%	12.1%	11.8%	11.9%	12.0%
MEX	13.4%	13.2%	13.0%	12.9%	12.7%	12.7%	12.4%	12.4%	12.2%	12.0%	12.1%	12.2%	12.3%	12.7%	12.8%
MLT	16.5%	16.6%	16.6%	16.3%	16.0%	16.5%	16.2%	18.2%	20.3%	19.9%	20.3%	20.4%	20.5%	21.6%	21.4%
NLD	10.3%	10.5%	10.7%	10.3%	10.0%	9.7%	9.6%	9.5%	9.2%	9.4%	9.2%	9.3%	9.3%	9.3%	9.5%
NOR	7.9%	7.7%	8.5%	8.2%	7.7%	7.2%	6.9%	7.5%	6.9%	7.4%	7.3%	7.0%	6.9%	6.8%	7.0%
POL	14.7%	15.6%	15.7%	14.8%	14.8%	15.7%	15.6%	15.3%	14.9%	15.6%	15.5%	15.2%	15.2%	15.1%	15.0%
PRT	13.7%	13.6%	13.9%	13.9%	13.9%	13.9%	13.9%	13.8%	13.9%	14.3%	14.3%	14.6%	15.1%	14.9%	15.1%
ROU	10.8%	8.7%	8.5%	8.6%	8.6%	9.4%	10.0%	10.0%	9.0%	8.6%	8.0%	8.1%	9.9%	7.9%	8.7%
ROW	10.8%	10.8%	10.3%	10.1%	9.9%	9.7%	9.6%	9.5%	9.1%	9.6%	9.3%	9.0%	9.0%	9.0%	9.0%
RUS	10.7%	10.6%	10.5%	10.4%	10.9%	10.6%	10.9%	11.4%	11.3%	11.3%	11.4%	11.1%	11.0%	11.0%	10.9%
SVK	9.0%	10.2%	10.4%	10.7%	10.7%	11.8%	12.0%	11.4%	10.9%	11.6%	11.5%	11.4%	13.5%	11.8%	13.5%
SVN	11.8%	11.6%	11.5%	11.3%	11.0%	11.4%	11.3%	11.2%	11.2%	11.5%	11.7%	11.5%	11.4%	11.7%	11.5%
SWE	8.7%	8.8%	9.0%	9.0%	9.3%	9.5%	9.5%	9.4%	9.3%	9.6%	9.6%	9.6%	9.8%	10.0%	10.2%
TUR	12.2%	11.8%	12.3%	12.6%	12.8%	12.6%	12.7%	12.4%	12.3%	11.6%	11.7%	12.5%	12.3%	12.7%	12.7%
TWN	13.5%	13.8%	13.6%	13.3%	13.3%	13.7%	13.5%	13.3%	13.5%	13.4%	12.7%	13.0%	13.2%	13.1%	12.9%
USA	13.1%	12.8%	13.0%	12.8%	12.6%	12.4%	12.2%	11.9%	11.6%	11.6%	11.5%	11.4%	11.5%	11.6%	11.6%
World	12.2%	12.1%	12.2%	12.0%	11.8%	11.6%	11.5%	11.3%	11.0%	11.2%	11.0%	10.8%	10.8%	10.8%	10.7%

Source: 2016 version WIOD, author's calculations

Table 6.11
Ratio of Value Added of *Total Services* as a Proportion of Total Value Added by Country, 2000 - 2014

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AUS	72.9%	72.6%	73.3%	73.0%	72.7%	71.7%	72.1%	72.1%	70.7%	72.8%	71.4%	72.0%	73.8%	73.4%	74.6%
AUT	69.7%	69.9%	70.9%	71.0%	71.1%	71.4%	71.2%	70.6%	71.4%	73.0%	72.9%	72.7%	72.6%	73.2%	73.3%
BEL	73.9%	74.6%	75.1%	75.9%	75.9%	76.4%	76.6%	76.6%	77.5%	79.2%	78.8%	79.2%	79.3%	79.6%	79.8%
BGR	66.9%	66.5%	67.9%	67.7%	68.9%	67.7%	67.8%	68.3%	67.6%	68.9%	72.1%	70.0%	70.4%	72.7%	72.5%
BRA	71.0%	71.5%	70.8%	68.7%	67.1%	69.7%	71.0%	71.1%	70.2%	71.1%	70.6%	70.4%	71.5%	71.8%	72.7%
CAN	71.1%	72.2%	73.0%	72.9%	72.2%	71.9%	72.2%	73.1%	73.1%	73.1%	72.4%	71.1%	71.0%	71.4%	71.2%
CHE	75.3%	74.7%	74.1%	74.4%	74.3%	74.3%	74.2%	74.2%	73.9%	75.1%	74.9%	74.5%	75.0%	75.0%	75.2%
CHN	42.0%	43.7%	45.0%	44.7%	44.0%	44.2%	44.6%	45.5%	44.4%	45.9%	45.6%	45.4%	46.3%	47.5%	48.6%
CYP	79.1%	79.5%	78.9%	79.2%	79.3%	79.4%	79.8%	79.5%	79.3%	82.1%	83.6%	85.2%	87.0%	88.9%	89.8%
CZE	63.1%	63.1%	65.2%	65.9%	64.2%	64.1%	64.1%	64.1%	65.4%	67.4%	66.7%	65.6%	65.5%	65.7%	64.3%
DEU	70.6%	71.2%	72.3%	72.5%	72.4%	72.7%	72.0%	71.7%	72.4%	75.0%	72.6%	71.7%	71.7%	72.0%	71.9%
DNK	72.6%	73.3%	74.1%	75.0%	74.9%	74.9%	74.2%	74.5%	74.9%	78.1%	78.4%	77.4%	76.7%	77.4%	77.8%
ESP	67.6%	67.8%	68.2%	68.5%	69.0%	69.3%	69.7%	70.7%	71.6%	73.6%	75.0%	76.2%	77.8%	78.2%	78.5%
EST	70.8%	70.4%	70.7%	70.6%	71.1%	70.4%	69.7%	69.0%	71.2%	75.1%	73.8%	71.3%	71.6%	72.3%	72.6%
FIN	62.6%	63.9%	65.0%	65.8%	66.3%	66.4%	65.7%	64.9%	66.5%	71.2%	70.8%	71.5%	73.4%	73.3%	73.9%
FRA	76.9%	77.3%	77.9%	78.5%	78.8%	79.2%	79.6%	79.3%	79.7%	80.6%	80.8%	80.6%	80.8%	81.1%	81.3%
GBR	74.4%	75.9%	76.4%	77.5%	78.3%	78.3%	78.5%	79.2%	79.4%	81.3%	80.8%	80.6%	81.2%	80.8%	80.9%
GRC	75.8%	75.5%	75.9%	74.8%	75.9%	78.8%	77.1%	79.2%	81.8%	83.0%	83.7%	83.8%	83.4%	83.3%	83.5%
HRV	67.8%	67.8%	68.6%	69.1%	68.0%	69.3%	69.0%	69.5%	69.6%	70.2%	71.5%	71.6%	72.1%	73.2%	73.3%
HUN	66.4%	66.5%	67.8%	68.3%	67.4%	67.7%	67.6%	68.6%	69.4%	71.0%	70.3%	68.9%	68.8%	68.5%	67.4%
IDN	42.5%	42.5%	44.3%	45.6%	45.7%	44.8%	44.6%	44.3%	42.3%	42.2%	42.9%	42.7%	43.0%	43.7%	44.5%
IND	54.6%	55.5%	56.6%	56.5%	56.2%	56.1%	55.8%	55.5%	56.6%	57.3%	57.2%	57.5%	58.5%	59.6%	61.2%
IRL	63.5%	61.4%	60.2%	63.9%	65.2%	66.2%	66.7%	68.9%	72.4%	73.6%	74.7%	72.7%	74.5%	75.2%	75.5%
ITA	72.2%	72.8%	73.1%	73.7%	73.7%	74.3%	74.1%	73.8%	74.4%	76.6%	76.3%	76.2%	76.6%	76.8%	77.1%
JPN	69.6%	71.0%	71.6%	71.6%	71.3%	71.4%	71.6%	71.8%	72.5%	74.7%	73.5%	74.0%	73.8%	73.6%	73.2%
KOR	60.3%	61.9%	62.7%	62.7%	61.1%	61.9%	62.7%	62.7%	62.9%	62.8%	61.5%	61.1%	61.6%	61.6%	62.2%
LTU	68.2%	68.5%	69.4%	69.0%	67.5%	66.8%	66.3%	66.8%	67.2%	73.6%	71.7%	68.9%	68.6%	69.6%	69.4%
LUX	82.3%	82.8%	82.9%	83.0%	83.3%	84.8%	86.0%	84.5%	85.9%	88.5%	88.3%	88.2%	88.6%	89.1%	89.1%
LVA	72.5%	73.4%	73.3%	75.2%	74.7%	75.7%	75.4%	74.5%	75.5%	77.3%	76.7%	76.7%	76.5%	77.0%	77.3%
MEX	61.6%	62.8%	64.0%	64.8%	63.1%	63.6%	62.3%	62.5%	62.1%	64.5%	63.5%	62.1%	61.8%	63.9%	64.2%
MLT	71.1%	73.9%	73.1%	72.7%	75.2%	76.3%	77.8%	79.0%	78.6%	80.7%	80.2%	81.1%	82.6%	83.8%	85.0%
NLD	74.6%	74.4%	75.5%	76.0%	76.0%	75.8%	75.6%	75.8%	75.7%	77.6%	77.9%	77.8%	78.0%	78.0%	78.7%
NOR	59.2%	61.2%	63.8%	64.1%	61.9%	58.9%	57.0%	59.2%	56.9%	63.0%	62.3%	59.9%	60.3%	61.3%	62.6%
POL	67.6%	69.6%	71.1%	70.4%	68.2%	68.9%	68.4%	67.8%	68.2%	68.4%	68.8%	67.6%	68.7%	68.3%	68.2%
PRT	71.1%	71.6%	72.6%	74.0%	74.6%	75.5%	75.8%	76.3%	76.9%	78.6%	78.4%	79.1%	79.5%	79.6%	79.5%
ROU	57.8%	52.9%	54.5%	55.8%	54.1%	57.4%	57.2%	60.5%	58.2%	59.7%	58.0%	57.7%	61.9%	61.6%	63.1%
ROW	59.4%	60.3%	58.9%	58.9%	58.9%	57.9%	57.7%	58.3%	55.9%	59.2%	57.9%	56.5%	56.9%	57.7%	58.1%
RUS	59.3%	61.6%	63.7%	64.7%	61.7%	60.2%	61.4%	62.2%	62.6%	65.7%	64.4%	62.4%	63.5%	64.5%	65.5%
SVK	63.7%	63.2%	64.6%	65.7%	65.7%	65.7%	64.9%	64.2%	63.6%	68.6%	67.0%	66.0%	66.0%	67.4%	65.9%
SVN	64.6%	65.3%	65.7%	66.1%	66.3%	66.8%	66.7%	66.1%	67.4%	70.3%	71.0%	70.4%	70.0%	69.7%	68.4%
SWE	70.2%	70.9%	71.4%	71.9%	71.7%	72.3%	71.6%	71.0%	72.5%	75.0%	73.0%	73.5%	75.0%	75.8%	75.7%
TUR	61.6%	64.7%	63.5%	63.4%	63.7%	63.6%	64.6%	66.0%	66.9%	68.4%	66.9%	66.1%	67.2%	67.8%	67.4%
TWN	68.1%	70.4%	68.6%	67.7%	66.8%	67.2%	67.0%	66.3%	67.2%	68.2%	65.6%	65.8%	66.2%	65.8%	64.7%
USA	78.2%	79.2%	80.0%	79.8%	79.4%	79.2%	78.9%	79.0%	79.3%	80.9%	80.7%	80.2%	80.3%	80.0%	80.1%
World	70.3%	71.3%	71.8%	71.7%	71.1%	70.7%	70.2%	69.9%	69.2%	70.8%	69.5%	68.4%	68.4%	68.4%	68.6%

Source: 2016 version WIOD, author's calculations

Table 6.12 Real GDP per capita (USD) by Country, 2000 - 2014															
Country	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
AUS	32,253	29,000	31,352	38,257	44,495	46,983	46,862	53,485	54,782	50,645	59,378	67,352	68,766	64,591	60,967
AUT	29,261	28,637	30,545	36,688	41,169	41,847	43,366	48,892	53,137	48,267	46,758	50,240	46,559	47,871	47,827
BEL	29,798	29,049	31,035	37,282	42,317	43,081	44,233	49,575	53,217	48,818	47,379	49,835	45,717	46,918	47,634
BGR	2,759	2,874	3,221	4,083	4,805	5,179	5,617	6,612	7,524	6,935	6,744	7,395	6,877	7,209	7,338
BRA	2,527	1,967	1,609	1,524	1,675	2,052	2,359	2,765	3,052	2,770	3,347	3,621	3,133	2,897	2,646
CAN	29,073	28,074	28,233	31,897	35,076	38,501	41,783	44,599	44,863	40,181	45,449	48,314	48,127	47,301	44,666
CHE	42,035	42,405	45,629	52,428	57,868	59,216	60,833	65,701	73,701	70,717	74,908	88,629	83,863	85,544	87,568
CHN	1,681	1,808	1,960	2,143	2,346	2,621	3,020	3,596	4,293	4,746	5,271	6,019	6,615	7,229	7,783
CYP	17,008	16,825	18,166	21,682	24,717	25,529	26,576	29,460	31,986	28,950	27,194	27,891	24,320	23,519	23,388
CZE	7,310	7,668	9,082	10,933	12,583	14,375	16,247	19,026	23,079	19,505	19,832	21,732	19,453	19,345	18,741
DEU	26,702	26,334	27,756	33,008	36,586	37,034	38,852	43,938	47,698	42,778	42,466	46,192	42,892	44,456	45,148
DNK	38,937	37,991	40,091	48,095	54,143	55,229	57,700	63,369	66,962	60,172	58,174	61,466	56,895	58,996	59,769
ESP	19,775	19,831	21,172	25,680	28,679	29,255	30,235	33,586	35,873	32,463	30,804	31,859	28,554	29,105	29,609
EST	7,037	7,303	8,210	10,627	12,499	13,761	15,399	18,208	18,545	15,010	14,656	16,565	16,026	16,940	17,492
FIN	28,249	28,034	29,977	36,532	41,631	42,733	44,657	51,070	54,992	47,507	46,395	49,679	45,028	45,945	45,477
FRA	27,814	27,297	28,901	34,648	38,895	39,301	40,265	44,703	47,830	43,701	42,249	45,006	41,457	42,860	43,065
GBR	36,513	35,488	37,724	42,299	48,354	49,102	50,599	55,919	51,027	40,923	40,889	42,692	42,477	42,453	45,726
GRC	16,493	16,344	17,825	22,523	25,959	26,094	27,700	31,138	33,247	30,019	26,974	25,693	22,079	22,235	22,483
HRV	7,093	7,409	8,263	10,238	11,485	12,126	12,955	14,837	16,467	14,260	13,505	14,299	12,814	13,038	12,931
HUN	6,312	6,466	7,526	9,012	10,495	11,150	11,008	12,682	13,680	10,887	10,684	11,280	9,950	10,260	10,304
IDN	2,336	1,959	2,225	2,496	2,481	2,379	2,621	2,755	2,752	2,646	3,178	3,432	3,358	3,148	2,863
IND	842	832	838	938	1,018	1,112	1,171	1,424	1,276	1,323	1,498	1,498	1,373	1,296	1,361
IRL	32,683	33,006	36,364	44,182	50,858	52,741	54,532	60,851	61,781	55,360	53,423	57,513	52,976	55,467	59,936
ITA	25,251	24,892	26,296	31,423	34,836	34,969	35,800	39,502	41,619	36,968	35,658	37,453	33,508	33,828	33,732
JPN	33,779	30,014	29,055	31,858	34,854	34,777	33,425	33,555	37,829	39,567	43,930	48,173	49,011	40,941	37,905
KOR	15,439	14,034	15,464	16,627	18,073	20,960	23,528	25,361	21,823	18,870	22,087	23,704	23,731	25,009	26,705
LTU	4,518	4,853	5,682	7,608	9,024	9,918	10,903	13,375	14,899	12,149	12,012	13,673	13,284	14,341	14,996
LUX	65,554	64,258	69,712	84,075	94,300	96,217	100,265	116,847	121,807	108,020	106,199	111,959	100,527	105,587	108,950
LVA	6,029	6,269	6,918	8,190	9,475	10,168	11,569	14,000	14,582	12,012	11,225	12,908	12,479	13,363	13,813
MEX	10,737	10,645	10,200	9,192	9,059	9,558	9,918	10,075	9,895	7,659	8,504	8,888	8,620	8,907	8,656
MLT	13,600	13,239	14,023	16,433	17,928	18,425	18,924	21,490	23,565	21,599	21,152	22,439	21,124	22,661	24,294
NLD	32,186	31,622	33,166	39,639	44,311	45,249	47,139	53,240	57,917	52,475	50,433	53,514	48,740	50,113	50,668
NOR	63,587	63,288	71,853	80,899	88,221	94,097	95,965	106,938	110,053	95,982	99,130	106,530	104,092	102,917	96,652
POL	5,963	6,409	6,525	7,094	7,942	9,294	10,295	12,395	14,788	11,722	12,602	13,452	12,454	13,002	13,464
PRT	14,969	14,686	15,521	18,342	20,482	20,642	21,091	23,550	25,301	23,209	22,520	23,216	20,671	21,231	21,547
ROU	7,182	5,667	5,388	5,705	6,320	7,422	8,368	10,372	11,220	8,666	8,277	8,797	7,790	8,438	8,673
RUS	12,036	12,246	11,987	13,197	15,126	16,432	18,530	21,402	23,194	16,740	18,280	19,844	19,586	19,301	16,123
SVK	5,081	5,016	5,607	7,291	8,741	9,704	11,034	14,656	17,925	16,649	16,636	17,930	16,803	17,596	18,041
SVN	15,174	14,259	14,938	17,805	19,986	20,741	22,038	25,630	28,437	24,545	23,499	24,766	22,217	22,649	23,313
SWE	38,225	34,337	37,042	45,488	52,017	52,374	55,137	61,767	62,489	50,558	56,451	63,873	60,578	63,199	60,922
TUR	18,084	8,559	7,313	7,671	8,747	9,984	9,908	11,293	11,269	8,882	9,789	9,623	9,289	9,379	8,468
TWN	13,179	11,943	12,275	12,783	13,973	15,252	15,859	16,674	17,429	16,307	18,809	20,912	21,155	21,454	21,821
USA	44,491	44,465	44,819	45,647	46,946	48,070	48,887	49,267	48,669	46,909	47,727	48,140	48,856	49,331	50,232
Source: 2016 version WIOD, author's calculations															

Table 6.13 Three-measure composite World Governance Index by Country, 2000 - 2014															
Country	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
AUS	94.08	93.15	92.22	94.43	96.10	94.65	94.34	95.34	95.81	96.03	95.71	96.22	95.75	95.91	95.51
AUT	95.41	95.42	95.43	95.44	93.63	95.12	96.91	97.41	95.80	93.95	95.23	93.53	93.85	94.00	93.11
BEL	88.85	89.81	90.76	90.93	90.26	89.48	90.46	90.67	89.52	89.51	89.19	90.24	90.08	90.24	87.34
BGR	54.98	58.43	61.88	60.22	61.58	60.05	57.99	59.29	59.54	62.35	62.19	60.97	60.81	60.02	61.70
BRA	56.74	56.53	56.32	57.03	51.64	49.19	47.28	48.33	50.98	52.31	55.01	54.32	52.75	52.60	51.76
CAN	94.09	94.10	94.10	94.44	94.80	94.82	95.95	95.00	95.64	96.34	96.18	95.44	95.43	95.91	95.99
CHE	98.64	98.55	98.47	96.10	97.56	95.77	96.10	97.26	96.29	96.03	95.55	95.44	96.53	96.06	97.92
CHN	41.64	41.89	42.14	44.88	45.30	44.99	45.40	48.53	49.87	48.83	47.72	47.43	45.86	46.16	49.20
CYP	84.30	84.50	84.71	83.54	82.96	83.01	87.06	87.29	88.55	87.76	89.51	87.26	85.36	82.84	83.01
CZE	74.36	77.77	81.18	80.66	76.79	78.93	81.10	79.87	81.78	81.72	81.56	81.73	80.15	80.31	82.05
DEU	92.90	92.74	92.58	91.39	91.52	91.88	94.01	94.04	91.93	93.16	92.85	91.97	92.44	92.28	94.23
DNK	96.95	97.72	98.48	98.98	98.70	98.86	99.51	99.68	99.35	99.37	99.21	99.21	98.27	98.42	96.79
ESP	90.54	89.98	89.42	89.76	87.17	88.19	83.31	84.37	83.87	82.98	83.14	82.98	81.25	81.26	79.81
EST	79.31	79.58	79.84	81.03	82.94	82.84	86.73	85.83	87.58	84.74	85.37	86.30	85.04	85.35	86.70
FIN	98.97	99.15	99.32	99.83	99.18	99.67	97.56	96.45	97.26	99.04	99.52	99.21	99.06	99.21	99.20
FRA	87.46	86.32	85.18	89.22	90.06	89.62	89.80	88.88	90.00	88.23	88.71	87.55	87.08	87.87	86.38
GBR	95.45	94.95	94.45	93.94	94.65	94.51	96.12	95.02	94.68	93.32	94.75	93.23	93.39	93.54	94.87
GRC	77.50	77.32	77.14	77.12	77.23	75.20	74.91	75.68	75.47	71.39	69.64	67.88	65.20	68.36	66.51
HRV	57.66	58.51	59.37	62.56	64.63	63.26	62.68	63.64	65.18	66.32	67.27	67.11	66.63	66.32	68.27
HUN	81.94	82.74	83.53	80.82	79.53	77.62	82.04	80.83	80.81	75.69	75.52	75.13	72.61	71.98	72.92
IDN	38.97	34.01	29.05	27.32	30.63	30.03	36.96	38.85	40.03	39.61	38.34	39.08	41.12	43.64	48.88
IND	52.59	51.19	49.79	52.46	48.55	51.50	52.38	51.99	50.95	51.02	49.91	49.44	45.49	45.33	44.87
IRL	93.08	93.26	93.44	91.42	92.03	92.55	93.86	94.37	94.03	92.84	92.36	92.74	93.70	92.75	93.27
ITA	78.56	77.51	76.45	77.31	74.20	70.55	68.67	67.65	69.05	69.34	69.34	68.20	68.20	68.68	69.39
JPN	84.60	81.67	78.73	84.00	86.49	86.70	89.64	87.75	86.93	86.32	86.64	86.30	86.93	88.97	89.90
KOR	76.65	77.55	78.44	76.60	77.39	78.25	77.18	81.96	78.06	79.80	81.56	82.37	80.79	80.79	83.01
LTU	66.79	69.88	72.97	74.66	75.18	74.11	74.47	76.51	75.98	74.10	75.68	75.12	77.64	77.81	81.41
LUX	98.14	98.57	98.99	96.64	96.91	96.60	93.37	94.36	94.84	96.34	95.86	97.16	95.90	95.90	93.75
LVA	66.66	68.55	70.44	73.61	73.06	71.50	74.15	74.24	75.16	75.04	75.68	74.50	76.23	76.70	80.77
MEX	55.42	97.88	58.39	57.72	56.09	52.76	54.14	53.38	51.04	51.24	51.40	52.02	56.12	55.34	55.45
MLT	86.11	86.04	85.98	85.28	82.53	81.77	85.40	87.25	88.38	87.91	88.07	86.61	87.09	87.24	83.17
NLD	98.00	97.50	96.99	96.82	97.26	97.42	95.48	95.81	95.32	96.34	96.34	97.01	96.85	96.53	96.47
NOR	93.00	92.69	92.38	93.73	95.89	95.44	94.13	94.83	95.31	96.02	96.50	96.37	97.00	97.63	96.47
POL	74.51	73.28	72.05	70.91	69.49	67.79	66.86	67.50	69.85	71.72	73.31	74.18	74.34	75.75	77.72
PRT	82.75	84.72	86.69	86.51	84.36	86.05	80.10	81.48	82.58	82.19	79.48	76.84	80.30	81.73	79.33
ROU	45.44	48.08	50.72	49.86	52.24	50.59	54.73	55.08	55.65	57.08	58.03	58.43	57.32	60.17	63.30
RUS	22.72	30.12	37.52	36.55	36.59	36.27	32.63	34.38	34.08	36.12	35.80	36.09	35.31	36.41	37.82
SVK	68.99	69.81	70.64	72.47	75.55	75.61	76.46	73.80	76.31	74.27	74.43	74.51	73.41	72.47	74.68
SVN	78.32	78.88	79.44	79.62	79.02	77.28	77.17	78.73	81.28	81.39	79.64	78.89	78.42	77.78	78.04
SWE	94.39	95.51	96.63	96.96	97.23	95.46	94.96	96.77	97.41	97.93	97.77	99.05	99.05	99.05	96.63
TUR	57.34	57.32	57.29	58.75	57.55	59.33	57.95	60.09	59.85	60.26	60.90	61.74	62.54	61.75	63.78
TWN	79.10	78.86	78.62	81.14	82.93	79.55	76.41	78.61	78.73	81.25	82.83	82.36	84.26	83.94	87.66
USA	93.59	92.92	92.25	92.08	91.88	92.39	93.05	92.27	92.58	90.78	92.05	91.34	89.92	89.45	89.58
Source: World Bank World Governance Indicators, author's calculations															

Figure 6.2
Scatter plot of *Distributive Services* as % of GDP and log of real GDP per capita (in USD)

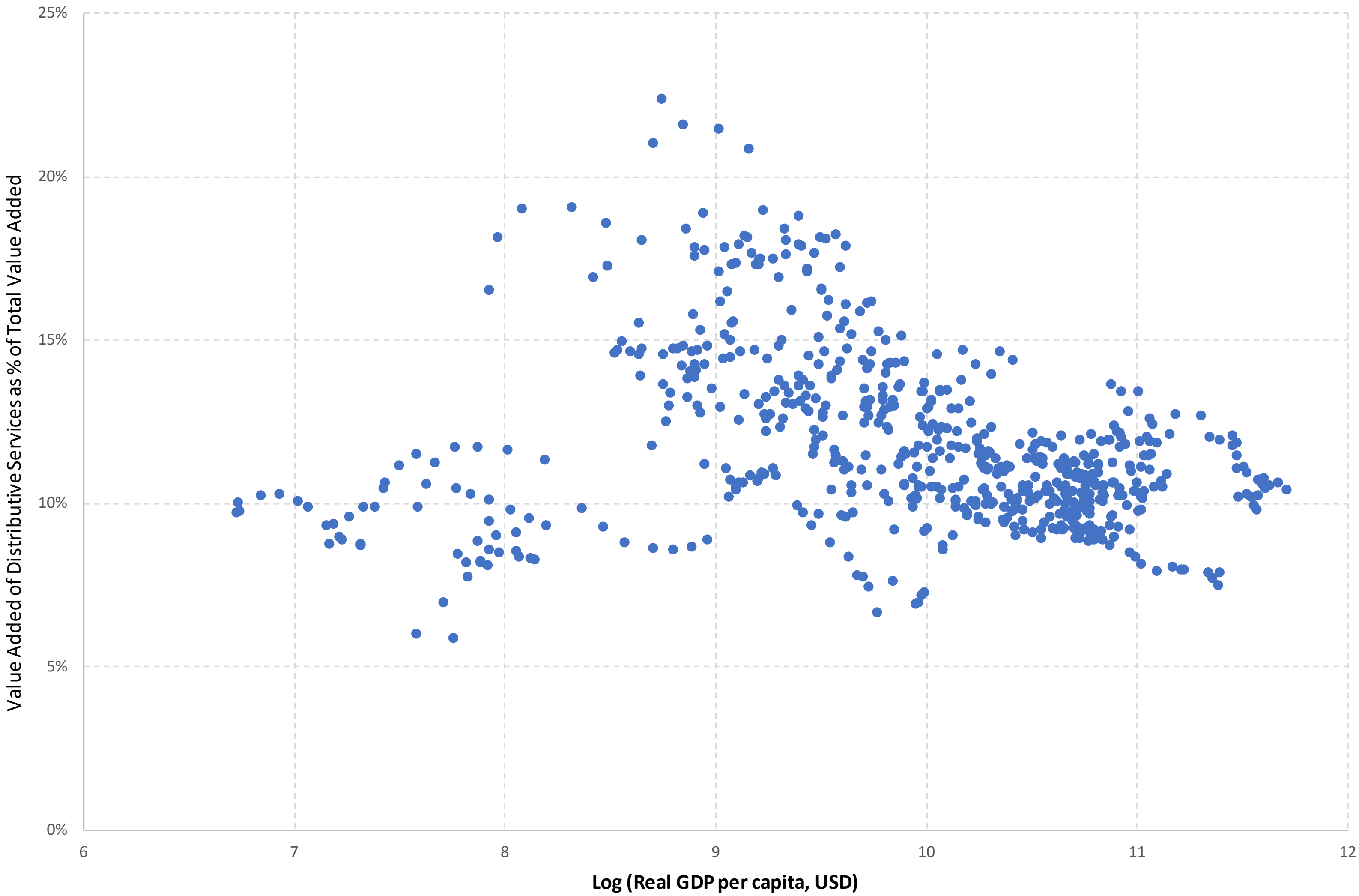


Figure 6.3
Scatter plot of *Producer Services* as % of GDP and log of real GDP per capita (in USD)

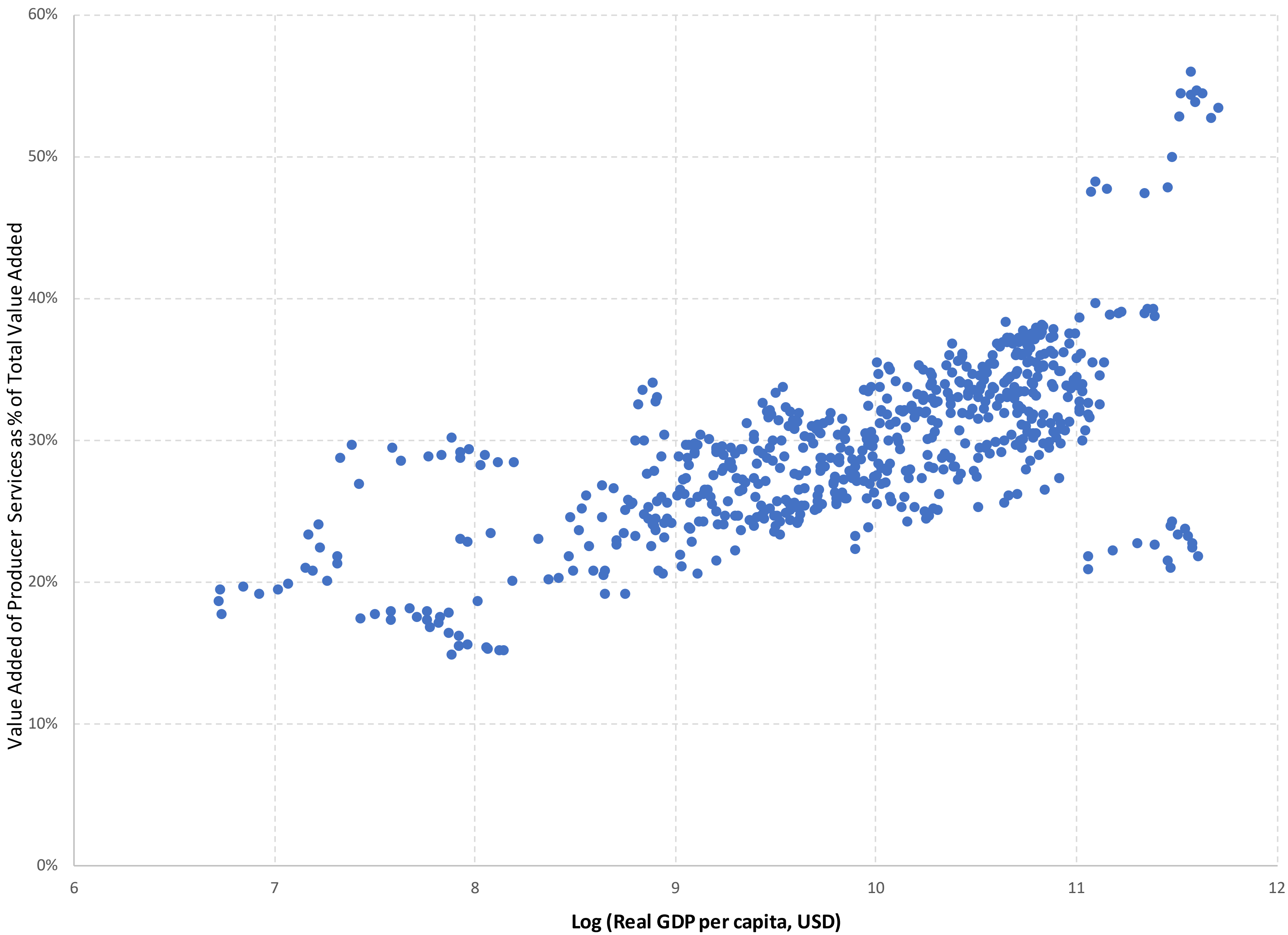


Figure 6.4
Scatter plot of *Social Services* as % of GDP and log of real GDP per capita (in USD)

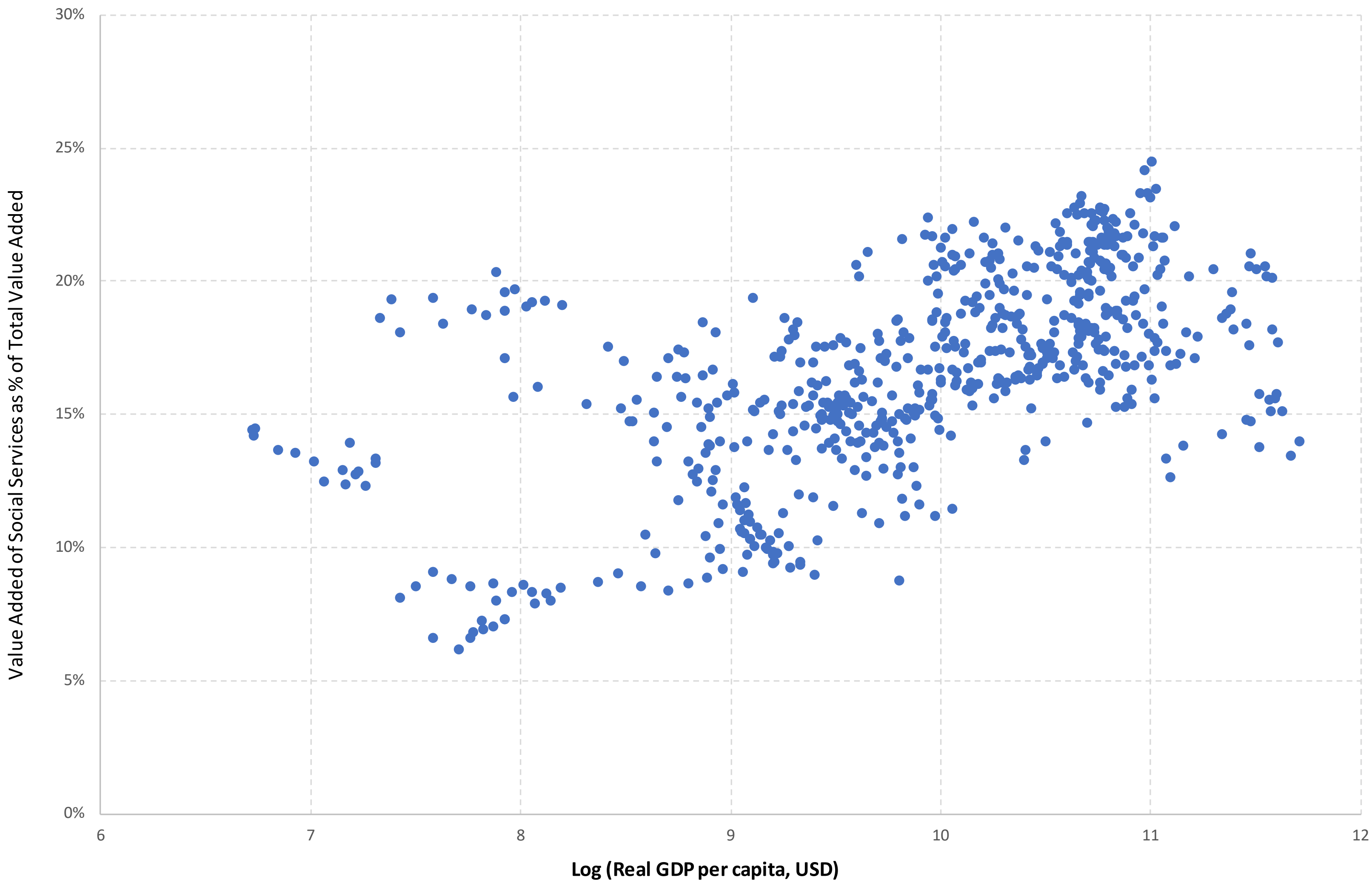


Figure 6.5
Scatter plot of *Personal Services* as % of GDP and log of real GDP per capita (in USD)

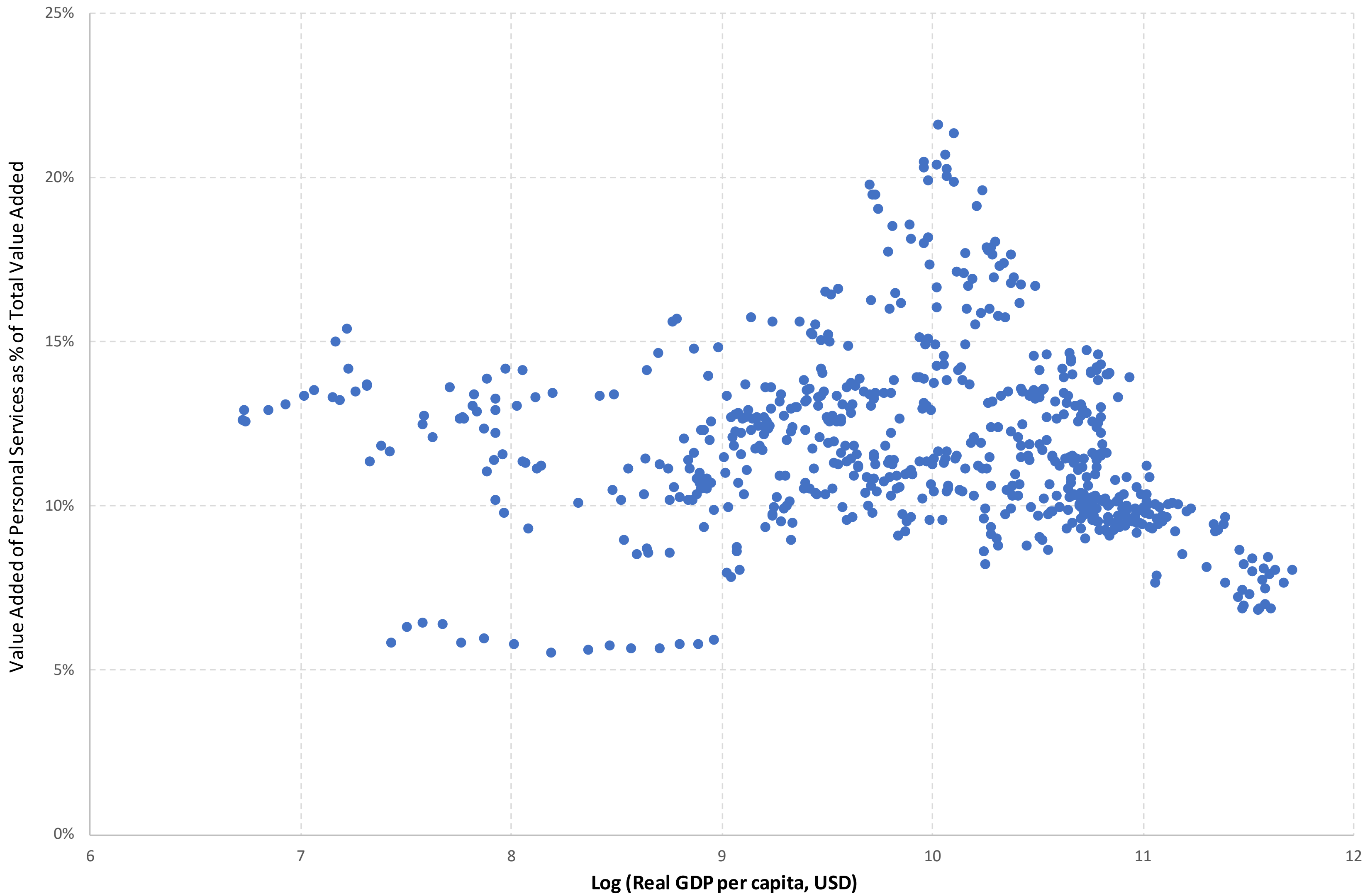
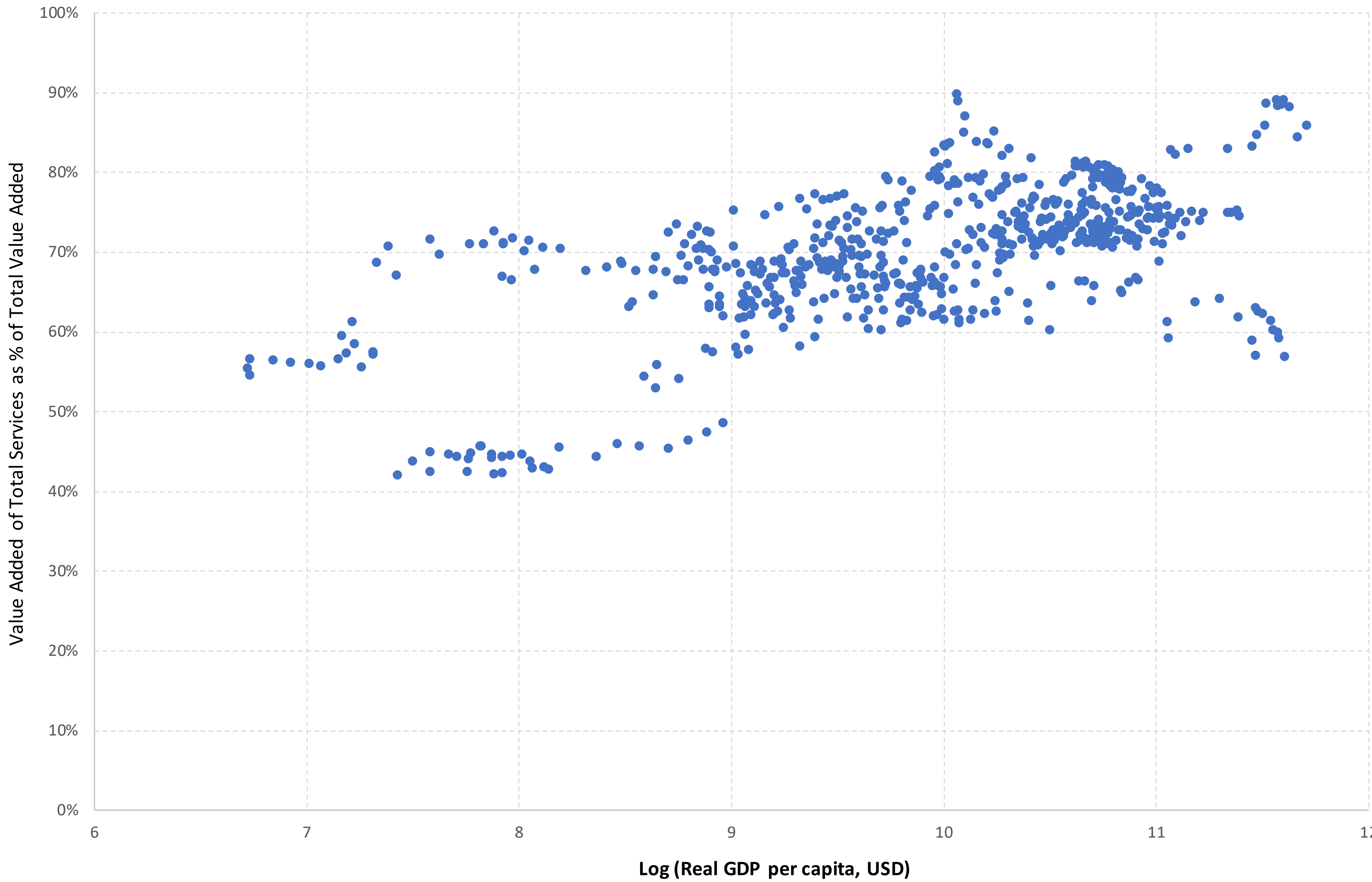


Figure 6.6
Scatter plot of *Total Services* as % of GDP and log of real GDP per capita (in USD)



6.3.3 Regression analysis

The empirical analysis presented below seeks to test whether a country's living standards, as measured by real GDP per capita (in USD terms), is influential in driving the economic make-up of a country in terms of the relative importance each sector plays in that economy.

As discussed in Section 6.3.1.3, the model to be used to test this proposition is:

$$r_{ij}^{t} = \alpha i_n + X_t\beta + \delta GI_t + \mu + \xi_t i_n + u_t \qquad (146)$$

where

r_{ij}^{t} =	N x 1 matrix consisting of one observation representing the ratio of value-added by sector *i* to value-added economic activities in country *j* in year *t*
X =	log of real GDP per capita (in USD) in country *j* in year *t*
GI =	aggregate three-measure percentile rank WGI for country *j* in year *t*
α =	constant term
i_n=	N x 1 matrix of ones associated with the constant term, α
β =	K x 1 matrix of parameter values
δ =	institutional parameter coefficient
μ =	spatial fixed effects
$\xi_t i_n$ =	time period fixed effects
u_t =	error term

6.3.4 Estimation

6.3.4.1 Basic OLS Equation

Table 6.14 presents the estimates of a basic demand model, being

$$r_{ij}^{t} = \alpha i_n + \beta X_t + \delta GI_t + \varepsilon_t \qquad (147)$$

using OLS and the time series panel dataset, ignoring for issues like spatial and time period effects.

Table 6.14
Estimates of Service Sub-Sectors as a Proportion of GVA
Basic OLS Specification[1]

	Distributive Services	Producer Services	Social Services	Personal Services	Total Services
Constant (α)	0.188	-0.100	0.043	0.170	0.300
	(15.758)***	(-4.833)***	(3.589)***	(13.601)***	(9.976)***
β	-0.008	0.039	0.0004	-0.007	0.024
	(-4.379)***	(12.579)***	(0.213)	(-3.922)***	(5.397)***
δ	0.00008	0.0002	0.002	0.0003	0.002
	(0.820)	(0.904)	(14.840)	(2.462)**	(7.850)***
R^2	0.063	0.463	0.523	0.026	0.438
DW	0.167	0.200	0.230	0.216	0.200
RSS	0.429	1.303	0.430	0.472	2.740

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

A number of observations can be made about these findings. Firstly, the results for Total Services are robust in the sense the coefficient signs are as expected, are statistically significant at the 1 per cent level, and show a reasonable level of predictive capability (as measured by the R^2), albeit the Durbin-Watson statistic shows signs of autocorrelation. Interpreting the coefficient values for Total Services, the Basic OLS specification suggests (i) the minimum level for the provision of services is approximately 30.0 per cent of total activity within an economy; (ii) for each 10 per cent increase in real GDP per capita (in USD terms), the relative proportion of services being supplied within an aggregate economy increases by 2.4 per cent; and (iii) for each 10 index points of the three-measure Governance Index, the structure of an economy becomes slightly more biased towards (by 0.02 per cent) the services sector.

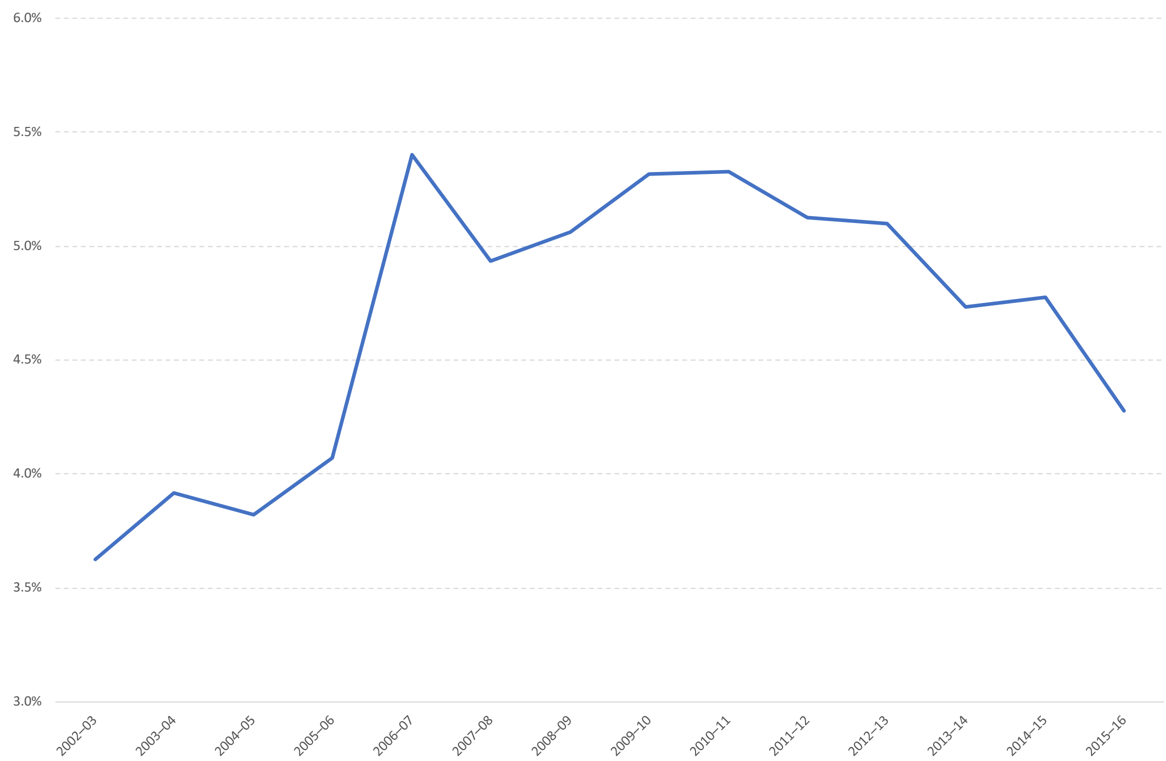
These findings are consistent with the underlying premise of the Clark-Fisher-Fourastié three-sector model of economic development: the proportion of economic activity associated with the provision of services increases as an economy expands.

Secondly, the results for individual sub-sectors are mixed, including a negative constant value for Producer Services; poor explanatory power for the Distributive Services and Personal Services equations; and autocorrelation concerns across all model specifications.

Thirdly, the negative coefficient sign for Distributive Services raises the question of whether this result reflects a statistical anomaly or economies of scale that occur within this sector, especially within infrastructure assets which exhibit characteristics of high fixed costs and low marginal costs, such as electricity, gas, water and wastewater and telecommunications network systems and to a lesser extent, postal and courier systems.

Fourthly, intuitively one would expect a positive coefficient for Personal Services, whereas the above results also show a small, negative value. As retail services are included within this service sub-sector, the negative coefficient may reflect the changing dynamics that have occurred within this sector during the time period under review. Strong competition from new entrants, combined with a global evolution of the retailing business model through the more intensive use of technology (such as an increased use of the internet as a channel to market), has meant profit margins have been declining within the sector since the middle of the 2000s (see Figure 6.7) (Commonwealth of Australia, 2018). While transactions and activity might increase in the retail services sector in line with positive per capita income growth, the per-unit profit associated with that incremental retail activity appears to have been steadily declining. This has the consequence of reducing the relative importance of the retail industry GVA within the overall economy, which would also result in a negative coefficient in the simple OLS equation modelled in this study.

Figure 6.7
Operating Profit before Tax as % of Total Revenue, Retail Trade, Australia



Source: ABS Cat 81550DO001_201516, Table 1 Key Data by Industry Division, ABS Cat 5204.0, Author's Calculations

Finally, given the value of the IGVA per capita for the four sub-sectors for each country sums to total IGVA per capita for the aggregate services sector in each country, then the sum of the coefficient values determined for the distributive, producer, social and personal services sub-sectors should also correspondingly equal (or close to equal) the coefficient value determined for the Total Services sector. Table 6.14 confirms this is the case for the Basic OLS regression model.

6.3.4.3 Basic OLS equation with Country Fixed Effects

The inclusion of Country Fixed Effects within the specification of the Basic OLS equation allows for the testing of whether the differences across countries are due to parametric shifts in the regression function (i.e.: differences across countries are captured in differences in the constant term) (Miller, 1996, p.1021).

The specification of the model that will allow for this testing is given by

$$r_{ij}^{t} = \alpha i_n + X_t\beta + \delta GI_t + \mu + \varepsilon_t \qquad (148).$$

A summary of the estimation results for equation 148 is presented in Table 6.15. The inclusion of Country Fixed Effects within the regression model has resulted in the Total Services iteration of the model lifting its explanatory power and reducing problems associated with autocorrelation across the explanatory variables. This improvement in the statistical robustness of the model is likely to be the result of additional explanatory variables being included within the equation (being μ).

The constant term, which also reflects the Country Fixed Effects value specific for Australia (as the number of country dummies is required to be N-1 in order to avoid perfect multicollinearity (Elhorst, 2014a, p. 1642)) in the Total Services model has now increased to be 0.430. The estimation results also show a slightly higher β value than compared with the no fixed effects Basic OLS model, with the statistically significant (at the 1 per cent level) coefficient value revealing for every 10 per cent in per capita real GDP (in USD), the relative proportion of the services sector in an economy increases by 3.6 per cent.

The estimation results for the service sub-sector models show improved statistical properties compared with the No Country Fixed Effects Basic OLS model, although the Personal Services specification now shows an insignificant statistical relationship between real GDP per capita (in USD) and the relative importance of the sector within the overall economy. Institutional effectiveness is a statistically significant factor in the Producer Services sub-sector under this model structure, whereas it was not a significant variable for this subsector in the Basic OLS framework. This suggests that including the Country Fixed Effects within the regression modelling better enables the importance of institutional effectiveness to services sector growth to be highlighted.

Table 6.15
Estimates of Service Sub-Sectors as a Proportion of GVA
Basic OLS Equation with Country Fixed Effects[1]

	Distributive Services	Producer Services	Social Services	Personal Services	Total Services
Constant (α)	0.283 (18.448)***	-0.090 (-3.032)***	0.142 (7.615)***	0.094 (6.829)***	0.430 (10.772)***
β	-0.016 (-12.376)***	0.048 (19.103)***	0.004 (2.757)***	-0.0002 (-0.143)	0.036 (10.613)***
δ	-0.000006 (-0.054)	-0.008 (-4.148)***	-0.0003 (-1.956)*	0.0001 (1.022)	-0.001 (-3.650)***
µ2 (AUT)	-0.003 (-0.937)	-0.044 (-7.945)***	0.008 (2.281)**	0.034 (13.222)***	-0.004 (-0.599)
µ3 (BEL)	0.002 (0.574)	0.001 (0.160)	0.044 (12.481)***	-0.0007 (-0.259)	0.046 (6.073)***
µ4 (BGR)	0.016 (3.169)**	0.009 (0.912)	-0.022 (-3.652)***	0.007 (1.543)	0.009 (0.725)
µ5 (BRA)	-0.059 (-10.048)***	0.046 (4.088)***	0.028 (3.959)***	0.031 (5.846)***	0.046 (3.031)***
µ6 (CAN)	-0.019 (-6.481)***	-0.021 (-3.759)***	0.046 (13.302)***	-0.004 (-1.503)	0.003 (0.409)
µ7 (CHE)	-0.020 (-7.023)***	0.019 (3.435)***	0.014 (3.874)***	-0.0009 (-0.344)	0.011 (1.528)
µ8 (CHN)	-0.048 (-7.754)***	-0.063 (-5.363)***	-0.080 (-10.692)***	-0.038 (-6.953)***	-0.229 (-14.350)***
µ9 (CYN)	0.009 (2.835)***	-0.008 (1.389)	0.027 (7.226)***	0.082 (29.596)***	0.110 (13.681)***
µ10 (CZE)	0.015 (4.453)***	-0.047 (-7.116)***	-0.017 (-4.030)***	-0.0004 (-0.113)	-0.049 (5.472)***
µ11 (DEU)	-0.010 (-3.368)***	-0.009 (-1.625)	0.009 (2.614)***	0.011 (4.430)***	0.002 (0.254)
µ12 (DNK)	0.005 (1.850)*	-0.034 (-6.095)***	0.063 (17.897)***	-0.004 (-1.626)	0.030 (3.988)***
µ13 (ESP)	-0.011 (-3.535)***	-0.066 (-11.146)***	0.006 (1.609)	0.076 (27.410)***	0.005 (0.631)

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

Table 6.15 (cont.)
Estimates of Service Sub-Sectors as a Proportion of GVA
Basic OLS Equation with Country Fixed Effects[1]

	Distributive Services	Producer Services	Social Services	Personal Services	Total Services
μ14 (EST)	0.034 (10.067)***	0.003 (0.444)	-0.019 (-4.643)***	0.006 (1.862)*	0.024 (2.681)***
μ15 (FIN)	0.003 (1.000)	-0.069 (-12.315)***	0.037 (10.571)***	-0.008 (-2.895)***	-0.036 (-4.800)***
μ16 (FRA)	-0.012 (-3.946)***	0.017 (3.040)***	0.052 (14.517)***	0.013 (4.764)***	0.070 (9.155)***
μ17 (GBR)	-0.003 (-0.883)	0.005 (0.873)	0.022 (6.287)***	0.042 (16.165)***	0.066 (8.836)***
μ18 (GRC)	0.016 (4.317)***	-0.036 (-5.113)***	0.031 (7.003)***	0.064 (19.500)***	0.075 (7.896)***
μ19 (HRV)	-0.008 (-1.853)*	-0.014 (-1.675)*	-0.015 (-2.730)***	0.032 (8.001)***	-0.005 (-0.457)
μ20 (HUN)	-0.004 (-1.015)	-0.015 (-2.025)**	0.016 (3.448)***	0.001 (0.149)	-0.002 (-0.229)
μ21 (IDN)	-0.075 (10.831)***	-0.098 (-7.321)***	-0.09 (-11.091)***	0.025 (3.936)***	-0.242 (13.399)***
μ22 (IND)	-0.073 (-11.141)***	-0.003 (-0.242)	-0.027 (-3.421)***	0.037 (6.318)***	-0.067 (-3.875)***
μ23 (IRL)	0.004 (1.420)	-0.039 (-7.001)***	-0.006 (-1.781)*	0.001 (0.539)	-0.039 (-5.280)***
μ24 (ITA)	-0.010 (-2.596)***	-0.013 (-1.761)*	-0.002 (-0.439)	0.036 (10.776)***	0.012 (1.224)
μ25 (JPN)	-0.017 (-5.782)***	-0.013 (-2.222)**	0.007 (1.831)*	0.022 (8.126)***	-0.002 (-0.202)
μ26 (KOR)	-0.024 (-7.243)***	-0.064 (-9.977)***	-0.008 (-1.984)**	0.006 (2.048)**	-0.091 (-10.389)***
μ27 (LTU)	0.043 (11.214)***	-0.066 (-8.927)***	-0.011 (-2.446)**	0.033 (9.446)***	-0.002 (-0.163)
μ28 (LUX)	0.015 (4.985)***	0.134 (23.319)***	-0.023 (-6.359)***	-0.017 (-6.344)***	0.109 (14.014)***
μ29 (LTA)	0.051 (13.182)***	-0.003 (-0.348)	-0.006 (-1.261)	0.020 (5.783)***	0.063 (6.229)***

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

Table 6.15 (cont.)
Estimates of Service Sub-Sectors as a Proportion of GVA
Basic OLS Equation with Country Fixed Effects[1]

	Distributive Services	Producer Services	Social Services	Personal Services	Total Services
μ30 (MEX)	-0.027 (-5.444)***	-0.009 (-0.926)	-0.065 (-10.838)***	0.028 (6.239)***	-0.007 (-5.677)***
μ31 (MLT)	0.005 (1.665)*	-0.026 (-4.301)***	0.016 (4.256)***	0.084 (29.460)***	0.079 (9.643)***
μ32 (NLD)	-0.014 (-5.002)***	0.022 (4.036)***	0.039 (11.352)***	-0.005 (-1.767)*	0.043 (5.747)***
μ33 (NOR)	0.015 (5.190)***	-0.156 (-27.178)***	0.027 (7.408)***	-0.028 (-10.318)***	-0.141 (18.234)***
μ34 (POL)	-0.003 (-0.799)	-0.044 (-5.730)***	-0.011 (-2.306)**	0.053 (14.755)	-0.005 (-0.515)
μ35 (PRT)	-0.020 (-6.123)***	-0.013 (-2.065)**	0.046 (11.777)***	0.041 (14.189)***	0.055 (6.523)***
μ36 (ROU)	0.009 (1.799)*	-0.068 (-6.843)***	-0.052 (-8.275)***	-0.008 (-1.765)*	-0.119 (-8.843)***
μ37 (RUS)	0.003 (0.371)	-0.074 (-5.724)***	-0.060 (-7.282)***	0.013 (2.195)**	-0.118 (-6.731)***
μ38 (SVK)	0.010 (2.561)**	-0.040 (-5.427)***	-0.023 (-5.042)***	0.014 (3.962)***	-0.040 (-4.012)***
μ39 (SVN)	-0.005 (-1.485)	-0.046 (-7.131)***	0.002 (0.497)	0.014 (4.636)***	-0.035 (-4.012)***
μ40 (SWE)	0.011 (3.780)***	-0.047 (-8.462)***	0.044 (12.774)	-0.081 (-2.950)***	0.001 (0.129)
μ41 (TUR)	0.040 (8.544)***	-0.044 (-4.874)***	-0.069 (-12.057)***	0.025 (5.856)***	-0.048 (-3.917)***
μ42 (TWN)	-0.044 (-13.149)***	-0.009 (-1.465)	-0.009 (-2.214)**	0.033 (10.782)***	-0.030 (-3.445)***
μ43 (USA)	-0.017 (-5.789)***	0.020 (3.591)***	0.045 (12.926)***	0.020 (7.659)***	0.068 (9.113)***
R^2	0.920	0.944	0.940	0.939	0.949
DW	0.597	0.666	0.685	0.598	0.737
RSS	0.037	0.136	0.054	0.030	0.248

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

The estimation also reveals a tendency that where the sign for those statistically significant country dummies is negative for the Distributive, Producer and Social service sub-sectors, it is correspondingly positive for the Personal Services sub-sector.

6.3.4.4 Basic OLS Equation with Time Fixed Effects

The next iteration of the OLS model allows for the testing of whether time creates a parametric shift in the regression function. This equation is given by the following specification

$$r_{ij}^{t} = \alpha_2 i_n + X_t\beta + \delta GI_t + \xi_t i_n + \varepsilon_{2t} \qquad (149).$$

A summary of the estimation results for equation 149 is presented in Table 6.16.

The results suggest the coefficients for the time fixed effects are not statistically significant at the 1 per cent level, and the constant and coefficients for relative importance of sector or sub-sector and institutional governance are similar in size and sign to those determined in the Basic OLS model. This suggests the time-fixed effects as individual independent variables provide little in additional explanatory power than just the two primary independent variables, real GDP per capita (in USD) and the strength of institutional governance arrangements in each jurisdiction.

Table 6.16
Estimates of Service Sub-Sectors as a Proportion of GVA
Basic OLS Equation with Time Fixed Effects[1]

	Distributive Services	Producer Services	Social Services	Personal Services	Total Services
Constant (α)	0.182 (14.308)***	-0.092 (-4.184)***	0.045 (3.583)***	0.172 (12.860)***	0.307 (9.657)***
β	-0.007 (-3.549)***	0.037 (11.133)***	-0.001 (-0.481)	-0.008 (-3.945)***	0.021 (4.413)***
δ	0.00004 (0.336)	0.0003 (1.462)	0.002 (14.882)***	0.0003 (2.580)**	0.002 (8.111)***
$\xi_2\, i$ (2001)	0.001 (0.197)	0.003 (0.314)	-0.000006 (-0.001)	-0.0004 (-0.075)	0.004 (0.263)
$\xi_3\, i$ (2002)	0.002 (0.386)	0.003 (0.345)	0.004 (0.732)	0.001 (0.103)	0.010 (0.725)
$\xi_4\, i$ (2003)	0.004 (0.657)	-0.001 (-0.057)	0.006 (1.106)	0.001 (0.103)	0.010 (0.704)
$\xi_5\, i$ (2004)	0.004 (0.719)	-0.004 (-0.443)	0.005 (0.817)	0.0005 (0.081)	0.005 (0.339)
$\xi_6\, i$ (2005)	0.001 (0.165)	0.0001 (0.014)	0.005 (0.840)	0.002 (0.296)	0.008 (0.532)
$\xi_7\, i$ (2006)	-0.001 (-0.164)	0.003 (0.282)	0.002 (0.338)	0.002 (0.264)	0.005 (0.373)
$\xi_8\, i$ (2007)	-0.002 (-0.353)	0.005 (0.542)	-0.001 (-0.145)	0.002 (0.280)	0.004 (0.293)
$\xi_9\, i$ (2008)	-0.004 (-0.618)	0.005 (0.510)	0.003 (0.498)	0.002 (0.265)	0.006 (0.414)
$\xi_{10}\, i$ (2009)	-0.001 (-0.094)	0.013 (1.345)	0.015 (2.653)*	0.002 (0.279)	0.029 (2.057)**
$\xi_{11}\, i$ (2010)	-0.0004 (-0.063)	0.011 (1.165)	0.011 (1.995)	0.002 (0.367)	0.024 (1.722)*
$\xi_{12}\, i$ (2011)	-0.003 (-0.571)	0.011 (1.110)	0.009 (1.635)	0.002 (0.367)	0.019 (1.338)
$\xi_{13}\, i$ (2012)	-0.003 (-0.583)	0.017 (1.717)	0.010 (1.815)*	0.003 (0.489)	0.027 (1.875)*
$\xi_{14}\, i$ (2013)	-0.003 (-0.563)	0.020 (2.016)	0.011 (1.877)*	0.004 (0.587)	0.031 (2.155)**
$\xi_{15}\, i$ (2014)	-0.004 (-0.618)	0.020 (2.051)	0.010 (1.792)*	0.005 (0.794)	0.031 (2.211)**
R^2	0.072	0.478	0.538	0.028	0.454
DW	0.166	0.188	0.209	0.215	0.179
RSS	0.426	1.268	0.417	0.471	2.665

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

6.3.4.4 Basic OLS Equation with Country and Time Fixed Effects

The full iteration of the cross-country analysis includes both Country and Time Fixed Effects. This equation is given by the following specification:

$$r_{ij}^{t} = \alpha i_n + X_t\beta + \delta GI_t + \mu + \xi_t i_n + u_t \qquad (150).$$

The estimation results for equation 150 are presented in Table 6.17.

The time fixed effects for Total Services show a marginally increasing (statistically significant) coefficient each year, with the exception of the first specified year (2001), indicating there has been a global trend for an increasing proportion of economic activity in any country to be derived from the services sector. That is, on average, the relative importance of the services sector across all countries grew by 5.2 per cent over the data analysis period (i.e.: $\xi_{15}\, i$ = 0.052).

The number of statistically significant Country Fixed Effects (at the 1 per cent level) for individual countries is marginally higher under equation 150 compared with equation 148. Time Fixed Effects, when combined with Country Fixed Effects, provide a two-dimensional framework which allows external jurisdictional influences (“beyond the border”) to be captured jointly with internal domestic influences (“behind the border”). This extended specification, compared with previous iterations of the Basic OLS Model, also produces better results for various statistical measures (i.e.: the R^2 and the Durbin-Watson measure for all models are marginally higher).

However, the main concern with this specification of the model is that the value of β for the Total Services equation is negative and statistically insignificant at the 1 per cent and 5 per cent levels. This concern is validated when the sum of the coefficients of the four subsectors is found to be approximately 11 per cent higher compared with the β value for the Total Services sector, suggesting this specification of the model is suboptimal.

Table 6.17
Estimates of Service Sub-Sectors as a Proportion of GVA
Basic OLS Equation with Country and Time Fixed Effects[1]

	Distributive Services	Producer Services	Social Services	Personal Services	Total Services
Constant (α)	0.298 (12.213)***	0.196 (4.766)***	0.346 (14.030)***	0.033 (1.468)	0.872 (16.878)***
β	-0.018 (-7.435)***	0.019 (4.546)***	-0.017 (-6.985)*	0.007 (2.986)***	-0.010 (-1.947)*
δ	0.00002 (0.157)	-0.001 (-3.537)***	-0.00009 (-0.831)	0.0001 (0.1038)	-0.001 (-3.091)***
μ2 (AUT)	-0.003 (-1.038)	-0.048 (-10.025)***	0.005 (1.724)*	0.035 (13.614)***	-0.011 (-1.808)*
μ3 (BEL)	0.002 (0.538)	-0.002 (-0.395)	0.042 (14.500)***	-0.0002 (-0.093)	0.041 (6.819)***
μ4 (BGR)	0.012 (2.020)**	-0.049 (-4.731)***	-0.064 (-10.244)***	0.019 (3.351)***	-0.082 (-6.261)***
μ5 (BRA)	-0.064 (-8.187)***	-0.033 (-2.545)**	-0.029 (-3.734)***	0.047 (6.722)***	-0.079 (-4.791)***
μ6 (CAN)	-0.019 (-6.646)***	-0.027 (-5.610)***	0.042 (14.431)***	-0.002 (-0.940)	-0.007 (-1.116)
μ7 (CHE)	-0.020 (-6.838)***	0.027 (5.567)***	0.019 (6.642)***	-0.003 (-1.016)	0.024 (3.934)***
μ8 (CHN)	-0.051 (-6.938)***	-0.130 (-10.452)***	-0.128 (-17.093)***	-0.025 (-3.725)***	-0.335 (21.338)***
μ9 (CYN)	0.008 (2.344)**	-0.027 (-4.768)***	0.014 (4.108)***	0.086 (28.982)***	0.081 (11.610)***
μ10 (CZE)	0.013 (3.393)***	-0.079 (-11.753)***	-0.040 (-9.879)***	0.006 (1.740)*	-0.099 (-11.714)***
μ11 (DEU)	-0.010 (-3.518)***	-0.016 (-3.208)***	0.004 (1.522)	0.013 (4.947)***	-0.008 (-1.367)
μ12 (DNK)	0.005 (1.920)*	-0.031 (-6.540)***	0.064 (22.395)***	-0.005 (-1.801)*	0.034 (5.620)***
μ13 (ESP)	-0.012 (-3.693)**	-0.080 (-15.042)***	-0.005 (-1.317)	0.078 (27.443)***	-0.017 (-2.579)**

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

Table 6.17 (cont.) Estimates of Service Sub-Sectors as a Proportion of GVA Basic OLS Equation with Country and Time Fixed Effects[1]					
	Distributive Services	**Producer Services**	**Social Services**	**Personal Services**	**Total Services**
μ14 (EST)	0.032 (7.760)***	-0.033 (-4.768)***	-0.045 (-10.860)***	0.013 (3.604)***	-0.033 (-3.767)***
μ15 (FIN)	0.003 (0.884)	-0.074 (-15.194)***	0.033 (11.476)***	-0.006 (-2.387)**	-0.044 (-7.213)***
μ16 (FRA)	-0.012 (-4.075)***	0.012 (2.453)**	0.048 (16.335)***	0.014 (5.116)***	0.062 (10.013)***
μ17 (GBR)	-0.003 (-0.954)	0.002 (0.436)	0.020 (6.948)***	0.042 (16.484)***	0.061 (10.273)***
μ18 (GRC)	0.015 (4.011)***	0.049 (6.197)***	0.019 (5.130)***	0.067 (19.796)***	0.049 (6.197)***
μ19 (HRV)	-0.010 (-2.071)**	-0.052 (-8.328)***	-0.040 (-8.149)***	0.038 (8.722)***	-0.061 (-5.948)***
μ20 (HUN)	-0.006 (-1.363)	-0.050 (-6.058)***	-0.016 (-3.388)***	0.010 (2.310)**	-0.070 (-7.136)***
μ21 (IDN)	-0.079 (-9.570)***	-0.171 (-12.295)***	-0.146 (-17.500)***	0.039 (5.210)***	-0.358 (-20.414)***
μ22 (IND)	-0.079 (-8.527)***	-0.104 (-6.647)***	-0.101 (-10.697)***	0.059 (6.963)***	-0.225 (-11.432)***
μ23 (IRL)	0.004 (1.478)	-0.037 (-7.832)***	-0.005 (-1.817)*	0.001 (0.392)	-0.037 (-6.230)***
μ24 (ITA)	-0.010 (-2.669)***	-0.019 (-3.030)***	-0.006 (1.670)*	0.037 (10.943)***	0.002 (0.221)
μ25 (JPN)	-0.018 (-5.932)***	-0.019 (-3.792)***	0.002 (0.746)	0.023 (8.515)***	-0.011 (-1.813)*
μ26 (KOR)	-0.026 (-7.102)***	-0.087 (-14.303)***	-0.024 (-6.650)***	0.011 (3.267)***	-0.126 (-16.502)***
μ27 (LTU)	0.041 (8.852)***	-0.108 (-13.690)***	-0.042 (-8.858)***	0.042 (9.749)***	-0.068 (-6.854)***
μ28 (LUX)	0.016 (4.971)***	0.154 (28.129)***	-0.009 (-2.609)***	-0.022 (-7.314)***	0.140 (20.339)***
μ29 (LTA)	0.049 (10.452)***	-0.044 (-5.544)***	-0.036 (-7.546)***	0.029 (6.782)***	-0.002 (-0.171)

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

Table 6.17 (cont.)
Estimates of Service Sub-Sectors as a Proportion of GVA
Basic OLS Equation with Country and Time Fixed Effects[1]

	Distributive Services	Producer Services	Social Services	Personal Services	Total Services
µ30 (MEX)	-0.029 (-5.296)***	-0.050 (-5.382)***	-0.094 (-16.990)***	0.036 (7.138)***	-0.138 (-11.830)***
µ31 (MLT)	0.004 (1.052)	-0.052 (-8.654)***	-0.002 (-0.633)***	0.089 (27.718)***	0.039 (5.184)***
µ32 (NLD)	-0.015 (5.128)***	0.020 (4.210)***	0.038 (13.238)***	-0.004 (-1.555)	0.039 (6.579)***
µ33 (NOR)	0.17 (5.186)***	-0.137 (-25.358)***	0.040 (12.450)***	-0.032 (-10.965)***	-0.119 (-16.475)***
µ34 (POL)	-0.006 (-1.172)	-0.086 (-10.654)***	-0.041 (-8.570)***	0.006 (14.204)***	-0.071 (-7.032)***
µ35 (PRT)	-0.021 (-6.002)***	-0.036 (-6.059)***	0.030 (8.275)***	0.046 (14.416)***	0.018 (2.471)**
µ36 (ROU)	0.007 (1.164)	-0.114 (-11.560)***	-0.085 (-14.354)***	0.001 (0.122)	-0.192 (-15.441)***
µ37 (RUS)	0.002 (0.276)	-0.094 (-8.258)***	-0.073 (-10.725)***	0.015 (2.512)**	-0.150 (-10.479)***
µ38 (SVK)	0.008 (1.682)*	-0.079 (-10.279)***	-0.051 (-11.187)***	0.022 (5.257)***	-0.101 (-10.467)***
µ39 (SVN)	-0.006 (-1.729)*	-0.068 (-11.200)***	-0.013 (-3.712)***	0.018 (5.630)***	-0.067 (-9.083)***
µ40 (SWE)	0.011 (3.871)***	-0.045 (-9.424)***	0.046 (16.012)	-0.008 (-3.101)***	0.004 (0.645)
µ41 (TUR)	0.038 (7.205)***	-0.085 (-9.485)***	-0.098 (-18.321)***	0.033 (6.808)***	-0.112 (-9.997)***
µ42 (TWN)	-0.046 (-12.002)***	-0.039 (-6.000)***	-0.030 (-7.803)***	0.039 (11.159)***	-0.076 (-9.381)***
µ43 (USA)	-0.017 (-5.865)***	0.020 (4.204)***	0.045 (15.811)***	0.020 (7.646)***	0.068 (11.394)***
$\xi_2\ i$ (2001)	0.001 (0.386)	0.004 (1.234)	0.002 (0.901)	0.001 (0.362)	0.006 (1.749)*
$\xi_3\ i$ (2002)	0.002 (1.391)	0.004 (1.515)	0.006 (3.289)**	0.001 (0.436)***	0.013 (3.617)***

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

Table 6.17 (cont.)
Estimates of Service Sub-Sectors as a Proportion of GVA
Basic OLS Equation with Country and Time Fixed Effects[1]

	Distributive Services	Producer Services	Social Services	Personal Services	Total Services
$\xi_4\ i$ (2003)	0.006 (3.234)***	0.003 (1.141)	0.011 (6.137)***	-0.001 (-0.890)	0.018 (4.983)***
$\xi_5\ i$ (2004)	0.007 (4.012)***	0.001 (0.470)	0.011 (5.881)***	-0.003 (-1.962)*	0.016 (4.234)***
$\xi_6\ i$ (2005)	0.005 (2.536)**	0.006 (2.071)**	0.011 (5.809)***	-0.003 (-1.718)*	0.019 (4.880)***
$\xi_7\ i$ (2006)	0.003 (1.822)*	0.010 (3.225)***	0.009 (4.897)***	-0.004 (-2.208)**	0.019 (4.816)***
$\xi_8\ i$ (2007)	0.004 (1.850)*	0.016 (4.493)***	0.010 (4.603)***	-0.005 (-2.874)***	0.024 (5.412)***
$\xi_9\ i$ (2008)	0.003 (1.387)	0.017 (4.602)***	0.015 (6.766)***	-0.006 (-3.206)***	0.028 (6.170)***
$\xi_{10}\ i$ (2009)	0.005 (2.314)**	0.022 (6.761)***	0.024 (12.312)***	-0.004 (-2.461)**	0.047 (11.290)***
$\xi_{11}\ i$ (2010)	0.005 (2.506)**	0.021 (6.314)***	0.021 (10.646)***	-0.004 (-2.300)**	0.044 (10.301)***
$\xi_{12}\ i$ (2011)	0.003 (1.371)	0.022 (6.149)***	0.020 (9.509)***	-0.005 (-2.750)***	0.039 (8.897)***
$\xi_{13}\ i$ (2012)	0.002 (1.050)	0.026 (7.781)***	0.020 (9.749)***	-0.004 (-2.004)**	0.045 (10.477)***
$\xi_{14}\ i$ (2013)	0.002 (1.184)	0.030 (8.705)***	0.021 (10.123)***	-0.003 (-1.757)*	0.050 (11.560)***
$\xi_{15}\ i$ (2014)	0.002 (1.039)	0.031 (8.975)***	0.021 (10.371)***	-0.002 (-1.003)	0.052 (12.147)***
R^2	0.924	0.959	0.961	0.941	0.968
DW	0.593	0.608	0.609	0.599	0.605
RSS	0.035	0.099	0.036	0.029	0.156

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

6.3.5 Reverse Causality

Choi and Beladi (1996) propose that institutional frameworks, government policies, economic growth and income distribution are linked and interdependent, and that understanding the cause and effect between variables can be difficult to determine over short time horizons (Choi and Beladi, 1996, p.209).

For any two variables, a and b, there are four possible relationships: (i) $a \rightarrow b$; or (ii) $b \rightarrow a$; or (iii) $a \leftrightarrow b$; or (iv) $a \emptyset b$, where the symbols $\rightarrow$ reflects the direction of causation, $\leftrightarrow$ reflects two-way contemporaneous causation, and $\emptyset$ reflects no causal relationship between the two variables (Choi and Beladi, 1996, p.209). Evaluating whether a relationship between two variables is best described as type (i), type (ii) or type (iv) is relatively straightforward because an OLS model will show the strength, if one exists, of any statistical correlation between the two variables. Bell, Johnson and Jones (2015) suggests that the existence of some reverse causality, relationship type (ii), does not mean that there could not be an effect in the original direction as well (i.e.: relationship type (iii)) (Bell, Johnson and Jones, 2015, p.456). However, evaluating whether two variables have a two-way contemporaneous causal relationship is more difficult. While it is possible to empirically test whether two variables have this form of relationship by estimating two linear equations, such as:

$$a_t = \alpha_1 + \gamma_1 b_t + \varepsilon_{1t} \quad (151)$$

$$b_t = \alpha_2 + \gamma_2 a_t + \varepsilon_{2t} \quad (152)$$

there still may be misspecification in the relationship (even if γ_1 and γ_2 are statistically significant) due to bias from omitted variable(s) that are common and influential to both a and b (Choi and Beladi, 1996, pp.210 - 211).

However, given the practical difficulties of identifying all omitted variables (de Mello and Barenstein, 2001, p.15; Kyriacou, Muinelo-Gallo and Oriol Roca-Sagalés, 2017, p.948) such that the "true model" of the relationship under review is found, for the purposes of this study the issue of reverse causality has been tested by empirically assessing whether Total Services and the log of real GDP per capita (in USD terms) exhibit type (ii) and type (iii) characteristics (recognising that the type (i) modelling has already been completed in Section 6.3.4). The model specification considers whether changes in real GDP per capita (in USD) is driven by changes in the relative proportion of services sector activity within the total activity of an economy.

The following table presents the parameter values and various statistical measures for the reverse causality regression equation, (i.e.: equation 152) under the four iterations previously modelled:

(i) Basic OLS

$$X_t = \alpha_2 i_n + \beta r_{ij}^t + \delta GI_t + \varepsilon_{2t} \tag{153}$$

(ii) Basic OLS with Country Fixed Effects

$$X_t = \alpha_2 i_n + \beta r_{ij}^t + \delta GI_t + \mu + \varepsilon_{2t} \tag{154}$$

(iii) Basic OLS with Time Fixed Effects.

$$X_t = \alpha_2 i_n + \beta r_{ij}^t + \delta GI_t + \xi_t i_n + \varepsilon_{2t} \tag{155}$$

(iv) Basic OLS with Country and Time Fixed Effects.

$$X_t = \alpha_2 i_n + \beta r_{ij}^t + \delta GI_t + \mu + \xi_t i_n + \varepsilon_{2t} \tag{156}$$

Table 6.18
Results of Reverse Causality Testing for Total Services by Model Specification[1]

	Basic OLS	Basic OLS - Country Fixed Effects	Basic OLS – Time Fixed Effects	Basic OLS - Country and Time Fixed Effects
Constant (α_2)	5.355 (29.724)***	5.692 (13.590)***	5.268 (28.156)***	9.688 (37.782)***
β	1.789 (5.397)***	04.369 (10.614)***	1.433 (4.412)***	-0.640 (-1.947)*
δ	0.042 (25.424)***	0.020 (6.978)**	0.043 (26.951)***	0.013 (7.431)
μ2 (AUT)		-0.096 (-1.178)		-0.144 (-3.018)***
μ3 (BEL)		-0.228 (-2.676)***		-0.034 (-0.671)***
μ4 (BGR)		-1.334 (-10.168)***		-1.768 (22.359)***
μ5 (BRA)		-2.043 (-13.864)***		-2.452 (-27.840)***
μ6 (CAN)		-0.194 (-2.378)**		-0.217 (-4.550)***
μ7 (CHE)		0.161 (1.961)*		0.275 (5.696)***
μ8 (CHN)		-0.411 (-2.029)**		-2.146 (-15.182)***
μ9 (CYN)		-0.914 (-9.715)***		-0.512 (-8.859)***
μ10 (CZE)		-0.532 (-5.415)***		-1.026 (-16.691)***
μ11 (DEU)		-0.170 (-2.069)**		-0.208 (-4.359)***
μ12 (DNK)		-0.096 (-1.158)		0.082 (1.657)*
μ13 (ESP)		-0.323 (-3.740)***		-0.420 (-8.302)***

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

Table 6.18 (cont.) Results of Reverse Causality Testing for Total Services by Model Specification[1]				
	Basic OLS	**Basic OLS - Country Fixed Effects**	**Basic OLS – Time Fixed Effects**	**Basic OLS - Country and Time Fixed Effects**
μ14 (EST)		-1.014 (-11.527)***		-1.156 (-22.365)***
μ15 (FIN)		-0.025 (-0.299)		-0.224 (-4.470)***
μ16 (FRA)		-0.384 (-4.341)***		-0.089 (-1.681)*
μ17 (GBR)		-0.359 (-4.195)***		-0.049 (-0.941)
μ18 (GRC)		-0.568 (-5.325)***		-0.374 (-5.937)***
μ19 (HRV)		-0.671 (-5.488)***		-1.027 (-14.034)***
μ20 (HUN)		-1.057 (-10.900)***		-1.396 (-23.823)***
μ21 (IDN)		-0.459 (-2.039)**		-2.332 (-14.967)***
μ22 (IND)		-2.129 (-12.581)***		-3.245 (-29.305)***
μ23 (IRL)		0.230 (2.764)***		0.034 (0.691)
μ24 (ITA)		0.011 (0.102)		-0.053 (-0.856)
μ25 (JPN)		-0.079 (-0.923)		-0.157 (-3.142)***
μ26 (KOR)		-0.081 (-0.784)		-0.729 (-10.847)***
μ27 (LTU)		-0.994 (-9.739)***		-1.335 (-21.712)***
μ28 (LUX)		0.078 (0.791)		0.749 (11.573)***
μ29 (LTA)		-1.223 (-11.920)***		-1.237 (-20.639)***

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

Table 6.18 (cont.) Results of Reverse Causality Testing for Total Services by Model Specification[1]				
	Basic OLS	**Basic OLS - Country Fixed Effects**	**Basic OLS – Time Fixed Effects**	**Basic OLS - Country and Time Fixed Effects**
µ30 (MEX)		-0.465 (-3.245)***		-1.218 (-13.502)***
µ31 (MLT)		-0.984 (-11.134)***		-0.777 (14.832)***
µ32 (NLD)		-0.267 (-3.199)***		-0.060 (-1.206)
µ33 (NOR)		1.146 (12.052)***		0.554 (9.017)***
µ34 (POL)		-0.931 (-8.691)***		-1.300 (-20.068)***
µ35 (PRT)		-0.771 (-8.522)***		-0.684 (-12.916)***
µ36 (ROU)		-0.377 (-2.400)**		-1.405 (-13.691)***
µ37 (RUS)		0.578 (2.908)***		-0.353 (-2.862)***
µ38 (SVK)		-0.701 (-6.528)***		-1.215 (-18.202)***
µ39 (SVN)		-0.294 (-3.047)***		-0.660 (-11.249)***
µ40 (SWE)		0.028 (0.339)		0.051 (1.067)
µ41 (TUR)		-0.584 (-4.324)***		-1.201 (-14.382)***
µ42 (TWN)		-0.560 (-5.932)***		-0.940 (-16.328)***
µ43 (USA)		-0.259 (-2.975)***		0.072 (1.356)
$\xi_2\ i$ (2001)			-0.108 (-0.932)	-0.056 (-1.992)**
$\xi_3\ i$ (2002)			-0.039 (-0.332)	0.009 (0.332)

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

Table 6.18 (cont.) Results of Reverse Causality Testing for Total Services by Model Specification[1]				
	Basic OLS	Basic OLS - Country Fixed Effects	Basic OLS – Time Fixed Effects	Basic OLS - Country and Time Fixed Effects
$\xi_4\ i$ (2003)			0.089 (0.764)	0.154 (5.371)***
$\xi_5\ i$ (2004)			0.211 (1.816)*	0.266 (9.332)***
$\xi_6\ i$ (2005)			0.286 (2.463)**	0.332 (11.599)***
$\xi_7\ i$ (2006)			0.332 (2.857)***	0.385 (13.463)***
$\xi_8\ i$ (2007)			0.431 (3.707)***	0.504 (17.481)***
$\xi_9\ i$ (2008)			0.473 (4.068)***	0.562 (19.271)***
$\xi_{10}\ i$ (2009)			0.325 (2.785)***	0.453 (14.381)***
$\xi_{11}\ i$ (2010)			0.346 (2.974)***	0.472 (15.227)***
$\xi_{12}\ i$ (2011)			0.434 (3.724)***	0.541 (17.830)***
$\xi_{13}\ i$ (2012)			0.371 (3.184)***	0.486 (15.621)***
$\xi_{14}\ i$ (2013)			0.371 (3.177)***	0.501 (15.752)***
$\xi_{15}\ i$ (2014)			0.344 (2.946)***	0.496 (15.344)***
R^2	0.693	0.954	0.723	0.985
DW	0.252	0.572	0.231	0.678
RSS	202.1	30.0	181.9	10.0

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: author's calculations

The above results show the reverse causality specification of the Basic OLS model exhibits higher R^2 and Durbin-Watson measures compared with the original specification. The constant and coefficient values across the reverse causality models are mixed, and are not clearly better or worse than the original model specification, with the exception of the reverse causality with Country and Time Fixed Effects, where the key independent variable, βr_{ij}^{t}, is not statistically significant at either the 1 per cent or 5 per cent level.

By applying the Akaike Information Criteria test, which is discussed in Section 4.4, it is possible to identify whether the original or reverse model specification is optimal, and therefore which direction causality flows. Again, the AIC value is estimated as per the following equation (Snipes and Taylor, 2014, p.4):

$$AIC = n\, log\left(\frac{RSS}{n}\right) + 2K \tag{157}$$

where

n = number of observations in the dataset

RSS = residual sum of squares

K = number of parameters in the model

The following table presents the AIC values calculated using equation 157 for each of the original and reverse causality models.

Table 6.19
AIC Calculations for Original and Reverse Causality Model Specifications

	Basic OLS		**Basic OLS - Country Fixed Effects**		**Basic OLS – Time Fixed Effects**		**Basic OLS - Country and Time Fixed Effects**	
	Original	Reverse	Original	Reverse	Original	Reverse	Original	Reverse
n	645	645	645	645	645	645	645	645
K	3	3	45	45	17	17	59	59
RSS	0.43	202.11	0.04	30.00	0.43	181.93	0.03	9.96
AIC[1]	**-4,711.8**	-742.5	**-6,212.9**	-1,888.9	**-4,689.5**	-782.3	**-6,220.6**	-2,572.1

1. Bolded numbers highlight the lowest AIC value between the Original model and Reverse Causality model specification

Source: author's calculations

These results suggest the original model specification produces a lower AIC value compared with the reverse causality model specification. This suggests, combined with the modelling results (being the statistical significance of the coefficient values of the key variables), that real GDP per capita (in USD) and the relative importance of the services sectors of an economy (as a proportion of GDP) is a type (i) relationship.

6.4 Commentary

The previous analysis provides insights into how the services sector and sub-sectors of individual countries have responded to changes in real GDP per capita (in USD terms) and domestic institutional and governance arrangements, specifically those associated with the rule of law, regulatory quality and government effectiveness.

Table 6.20 shows the Basic OLS model with Country Fixed Effects has the lowest sum of squared residuals for the services sector and the distributive, producer and personal sub-sectors, while for the social services sub-sector the sum of squared residuals is minimised under the Basic OLS model with Country and Time Fixed Effects model structure.

A possible explanation for why the social services sub-sector has a different optimal regression model structure compared with the other sectors is that during the time period under consideration, fiscal policy in many countries expanded and contracted by abnormally large amounts in response to the economic uncertainty caused by the Global Financial Crisis. The inclusion of Time Fixed Effects enables those “abnormal” fiscal policy responses (which were often associated with infrastructure spending in the health and education sectors, and other social infrastructure) to be assigned to particular years, thereby allowing temporal adjustments in spending on social services to be properly accounted for within the model.

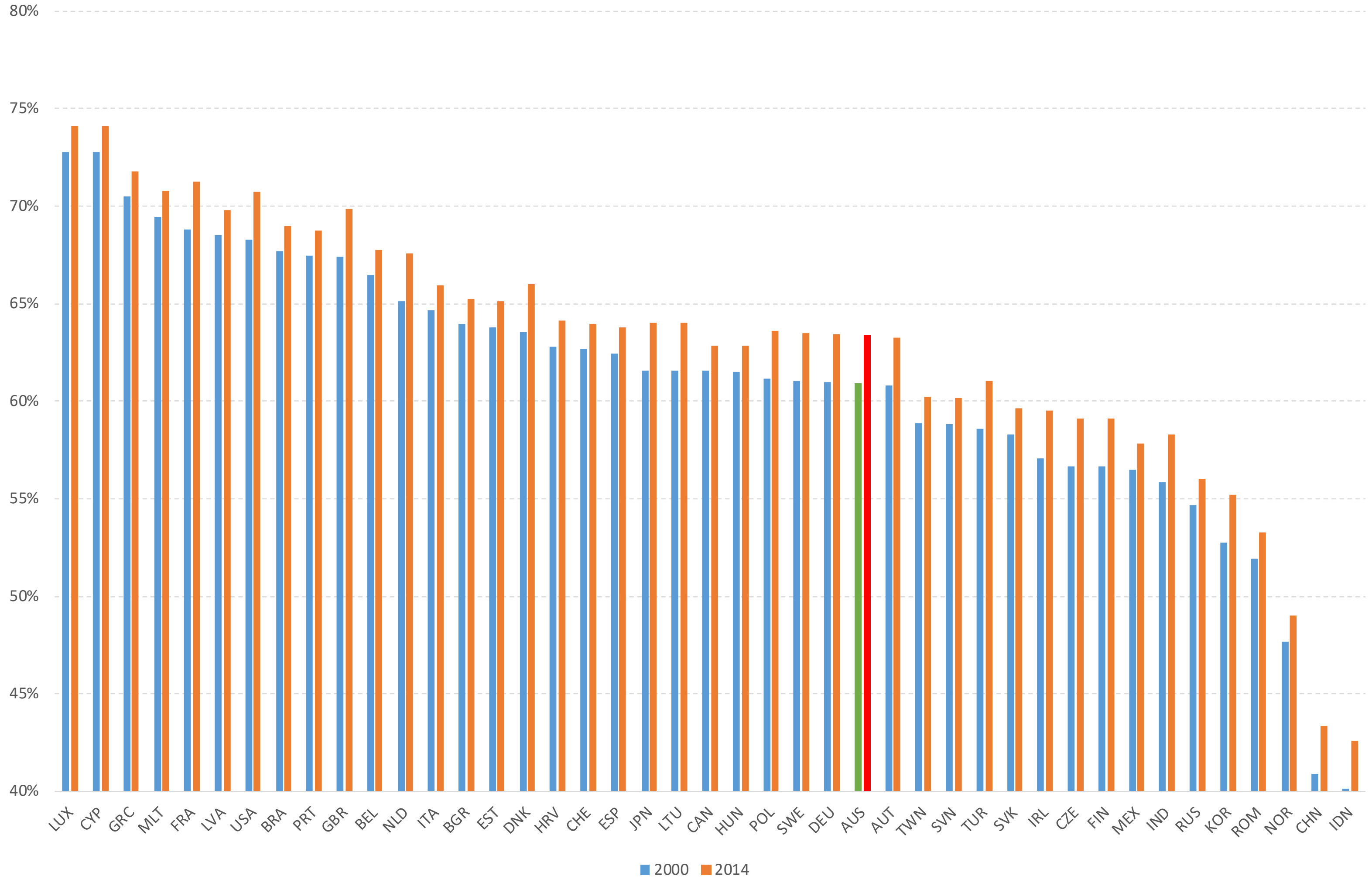
Table 6.20 Sum of Squared Residuals for Each Model Specifications by Services Sector and Sub-Sectors, Australia, 2000 - 2014				
	Basic OLS	**Basic OLS - Country Fixed Effects**	**Basic OLS – Time Fixed Effects**	**Basic OLS - Country and Time Fixed Effects**
Distributive	0.0003	**0.0001**	0.0002	0.0006
Producer	0.0054	**0.0021**	0.0063	0.0034
Social	0.0105	0.0005	0.0119	**0.0003**
Personal	0.0033	**0.0002**	0.0015	0.0003
Total	0.0149	**0.0026**	0.0140	0.0028

1. Bolded numbers highlight the lowest AIC value between the Original model and Reverse Causality model specification

Source: Author's calculations

By using the Basic OLS model with Country Fixed Effects model it is also possible to identify countries that have a propensity to generate a higher proportion of economic output from the services sector for a given level of national income. This assessment is presented in Figure 6.8 below, which shows Luxembourg and Cyprus generate the highest proportion of output from the services sector for a given level of income per capita, while China and India generate the least amount of services sector output given the same per capita income. This analysis also shows that relative to the rest of the countries in the sample, Australia would have generated a slightly below-average proportion of output from the services sector for a given level of income per capita in 2000; but by 2014 the country's economic structure had changed such that it would have generated a slightly above-average proportion of output from the services sector for a given level of income per capita. Given this analysis is based on applying a consistent value of per capita incomes in 2000 and 2014 across all countries, the improvement in Australia's ranking from 27th to 25th must reflect a marginally greater improvement in the domestic institutional and governance arrangements within Australia compared with the other 42 countries in the sample.

Figure 6.8
Services Sector Value Added as a Proportion of Total GDP by Country at fixed per capita income levels, 2000 and 2014

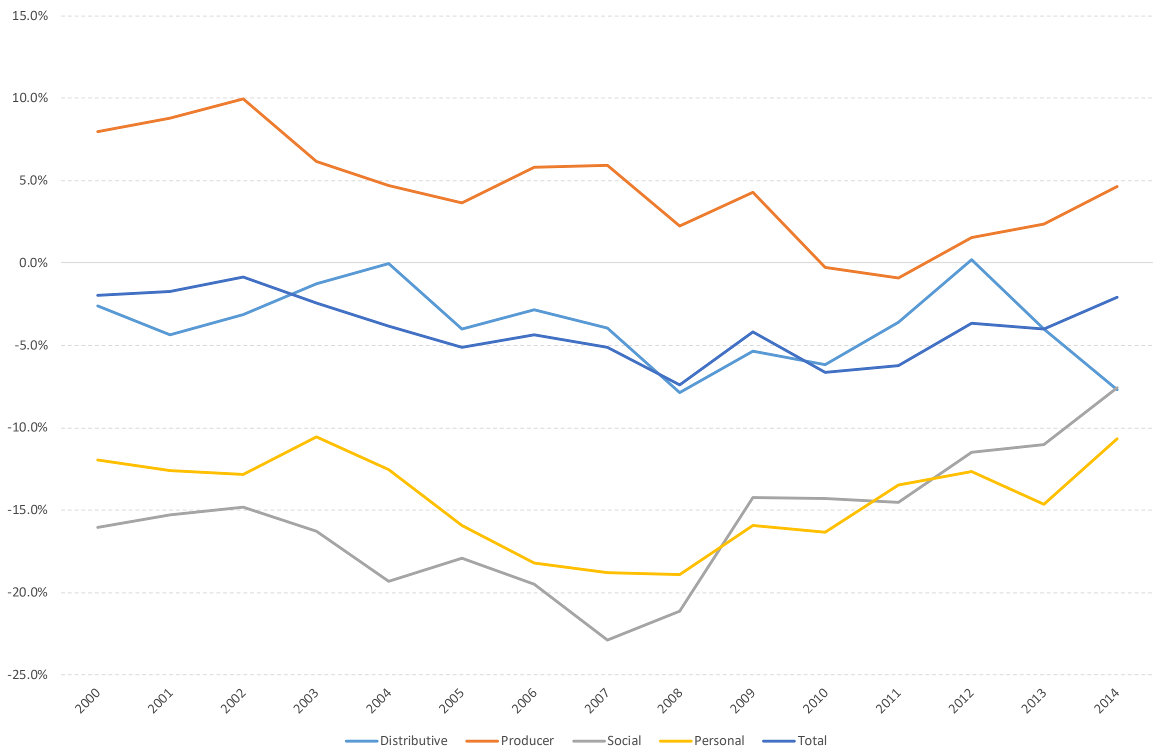


Source: Author's calculations

Also, by comparing the actual results to a model structure that excludes Country Fixed Effects, it is possible to identify the expected relative importance the services sector should play in an economy without the influences of any local nuisances, historical impediments or natural comparative advantages. As noted earlier, the coefficients under the Basic OLS with Time Fixed Effects are not statistically significant at the 1 per cent level, and the constant and coefficients for relative importance of sector or sub-sector and institutional governance are similar in size and sign to those determined in the Basic OLS model and this suggests that using the latter model is more appropriate in comparing actual verses theoretical results.

Figure 6.9 shows the percentage difference in actual outcomes verses theoretical estimates of each services sub-sector and total services over the period 2000 to 2014, where the theoretical estimates are calculated using the Basic OLS model. This analysis suggests Australia has a greater amount of its economic activity generated in the producer services sub-sector than it comparatively ought to have, while distributive, social and personal services and total services economic activity appears to be theoretically underweight.

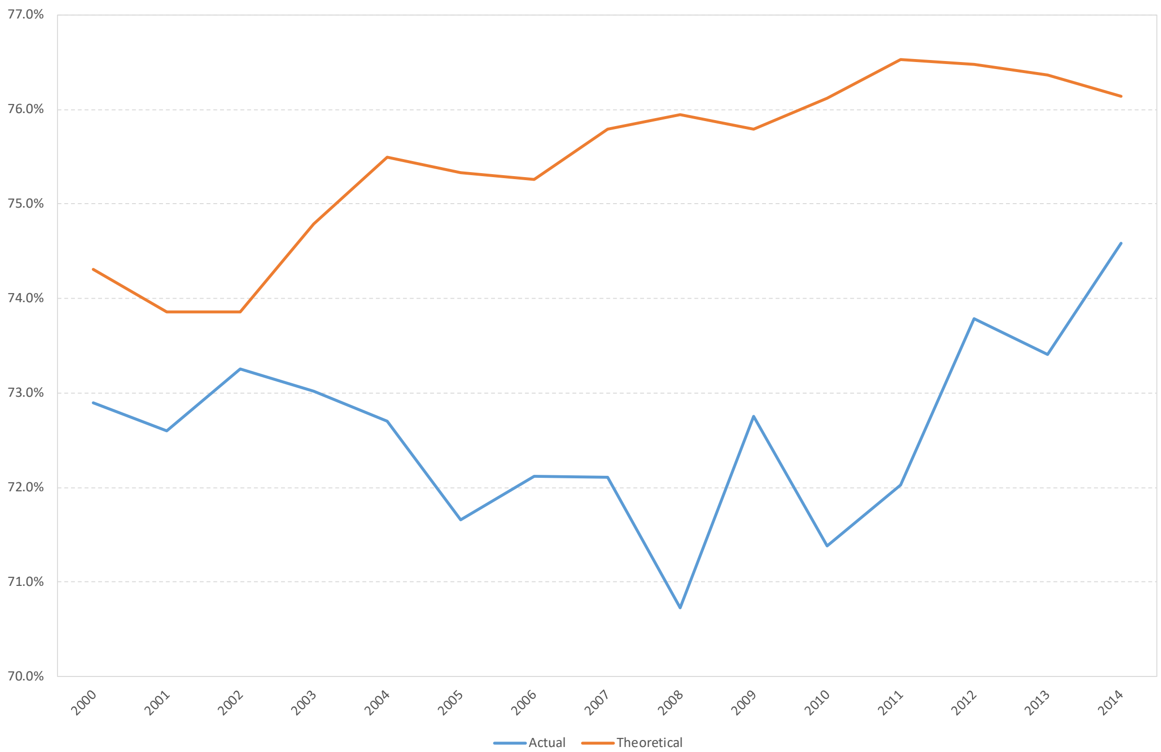
Figure 6.9
Percentage difference in the Actual Outcome verses Theoretical Estimate of the relative importance of the Services Sector and Services Sub-sectors, Australia, 2000 - 2014



Source: Author's Calculations

Figure 6.10 shows the difference between actual outcomes and theoretical estimates for total services is about 4 per cent during the analysis period. That is, during the analysis period services as a proportion of GDP was on average about 4 per cent lower than it theoretically should on a country agnostic basis. This difference will reflect a number of Australian specific factors (which should be incorporated within the country fixed effects coefficients), with the most significant likely to be the impact of the 2000s commodity boom (discussed in Chapter 4 and 5) which saw capital and labour being diverted towards the primary sector (and correspondingly away from the secondary and services sectors) in order to meet the uplift in global demand for mining and mineral products, in which Australia has a natural comparative advantage.

Figure 6.10
Actual Outcome verses Theoretical Estimate of the relative importance of the Services Sector, Australia, 2000 - 2014



Source: Author's Calculations

6.5 Summary

This chapter has investigated whether there is a commonality among countries in the relationship between real GDP per capita (in USD), institutional arrangements within countries and the relative importance of the services sector within the broader economy. This study was completed using panel data sourced from the World Bank, the European Commission and the IMF, and applying an OLS regression modelling approach extended for Country and Time Fixed Effects.

Of the models considered, the Basic OLS model with Country Fixed Effects has the lowest sum of squared residuals for the services sector and the distributive, producer and personal sub-sectors, while for the social services sub-sector the sum of squared residuals is minimised under the Basic OLS model with a Country and Time Fixed Effects model structure.

The modelling results suggest Australia has a greater amount of its economic activity generated in the producer services sub-sector than it comparatively ought to have, while distributive, social and personal services and total services economic activity appears to be theoretically underweight.

The analysis also shows services as a proportion of Australian GDP was on average about 4 per cent lower than it theoretically should have been during the period 2000 to 2014. This difference is likely to reflect a number of Australian specific factors, the most significant being the impact of the 2000s commodity boom which saw capital and labour being diverted towards the primary sector and, hence, away from the secondary and service sectors.

Chapter 7 The Role of Public Policy in the Future Growth of the Australian Services Sector

7.1 Introduction

Unvala and Donaldson in their paper of 30 years ago, *The Service Sector: Some Unresolved Issues*, proposed there were “no compelling reasons for believing that services cannot take up any likely shortfalls in employment and income due to manufacturing decline, but conversely, there are no compelling reasons for believing they will do so (either)”, (Unvala and Donaldson, 1988, p.468). Further, following the recognition by Bhagwati (1984) that technical change was allowing a greater proportion of services to enter the tradable category, Unvala and Donaldson also proposed that it was now conceivable for a large advanced economy to emerge with no manufacturing sector in its economic make-up (Unvala and Donaldson, 1988, p.468).

Australia’s economy now has an industrial structure that is heavily weighted towards the services sector. Given Unvala and Donaldson’s proposition, a reasonable question to ask today is what could be the relative proportion of the services sector in the Australian economy at the steady state. Technically, the MGM model advanced by Ngai and Pissarides (2007) proposes a steady state (and an alignment to a balanced growth path) is achieved when (i) MFP is the same for the consumption goods sector and the manufacturing goods sector; (ii) the rate of change in consumption expenditure is the same as the rate of change in output per capita; and (iii) there is a unitary elasticity of substitution between sectors (Ngai and Pissarides, 2007, p.433).

As noted in Chapter 5, Australia’s sector MFP is not aligned between sectors and, as such, the first pre-condition for achievement of a steady state remains unfulfilled. This suggests the necessary and sufficient condition for structural change remains in the Australian economy, and it is reasonable to conclude there will be a continuation of adjustments in the sectoral make-up of the domestic economy in, at least, the short to medium term.

Kyoji (2010) supports the point that economic growth can occur because of increases in labour supply, capital deepening and changes in multifactor productivity (Kyoji, 2010, p.ii). Government policies[15] can assist in or detract from achieving those outcomes and have the potential to enhance or diminish the role the services sector will play in a future Australian economy.

The purpose of this chapter is to examine the current government policy framework guiding the services sector in Australia and identify how it should be amended to enable the continued growth of the sector in the short to medium term.

7.2 Services Sector Industry Policy

Trade and industry policy has traditionally been focused on the secondary sector, although the primary sector also received attention from an economic development perspective due to its ability to be traded, its generally positive response to policies aimed at improving factor markets, and its importance in "feeding the nation" (Hodge, 1997, p.1).

In contrast, the services sector in most countries, including Australia, has historically been largely disregarded from a trade and industrial policy perspective. De Backer, Desnoyers-James and Moussiegt (2015) propose this lack of policy focus towards services reflected the poor understanding of the sector at the time and the view that as services were broadly non-tradable, their scope and scale within an economy was only driven by domestic demand (de Backer, Desnoyers-James and Moussiegt, 2015, p.6).

[15] The European Commission defines a government policy as "a deliberate act of government that in some way alters or influences the society or economy outside the government" (European Commission, 2011, p.25), while the UK Government has three working definitions of what is a policy: (i) a course or general plan of action to be adopted by government, party, person etc; (ii) the process by which governments translate their political vision into programmes and actions to deliver "outcomes", desired changes in the real world; and (iii) statements of the government's position, intent or action (Williams, 2012).

These dynamics caused governments to believe there was no need to have trade and industry policies for the services sector. However, given that the sector exhibited a range of market failures, including information asymmetries, public good characteristics and natural monopolies, there was a need for government policies to regulate and, in some cases, supply the domestic services market (Hodge, 1997, pp. 1-2).

Contemporary economic growth theory explicitly recognises the role of technology and innovation in achieving "balanced growth", and the linkage between the services sector and the primary and secondary sectors (see Ngai and Pissarides, 2007). Further, the rise of Global Value Chains (GVCs) and the associated fragmentation of production activities internationally have seen services take up a larger proportion of intermediate inputs used in the manufacturing production process (de Backer, Desnoyers-James and Moussiegt, 2015, pp.34-35).

This "servicification" of the manufacturing sector has meant that the efficiency of the downward linkage of services within an economy, particularly intangible services such as design, research and development and logistics, has become an increasingly significant factor in how multinational corporations choose jurisdictions to locate their GVC activities (Thangavelu, Wenxiao and Oum, 2017, p.1).

These current dynamics, combined with the continuation of market failures such as spillovers and information deficiencies / asymmetries, suggest the development of a services sector-specific industry policy should be considered as an enabling instrument of government to improve the growth outcomes for the sector and the domestic economy. This is supported by Arnold, Javorcik and Mattoo (2011) who note that services policy is an important determinant in the performance of the manufacturing sector because of the strong positive relationship between services sector reform and the productivity of local manufacturing businesses relying on services as intermediate inputs (Arnold, Javorcik and Mattoo, 2011, p.145).

De Backer, Desnoyers-James and Moussiegt (2015) have noted that "some service industries are the most innovative industries in OECD economies". It is just that innovation in the services sector has been traditionally underestimated because it is largely heterogeneous across firms and industries (de Backer, Desnoyers-James and Moussiegt, 2015, p.27).

7.3 Impact of Services Sector Industry Policy on Economic Structure

7.3.1 International Experience

By amending the cross-country econometric analysis (as presented in Chapter 6) it is possible to test whether the presence of a services sector industry policy has the potential to positively influence the sector's relative importance within an economy, and if so, by what degree.

Audretsch and Callejon (2007) suggest the objective of industry policy is "to help companies and sectors equip themselves with dynamic capabilities they need to compete globally", and importantly for this experiment, it has no fixed, immutable formulation as regards the measures or instruments used" (Audretsch and Callejon, 2007, p.1). Banks (2008) in his Colin Clarke lecture, *Industry policy for a productive Australia*, quotes the former Australian Minister for Industry, Innovation, Science and Research, Senator Kim Carr. who observed: "In today's economy, innovation policy is industry policy" (Banks, 2008, p.10). Therefore, for the purposes of this experiment, a services sector industry policy and services sector innovation policy, are considered as equivalent.

Information on whether a country has a national services sector industry / innovation policy has been sourced from the OECD Science, Technology and Innovation Policy (STIP) Database, the INNO-Grips Policy Brief No.3 "Policies in Support of Service Innovation", and primary research. Table 7.1 presents services sector industry and/or innovation polices for countries included in the WIOD, and the year in which they were implemented.

Table 7.1
Services Sector Industry / Innovation Policy by Country by Year

Country	Policy
Australia	Service Economy Strategy (2008-) Industry Growth Centres Initiative (2014-)
Austria	Service Initiative (2009-2018) “The Way to Become a Leader in Innovation” (2011-)
Belgium	n.a.
Bulgaria	n.a.
Brazil	n.a.
Canada	n.a.
Switzerland	n.a.
China	12th Five Year Plan (2011-)
Cyprus	n.a.
Czech Republic	ICT and Business Support Services Programme (2010-) ICT and Shared Services (ICT a Sdilene Sluzby) (2014-2020)
Germany	Innovation with Services (2006-2013) Services Taskforce (2011-) BMBF (Bundesministerium für Bildung und Forschung): Hightech-Strategie 2020 (2010-)
Denmark	Danish PWT Foundation – Investments in Public Welfare Technology 2009-2015 (2009-) Innovation Denmark 2007-2010 (2007-) Innovation Denmark 2010-2013 (2010-)
Spain	n.a.
Estonia	n.a.
Finland	SERVE - Innovative Services Programme (2006-2010) National Innovation strategy (2009-) TEKES Thematic Programmes (2011-)
France	Plans for Industrial Recovery (2013-)
United Kingdom	NESTA Innovation in the UK retail sector report (2007) NESTA Innovation in environmental services report (2007) NESTA Innovation in the logistics sector report (2007) Supporting Innovation in Services (2008) NESTA Innovation in internet content services report (2008) Innovation in construction services (2008) Professional and Business Services: a 2020 Vision for Growth (2010-)
Greece	n.a.
Croatia	n.a.
Hungary	n.a.
Indonesia	National Innovation System (SINas) Research Incentives (2012-) National Medium Term Development Plan (Rpjmn) (2015-2019)
India	n.a.
Ireland	Services Strategy Group (2004-) Services Innovation in Ireland – Options for Innovation Policy (2006-) Innovation 2020 - Innovation in Services and Business Process (2015-) Enterprise Ireland Support for Innovation in Services (2015-)
Italy	Collaboration Agreement for Planning and Implementation of the Activities Related to the Development of Innovative Products Service (2015-)
Japan	100 Actions to Launch Japan's New Growth Strategy (2010-) Realising the New Growth Strategy 2011 (2011-)
Korea	Service Progress (2009-) Industry Policy - 17 New Growth Engines in 3 Sectors
Lithuania	Lithuanian innovation strategy for the year 2010-2020 (2010-)
Luxembourg	n.a.
Latvia	n.a.
Mexico	n.a.
Malta	n.a.
Netherlands	Service Innovation and ICT (SII) (2010-) Top Areas innovation strategy (2011-)
Norway	Governmental whitepaper No. 7 (2007-2009) Norwegian Research Council, SIVA
Poland	Innovative Entrepreneurs’ Club (2006-) Programme Innovative Economy (Priority Axis 4., Priority Axis 5.) (2009-)
Portugal	n.a.

Table 7.1 (cont) Services Sector Industry / Innovation Policy by Country by Year	
Country	Policy
Romania	n.a.
Russia	n.a.
Slovak Republic	n.a.
Slovenia	n.a.
Sweden	VINNOVA – Sectoral R&D Programmes (2001-) The Strategy for Greater Service Innovation (2010-)
Turkey	Programme for Supporting R&D Projects in Priority Areas (Tübitak_1511) (2013-) Support Programme for Research, Technological Development and Innovation Projects in Priority Areas (Tübitak_1003) (2013-)
Taiwan	n.a.
United States	A Strategy for American Innovation. Securing Our Economic Growth and Prosperity (2011-)
n.a. = not applicable Source: STIO policy questionnaire 2016 (STIO-2016), ICEG European Centre	

As previously noted, of the models considered in Chapter 6, the Basic OLS model with Country Fixed Effects has the lowest sum of squared residuals for the services sector, and therefore is the "best structure" to use for this regression modelling experiment. As the model already incorporates a parameter for institutional governance (which combines measures of government effectiveness, regulatory quality, and rule of law), including both that parameter and a dummy variable identifying the presence of a central government services sector industry/innovation policy is likely to result in problems of multicollinearity.

The challenge in confirming this statistical anomaly is that the institutional governance measure is an ordinal value of between 0 and 100, whereas the dummy variable is a binary value of either 0 or 1. To overcome this potential issue the institutional governance parameter has been dropped from this equation and replaced with a dummy variable identifying the presence of a central government services sector industry/innovation policy. This equation is given by the following specification

$$r_{ij}^{t} = \alpha i_n + X_t \beta + \varpi IP_t + \mu + \varepsilon_t \qquad (158)$$

where

IP = dummy variable identifying the existence of a services sector industry policy

ϖ = industry policy parameter coefficient.

A summary of the estimation results for equation 158 is presented in Table 7.2. These results show that where a country either:

(a) has an explicit services sector industry/innovation policy, or

(b) develops such a policy,

then the relative share of the services sector in that country is about 1 per cent higher compared, respectively, with either:

(a) those countries where no explicit services sector industry/innovation policy exists, or

(b) the relative share of the services sector in that country prior to the development of the policy.

It appears that if a country has an explicit services sector industry/innovation policy, the relative share of the services sector in the economy will be about 1 per cent higher than if it does not have one. This means that once a services innovation policy is developed, the sector lifts in its importance from a government and bureaucratic perspective, and policy actions are then implemented (by different degrees) that seek to improve the general business environment in which the sector operates. Prior to development of an explicit sector policy it is as if, from a government perspective, services are "out of sight, out of mind".

Table 7.2 Estimates of Services as a Proportion of GVA Basic OLS Equation with Policy Dummy and Country Fixed Effects[1]							
Variable	**Value**	**Variable**	**Value**	**Variable**	**Value**	**Variable**	**Value**
α	0.424 (11.00)***	μ11 (DEU)	0.001 (0.09)	μ23 (IRL)	-0.039 (-5.21)***	μ35 (PRT)	0.065 (8.24)***
β	0.028 (7.69)***	μ12 (DNK)	0.026 (3.57)***	μ24 (ITA)	0.037 (4.91)***	μ36 (ROU)	-0.090 (-9.32)***
ϖ	0.011 (4.09)***	μ13 (ESP)	0.015 (1.99)**	μ25 (JPN)	0.006 (0.86)	μ37 (RUS)	-0.062 (-7.60)***
μ2 (AUT)	-0.001 (-0.15)	μ14 (EST)	0.029 (3.34)***	μ26 (KOR)	-0.081 (-10.21)***	μ38 (SVK)	-0.026 (-2.95)***
μ3 (BEL)	0.055 (7.35)***	μ15 (FIN)	-0.043 (-5.73)***	μ27 (LTU)	0.006 (0.68)	μ39 (SVN)	-0.021 (-2.67)***
μ4 (BGR)	0.030 (2.87)***	μ16 (FRA)	0.079 (10.53)***	μ28 (LUX)	0.119 (14.74)***	μ40 (SWE)	0.001 (0.16)
μ5 (BRA)	0.068 (5.34)***	μ17 (GBR)	0.064 (8.71)***	μ29 (LTA)	0.076 (8.41)***	μ41 (TUR)	-0.024 (-2.55)**
μ6 (CAN)	0.006 (0.84)	μ18 (GRC)	0.096 (12.30)***	μ30 (MEX)	-0.044 (-4.80)***	μ42 (TWN)	-0.020 (-2.49)**
μ7 (CHE)	0.017 (2.27)**	μ19 (HRV)	0.019 (2.17)**	μ31 (MLT)	0.085 (10.66)***	μ43 (USA)	0.074 (9.90)***
μ8 (CHN)	-0.020 (-17.07)***	μ20 (HUN)	0.006 (0.65)	μ32 (NLD)	0.042 (5.68)***	R^2 DW RSS	0.949 0.699 0.247
μ9 (CYN)	0.119 (15.29)***	μ21 (IDN)	-0.208 (-16.46)***	μ33 (NOR)	-0.133 (-16.87)***		
μ10 (CZE)	-0.043 (-5.05)***	μ22 (IND)	-0.051 (-3.38)***	μ34 (POL)	0.002 (0.26)		

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
1. Values in parentheses are t-statistics
Source: Author's Calculations

However, the public policy dummy variable only identifies the presence of a central government-developed services sector industry/innovation policy. It does not provide any insight on the quality of the policy, how well it was implemented, and whether other intangible costs or benefits occurred as a consequence of the policy (such as improvements in educational attainment by the resident population).

For example, the cross-country analysis confirmed Sweden has had a services sector industry/innovation policy since 2010. However, research by Wihlman, Sandmark and Hoppe (2013) found that a lack of interdepartmental coordination within the Swedish Government had obstructed sector innovation within Sweden (Wihlman, Sandmark and Hoppe, 2013, p.30). This finding suggests economic growth during the analysis period within the Swedish services sector may have been higher than that actually achieved if the designated public policy was better implemented. This higher than actual economic outcome would have influenced the results of the cross-country analysis by (marginally) increasing the size of the policy parameter coefficient, ϖ.

7.3.2 Australian experience

Levine and Zervos (1993) suggest that cross-country regressions, while a useful tool, should not be held out to be the perfect mechanism by which to assess policy impacts, but rather any judgement on the benefits of a policy framework for a country requires detailed analysis (Levine and Zervos, 1993, pp.426-427; Maddala, 1999, p.432).

The extended cross-country regression acknowledges Australia has had a form of a services sector specific industry/innovation policy developed and implemented by the Commonwealth Government since 2008. Again however, no account has necessarily been taken in the extended regression modelling for the quality, effectiveness or inter-relationship with other sub-national services sector industry/innovation policies.

It is necessary to define the attributes that represent "good" public policy in order to assess whether an existing (or proposed) services sector industry/innovation policy represents "good policy". Williams (2012) proposes the following elements represent the components of "good" public policy:

i. A description of the problem or opportunity the policy is seeking to address;

ii. A description of the aim the Government is seeing to achieve through the implementation of the policy, and what actions it is doing / will do / has done to address the problem or capture the opportunity;

iii. A summary of the background to the policy, including how it has developed to date and why (explained by evidence) the government has chosen this response and not others;

iv. A description of when and how the government has asked/is asking/will ask impacted stakeholders;

v. Documentation of the distributional impact of the policy;

vi. An explanation of the legal framework, including Bills and legislation, in which this policy is operating, and how the policy might change those statutory instruments;

vii. Details of what parts of government, and if any non-government organisations, are involved (and in what capacity) for the delivery of the policy actions; and

viii. Continuous disclosure of information pertaining to the implementation and development of the policy over time, including relevant news, speeches, publications and consultations.

The industry portfolio within Australia is a shared Commonwealth and State responsibility within the economic sphere of government activities (Commonwealth of Australia, 2014, p. 18, p.30), which in practice means the Commonwealth, State and Territory governments in Australia all have the legal ability to develop and implement their own policy to support the services sector within their jurisdiction.

The following assessment of the policy environment supporting the services sector in Australia has been completed through a combination of reviewing documentation presented on the websites of each Federal, State and Territory government department's responsible for industry policy and then having discussions with senior representatives of those same departments.

Table 7.3 presents information on industry gross value-added for primary, secondary and services sectors for Australia and each state and territory for the 2015-16 financial year. Table 7.4 presents the contemporary listing of priority industries and sectors by jurisdiction, while Table 7.5 identifies those priority industries and sectors which have a documented industry plan or strategy (including the link to each of those documents).

These three tables suggest that (i) the services sector is the largest sector across all jurisdictions; (ii) each jurisdiction has identified specific services sub-sectors for targeted industry policy support, even if only a few jurisdictions have developed documented policies or strategic plans for each of the identified services sub-sectors; and (iii) there is considerable variation in the quality of each of these policies and plans.

Table 7.6 presents a subjective evaluation of each jurisdiction's approach to developing a supportive policy environment for their services sector, with the initial assessment relating to what proportion of the services sector is "covered" by the policies or plans in place, whether the policies or plans are contemporaneous, and then how these existing policies and plans compare with Williams' proposed criteria of what constitutes a "good" public policy. Each criterion is subjectively scored as either "low", "medium" or "high", and assigned the values of 1, 2 and 3 respectively.

Table 7.3
Relative Economic Importance of the Services sector by Australian Jurisdiction as measured by Sectoral GVA as % of GDP, FY16

Jurisdiction	Primary	Secondary	Services
New South Wales	4.0%	15.0%	81.0%
Victoria	4.1%	17.4%	78.5%
Queensland	10.3%	17.2%	72.5%
Western Australia	30.7%	18.4%	50.8%
South Australia	9.8%	15.0%	75.2%
Tasmania	16.5%	14.3%	69.2%
Northern Territory	18.5%	30.2%	51.3%
Australian Capital Territory	0.2%	7.4%	92.4%
Australia	10.0%	16.5%	73.5%

Primary sector (Agriculture and Mining)
Secondary sector (Manufacturing and Construction)
Services sector (Electricity, Gas, Water and Wastewater; Wholesale Trade; Retail Trade; Accommodation and Food Services; Transport, Postal and Warehousing; Information, Media and Telecommunications; Financial and Insurance Services; Rental, Hiring and Real Estate Services; Professional, Scientific and Technical Services; Administrative and Support Services; Public Administration and Safety; Education and Training; Health Care and Social Assistance; Arts and Recreation Services; and Other Services)
Source: ABS, National Accounts, State Accounts, cat.No.5220.0

Table 7.4
Targeted and Priority Industries and Sectors by Australian Jurisdiction at April 2018

Commonwealth[1]	New South Wales[2]	Victoria[3]	Queensland[4]	Western Australia[5]	South Australia[6]	Tasmania[7]	Australian Capital Territory[8]	Northern Territory[9]
Advanced Manufacturing Cyber Security Food and Agribusiness Industry Mining equipment, technology and ***services*** ***Pharmaceuticals and Medical Technologies*** Oil, Gas and Energy Resources	Agribusiness and food ***Arts, culture and creative*** ***Education*** ***Financial and professional services*** Advanced technologies Infrastructure and construction Manufacturing Renewable energy and sustainability ***Tourism***	Construction technologies ***Creative industries*** Defence technologies Digital technologies Food and fibre ***International education*** ***Medical technologies and pharmaceuticals*** ***Professional services*** ***Retail, transport distribution and logistics and postal*** ***Transport technologies*** ***Visitor economy***	Advanced manufacturing Aerospace Biofutures ***Biomedical*** ***Defence*** Mining equipment, technology and ***services***	Oil and gas Mining equipment, technology and **services** Downstream processing Industrial areas Economic infrastructure Agriculture and food ***Financial services*** ***Retail*** ***Tourism infrastructure*** ***Science*** o ***mining and energy*** o ***medicine and health*** o ***agriculture and food*** o ***biodiversity and marine science*** o ***radio astronomy***	Aerospace Music Technology Clean Water Technology Medical Devices Specialist Vehicles Internet of Things (IoT) for Resources **Food and Wine**	Advanced manufacturing Antarctic and Southern Ocean Building and construction ***Cultural and tourism industry development sector*** ***Defence*** Food and agribusiness Forestry ***Information communication and technology*** ***International education*** Mining and mineral processing Renewable energy ***Science***	***Space, Satellite and Spatial Sciences*** ***Defence and Cyber Security*** Renewable Energy ***Digital Economy and e-Government*** ***Health and Sports Science*** ***Innovation and Higher Education*** ***Tourism Infrastructure***	Crocodile farming ***International education and training*** ***Defence and national security*** Defence construction ***Marine services***

Table 7.4 (cont.)
Targeted and Priority Industry's and Sectors by Australian Jurisdiction
as at April 2018

1. https://www.industry.gov.au/industry/IndustrySectors/Pages/default.aspx; https://industry.gov.au/industry/Industry-Growth-Centres/Pages/default.aspx
2. https://www.industry.nsw.gov.au/invest-in-nsw/industry-opportunities
3. https://economicdevelopment.vic.gov.au/priority-industries-sectors; http://www.business.vic.gov.au/support-for-your-business/future-industries#utm_source=businessvictoria-offline-marketingandutm_medium=vanity-url-301ssredirectandutm_content=futureindustriesandutm_campaign=support-for-your-business;
4. https://www.statedevelopment.qld.gov.au/industry-development/priority-industries.html
5. http://www.jtsi.wa.gov.au/invest-in-wa
6. http://saplan.org.au/; http://innovation.sa.gov.au/opportunities/; http://economic.priorities.sa.gov.au/__data/assets/pdf_file/0005/4586/Economic_Priorities_Booklet_digital.pdf
7. https://www.stategrowth.tas.gov.au/business/sectors#main-content
8. http://investcanberra.com/opportunities.aspx
9. https://business.nt.gov.au/business/publications

Table 7.5
Details of Services Sub-Sector Industry Plans by Jurisdiction
as at April 2018

Jurisdiction	Services Sub-Sector Industry Plan	Link to Documentation
Commonwealth	Medtech, Biotechnology and Pharmaceutical Sector Competitiveness Plan, December 2016	https://www.mtpconnect.org.au/SCP
Commonwealth	Mining equipment technology services 10 Year sector Competitiveness Plan, November 2016	https://www.metsignited.org/Category?Action=ViewandCategory_id=74
New South Wales	NSW Professional Services Industry Action Plan, September 2012	https://www.industry.nsw.gov.au/invest-in-nsw/industry-opportunities/financial-professional-and-business-services/industry-action-plan-professional-services
New South Wales	NSW Creative Industries Industry Action Plan, April 2013	https://www.industry.nsw.gov.au/invest-in-nsw/industry-opportunities/arts-culture-and-creative
New South Wales	NSW Government Defence and Industry Strategy, 2017	https://www.industry.nsw.gov.au/invest-in-nsw/industry-opportunities/defence/nsw-defence-and-industry-strategy
New South Wales	NSW International Education and Research Industry Action Plan, September 2012	https://www.industry.nsw.gov.au/invest-in-nsw/industry-opportunities/education/industry-action-plan
New South Wales	Visitor Economy Industry Action Plan, December 2012	https://www.industry.nsw.gov.au/invest-in-nsw/industry-opportunities/tourism/industry-action-plan-tourism
Victoria	Medical Technologies and Pharmaceuticals Sector Strategy, March 2016	http://www.business.vic.gov.au/__data/assets/pdf_file/0010/1275454/Medtech-and-Pharma-Strategy-web-version-20160308.PDF
Victoria	New Energy Technologies Strategy, March 2016	http://www.business.vic.gov.au/__data/assets/pdf_file/0004/1275457/New-Energy-Technology-Strategy-web-version-20160308.PDF
Victoria	Transport Technologies Strategy, March 2016	http://www.business.vic.gov.au/__data/assets/pdf_file/0006/1275351/Transport-Technologies-strategy-web-version-20160310.pdf
Victoria	Defence Technologies Strategy, March 2016	http://www.business.vic.gov.au/__data/assets/pdf_file/0008/1275479/9778-DEDJTR-IT-VFI-International-Defence-strategy-WEB.pdf
Victoria	International Education Sector Strategy, March 2016	http://www.business.vic.gov.au/__data/assets/pdf_file/0010/1275499/International-Education-Strategy-web-version-20160308.PDF

Table 7.5 (cont.) Details of Services Sub-Sector Industry Plans by Jurisdiction as at April 2018		
Jurisdiction	**Services Sub-Sector Industry Plan**	**Link to Documentation**
Victoria	Professional Services sector Strategy, March 2016	http://www.business.vic.gov.au/__data/assets/pdf_file/0006/1275504/Professional-Services-strategy-web-version-20160310.pdf
Queensland	Queensland Mining Equipment, Technology and Services 10-Year Roadmap and Action Plan, July 2017	https://www.statedevelopment.qld.gov.au/industry-development/mining-equipment-technology-and-services.html
Queensland	Queensland Biomedical 10-Year Roadmap and Action Plan, June 2017	https://www.statedevelopment.qld.gov.au/resources/plan/eid/biomedical-10-year-roadmap-and-action-plan.pdf
Western Australia	Tourism WA Two-Year Action Plan – 2018 and 2019, 2017	https://www.tourism.wa.gov.au/Publications%20Library/About%20Us/Two%20Year%20Action%20Plan.PDF
South Australia	South Australia's 10 Economic Priorities, 2017	http://economic.priorities.sa.gov.au/__data/assets/pdf_file/0005/4586/Economic_Priorities_Booklet_digital.pdf
South Australia	South Australia's Strategic Plan, 2011	http://saplan.org.au/media/BAhbBlsHOgZmSSIhMjAxMS8xMS8wNC8wMV8wMl8xNF8yMjNfZmlsZQY6BkVU/01_02_14_223_file
Tasmania	Cultural and Creative Industries Strategy: A plan to grow jobs and investment in the cultural economy 2016-2018, December 2015	https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0009/128691/Cultural_and_Creative_Industries_Strategy_for_Web.PDF
Tasmania	Our Fair Share of Defence Strategy: Attracting Tasmania's Fair Share of Defence Spending, March 2016	https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0019/131347/Defence_strategy_Web_20160218.pdf
Tasmania	Information and Communication Technology Sector Summary 2014	https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0006/89583/ICT.pdf
Tasmania	Tasmanian Global Education Growth Strategy, May 2017	https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0008/149804/Global_Education_Strategy_for_web.pdf
Tasmania[1]	Tasmanian Integrated Freight Strategy, April 2016	https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0017/134216/Tasmanian_Integrated_Freight_Strategy_Part_one.pdf

Table 7.5 (cont) **Details of Services Sub-Sector Industry Plans by Jurisdiction** **as at April 2018**		
Jurisdiction	**Services Sub-Sector Industry Plan**	**Link to documentation**
Northern Territory	Northern Territory International Education and Training Strategy 2014 to 2024	https://business.nt.gov.au/__data/assets/pdf_file/0003/229008/international-education-training-strategy-2014-2024.pdf
Northern Territory	Northern Territory Defence and National Security Strategy 2018, March 2018	https://business.nt.gov.au/__data/assets/pdf_file/0008/476576/defence-national-security-strategy.pdf
Source: Various Commonwealth and State Department websites (as per "Links to documentation")		

Table 7.6 **Policy Score by Australian Jurisdiction for Services sector using Williams "Good" Public Policy Framework** **at April 2018**										
Williams "good policy" categories		**Common-wealth**	**New South Wales**	**Victoria**	**Queensland**	**Western Australia**	**South Australia**	**Tasmania**	**Australian Capital Territory**	**Northern Territory**
A	Actual Policy Coverage	Low	Medium	Medium	Low	Low	Medium	Medium	Low	Low
B	Contemporaneous	High	Medium	High	High	Low	Medium	High	Low	High
C	Problem/ Opportunity Identified	High	High	High	High	Medium	Medium	High	Low	High
D	Aims / Actions	High	High	High	High	High	High	High	Low	High
E	Background / Evidence	High	High	High	High	Medium	Medium	High	Low	High
F	Stakeholder consultation	High	High	High	High	Medium	Medium	Medium	Low	Medium
G	Distributional impacts	Low	Low	Low	Low	Low	Low	Low	Low	Low
H	Legal framework	Medium	Low	Low	Low	Low	Low	Low	Low	Low
I	Stakeholder organisations identified	High	High	High	High	Low	Medium	High	Low	High
J	Continuous disclosure process	Medium	Medium	Medium	Medium	Low	Medium	Medium	Low	Medium
	Policy Score[1]	**60**	**76**	**114**	**57**	**13**	**60**	**108**	**8**	**54**
Policy Score = A x B x (C + D + E + F + G + H + I +J) Maximum Score = 144 Source: Williams (2012); Author's own assessment and calculations										

As shown in the footnote of Table 7.6, the policy score for each jurisdiction is calculated by multiplying the values assigned for coverage and contemporaneous (timing) and the sum of the values assigned for the Williams "good" policy criteria. The maximum possible policy score for any one jurisdiction is 144, although for the purposes of comparisons the policy scores are converted into a value of between 0 and 1. A summary of the normalised policy score and the relative economic importance of the services sector by jurisdiction is presented in Table 7.8.

Table 7.7
Summary of Policy Score and relative importance of the Services Sector by Jurisdiction

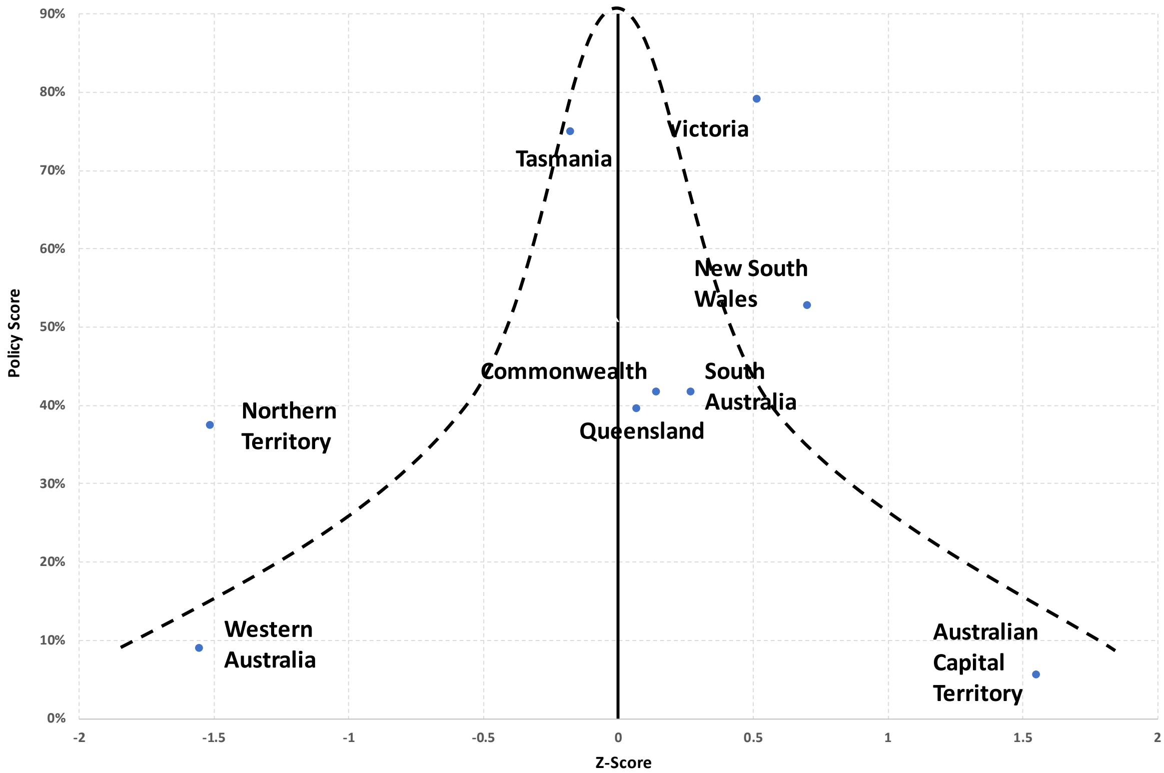
Jurisdiction	Services as % of GVA	Normalised Policy Score
New South Wales	81.0%	0.527
Victoria	78.5%	0.792
Queensland	72.5%	0.396
Western Australia	50.8%	0.090
South Australia	75.2%	0.417
Tasmania	69.2%	0.750
Northern Territory	51.3%	0.375
Australian Capital Territory	92.4%	0.056
Australia	73.5%	0.417

Source: ABS, National Accounts, State Accounts, cat.No.5220.0; Author's calculations

The scatter-plot (in Figure 7.1) of the data presented in Table 7.7 reveals a near normal-distribution (as shown by the stylised dotted line in Figure 7.1) in the relationship between a jurisdiction's policy score and the relative importance of the services sector in its economy (calculated on a z-score basis).

The two jurisdictions with the lowest policy scores, Western Australia and the Australian Capital Territory, are also the two jurisdictions with the lowest and highest proportion of their economy allocated to the services sector respectively. This laissez-faire approach to services sector industry policy seems to reflect a mind-set within each jurisdictional bureaucracy that they are unable to materially influence the relative growth in the local services sector, even if for different reasons. Western Australia has a significant natural comparative advantage in the primary sector, which, as noted in Section 5.3.3, has poor forward and backward linkages with the rest of the economy. This means any growth in the local services sector is heavily dependent on final demand (as opposed to intermediate usage) and with a relatively small population and non-primary sector economy, this final demand is likely to be muted compared with other jurisdictions. For the Australian Capital Territory, the structure of the local economy is dominated by the services sector and again, given the strong forward and backward linkages of this sector, any economic growth within the jurisdiction would be expected to be influenced by the deep intra-sectoral relationships that exist within the services sector.

Figure 7.1
Services sector Policy Score and IGVA Z-Score of by Jurisdiction, April 2018



Overall, based on the previous analysis I suggest the current policy environment supporting the services sector in Australia could be assessed as ranging between "Poor" to "Good", with the overall national framework assessed as "Average". This suggests there is potential for an improvement in the public policy environment supporting the services sector in Australia. The following section discusses what supportive industrial/innovation policies and reforms could be implemented to encourage the continued growth of the Australian services sector in the short-to-medium term.

7.4 Conclusions

Australia's sectoral MFP is not aligned, and as such the first pre-condition for achievement of a steady state remains unfulfilled even though the economy now has an industrial structure that is already heavily weighted towards the services sector. This suggests that a necessary and sufficient condition for structural change remains in the Australian economy, and it is reasonable to conclude there will be a continuation of adjustments in the sectoral make-up of the domestic economy into, at least, the short-to-medium term.

Economists have shown growth can occur because of increases in labour supply, capital deepening and changes in multifactor productivity (Kyoji, 2010, p.ii), although it is also well understood that government policies can assist with or detract from achieving those outcomes and can enhance or diminish the role the services sector will play in a future Australian economy. An extension to the cross-country analysis empirically proves this point specifically for the services sector and proactive industry / innovation policy. However, what the extended cross-country analysis cannot show is whether or not the quality of the policy framework being implemented is influential in driving incremental economic growth towards the services sector. An assessment of the national and state government industry policy environment in Australia, including (a) whether service industries have been nominated as target sectors, (b) whether sector growth policies have been documented, and (c) how well post-implementation support occurs, was also completed to test whether the quality of the policy framework is influential in driving incremental services sector economic activity.

The analysis found a relationship between the quality of the approach taken to support the services sector through industry policy and the proportion of Gross State Product (GSP) generated by the services sector within each jurisdiction. The jurisdictional assessment found that the way in which industry policy is implemented influences how successful a jurisdiction becomes in generating incremental output from the services sector. For example, Western Australia achieved the lowest policy score of all Australian jurisdictions and it also recorded the lowest proportion of GSP being generated by the services sector of all Australian jurisdictions. Given the empirical finding that Australia has experienced a servicification of its primary sector, this result for Western Australia suggests incremental growth in services sector output for the state could be achieved through implementing more extensive and better quality government policy rather than continuing to take what has been in essence a laissez-faire approach to industry policy for the services sector.

Chapter 8 Conclusion

8.1 Introduction

The provision of services has been an integral component to success of any society since time immemorial, even though the broad recognition of services as an economic construct has only occurred within the past 100 years. Chapter 2 discusses how early theorists initially struggled to acknowledge explicitly the role the services-producing sector, as distinct from the goods-producing sector, plays within an economy. This challenge was due in part to the difficulties of incorporating the characteristics of services, including perishability, instantaneous production and consumption and heterogeneity within economic frameworks that were devised for goods, which conversely can exhibit characteristics of durability, storability and homogeneity.

Despite these challenges, economists including Clarke, Fisher and Fourastié, concurrently but independently developed empirically supported theories describing how an economy's primary, secondary and tertiary sectors adjust over time due to the interplay between each sector's factor productivity and income elasticities for output. Fourastié also argued that as workers become wealthier, consumers' demand for services associated with leisure, enjoyment and timesaving increases, while correspondingly demand for goods by consumers can reach a "saturation point" which causes a relative shift in the make-up of outputs generated within an economy. Importantly, Fourastié contends this "saturation point" is never reached for services.

If Fourastié is right, a logical question one may then ask is:

What is the optimal proportion of production generated by the services sector in an economy?

Chapter 3 shows how attempting to answer this question formally using traditional growth theory is problematic as the one-sector growth model abstracts the process of reallocating economic activity across the three key sectors, which Kuzents recognised as "one of the six main features of modern economic growth". The conception of multi-sector growth models, such as the one proposed by Ngai and Pissarides, has extended the work of Harrod, Domar, Solow, Swan, Romer, Aghion and Howitt, and incorporated new theory into traditional growth models that can explain how and why sectors rise and fall over time, albeit still in a closed-economy setting.

An extension to Aghion and Howitt's growth theory model, which is based on the Schumpeter's process of "creative destruction", was completed as part of this thesis and enables the optimal sectoral economic growth to be determined. This extension to the Aghion and Howitt model links sectoral R&D and innovation activities, the marginal productivity associated with those activities in that sector, and the proportion of workers engaged in R&D activities relative to the total sectoral workforce and the level of sectoral economic growth, which is equal to the residual between aggregate growth and growth achieved in the other defined sectors of the economy. This extended model allows the concepts of sectoral "creative destruction" to be explicitly identified through empirically modelling the aggregate economy and individual sectors and isolating the unobservable terms, such as marginal productivity, within the equation.

While Unvala and Donaldson propose there is no reason to suggest the services sector cannot continually achieve relative economic growth and crowd out a weakening manufacturing sector, the two key theoretical arguments underpinning the structural change growth model proposed by Ngai and Pissarides, which are also consistent with Baumol's "cost disease" hypothesis, provide guidance about when an economy's structure is optimal. That is, if MFP is the same for the consumption good sector and the manufacturing good sector, a necessary and sufficient condition for structural change is that the rate of change in consumption expenditure is different from the rate of change in output per capita; and if the rate of change in consumption expenditure is the same as the rate of change in output per capita, a necessary and sufficient condition for structural change is a non-unitary elasticity of substitution for each sector[16].

Even under these conditions however, structural change may continue to occur, not because of domestic factors, but rather because of opportunities to trade. That is, Markusen's argument surrounding trade in service inputs implies the economic welfare of a country would be improved by growing its services sector more than domestic demand warrants, but then exporting this excess supply in services as either intermediate inputs or final goods to foreign countries who are unable to provide these activities for themselves.

[16] Noting that on a sector pair's basis, if the elasticity of substitution is less than one, then employment moves from the sector with high MFP to the sector with low MFP, or if the elasticity of substitution is less than one then the opposite occurs.

Understanding how and why structural change may occur within an economy, and in particular which sectors will be impacted in what way, is therefore a vitally important tool for economic planners to comprehend. In this thesis the Australian economy has been considered, with Chapter 4 presenting how the services sector has developed in Australia since post-European settlement, while Chapter 5 presents in detail how the services sector has contributed to the Australian economy since 1975. Idiosyncratic factors, such as distance to foreign markets, natural comparative advantages and government policies designed to ensure the nation's safety and security in the event of conflict, have all shaped how the services sector has evolved in Australia over the past 230 years.

Today, the services sector represents about three-quarters of all economic activity within Australia, with producer services being a larger proportion of GDP than both the primary and secondary sectors combined. In this thesis the question posed above has been asked specifically in relation to the Australian economy. That is: Given the significant representation of the services sector within the Australian economy today, has it "topped out" in terms of its contribution to the economy or will the sector continue to grow in importance, either organically or as a consequence of supportive government policies? The key findings of the empirical analysis conducted in this thesis relevant to this question are presented in the following section.

8.2 Summary of key findings

European settlement of Australia immediately transformed the continent into a services economy. The need for food for sustenance, combined with the need to supply tangible goods locally as either intermediate inputs or final goods, meant the primary and secondary sectors rose in relative importance in the first 60 years of the settlement but from around 1840 onwards services has been the dominate sector within the Australian economy.

Chapter 5 presents data to show how the modern Australian economy, relating to the period from 1975 onwards, is a services economy. With the winding back of tariffs aimed to explicitly support the manufacturing sector within Australia from the early 1970s, growth within the domestic economy has been largely as a result of the services sector, even though the post-2000 commodities boom has seen a significant positive contribution by the primary sector to national income.

Analysis of sectoral backward and forward linkages using official input-output tables shows the services sector has deepened its connection to consumers, mainly because of how distributive services, specifically energy, transport, communications, has evolved into a critical component in the production of output in Australia. The same input-output analysis revealed Australia has experienced a servicification of its primary sector rather than, as has been the broad macroeconomic experience of many other countries, a servicification of its manufacturing sector. Australia's limited connectivity in GVCs and the consequential impact of "Dutch Disease", combined with the rationale of seeking to maximise the nation's natural comparative advantages within the agricultural and mining industries, are reasons servicification has occurred within Australia's primary sector rather than its secondary sector.

Analysis of capital, labour and output shows the primary, secondary and services sectors in Australia have recorded different MFP growth rates across over the past two decades. The MFP analysis was completed on a first-principles basis using four different methods – Cobb Douglas production function, Translog production function, Growth Accounting Framework and the OECD / ABS Index Number approach in a production theoretic framework – given the importance of understanding how MFP has performed by sector in the Australian economy in being able to answer the key question in this thesis. The MFP analysis shows the primary sector experienced negative growth since the mid-2000s, while Australia's secondary sector achieved the highest rate of MFP growth of the three sectors. This result is consistent with Baumol's "cost disease" study, as well as the findings of the Verma and Echevarria studies, which observed most advanced economies exhibit lower MFP growth in their services sector compared with their industrial sector. Given the economic theory discussed previously regarding structural change, this finding enables one to conclude that Australia's sectoral composition is not in a "steady state", and as such, will continue to adjust over the short to medium term.

In Chapter 6 a cross-country empirical analysis has been completed which has shown, relative to other countries and taking into consideration those idiosyncratic characteristics that are embedded in how Australia's economy operates, Australia's services sector as a whole is "underweight" compared with what theoretical proportion of GDP it should represent. On a sub-sector level, producer services represents a greater proportion of GDP than it theoretically should, while distributive, social and personal services represent lower proportions of GDP than they theoretically should.

In Chapter 7 an extension to the cross-country empirical analysis has shown government industry policy also can affect the structure of an economy. Australia has implemented a national industry policy for the services sector since 2008 which, based on the extended cross-country modelling, has helped increase the importance of the services sector relative to the primary and secondary sectors.

However, the extended cross-country analysis is unable to show whether or not the quality of the policy framework being implemented is influential in driving incremental economic growth towards the services sector. An assessment of the national and state government industry policy environment in Australia, including whether service industries have been nominated as target sectors, whether sector growth policies have been documented, and how well post-implementation support occurs, was also completed as part of this thesis.

This assessment found there is a relationship between the quality of the approach taken to support the services sector through industry policy and the proportion of Gross State Product (GSP) generated by the services sector within each jurisdiction. Simply, the jurisdictional assessment found that the way in which industry policy is implemented matters in how successful a jurisdiction becomes in generating incremental output from the services sector. For example, Western Australia achieved the lowest policy score of all Australian jurisdictions, and it also recorded the lowest proportion of GSP of all Australian jurisdictions being generated by the services sector. Given the empirical finding that Australia has experienced a servicification of its primary sector, this result for Western Australia suggests incremental growth in services-sector output for the state could be achieved through implementing more extensive and better-quality government policy rather than continuing to take what has been in essence a laissez-faire approach to industry policy for the services sector.

The combination of the findings of this thesis enable one to conclude that despite the services sector in Australia holding a dominant position within the economy relative to the primary and secondary sectors, in the short-to-medium term it is likely to continue to experience an increase in its importance.

8.3 Future work

This thesis found that industry policy can have a positive impact on increasing the relative importance of the services sector within an economy. The working definition of what is an industry policy applied in this thesis was "any government policy that seeks to explicitly encourage the development and growth of part or all of a specific industry or sector of the economy". There are researchers, such as Banks, who argue this definition is too narrow, and that a more appropriate definition of industrial policy for the modern economy[17] is one that "should not promote any particular industry or sector as an end in itself", but rather should be policies that (i) incentivise innovation within competitive markets, and (ii) create a supportive regulatory environment that facilitates innovation within businesses (Banks, 2008, p.10, p.13).

Warwick (2013) also proposes that new industrial policy should be an environment where government's role is not to "pick winners", but rather has a role of reducing unnecessary regulatory burdens and promoting coordination, information flows, institution building that enables more efficient interactions between markets and economic agents (Warwick, 2013, p25).

These suggestions regarding the scope and function of industry policy are consistent with the views of the European Commission (EC) who also suggest the contemporary form of this type of policy

> *… is horizontal in nature and aims at securing framework conditions favourable to industrial competitiveness. Its instruments, which are those of enterprise policy, aim to provide the framework conditions in which entrepreneurs and business can take initiatives, exploit their ideas and build on their opportunities. However, it needs to take into account the specific needs and characteristics of individual sectors. It therefore needs to be applied differently, according to the sector. For example, many products, such as pharmaceuticals, chemicals, automobiles, are subject to detailed sector-specific regulations dependent on their inherent characteristics or use. Industrial policy therefore inevitably brings together a horizontal basis and sectoral applications.* (European Commission, 2002, p.3)

[17] Some researchers refer to this as "new industrial policy"

The framework conditions recognised by the EC are policies that improve the overall business environment for all economic agents working within it but are not necessarily policies that are developed which have the objective of changing the structure of the economy. These framework conditions therefore include regulatory arrangements that limit business activities, for whatever reason, across all sectors of the economy.

Spies, Taylor and Zimmerman (2017) suggest that reforms to public policy (including regulation, trade, and migration) lag far behind technology change, which suggest current regulatory settings often reflect perceived market failures of the past rather than perceived market failures of today (Spies, Taylor and Zimmerman, 2017, p.56). Banks (2008) supports this by suggesting that once existing government regulatory failures are rectified there would be limited reasons within the business environment to impede the innovation necessary to keep the Australian economy growing and developing (Banks, 2008, p.13).

The removal of domestic policy barriers is likely to have consequential effects not only on industry profitability and national income, but also on growth in MFP. To the extent that reforming domestic policy barriers results in disequilibrium in MFP growth across sectors, these reforms will also cause compositional change in the sectoral make-up of the Australian economy. The Productivity Commission (PC) in its recent study on the barriers to growth in Australian export services, identified a range of domestic policy reforms[18] which, if implemented, would support not only growth in the export of services but also growth in the domestic services sector more broadly. However, the PC only undertook a qualitative assessment of the benefits to the Australian community of reducing these barriers to growth in services due to “insufficiently robust data” (PC, 2015, pp.56-57).

[18] Including barriers associated with foreign direct investment, infrastructure investments, workplace relations, education and training, temporary work visas for migrants, export grant programs, information asymmetries for exporters, export finance and insurance schemes, intellectual property rights, licensing and standards for professional services, withholding taxes, dividend imputation and international air service agreements.

Prasad and Sathish (2010) believe domestic regulations are akin to tariffs in the way they regulate services within an economy (Prasad and Sathish, 2010, p.iii). In the same way explicit trade barriers have “rent-creating” and “cost-creating” effects, domestic policy barriers also create the same direct effects. Domestic policies that generate “rent-creating” effects are those which limit entry and competition in a sector which results in an explicit margin in the price over cost, while domestic policies that generate “cost-creating” effects are those which directly cause the cost base of a business activity to rise (Centre for International Economics, 2010, p.20; Dee, 2005, p.119).

A possible future extension of this thesis is to quantify the direct effects of each domestic policy barrier identified by the PC and assess the impact of their removal using Computable General Equilibrium (CGE) modelling. This could be undertaken using the Global Trade Analysis Project[19] global CGE model. To do this extension the quantum of the domestic policy barriers needs to be estimated using econometric models which convert the “cost” of the barrier into ad valorem equivalent measures (i.e., as a rate equal to a percentage of traded services value), which is then able to be interpreted as either rent-creating barriers or cost-escalating barriers, and modelled as either an exogenous tax over total costs or as a productivity improvement of primary factors respectively (Cretegny, 2006, p.3).

The significance of identifying which effect a domestic policy causes lies in the context of modelling the counter-factual situation, vis-à-vis, no or reduced domestic policy barriers. The removal of “rent-creating” barriers improves allocative efficiency and increases both consumer and producer surplus relative to the status quo, although it also has a distributional impact in reducing income to incumbent participants. The removal of “cost-escalating” barriers improves productive efficiency within the economy, resulting in higher returns for service providers and/or cost reductions for consumers (McCredie et al., 2010, pp.57-58).

This extension to the thesis would show whether the proposed reforms to domestic policy barriers identified by the PC may help in the equalising of sectoral MFP growth, enabling a “steady-state” outcome to be reached, or cause a further divergence in sectoral MFP growth, resulting in a continuation of structural change in the Australian economy.

[19] See www.gtap.org

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Appendix A Detailed MFP Index Calculations using OECD / ABS Methodology

Appendix A.1 - Productive Capital Stock ($ million) - Primary Sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Primary (Incorporated)												
Cultivated biological resources - Livestock fixed assets	1,177.89	1,123.82	1,109.49	979.38	869.06	850.19	734.18	676.26	554.68	491.24	432.62	381.99
Cultivated biological resources - Orchards, plantations & vineyards	1,810.58	1,886.47	1,995.41	2,119.84	2,267.51	2,431.65	2,558.13	2,666.94	2,750.84	2,818.23	2,883.48	2,935.19
Intellectual propery products - Computer software	77.67	85.73	97.45	112.72	128.82	158.48	178.54	207.89	235.88	268.18	301.57	323.53
Intellectual property products - Mineral & petroleum exploration	67,020.86	69,141.76	71,660.40	74,157.41	76,062.50	77,178.36	78,599.09	79,644.45	80,814.06	81,854.79	83,092.52	84,603.29
Intellectual propery products - Research & development	7,224.11	7,938.17	8,478.84	8,915.98	9,240.61	9,476.93	9,872.35	10,505.49	11,193.58	12,044.71	13,033.53	13,706.48
Inventories - farm	1,485.44	1,643.61	1,632.00	1,688.77	1,678.14	1,712.35	1,897.32	1,958.63	1,870.56	1,866.56	1,894.40	2,087.53
Inventories - Non-farm	6,131.30	7,384.94	8,226.59	7,745.80	7,306.73	7,129.99	5,978.23	7,280.63	7,414.60	7,567.41	7,204.17	6,686.04
Land	141,409.88	143,103.24	144,812.21	147,129.70	150,294.05	150,884.47	151,107.67	152,705.97	155,318.52	157,594.05	160,165.67	166,043.05
Machinery & equipment - Computers	6.30	8.66	12.20	22.46	27.72	31.80	33.73	37.49	46.00	60.90	74.45	91.12
Machinery & equipment - Electrical & Electronic Eqt	515.92	545.26	580.64	710.48	740.13	767.36	785.55	825.74	937.86	1,101.19	1,258.19	1,437.28
Machinery & equipment - Industrial Machinery & Equip	44,560.37	45,421.39	47,056.03	50,370.47	50,979.68	50,805.06	50,821.88	51,614.37	53,027.16	55,118.81	57,412.68	61,456.72
Machinery & equipment - Other Plant & Equipment	6,997.94	7,711.99	8,554.53	9,982.74	10,341.75	10,478.72	10,615.34	10,922.00	11,273.54	11,810.44	12,197.47	12,812.54
Machinery & equipment - Other Transport Equipment	1,920.62	2,566.85	3,208.45	3,696.77	3,849.13	3,941.93	4,154.66	4,143.01	4,125.94	4,280.64	4,356.54	4,446.30
Machinery & equipment - Road Vehicles	3,980.54	4,004.29	4,066.32	4,306.39	4,376.62	4,413.37	4,333.70	4,294.57	4,287.66	4,300.17	4,340.26	4,417.05
Non-dwelling construction	135,706.54	141,112.62	146,629.88	153,975.31	164,038.49	167,418.53	169,563.04	175,672.04	184,958.45	193,676.00	203,580.73	224,119.72
Ownership transfer costs	15,523.48	15,934.86	16,360.25	17,028.13	17,909.23	18,239.69	18,485.01	19,302.17	20,441.17	21,422.45	22,161.05	23,642.35
Primary (Unincorporated)												
Cultivated biological resources - Livestock fixed assets	42,023.17	41,491.25	40,947.66	38,964.77	36,496.10	34,429.36	32,586.37	31,221.02	28,280.87	27,912.57	27,358.35	27,594.56
Cultivated biological resources - Orchards, plantations & vineyards	4,404.92	4,589.56	4,854.61	5,157.33	5,516.60	5,915.93	6,223.63	6,488.37	6,692.49	6,856.43	7,015.19	7,140.98
Intellectual propery products - Computer software	154.54	170.61	191.83	222.91	240.39	271.80	286.64	306.48	297.97	297.70	302.22	308.16
Intellectual property products - Mineral & petroleum exploration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Intellectual propery products - Research & development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inventories - farm	5,764.16	6,118.00	6,072.83	6,506.54	6,387.42	6,524.55	7,266.76	7,523.21	7,110.24	7,145.69	7,259.41	7,994.50
Inventories - Non-farm	22.63	26.93	29.50	29.15	27.11	25.25	20.91	25.45	24.92	24.07	21.81	19.57
Land	198,892.11	198,892.34	198,892.59	198,892.95	198,893.48	198,893.57	198,893.60	198,893.87	198,894.32	198,894.71	198,895.16	198,896.18
Machinery & equipment - Computers	4.32	5.60	7.36	11.60	15.76	20.01	23.65	26.96	34.25	43.58	54.77	63.16
Machinery & equipment - Electrical & Electronic Eqt	417.80	425.74	435.04	483.56	503.72	529.97	557.81	588.71	683.44	797.72	934.94	1,046.27
Machinery & equipment - Industrial Machinery & Equip	20,723.61	20,298.19	19,965.84	19,683.52	19,546.93	19,403.90	19,677.35	19,732.44	20,139.09	20,450.90	21,354.46	22,089.54
Machinery & equipment - Other Plant & Equipment	2,554.02	2,649.58	2,743.17	2,871.16	2,950.76	3,016.97	3,149.03	3,238.84	3,366.90	3,488.69	3,657.33	3,775.08
Machinery & equipment - Other Transport Equipment	573.66	716.81	835.09	888.84	929.67	968.94	1,080.24	1,077.88	1,078.87	1,112.62	1,149.16	1,158.08
Machinery & equipment - Road Vehicles	11,082.42	10,921.52	10,850.37	11,026.27	11,137.65	11,250.32	11,112.03	10,973.82	10,968.34	10,953.20	11,127.67	11,228.12
Non-dwelling construction	41,573.88	42,089.39	42,528.31	43,419.53	44,841.09	46,374.73	47,213.32	48,697.42	50,879.96	53,113.02	55,380.40	57,487.34
Ownership transfer costs	4,751.03	4,748.39	4,740.80	4,797.68	4,891.86	5,049.05	5,144.03	5,348.17	5,621.21	5,873.36	6,027.68	6,064.25

Appendix A.1 - Productive Capital Stock ($ million) - Primary Sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Primary (Incorporated)											
Cultivated biological resources - Livestock fixed assets	315.79	250.20	192.21	148.86	156.34	158.89	153.35	138.98	122.48	102.46	108.02
Cultivated biological resources - Orchards, plantations & vineyards	3,039.20	3,117.48	3,216.19	3,304.80	3,420.25	3,498.83	3,609.59	3,704.24	3,746.96	3,814.52	3,874.83
Intellectual propery products - Computer software	349.35	433.91	540.88	656.87	704.86	890.34	963.86	1,023.60	1,131.38	1,204.27	1,322.40
Intellectual property products - Mineral & petroleum exploration	87,600.51	91,881.50	96,579.19	100,892.69	105,457.47	110,571.46	116,134.46	120,548.19	123,525.35	124,455.11	125,036.35
Intellectual propery products - Research & development	15,259.02	17,330.54	19,504.18	21,154.45	22,503.34	23,986.54	24,737.19	24,796.04	24,245.55	23,136.06	22,171.44
Inventories - farm	2,224.52	2,502.20	2,599.34	2,519.56	2,761.64	2,938.48	3,123.85	3,291.14	3,319.30	3,234.64	3,265.98
Inventories - Non-farm	8,056.76	7,673.62	8,365.78	8,732.99	8,692.21	11,225.63	12,415.22	13,538.71	13,166.31	12,982.62	12,421.41
Land	172,801.94	179,830.45	188,391.34	194,921.76	204,005.18	220,908.12	239,835.61	255,603.49	265,491.95	270,853.36	272,973.69
Machinery & equipment - Computers	119.25	173.25	201.59	238.44	272.11	319.46	376.45	373.49	345.29	297.37	250.41
Machinery & equipment - Electrical & Electronic Eqt	1,677.32	1,921.44	2,083.42	2,189.35	2,303.16	2,472.03	2,770.10	2,875.29	2,916.01	2,881.82	2,849.93
Machinery & equipment - Industrial Machinery & Equip	65,495.10	72,325.94	78,750.61	82,784.18	87,820.55	98,251.72	107,344.75	110,699.69	112,734.66	111,978.08	110,760.80
Machinery & equipment - Other Plant & Equipment	13,524.86	14,808.01	15,563.34	16,228.60	16,996.91	18,243.57	20,143.55	20,541.21	20,593.65	20,063.14	19,537.78
Machinery & equipment - Other Transport Equipment	4,418.27	4,621.00	4,795.48	4,765.75	4,822.20	4,827.89	5,421.27	5,502.54	5,526.74	5,382.16	5,331.04
Machinery & equipment - Road Vehicles	4,635.21	5,158.48	5,338.73	5,789.87	6,181.28	6,567.57	7,115.23	7,437.30	7,575.21	7,664.11	7,774.54
Non-dwelling construction	249,183.00	277,401.72	314,441.13	345,053.95	388,586.71	471,343.80	575,376.23	675,033.96	748,508.22	797,436.26	827,047.80
Ownership transfer costs	25,520.09	27,259.55	29,067.85	30,291.07	32,121.50	35,951.25	40,653.12	44,275.81	46,249.69	47,091.71	47,038.11
Primary (Unincorporated)											
Cultivated biological resources - Livestock fixed assets	26,818.76	26,104.92	25,342.79	24,103.76	24,387.34	23,952.46	23,510.04	22,624.53	21,068.10	19,539.31	19,653.73
Cultivated biological resources - Orchards, plantations & vineyards	7,394.04	7,584.48	7,824.64	8,040.20	8,321.09	8,512.27	8,781.72	9,012.00	9,115.92	9,280.31	9,427.03
Intellectual propery products - Computer software	322.44	283.15	241.53	193.17	160.00	147.48	156.90	155.63	162.47	170.93	181.67
Intellectual property products - Mineral & petroleum exploration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Intellectual propery products - Research & development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inventories - farm	8,419.13	9,428.71	9,224.79	8,883.18	9,709.37	10,361.10	10,957.72	11,208.07	11,243.80	10,948.43	11,100.63
Inventories - Non-farm	22.34	18.44	19.45	19.95	19.74	23.70	22.47	22.46	19.84	18.84	16.44
Land	198,897.36	198,900.14	198,900.79	198,900.72	198,901.38	198,903.31	198,903.34	198,907.25	198,906.51	198,905.99	198,905.38
Machinery & equipment - Computers	82.26	106.10	123.12	130.69	142.19	153.73	170.08	174.61	175.42	166.49	157.17
Machinery & equipment - Electrical & Electronic Eqt	1,228.62	1,349.36	1,455.04	1,468.42	1,500.91	1,535.94	1,637.21	1,691.35	1,748.48	1,765.73	1,796.02
Machinery & equipment - Industrial Machinery & Equip	23,321.60	24,520.23	26,188.21	26,356.15	26,831.09	27,834.61	28,608.40	29,413.84	30,461.72	31,152.97	31,839.29
Machinery & equipment - Other Plant & Equipment	3,995.38	4,189.40	4,363.75	4,381.19	4,459.52	4,532.86	4,666.64	4,737.33	4,816.35	4,811.93	4,835.02
Machinery & equipment - Other Transport Equipment	1,151.22	1,165.58	1,198.66	1,156.88	1,139.88	1,097.71	1,134.68	1,141.08	1,159.71	1,155.28	1,190.10
Machinery & equipment - Road Vehicles	11,745.32	12,595.29	12,991.93	13,396.68	14,049.39	14,615.56	15,546.42	16,168.59	16,841.27	17,473.03	18,257.76
Non-dwelling construction	59,784.54	61,096.87	62,279.12	63,746.95	63,727.55	64,213.12	63,818.04	63,217.17	62,870.66	62,604.15	62,419.47
Ownership transfer costs	6,123.36	6,004.26	5,756.60	5,595.87	5,267.67	4,897.67	4,508.93	4,146.37	3,884.70	3,697.02	3,550.09

Appendix A.2 - Productive Capital Stock ($ million) - Secondary Sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Secondary (Incorporated)												
Intellectual propery products - Computer software	626.73	695.91	782.90	897.80	994.71	1,072.90	1,147.64	1,246.60	1,353.88	1,497.89	1,639.72	1,759.59
Intellectual propery products - Research & development	10,443.01	11,583.71	12,495.85	13,210.31	13,720.44	14,077.54	14,636.01	15,525.23	16,594.67	17,864.89	19,277.56	21,607.66
Inventories - Non-farm	38,383.29	41,201.17	40,952.59	43,081.91	47,353.47	48,669.86	48,800.46	50,487.30	50,747.62	51,670.52	50,700.70	50,038.26
Land	22,266.14	22,468.65	22,738.48	23,301.81	23,482.59	23,854.00	23,978.25	23,965.19	24,513.81	25,202.00	26,229.04	27,251.45
Machinery & equipment - Computers	78.67	105.21	131.77	186.92	233.23	290.37	317.42	355.92	437.78	570.07	691.75	834.63
Machinery & equipment - Electrical & Electronic Eqt	1,418.83	1,528.55	1,598.56	1,785.22	1,842.78	1,942.31	1,995.92	2,101.30	2,409.14	2,834.83	3,288.78	3,794.13
Machinery & equipment - Industrial Machinery & Equip	73,820.89	74,243.46	74,295.75	73,662.02	72,996.04	72,893.99	72,682.10	72,443.84	73,233.66	74,476.10	76,527.22	80,020.00
Machinery & equipment - Other Plant & Equipment	11,887.49	13,114.98	13,957.59	14,655.50	14,931.76	15,298.92	15,505.82	15,672.15	15,876.31	16,234.71	16,450.60	16,823.69
Machinery & equipment - Other Transport Equipment	1,469.50	1,982.79	2,275.91	2,367.08	2,418.15	2,495.34	2,663.31	2,610.03	2,551.49	2,583.24	2,606.46	2,604.05
Machinery & equipment - Road Vehicles	8,875.20	9,227.81	9,407.32	9,719.43	9,900.91	10,153.34	10,023.65	9,985.01	10,003.79	10,071.72	10,214.06	10,481.89
Non-dwelling construction	73,395.12	74,652.06	76,233.59	79,293.66	80,552.94	82,775.69	83,779.11	84,083.79	87,277.91	91,320.51	97,376.56	103,737.13
Ownership transfer costs	8,395.67	8,429.94	8,505.77	8,769.08	8,794.53	9,018.13	9,133.23	9,238.81	9,645.75	10,100.93	10,600.06	10,943.21
Secondary (Unincorporated)												
Intellectual propery products - Computer software	217.35	239.95	256.47	287.07	311.45	331.28	351.54	379.22	406.30	444.19	484.17	517.48
Intellectual propery products - Research & development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inventories - Non-farm	2,780.17	2,880.37	2,782.27	2,870.00	3,089.19	3,133.13	3,106.95	3,158.73	3,153.42	3,145.80	3,010.96	2,901.60
Land	2,975.69	2,980.80	2,977.56	2,990.84	3,043.53	3,063.35	3,054.52	3,051.91	3,041.84	3,032.76	3,044.78	3,056.45
Machinery & equipment - Computers	16.15	21.78	25.52	35.02	44.28	55.71	65.22	78.29	104.39	140.37	182.30	228.31
Machinery & equipment - Electrical & Electronic Eqt	121.38	133.62	136.82	151.85	157.58	166.68	176.70	192.71	235.24	289.09	355.98	427.60
Machinery & equipment - Industrial Machinery & Equip	5,070.63	5,188.53	5,144.03	5,088.56	5,070.35	5,083.75	5,244.15	5,417.28	5,720.55	6,013.24	6,567.03	7,249.92
Machinery & equipment - Other Plant & Equipment	1,817.98	2,000.51	2,089.83	2,163.84	2,200.83	2,251.03	2,335.92	2,418.60	2,524.59	2,642.48	2,782.45	2,947.33
Machinery & equipment - Other Transport Equipment	372.34	551.15	625.14	653.85	676.45	703.81	784.75	786.22	788.88	822.84	864.54	894.99
Machinery & equipment - Road Vehicles	6,119.45	6,482.27	6,567.39	6,791.15	6,962.90	7,177.94	7,202.18	7,310.79	7,498.43	7,689.31	8,049.39	8,501.09
Non-dwelling construction	12,803.79	12,955.91	13,026.41	13,226.08	13,730.18	13,985.27	14,049.03	14,152.95	14,184.78	14,213.50	14,379.48	14,529.29
Ownership transfer costs	1,467.88	1,466.24	1,456.59	1,465.67	1,502.12	1,526.70	1,534.49	1,558.01	1,570.34	1,574.51	1,567.25	1,534.33

Appendix A.2 - Productive Capital Stock ($ million) - Secondary Sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Secondary (Incorporated)											
Intellectual propery products - Computer software	1,893.20	2,095.17	2,342.52	2,642.92	2,799.61	2,987.32	3,169.47	3,198.81	3,306.77	3,531.33	3,799.18
Intellectual propery products - Research & development	23,857.94	26,569.94	28,443.27	30,102.21	31,992.00	33,648.90	35,189.05	36,608.89	37,080.00	36,673.73	36,433.11
Inventories - Non-farm	50,746.58	52,835.69	50,030.30	48,993.55	49,481.63	47,800.46	48,196.86	45,752.02	44,062.82	41,342.56	41,000.40
Land	27,893.84	28,483.67	29,041.51	29,418.03	29,975.59	30,683.28	30,839.38	30,882.17	30,835.85	30,639.04	30,591.73
Machinery & equipment - Computers	990.70	1,279.98	1,375.56	1,650.13	1,886.46	2,050.16	2,194.31	2,140.96	2,055.11	1,884.54	1,746.04
Machinery & equipment - Electrical & Electronic Eqt	4,276.62	4,754.07	5,014.82	5,356.00	5,669.10	5,906.05	6,345.53	6,469.61	6,635.36	6,632.83	6,719.24
Machinery & equipment - Industrial Machinery & Equip	81,411.89	83,686.71	84,544.31	84,444.06	84,484.09	85,467.17	84,355.60	82,879.15	81,628.09	80,267.12	78,962.04
Machinery & equipment - Other Plant & Equipment	16,867.76	17,190.97	16,821.38	16,650.57	16,433.71	16,110.82	15,889.56	15,387.89	14,925.46	14,380.20	13,978.90
Machinery & equipment - Other Transport Equipment	2,501.52	2,512.18	2,505.46	2,485.47	2,494.85	2,401.11	2,547.31	2,564.78	2,646.66	2,652.87	2,795.20
Machinery & equipment - Road Vehicles	10,744.75	11,666.67	11,906.04	13,393.40	14,798.24	15,749.06	16,966.52	17,567.26	18,345.87	19,033.16	19,988.85
Non-dwelling construction	108,184.11	112,453.32	116,672.29	119,873.93	124,296.59	129,822.39	131,840.05	133,143.16	133,860.12	133,572.97	134,249.32
Ownership transfer costs	11,079.68	11,050.49	10,785.52	10,523.31	10,274.66	9,902.06	9,315.14	8,732.93	8,271.10	7,888.01	7,635.39
Secondary (Unincorporated)											
Intellectual propery products - Computer software	554.77	501.13	464.58	436.29	530.73	509.74	511.91	481.95	467.31	464.87	482.90
Intellectual propery products - Research & development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inventories - Non-farm	2,883.51	2,885.67	2,783.70	2,807.91	2,770.03	2,552.12	2,600.29	2,465.65	2,332.96	2,204.48	2,154.85
Land	3,055.75	3,003.91	3,000.43	3,013.50	3,001.58	2,969.58	2,920.88	2,874.81	2,820.63	2,777.01	2,731.38
Machinery & equipment - Computers	280.73	344.88	387.20	436.28	432.84	427.03	422.43	417.45	416.00	410.30	402.53
Machinery & equipment - Electrical & Electronic Eqt	500.90	543.41	576.25	588.50	581.90	575.19	568.56	565.46	575.99	580.49	589.01
Machinery & equipment - Industrial Machinery & Equip	7,756.77	8,209.71	8,813.35	9,069.45	8,989.05	9,032.64	8,883.61	8,891.87	9,059.99	9,241.18	9,370.50
Machinery & equipment - Other Plant & Equipment	3,049.47	3,153.77	3,250.24	3,298.83	3,189.22	3,058.14	3,026.34	2,977.65	2,904.38	2,836.56	2,779.49
Machinery & equipment - Other Transport Equipment	881.91	886.14	900.51	870.96	827.34	772.32	747.39	731.99	748.15	757.69	801.44
Machinery & equipment - Road Vehicles	8,980.15	9,637.36	9,912.23	10,532.27	10,751.93	10,922.61	10,986.40	11,178.08	11,621.06	12,211.83	12,875.57
Non-dwelling construction	14,641.64	14,465.20	14,547.61	14,732.18	14,766.69	14,662.16	14,441.59	14,206.03	13,898.44	13,644.60	13,368.62
Ownership transfer costs	1,500.76	1,422.08	1,344.97	1,293.13	1,220.34	1,117.99	1,020.04	931.54	858.68	805.77	760.34

Appendix A.3 - Productive Capital Stock ($ million) - Services (Market) Sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Services - Market (Incorporated)												
Intellectual propery products - Artistic Originals	20.32	24.44	29.39	33.27	36.82	43.68	52.52	58.64	67.48	76.90	85.15	90.93
Intellectual propery products - Computer software	4,168.40	4,557.92	5,376.04	6,180.79	7,200.39	8,308.98	9,463.79	10,452.09	11,528.66	12,964.94	14,129.37	15,176.44
Intellectual propery products - Research & development	9,754.89	10,899.73	11,865.08	12,390.99	12,916.52	13,303.41	13,918.74	14,771.69	15,651.60	16,634.91	17,716.84	18,961.97
Inventories - Non-farm	89,342.33	91,278.35	95,446.45	98,714.83	103,956.44	107,381.88	110,547.98	110,198.79	115,195.32	119,513.16	123,773.56	127,475.05
Land	201,151.60	203,444.58	205,516.47	207,447.12	209,877.96	212,401.37	213,817.93	215,917.63	217,975.40	220,708.94	224,269.06	228,120.44
Machinery & equipment - Computers	1,646.57	1,764.93	1,957.36	2,245.58	2,505.40	2,864.63	3,337.99	3,817.08	4,603.66	5,687.31	6,944.95	8,415.91
Machinery & equipment - Electrical & Electronic Eqt	9,807.49	10,239.40	10,898.79	11,534.05	12,351.41	13,951.12	16,191.62	18,070.14	20,394.91	22,857.85	25,823.99	29,133.32
Machinery & equipment - Industrial Machinery & Equip	29,819.18	29,364.91	29,202.48	28,810.81	29,085.09	29,949.49	31,556.12	32,623.94	33,667.74	34,862.55	36,923.10	39,644.17
Machinery & equipment - Other Plant & Equipment	19,260.72	19,446.28	19,904.76	20,180.84	21,155.63	22,653.83	24,601.58	26,076.47	27,313.92	28,751.00	30,218.85	32,035.06
Machinery & equipment - Other Transport Equipment	43,051.45	43,288.59	43,840.16	43,778.12	44,078.40	44,123.41	43,081.39	43,441.20	45,020.12	47,078.86	48,896.05	51,797.44
Machinery & equipment - Road Vehicles	183,505.44	187,924.38	194,574.10	201,768.24	209,271.33	215,781.27	221,127.25	225,154.74	229,120.68	233,681.10	238,186.88	242,464.17
Non-dwelling construction	680,829.41	695,674.18	709,659.26	723,174.05	739,416.53	756,254.70	767,040.27	781,405.16	795,233.92	811,811.00	832,092.16	853,527.63
Ownership transfer costs	75,729.01	76,402.63	76,995.71	77,745.04	78,469.61	80,075.34	81,242.51	83,399.38	85,358.08	87,211.90	88,036.58	87,620.07
Services - Market (Unincorporated)												
Intellectual propery products - Artistic Originals	99.28	90.23	103.86	118.93	138.66	160.72	191.93	210.87	224.91	234.99	245.39	256.78
Intellectual propery products - Computer software	376.99	390.08	424.44	486.24	550.36	617.06	704.52	775.65	927.16	1,095.41	1,255.63	1,383.33
Intellectual propery products - Research & development	627.86	666.50	727.22	775.43	811.48	825.91	849.69	895.37	984.74	1,101.48	1,277.24	1,528.65
Inventories - Non-farm	43,456.09	43,739.29	44,695.58	45,252.43	46,555.99	47,624.78	48,769.13	48,813.06	49,829.50	50,475.21	51,245.21	51,998.84
Land	4,070.34	4,204.48	4,296.70	4,381.18	4,536.33	4,729.38	4,844.91	4,934.63	5,082.42	5,300.03	5,538.94	5,818.66
Machinery & equipment - Computers	258.86	282.98	317.76	375.92	426.38	493.89	574.37	669.71	847.12	1,107.63	1,409.40	1,755.82
Machinery & equipment - Electrical & Electronic Eqt	2,141.53	2,204.98	2,321.64	2,400.11	2,506.65	2,651.00	2,936.71	3,193.85	3,539.98	3,964.46	4,551.33	5,267.39
Machinery & equipment - Industrial Machinery & Equip	3,486.81	3,617.70	3,825.96	3,957.23	4,130.56	4,349.61	4,782.18	5,164.88	5,550.10	5,987.81	6,607.23	7,363.19
Machinery & equipment - Other Plant & Equipment	3,591.21	3,864.24	4,155.30	4,376.46	4,733.08	5,082.83	5,619.91	6,049.61	6,533.77	7,173.94	7,913.68	8,718.65
Machinery & equipment - Other Transport Equipment	11,417.15	12,104.71	13,193.20	14,031.30	15,215.20	16,406.87	17,598.20	18,607.61	20,046.10	22,081.23	24,356.66	27,205.22
Machinery & equipment - Road Vehicles	119,145.84	121,148.60	125,109.28	128,554.89	133,060.57	139,570.39	144,577.52	148,347.86	152,682.62	157,182.70	161,942.59	166,285.66
Non-dwelling construction	26,699.27	27,506.03	28,276.91	28,924.33	29,962.32	31,564.52	32,561.91	33,338.20	34,155.74	34,856.46	35,343.07	35,489.05
Ownership transfer costs	1,643.79	1,705.46	1,738.83	1,767.20	1,826.97	1,929.49	1,979.03	2,026.22	2,073.69	2,104.34	2,106.06	2,074.79

Appendix A.3 - Productive Capital Stock ($ million) - Services (Market) Sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Services - Market (Incorporated)											
Intellectual propery products - Artistic Originals	102.93	117.36	131.07	143.37	153.45	150.76	146.13	146.03	151.09	159.33	168.34
Intellectual propery products - Computer software	16,400.48	17,943.35	19,359.44	20,933.88	22,497.02	24,826.83	26,977.41	28,615.16	30,577.92	33,269.00	36,374.16
Intellectual propery products - Research & development	20,422.62	22,104.14	23,790.78	26,228.83	28,998.08	32,330.95	35,522.48	38,730.99	41,217.45	43,394.37	45,284.43
Inventories - Non-farm	129,999.24	136,717.07	135,755.00	136,301.34	138,427.37	141,484.23	142,128.59	142,244.96	145,508.95	148,676.95	152,086.73
Land	232,573.73	237,882.06	243,976.85	249,469.18	253,692.74	257,751.00	261,380.85	264,939.73	267,809.29	270,559.53	273,902.04
Machinery & equipment - Computers	9,959.50	11,595.87	12,889.69	14,056.72	15,010.23	16,150.90	17,135.48	17,787.18	18,280.51	18,603.30	18,953.78
Machinery & equipment - Electrical & Electronic Eqt	32,467.26	35,867.11	38,992.31	41,216.75	43,387.30	45,938.69	48,164.64	49,949.56	51,366.53	53,019.15	54,563.50
Machinery & equipment - Industrial Machinery & Equip	41,642.80	44,377.78	47,864.80	49,646.53	51,321.15	54,100.89	55,698.19	57,272.43	58,834.79	60,836.16	62,189.68
Machinery & equipment - Other Plant & Equipment	33,590.98	35,914.03	38,220.21	40,420.19	42,669.42	45,372.31	47,425.10	49,072.61	50,210.87	51,281.06	52,186.22
Machinery & equipment - Other Transport Equipment	53,722.13	57,565.95	61,812.09	67,433.74	72,675.08	77,663.67	82,849.84	87,205.64	91,288.12	95,263.46	98,918.41
Machinery & equipment - Road Vehicles	247,857.59	253,860.59	258,072.77	264,805.01	271,835.05	278,616.77	284,081.96	289,170.04	294,572.76	301,569.86	308,096.16
Non-dwelling construction	878,568.30	907,892.23	943,612.55	975,874.35	1,003,071.04	1,029,075.28	1,054,029.52	1,080,227.15	1,103,379.28	1,126,878.84	1,155,934.69
Ownership transfer costs	87,657.74	87,048.09	85,294.47	83,894.76	81,317.23	77,111.72	73,274.31	69,807.31	67,234.56	65,669.14	64,914.40
Services - Market (Unincorporated)											
Intellectual propery products - Artistic Originals	265.36	272.83	282.34	297.15	314.07	315.35	318.26	330.70	351.64	377.49	405.71
Intellectual propery products - Computer software	1,506.49	1,602.74	1,624.29	1,720.31	1,948.32	2,343.60	2,614.72	2,710.26	2,911.44	2,911.01	3,068.09
Intellectual propery products - Research & development	1,784.18	2,066.04	2,296.05	2,490.34	2,681.31	2,907.91	3,182.92	3,491.78	3,756.62	3,967.14	4,150.63
Inventories - Non-farm	52,676.44	53,695.01	53,812.63	54,083.35	54,386.98	54,198.31	54,227.00	53,960.54	54,781.64	55,402.97	55,943.51
Land	6,196.92	6,393.89	6,641.85	6,587.93	6,506.95	6,425.27	6,382.56	6,206.04	6,100.35	6,069.73	6,053.67
Machinery & equipment - Computers	2,126.60	2,310.99	2,498.46	2,498.22	2,465.19	2,442.12	2,459.27	2,401.44	2,419.86	2,347.79	2,293.32
Machinery & equipment - Electrical & Electronic Eqt	5,919.21	6,244.56	6,825.04	6,835.14	6,873.78	7,021.07	7,072.28	7,034.46	7,113.75	7,101.81	7,052.45
Machinery & equipment - Industrial Machinery & Equip	7,978.09	8,250.72	8,699.11	8,641.51	8,545.04	8,568.43	8,455.95	8,214.46	8,136.57	7,938.42	7,738.65
Machinery & equipment - Other Plant & Equipment	9,308.71	9,549.07	9,907.69	9,831.46	9,703.00	9,495.43	9,364.30	9,131.35	9,119.24	8,849.56	8,701.07
Machinery & equipment - Other Transport Equipment	29,993.87	32,284.02	34,434.55	34,656.58	34,974.20	35,080.60	35,910.32	35,755.92	35,559.83	35,150.63	34,968.98
Machinery & equipment - Road Vehicles	171,829.48	178,254.06	183,171.02	185,944.92	190,633.58	193,455.74	196,901.84	199,311.32	204,473.03	209,406.63	214,085.08
Non-dwelling construction	36,057.75	35,987.33	35,450.76	35,220.31	34,901.58	33,898.34	33,070.57	32,130.24	31,908.46	32,490.18	33,113.59
Ownership transfer costs	2,075.09	1,992.67	1,870.22	1,805.26	1,713.73	1,573.14	1,452.04	1,334.17	1,267.44	1,258.22	1,256.08

Appendix A.4 - Productive Capital Stock ($ million) - Distributive Services Sub-sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Distributive (Incorporated)												
Intellectual propery products - Computer software	2,436.52	2,737.24	3,205.94	3,488.54	3,887.17	4,223.77	4,529.60	4,779.18	4,898.12	5,360.26	5,652.22	5,995.53
Intellectual propery products - Research & development	3,061.35	3,433.48	3,724.23	3,930.71	4,203.98	4,473.85	5,026.15	5,622.28	6,112.86	6,481.62	6,884.68	7,276.33
Inventories - Non-farm	2,718.59	3,055.73	3,533.66	3,568.58	3,798.57	3,873.92	4,257.66	4,231.39	4,562.04	4,747.34	4,918.90	5,131.80
Land	172,353.69	174,152.97	175,880.63	177,427.54	179,126.92	180,722.47	181,681.48	183,396.93	184,943.20	187,136.34	190,041.19	193,205.32
Machinery & equipment - Computers	50.99	58.95	80.66	100.36	143.42	241.78	360.23	475.47	593.89	686.70	762.50	874.52
Machinery & equipment - Electrical & Electronic Eqt	5,610.50	5,931.66	6,373.80	6,702.67	7,206.53	8,474.72	10,214.22	11,644.11	13,226.46	14,655.89	16,295.12	18,011.91
Machinery & equipment - Industrial Machinery & Equip	10,107.68	9,618.57	9,175.20	8,728.81	8,732.36	9,254.81	10,086.43	10,597.63	11,127.11	11,561.52	11,994.98	12,697.15
Machinery & equipment - Other Plant & Equipment	11,708.80	11,463.10	11,410.14	11,239.88	11,562.78	12,361.42	13,597.98	14,522.32	15,272.18	15,970.05	16,482.24	17,232.49
Machinery & equipment - Other Transport Equipment	32,165.74	32,080.81	32,050.55	31,428.22	31,075.13	30,347.81	28,665.43	28,567.35	29,629.92	30,886.98	31,587.19	33,032.12
Machinery & equipment - Road Vehicles	9,885.32	9,719.60	9,791.52	9,859.10	10,095.11	10,576.94	11,192.51	11,646.04	12,257.63	12,808.89	13,623.46	14,695.87
Non-dwelling construction	556,689.56	567,881.59	578,852.79	589,233.44	600,541.52	611,256.63	618,887.63	630,471.22	641,277.09	655,574.45	673,920.94	694,090.65
Ownership transfer costs	63,679.73	64,126.91	64,585.56	65,163.31	65,565.30	66,594.35	67,468.38	69,273.80	70,872.45	72,512.92	73,360.59	73,219.49
Distributive (Unincorporated)												
Intellectual propery products - Computer software	34.46	38.72	43.58	47.81	51.18	56.19	59.33	62.34	68.62	76.51	84.56	91.34
Intellectual propery products - Research & development	8.87	10.57	12.65	14.29	16.40	19.40	23.56	26.84	29.33	32.14	34.76	36.83
Inventories - Non-farm	37.42	38.14	38.23	40.67	42.96	38.04	37.80	38.90	42.62	42.97	39.73	34.56
Land	236.55	251.89	266.45	277.63	288.81	298.28	306.78	317.33	327.34	353.95	383.75	409.18
Machinery & equipment - Computers	4.29	4.98	6.27	8.48	12.42	17.50	21.58	31.11	52.04	75.39	98.80	126.68
Machinery & equipment - Electrical & Electronic Eqt	126.48	129.69	134.76	143.98	152.81	167.80	183.45	216.06	298.95	388.80	484.30	596.71
Machinery & equipment - Industrial Machinery & Equip	363.63	358.75	357.65	350.86	355.04	363.33	380.67	418.57	485.38	541.04	614.70	710.04
Machinery & equipment - Other Plant & Equipment	478.12	497.00	521.31	531.33	556.79	591.74	645.31	736.46	867.66	981.53	1,102.85	1,245.68
Machinery & equipment - Other Transport Equipment	1,130.27	1,333.97	1,527.81	1,574.58	1,670.79	1,789.54	2,014.68	2,136.93	2,334.58	2,648.38	2,945.02	3,243.67
Machinery & equipment - Road Vehicles	4,556.61	4,502.60	4,513.74	4,516.98	4,646.59	4,826.70	4,810.37	5,085.44	5,621.83	6,084.15	6,623.55	7,353.74
Non-dwelling construction	376.12	442.24	507.87	563.01	621.75	668.93	718.09	778.62	837.61	989.10	1,159.72	1,311.12
Ownership transfer costs	46.05	52.27	58.37	63.47	68.55	73.45	78.52	85.44	92.22	108.28	124.85	137.15

Appendix A.4 - Productive Capital Stock ($ million) - Distributive Services Sub-sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Distributive (Incorporated)											
Intellectual propery products - Computer software	6,498.89	7,055.21	7,835.98	8,426.13	9,128.43	10,288.35	11,022.50	11,371.63	11,651.39	12,483.09	13,530.76
Intellectual propery products - Research & development	7,594.21	7,849.86	8,011.53	8,442.58	9,316.21	10,274.52	11,132.59	12,077.85	12,580.37	13,070.47	13,557.85
Inventories - Non-farm	5,786.42	6,178.10	6,550.82	6,415.19	6,633.53	6,608.48	6,596.52	6,533.90	6,539.31	6,536.80	6,407.04
Land	196,948.16	201,357.29	206,922.91	211,808.90	215,655.72	219,270.35	222,605.28	225,969.71	228,701.87	231,379.60	234,751.36
Machinery & equipment - Computers	1,011.16	1,326.49	1,616.46	1,793.74	2,067.72	2,409.99	2,584.40	2,611.59	2,508.55	2,528.03	2,503.03
Machinery & equipment - Electrical & Electronic Eqt	19,881.02	21,733.42	23,490.50	24,358.05	25,568.83	26,951.91	28,286.36	29,231.24	29,761.30	30,629.24	31,380.75
Machinery & equipment - Industrial Machinery & Equip	13,266.42	14,164.01	15,520.01	16,238.92	17,147.21	18,517.23	19,286.86	19,925.38	20,314.11	20,915.56	21,224.17
Machinery & equipment - Other Plant & Equipment	17,917.19	18,917.12	20,096.79	21,511.42	23,210.98	25,484.71	26,884.45	27,855.97	28,354.28	28,991.28	29,319.11
Machinery & equipment - Other Transport Equipment	33,533.60	35,194.86	38,445.93	41,212.74	44,270.63	47,346.27	50,805.30	53,664.34	56,074.72	57,890.50	59,044.88
Machinery & equipment - Road Vehicles	15,767.25	17,491.73	19,116.29	21,232.85	23,516.11	26,322.33	28,112.03	29,422.16	30,218.69	31,455.48	32,236.67
Non-dwelling construction	717,919.97	746,133.93	781,729.72	814,499.12	842,011.03	868,709.25	894,300.63	920,597.62	943,400.84	966,269.47	994,228.92
Ownership transfer costs	73,525.82	73,320.64	72,265.37	71,502.00	69,602.64	66,259.88	63,186.67	60,382.45	58,291.94	57,061.96	56,546.49
Distributive (Unincorporated)											
Intellectual propery products - Computer software	98.48	136.55	125.85	118.97	109.62	106.15	98.38	102.44	98.18	96.78	97.60
Intellectual propery products - Research & development	39.27	39.18	38.34	30.71	30.29	24.81	25.17	21.83	24.71	23.22	25.25
Inventories - Non-farm	37.34	27.91	33.85	31.18	26.76	25.35	25.34	23.80	27.04	29.95	27.84
Land	473.42	489.41	488.08	490.09	513.99	510.05	503.14	493.13	486.87	482.44	478.18
Machinery & equipment - Computers	154.06	162.20	153.65	150.36	138.43	147.32	155.65	147.83	153.78	138.60	123.52
Machinery & equipment - Electrical & Electronic Eqt	700.55	732.58	746.66	745.83	735.05	741.07	759.08	747.01	755.61	736.08	717.04
Machinery & equipment - Industrial Machinery & Equip	778.93	802.11	816.17	817.81	806.70	828.83	832.18	821.48	837.60	822.86	806.44
Machinery & equipment - Other Plant & Equipment	1,355.89	1,389.02	1,389.20	1,379.42	1,344.23	1,341.13	1,341.47	1,302.60	1,302.78	1,253.41	1,206.62
Machinery & equipment - Other Transport Equipment	3,336.04	3,353.20	3,325.34	3,236.90	3,122.63	3,022.94	3,037.18	2,948.34	2,967.65	2,846.97	2,777.71
Machinery & equipment - Road Vehicles	8,000.21	8,321.27	8,253.46	8,444.55	8,462.13	8,747.23	8,997.68	8,951.08	9,203.89	9,103.61	9,045.03
Non-dwelling construction	1,677.96	1,798.98	1,826.10	1,865.79	2,034.22	2,046.25	2,039.25	2,011.12	2,001.73	2,002.46	2,001.22
Ownership transfer costs	171.94	177.09	168.80	163.67	168.17	156.02	143.99	131.82	123.62	118.26	113.81

Appendix A.5 - Productive Capital Stock ($ million) - Producer Services Sub-sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Producer (Incorporated)												
Intellectual propery products - Computer software	1,267.21	1,346.81	1,665.43	2,138.55	2,692.77	3,398.58	4,159.84	4,815.31	5,650.17	6,479.65	7,217.66	7,813.01
Intellectual propery products - Research & development	6,128.11	6,851.40	7,485.22	7,772.13	7,998.96	8,096.22	8,135.38	8,358.32	8,696.27	9,261.76	9,890.29	10,687.44
Inventories - Non-farm	59,109.31	60,037.74	61,596.47	64,064.01	66,062.57	68,749.93	69,735.16	70,104.50	73,419.57	76,560.99	79,841.90	82,203.98
Land	9,182.97	9,167.03	9,216.50	9,308.39	9,408.37	9,546.67	9,661.70	9,774.24	9,959.99	10,260.11	10,713.62	11,188.39
Machinery & equipment - Computers	947.88	986.20	1,050.30	1,215.06	1,322.27	1,464.08	1,647.97	1,832.15	2,248.78	2,899.37	3,676.96	4,578.11
Machinery & equipment - Electrical & Electronic Eqt	2,796.81	2,847.71	2,991.40	3,165.60	3,320.82	3,484.48	3,807.81	4,062.69	4,480.31	5,054.02	5,831.96	6,810.78
Machinery & equipment - Industrial Machinery & Equip	16,006.25	15,962.18	16,208.18	16,230.59	16,316.94	16,519.18	17,063.93	17,420.54	17,718.21	18,193.99	19,354.83	20,833.01
Machinery & equipment - Other Plant & Equipment	2,738.57	2,870.92	3,068.09	3,205.87	3,311.85	3,415.43	3,587.74	3,657.86	3,711.10	3,856.76	4,075.28	4,327.70
Machinery & equipment - Other Transport Equipment	9,274.31	9,428.40	9,832.99	10,308.10	10,808.15	11,417.07	11,883.84	12,217.59	12,648.55	13,316.92	14,282.34	15,543.66
Machinery & equipment - Road Vehicles	140,980.77	142,647.90	145,764.52	149,899.82	153,428.10	158,029.80	161,687.62	164,064.85	166,239.39	168,399.47	170,647.62	172,107.10
Non-dwelling construction	56,437.56	56,465.81	56,924.13	57,610.76	58,092.30	58,881.54	59,303.49	59,780.79	60,156.26	60,314.19	60,465.23	59,934.18
Ownership transfer costs	4,685.05	4,628.38	4,606.56	4,607.71	4,582.24	4,608.47	4,610.81	4,654.59	4,683.68	4,675.88	4,623.05	4,467.75
Producers (Unincorporated)												
Intellectual propery products - Computer software	121.51	139.14	163.33	199.18	226.22	253.40	294.33	325.19	409.97	502.41	589.32	657.77
Intellectual propery products - Research & development	583.35	618.81	676.75	721.70	756.04	769.88	791.44	836.93	924.04	1,037.34	1,206.58	1,453.09
Inventories - Non-farm	37,195.47	37,448.68	38,070.60	38,606.30	39,267.39	40,314.48	41,023.42	41,386.90	42,071.81	42,752.41	43,429.11	43,905.02
Land	672.62	675.57	690.03	715.98	751.56	792.49	843.34	894.20	996.82	1,170.48	1,358.49	1,585.87
Machinery & equipment - Computers	157.89	168.72	186.92	217.81	238.52	266.95	305.20	346.98	433.41	561.69	709.37	885.06
Machinery & equipment - Electrical & Electronic Eqt	1,419.66	1,455.37	1,535.19	1,578.13	1,643.07	1,731.10	1,932.16	2,093.65	2,267.62	2,466.21	2,778.98	3,185.79
Machinery & equipment - Industrial Machinery & Equip	1,887.97	2,009.08	2,197.97	2,323.70	2,441.00	2,591.88	2,891.16	3,129.11	3,336.20	3,588.34	3,933.58	4,354.70
Machinery & equipment - Other Plant & Equipment	481.78	571.60	676.55	717.44	767.69	817.65	961.41	994.48	1,035.93	1,145.74	1,258.69	1,374.56
Machinery & equipment - Other Transport Equipment	8,716.00	9,067.59	9,789.37	10,475.36	11,434.82	12,341.72	13,143.27	13,897.00	15,046.36	16,633.11	18,429.43	20,775.04
Machinery & equipment - Road Vehicles	108,568.59	110,509.42	114,286.38	117,433.32	121,444.45	127,311.17	132,184.96	135,509.79	138,978.00	142,701.03	146,475.29	149,530.00
Non-dwelling construction	15,785.86	15,811.71	16,067.10	16,291.24	16,549.68	17,149.31	17,659.40	18,113.37	18,556.90	18,946.88	19,094.76	18,890.23
Ownership transfer costs	403.10	393.55	386.76	382.12	375.62	373.58	370.13	370.09	369.07	365.40	358.23	343.63

Appendix A.5 - Productive Capital Stock ($ million) - Producer Services Sub-sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Producer (Incorporated)											
Intellectual propery products - Computer software	8,419.94	9,251.61	9,729.99	10,486.91	11,109.32	11,932.93	12,838.65	13,586.30	14,986.10	16,508.48	18,274.75
Intellectual propery products - Research & development	11,735.79	13,077.83	14,514.97	16,414.70	18,230.77	20,454.82	22,553.00	24,508.60	26,217.87	27,662.23	28,845.94
Inventories - Non-farm	83,665.87	88,617.38	87,197.54	86,460.21	87,655.42	90,773.00	90,660.52	90,466.24	91,472.39	93,229.25	95,264.09
Land	11,682.31	12,330.58	12,668.36	13,183.36	13,462.46	13,837.84	14,080.93	14,148.23	14,140.23	14,203.44	14,116.61
Machinery & equipment - Computers	5,488.37	6,213.47	6,691.07	7,228.71	7,604.62	7,966.06	8,372.56	8,541.50	8,746.95	8,924.41	9,121.49
Machinery & equipment - Electrical & Electronic Eqt	7,686.79	8,605.72	9,392.90	10,400.73	11,072.21	11,909.44	12,380.32	12,768.76	13,234.84	13,737.42	14,202.14
Machinery & equipment - Industrial Machinery & Equip	21,863.64	23,040.61	24,377.30	24,996.83	25,383.83	26,312.16	26,782.57	27,129.91	27,733.92	28,662.20	29,290.74
Machinery & equipment - Other Plant & Equipment	4,475.86	4,707.02	4,889.24	5,015.79	5,093.98	5,164.83	5,288.70	5,300.55	5,364.83	5,441.01	5,573.95
Machinery & equipment - Other Transport Equipment	16,794.18	18,630.12	19,354.70	21,830.34	23,742.15	25,306.24	26,730.64	27,838.10	29,114.86	30,945.52	33,056.96
Machinery & equipment - Road Vehicles	174,573.10	176,060.92	176,345.47	178,174.79	180,237.55	181,449.98	182,483.15	183,891.60	186,032.75	188,923.94	191,510.45
Non-dwelling construction	59,358.32	58,733.15	57,585.23	56,475.75	55,323.23	54,313.41	53,186.62	52,231.99	51,430.21	51,345.02	51,361.30
Ownership transfer costs	4,306.12	4,127.81	3,867.21	3,632.68	3,385.95	3,126.56	2,882.17	2,665.60	2,495.52	2,400.01	2,327.61
Producers (Unincorporated)											
Intellectual propery products - Computer software	721.14	738.44	800.28	880.54	1,037.77	1,324.88	1,535.69	1,585.09	1,668.96	1,632.44	1,684.92
Intellectual propery products - Research & development	1,698.46	1,976.46	2,204.38	2,402.91	2,592.64	2,820.84	3,087.29	3,387.33	3,638.50	3,841.16	4,014.21
Inventories - Non-farm	44,500.33	45,496.40	45,937.26	45,987.05	46,565.53	46,854.52	47,081.27	47,078.15	47,573.23	48,041.06	48,514.90
Land	1,858.38	2,045.11	2,295.64	2,191.08	2,081.82	2,020.67	1,991.48	1,849.41	1,717.52	1,590.99	1,478.39
Machinery & equipment - Computers	1,069.35	1,154.04	1,269.19	1,267.63	1,264.95	1,261.90	1,272.45	1,227.18	1,186.46	1,132.17	1,078.48
Machinery & equipment - Electrical & Electronic Eqt	3,539.17	3,715.43	4,064.60	4,024.77	4,008.29	4,112.34	4,077.12	3,968.92	3,902.00	3,852.10	3,743.54
Machinery & equipment - Industrial Machinery & Equip	4,721.56	4,904.84	5,222.52	5,177.54	5,126.24	5,135.44	5,078.68	4,889.56	4,762.32	4,601.45	4,424.88
Machinery & equipment - Other Plant & Equipment	1,423.04	1,464.93	1,567.24	1,527.62	1,488.45	1,416.10	1,407.46	1,347.71	1,291.33	1,219.13	1,169.32
Machinery & equipment - Other Transport Equipment	23,247.05	25,329.66	27,317.26	27,491.38	27,740.52	27,832.70	28,432.70	28,151.11	27,636.14	27,168.06	26,780.55
Machinery & equipment - Road Vehicles	153,784.60	158,943.75	163,549.38	165,396.33	169,417.44	171,729.45	174,459.56	176,372.58	180,725.42	185,015.46	188,999.37
Non-dwelling construction	18,821.59	18,607.23	18,073.66	17,375.54	16,782.02	15,803.46	14,992.73	14,193.19	13,753.09	13,508.95	13,325.37
Ownership transfer costs	328.96	307.58	285.90	263.15	241.38	216.35	197.36	179.83	166.62	158.65	152.18

Appendix A.6 - Productive Capital Stock ($ million) - Personal Services Sub-sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Social (Incorporated)												
Intellectual propery products - Artistic Originals	20.32	24.44	29.39	33.27	36.82	43.68	52.52	58.64	67.48	76.90	85.15	90.93
Intellectual propery products - Computer software	464.67	473.87	504.67	553.70	620.45	686.63	774.35	857.60	980.37	1,125.03	1,259.49	1,367.90
Intellectual propery products - Research & development	565.43	614.85	655.63	688.15	713.58	733.34	757.21	791.09	842.47	891.53	941.87	998.20
Inventories - Non-farm	27,514.43	28,184.88	30,316.32	31,082.24	34,095.30	34,758.03	36,555.16	35,862.90	37,213.71	38,204.83	39,012.76	40,139.27
Land	19,614.94	20,124.58	20,419.34	20,711.19	21,342.67	22,132.23	22,474.75	22,746.46	23,072.21	23,312.49	23,514.25	23,726.73
Machinery & equipment - Computers	647.70	719.78	826.40	930.16	1,039.71	1,158.77	1,329.79	1,509.46	1,760.99	2,101.24	2,505.49	2,963.28
Machinery & equipment - Electrical & Electronic Eqt	1,400.18	1,460.03	1,533.59	1,665.78	1,824.06	1,991.92	2,169.59	2,363.34	2,688.14	3,147.94	3,696.91	4,310.63
Machinery & equipment - Industrial Machinery & Equip	3,705.25	3,784.16	3,819.10	3,851.41	4,035.79	4,175.50	4,405.76	4,605.77	4,822.42	5,107.04	5,573.29	6,114.01
Machinery & equipment - Other Plant & Equipment	4,813.35	5,112.26	5,426.53	5,735.09	6,281.00	6,876.98	7,415.86	7,896.29	8,330.64	8,924.19	9,661.33	10,474.87
Machinery & equipment - Other Transport Equipment	1,611.40	1,779.38	1,956.62	2,041.80	2,195.12	2,358.53	2,532.12	2,656.26	2,741.65	2,874.96	3,026.52	3,221.66
Machinery & equipment - Road Vehicles	32,639.35	35,556.88	39,018.06	42,009.32	45,748.12	47,174.53	48,247.12	49,443.85	50,623.66	52,472.74	53,915.80	55,661.20
Non-dwelling construction	67,702.29	71,326.78	73,882.34	76,329.85	80,782.71	86,116.53	88,849.15	91,153.15	93,800.57	95,922.36	97,705.99	99,502.80
Ownership transfer costs	7,364.23	7,647.34	7,803.59	7,974.02	8,322.07	8,872.52	9,163.32	9,470.99	9,801.95	10,023.10	10,052.94	9,932.83
Social (Unincorporated)												
Intellectual propery products - Artistic Originals	99.28	90.23	103.86	118.93	138.66	160.72	191.93	210.87	224.91	234.99	245.39	256.78
Intellectual propery products - Computer software	221.02	212.22	217.53	239.25	272.96	307.47	350.86	388.12	448.57	516.49	581.75	634.22
Intellectual propery products - Research & development	35.64	37.12	37.82	39.44	39.04	36.63	34.69	31.60	31.37	32.00	35.90	38.73
Inventories - Non-farm	6,223.20	6,252.47	6,586.75	6,605.46	7,245.64	7,272.26	7,707.91	7,387.26	7,715.07	7,679.83	7,776.37	8,059.26
Land	3,161.17	3,277.02	3,340.22	3,387.57	3,495.96	3,638.61	3,694.79	3,723.10	3,758.26	3,775.60	3,796.70	3,823.61
Machinery & equipment - Computers	96.68	109.28	124.57	149.63	175.44	209.44	247.59	291.62	361.67	470.55	601.23	744.08
Machinery & equipment - Electrical & Electronic Eqt	595.39	619.92	651.69	678.00	710.77	752.10	821.10	884.14	973.41	1,109.45	1,288.05	1,484.89
Machinery & equipment - Industrial Machinery & Equip	1,235.21	1,249.87	1,270.34	1,282.67	1,334.52	1,394.40	1,510.35	1,617.20	1,728.52	1,858.43	2,058.95	2,298.45
Machinery & equipment - Other Plant & Equipment	2,631.31	2,795.64	2,957.44	3,127.69	3,408.60	3,673.44	4,013.19	4,318.67	4,630.18	5,046.67	5,552.14	6,098.41
Machinery & equipment - Other Transport Equipment	1,570.88	1,703.15	1,876.02	1,981.36	2,109.59	2,275.61	2,440.25	2,573.68	2,665.16	2,799.74	2,982.21	3,186.51
Machinery & equipment - Road Vehicles	6,020.64	6,136.58	6,309.16	6,604.59	6,969.53	7,432.52	7,582.19	7,752.63	8,082.79	8,397.52	8,843.75	9,401.92
Non-dwelling construction	10,537.29	11,252.08	11,701.94	12,070.08	12,790.89	13,746.28	14,184.42	14,446.21	14,761.23	14,920.48	15,088.59	15,287.70
Ownership transfer costs	1,194.64	1,259.64	1,293.70	1,321.61	1,382.80	1,482.46	1,530.38	1,570.69	1,612.40	1,630.66	1,622.98	1,594.01

Appendix A.6 - Productive Capital Stock ($ million) - Personal Services Sub-sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Social (Incorporated)											
Intellectual propery products - Artistic Originals	102.93	117.36	131.07	143.37	153.45	150.76	146.13	146.03	151.09	159.33	168.34
Intellectual propery products - Computer software	1,481.65	1,636.53	1,793.47	2,020.84	2,259.27	2,605.55	3,116.26	3,657.23	3,940.43	4,277.43	4,568.65
Intellectual propery products - Research & development	1,092.62	1,176.45	1,264.28	1,371.55	1,451.10	1,601.61	1,836.89	2,144.54	2,419.21	2,661.67	2,880.64
Inventories - Non-farm	40,546.95	41,921.59	42,006.64	43,425.94	44,138.42	44,102.75	44,871.55	45,244.82	47,497.25	48,910.90	50,415.60
Land	23,943.26	24,194.19	24,385.58	24,476.92	24,574.56	24,642.81	24,694.64	24,821.79	24,967.19	24,976.49	25,034.07
Machinery & equipment - Computers	3,459.97	4,055.91	4,582.16	5,034.27	5,337.89	5,774.85	6,178.52	6,634.09	7,025.01	7,150.86	7,329.26
Machinery & equipment - Electrical & Electronic Eqt	4,899.45	5,527.97	6,108.91	6,457.97	6,746.26	7,077.34	7,497.96	7,949.56	8,370.39	8,652.49	8,980.61
Machinery & equipment - Industrial Machinery & Equip	6,512.74	7,173.16	7,967.49	8,410.78	8,790.11	9,271.50	9,628.76	10,217.14	10,786.76	11,258.40	11,674.77
Machinery & equipment - Other Plant & Equipment	11,197.93	12,289.89	13,234.18	13,892.98	14,364.46	14,722.77	15,251.95	15,916.09	16,491.76	16,848.77	17,293.16
Machinery & equipment - Other Transport Equipment	3,394.35	3,740.97	4,011.46	4,390.66	4,662.30	5,011.16	5,313.90	5,703.20	6,098.54	6,427.44	6,816.57
Machinery & equipment - Road Vehicles	57,517.24	60,307.94	62,611.01	65,397.37	68,081.39	70,844.46	73,486.78	75,856.28	78,321.32	81,190.44	84,349.04
Non-dwelling construction	101,290.01	103,025.15	104,297.60	104,899.48	105,736.78	106,052.62	106,542.27	107,397.54	108,548.23	109,264.35	110,344.47
Ownership transfer costs	9,825.80	9,599.64	9,161.89	8,760.08	8,328.64	7,725.28	7,205.47	6,759.26	6,447.10	6,207.17	6,040.30
Social (Unincorporated)											
Intellectual propery products - Artistic Originals	265.36	272.83	282.34	297.15	314.07	315.35	318.26	330.70	351.64	377.49	405.71
Intellectual propery products - Computer software	686.87	727.75	698.16	720.80	800.93	912.57	980.65	1,022.73	1,144.30	1,181.79	1,285.57
Intellectual propery products - Research & development	46.45	50.40	53.33	56.72	58.38	62.26	70.46	82.62	93.41	102.76	111.17
Inventories - Non-farm	8,138.77	8,170.70	7,841.52	8,065.12	7,794.69	7,318.44	7,120.39	6,858.59	7,181.37	7,331.96	7,400.77
Land	3,865.12	3,859.37	3,858.13	3,906.76	3,911.14	3,894.55	3,887.94	3,863.50	3,895.96	3,996.30	4,097.10
Machinery & equipment - Computers	903.19	994.75	1,075.62	1,080.23	1,061.81	1,032.90	1,031.17	1,026.43	1,079.62	1,077.02	1,091.32
Machinery & equipment - Electrical & Electronic Eqt	1,679.49	1,796.55	2,013.78	2,064.54	2,130.44	2,167.66	2,236.08	2,318.53	2,456.14	2,513.63	2,591.87
Machinery & equipment - Industrial Machinery & Equip	2,477.60	2,543.77	2,660.42	2,646.16	2,612.10	2,604.16	2,545.09	2,503.42	2,536.65	2,514.11	2,507.33
Machinery & equipment - Other Plant & Equipment	6,529.78	6,695.12	6,951.25	6,924.42	6,870.32	6,738.20	6,615.37	6,481.04	6,525.13	6,377.02	6,325.13
Machinery & equipment - Other Transport Equipment	3,410.78	3,601.16	3,791.95	3,928.30	4,111.05	4,224.96	4,440.44	4,656.47	4,956.04	5,135.60	5,410.72
Machinery & equipment - Road Vehicles	10,044.67	10,989.04	11,368.18	12,104.04	12,754.01	12,979.06	13,444.60	13,987.66	14,543.72	15,287.56	16,040.68
Non-dwelling construction	15,558.20	15,581.12	15,551.00	15,978.98	16,085.34	16,048.63	16,038.59	15,925.93	16,153.64	16,978.77	17,787.00
Ownership transfer costs	1,574.19	1,508.00	1,415.52	1,378.44	1,304.18	1,200.77	1,110.69	1,022.52	977.20	981.31	990.09

Appendix A.7 - Rental Price of Capital Stock ($ million) - Primary Sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Primary (Incorporated)												
Cultivated biological resources - Livestock fixed assets	325.45	609.34	195.49	80.31	259.24	190.27	160.93	161.42	206.23	140.69	145.62	137.71
Cultivated biological resources - Orchards, plantations & vineyards	248.59	348.05	316.87	240.81	369.38	365.72	441.79	382.44	98.20	368.06	432.52	405.64
Intellectual propery products - Computer software	155.01	168.20	164.05	163.32	114.93	136.76	169.41	189.83	216.21	231.52	246.87	267.71
Intellectual property products - Mineral & petroleum exploration	6,581.45	6,603.04	1,569.36	1,408.99	1,795.08	1,288.88	2,892.45	3,161.88	2,505.24	2,954.96	5,151.74	3,519.50
Intellectual propery products - Research & development	604.27	585.61	799.34	1,093.75	1,140.40	1,272.86	936.32	945.87	1,178.80	1,287.40	1,492.74	1,803.04
Inventories - farm	60.75	60.65	62.83	65.86	66.12	68.84	76.08	78.93	77.25	79.33	82.41	92.90
Inventories - Non-farm	297.37	321.98	632.62	7.75	436.94	366.48	5.98	409.90	714.03	942.90	7.20	6.69
Land	210.86	9,502.14	3,338.56	3,249.78	2,913.37	2,971.53	5,924.86	5,887.57	6,598.05	5,002.10	5,185.35	6,043.46
Machinery & equipment - Computers	115.64	128.74	158.94	161.52	187.72	227.57	151.50	177.46	197.88	220.63	172.58	179.91
Machinery & equipment - Electrical & Electronic Eqt	332.17	202.56	427.14	238.30	273.75	393.86	297.47	300.68	443.97	629.46	578.50	622.59
Machinery & equipment - Industrial Machinery & Equip	6,307.23	6,158.29	6,349.76	4,817.15	3,460.77	7,497.48	6,549.58	6,365.33	9,671.72	11,531.84	9,723.27	11,270.98
Machinery & equipment - Other Plant & Equipment	1,162.66	1,224.15	1,263.74	1,138.43	1,045.47	1,521.88	1,642.62	1,574.56	2,152.10	2,404.40	2,416.63	2,575.29
Machinery & equipment - Other Transport Equipment	376.13	396.77	466.26	127.18	129.34	596.75	377.49	632.97	1,059.90	1,261.84	916.56	844.02
Machinery & equipment - Road Vehicles	822.88	869.59	964.55	766.23	753.62	914.83	1,044.97	1,014.79	776.91	1,005.16	1,041.69	1,108.13
Non-dwelling construction	8,716.38	11,128.95	10,694.24	9,436.35	10,493.48	10,857.36	14,906.49	13,753.05	12,386.96	9,211.37	15,351.44	31,542.85
Ownership transfer costs	534.81	327.64	431.30	200.93	596.93	446.87	837.37	125.72	20.44	21.42	1,312.76	1,993.64
Primary (Unincorporated)												
Cultivated biological resources - Livestock fixed assets	0.09	0.09	0.09	0.09	0.09	0.07	0.09	0.13	0.13	0.13	0.14	0.14
Cultivated biological resources - Orchards, plantations & vineyards	0.05	0.05	0.05	0.05	0.05	0.05	0.07	0.08	0.01	0.06	0.06	0.05
Intellectual propery products - Computer software	2.44	2.44	2.44	2.44	2.44	2.69	3.58	2.36	1.98	1.52	1.67	3.26
Intellectual property products - Mineral & petroleum exploration	0.07	0.07	0.07	0.07	0.07	0.06	0.14	0.09	0.06	0.05	0.10	0.15
Intellectual propery products - Research & development	0.39	0.39	0.39	0.39	0.39	0.48	0.40	0.26	0.25	0.20	0.24	0.51
Inventories - farm	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.02
Inventories - Non-farm	0.17	0.17	0.17	0.17	0.17	0.17	0.00	0.12	0.19	0.17	0.00	0.00
Land	0.02	0.02	0.02	0.02	0.02	0.02	0.16	0.10	0.10	0.05	0.06	0.13
Machinery & equipment - Computers	21.68	21.68	21.68	21.68	21.68	26.22	19.35	13.17	10.17	6.60	4.85	7.89
Machinery & equipment - Electrical & Electronic Eqt	1.14	1.14	1.14	1.14	1.14	1.82	1.55	1.00	1.10	1.04	0.96	1.77
Machinery & equipment - Industrial Machinery & Equip	0.22	0.22	0.22	0.22	0.22	0.54	0.54	0.34	0.43	0.38	0.35	0.72
Machinery & equipment - Other Plant & Equipment	0.32	0.32	0.32	0.32	0.32	0.53	0.65	0.40	0.45	0.37	0.41	0.80
Machinery & equipment - Other Transport Equipment	0.11	0.11	0.11	0.11	0.11	0.55	0.38	0.42	0.61	0.54	0.44	0.75
Machinery & equipment - Road Vehicles	0.52	0.52	0.52	0.52	0.52	0.72	0.98	0.65	0.42	0.42	0.53	1.11
Non-dwelling construction	0.20	0.20	0.20	0.20	0.20	0.24	0.37	0.22	0.16	0.08	0.15	0.56
Ownership transfer costs	0.11	0.11	0.11	0.11	0.11	0.09	0.19	0.02	0.00	0.00	0.12	0.33

Appendix A.7 - Rental Price of Capital Stock ($ million) - Primary Sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Primary (Incorporated)											
Cultivated biological resources - Livestock fixed assets	131.53	64.75	122.57	49.41	51.23	74.84	77.92	70.92	50.01	39.57	37.29
Cultivated biological resources - Orchards, plantations & vineyards	533.08	394.67	556.08	3.30	675.84	881.01	637.45	599.72	815.34	340.26	553.71
Intellectual propery products - Computer software	288.78	331.03	362.82	404.17	483.25	495.19	535.53	581.59	586.19	525.07	578.38
Intellectual property products - Mineral & petroleum exploration	5,326.11	3,372.05	8,730.76	5,569.28	6,401.27	4,433.92	5,167.98	5,400.56	8,424.43	9,010.55	5,801.69
Intellectual propery products - Research & development	2,117.88	2,082.19	3,715.87	3,554.62	4,904.75	4,146.23	4,291.36	4,707.63	4,963.34	5,040.94	4,819.05
Inventories - farm	101.22	117.10	126.33	125.98	141.95	156.33	169.94	183.32	190.53	189.23	193.67
Inventories - Non-farm	562.36	1,535.49	8.37	4,889.60	8.69	955.30	4,270.84	2,117.45	5,710.23	3,092.46	12.42
Land	8,417.15	8,674.97	18,016.62	9,610.82	16,692.22	9,100.95	8,615.01	13,777.99	14,232.85	14,094.62	15,061.64
Machinery & equipment - Computers	217.25	271.27	235.99	255.82	244.22	222.94	227.54	225.54	202.05	156.77	131.99
Machinery & equipment - Electrical & Electronic Eqt	699.99	778.99	651.17	690.72	813.19	677.93	583.65	433.06	462.78	370.22	697.81
Machinery & equipment - Industrial Machinery & Equip	15,105.51	16,490.01	13,941.33	13,809.88	23,257.24	17,406.71	17,090.37	9,608.77	17,216.77	9,567.34	19,874.88
Machinery & equipment - Other Plant & Equipment	3,403.13	3,691.19	3,179.61	4,225.30	4,947.30	3,727.06	3,609.77	3,390.31	3,067.08	2,502.30	4,380.61
Machinery & equipment - Other Transport Equipment	1,225.92	1,485.57	902.10	1,522.94	1,145.68	869.71	752.35	476.95	587.71	357.69	1,144.11
Machinery & equipment - Road Vehicles	1,108.88	1,347.37	1,521.37	1,287.91	1,341.09	1,205.40	1,337.41	1,359.52	1,188.19	1,064.14	1,401.35
Non-dwelling construction	28,413.82	31,507.77	44,328.99	41,840.39	54,751.91	63,979.87	53,879.94	68,004.84	73,809.27	80,111.63	80,066.44
Ownership transfer costs	1,849.68	2,890.69	9,215.61	880.08	2,884.83	6,712.74	6,275.57	5,037.69	4,218.54	4,041.15	7,686.95
Primary (Unincorporated)											
Cultivated biological resources - Livestock fixed assets	0.13	0.10	0.21	0.12	0.14	0.19	0.22	0.23	0.19	0.22	0.23
Cultivated biological resources - Orchards, plantations & vineyards	0.06	0.05	0.06	0.00	0.08	0.10	0.08	0.07	0.10	0.05	0.09
Intellectual propery products - Computer software	1.99	2.68	2.71	1.41	1.88	1.06	1.17	1.92	3.32	4.95	3.30
Intellectual property products - Mineral & petroleum exploration	0.12	0.12	0.35	0.11	0.14	0.06	0.07	0.13	0.41	0.78	0.32
Intellectual propery products - Research & development	0.32	0.44	0.78	0.39	0.59	0.32	0.36	0.63	1.31	2.48	1.63
Inventories - farm	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.04
Inventories - Non-farm	0.14	0.65	0.00	1.08	0.00	0.13	0.57	0.46	2.58	2.57	0.01
Land	0.12	0.18	0.49	0.11	0.25	0.07	0.07	0.18	0.34	0.57	0.41
Machinery & equipment - Computers	4.43	5.74	5.03	2.44	2.46	1.30	1.27	2.04	3.80	6.14	4.09
Machinery & equipment - Electrical & Electronic Eqt	1.05	1.51	1.40	0.71	0.98	0.51	0.44	0.49	0.99	1.40	1.81
Machinery & equipment - Industrial Machinery & Equip	0.54	0.83	0.74	0.38	0.72	0.33	0.33	0.29	0.98	0.97	1.35
Machinery & equipment - Other Plant & Equipment	0.60	0.91	0.87	0.60	0.79	0.38	0.38	0.56	0.96	1.42	1.69
Machinery & equipment - Other Transport Equipment	0.66	1.17	0.79	0.73	0.65	0.34	0.30	0.29	0.68	0.75	1.62
Machinery & equipment - Road Vehicles	0.68	1.03	1.39	0.51	0.65	0.35	0.39	0.61	0.99	1.56	1.36
Non-dwelling construction	0.26	0.41	0.58	0.28	0.37	0.25	0.20	0.34	0.64	1.15	0.73
Ownership transfer costs	0.16	0.38	1.32	0.07	0.23	0.35	0.32	0.38	0.59	0.98	1.23

Appendix A.8 - Rental Price of Capital Stock ($ million) - Secondary Sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Secondary (Incorporated)												
Intellectual propery products - Computer software	1,211.37	1,370.49	1,330.57	1,385.88	968.92	1,076.62	1,160.44	1,201.26	1,336.26	1,408.72	1,462.13	1,551.07
Intellectual propery products - Research & development	952.72	1,074.97	1,348.04	1,640.17	1,801.80	2,049.53	1,466.04	1,545.01	2,307.37	2,139.44	2,356.78	2,557.65
Inventories - Non-farm	1,682.92	2,635.62	3,053.53	2,629.16	4,079.11	1,494.90	2,299.87	3,750.80	3,379.68	4,016.46	735.99	1,611.77
Land	260.63	542.82	408.55	503.13	341.89	353.09	1,186.08	1,107.72	1,554.95	1,153.02	1,015.76	686.54
Machinery & equipment - Computers	1,469.38	1,665.20	1,855.98	1,582.46	1,747.17	2,173.61	1,460.95	1,727.25	2,019.69	2,246.66	1,758.23	1,783.86
Machinery & equipment - Electrical & Electronic Eqt	1,119.19	1,267.36	1,413.06	896.83	1,016.74	1,364.18	1,075.39	1,006.15	1,572.58	2,162.99	2,042.93	2,245.52
Machinery & equipment - Industrial Machinery & Equip	12,987.28	12,971.34	13,033.93	11,109.70	9,232.62	14,643.44	13,066.88	12,348.97	17,583.44	19,909.62	16,941.54	16,376.40
Machinery & equipment - Other Plant & Equipment	2,437.40	2,674.35	2,733.05	2,626.45	2,513.90	3,192.37	3,377.81	3,184.38	4,181.61	4,518.21	4,429.78	4,128.28
Machinery & equipment - Other Transport Equipment	352.45	405.77	444.70	228.33	263.91	602.60	417.91	590.02	954.29	1,081.24	816.16	754.03
Machinery & equipment - Road Vehicles	2,009.92	2,297.87	2,511.54	2,197.92	2,271.00	2,771.50	2,754.87	2,682.64	2,533.14	3,276.43	3,360.48	3,763.01
Non-dwelling construction	4,943.18	6,235.31	5,796.33	5,657.05	6,990.49	6,825.98	8,286.04	7,150.92	7,284.20	5,948.87	8,534.13	13,768.04
Ownership transfer costs	338.98	233.08	280.05	197.67	419.89	336.17	481.50	118.79	111.57	121.12	802.94	860.85
Secondary (Unincorporated)												
Intellectual propery products - Computer software	2.09	2.09	2.09	2.09	2.09	1.96	1.52	1.74	1.68	1.96	2.01	1.59
Intellectual propery products - Research & development	0.30	0.30	0.30	0.30	0.30	0.30	0.16	0.21	0.27	0.32	0.34	0.29
Inventories - Non-farm	0.24	0.24	0.24	0.24	0.24	0.20	0.13	0.17	0.19	0.28	0.21	0.28
Land	0.08	0.08	0.08	0.08	0.08	0.11	0.10	0.11	0.18	0.20	0.19	0.18
Machinery & equipment - Computers	16.10	16.10	16.10	16.10	16.10	14.60	6.95	8.26	7.51	8.00	5.55	3.81
Machinery & equipment - Electrical & Electronic Eqt	1.21	1.21	1.21	1.21	1.21	1.40	0.85	0.85	1.10	1.55	1.36	1.04
Machinery & equipment - Industrial Machinery & Equip	0.33	0.33	0.33	0.33	0.33	0.48	0.35	0.32	0.47	0.64	0.57	0.49
Machinery & equipment - Other Plant & Equipment	0.42	0.42	0.42	0.42	0.42	0.50	0.40	0.38	0.50	0.66	0.67	0.54
Machinery & equipment - Other Transport Equipment	0.25	0.25	0.25	0.25	0.25	0.49	0.24	0.41	0.63	0.85	0.69	0.52
Machinery & equipment - Road Vehicles	0.50	0.50	0.50	0.50	0.50	0.55	0.41	0.48	0.45	0.68	0.73	0.64
Non-dwelling construction	0.21	0.21	0.21	0.21	0.21	0.22	0.16	0.17	0.20	0.23	0.28	0.34
Ownership transfer costs	0.13	0.13	0.13	0.13	0.13	0.12	0.09	0.05	0.08	0.09	0.26	0.27

Appendix A.8 - Rental Price of Capital Stock ($ million) - Secondary Sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Secondary (Incorporated)											
Intellectual propery products - Computer software	1,661.62	1,776.96	1,689.62	1,919.54	1,948.58	2,091.95	2,104.27	2,207.57	2,068.45	1,583.70	1,636.78
Intellectual propery products - Research & development	3,477.26	3,422.35	4,894.97	6,084.86	7,215.00	6,898.22	7,543.27	8,336.83	8,595.31	8,963.64	8,706.04
Inventories - Non-farm	1,533.94	3,099.65	214.47	6,210.87	3,007.76	3,701.82	4,746.17	2,473.17	3,083.19	3,703.36	2,865.10
Land	911.31	1,121.42	2,209.82	2,333.36	2,117.44	1,720.61	1,923.57	2,855.50	2,899.96	2,949.06	2,842.11
Machinery & equipment - Computers	2,028.48	2,249.19	1,773.33	2,078.80	1,860.19	1,837.37	1,778.67	1,670.06	1,432.10	955.43	812.74
Machinery & equipment - Electrical & Electronic Eqt	2,574.61	2,599.12	2,098.04	2,629.01	2,605.43	2,688.84	2,494.14	2,239.21	2,275.68	1,781.57	2,286.23
Machinery & equipment - Industrial Machinery & Equip	19,655.39	21,890.07	15,775.42	20,612.79	25,259.16	21,181.55	20,458.04	14,673.09	19,976.73	12,486.76	18,412.12
Machinery & equipment - Other Plant & Equipment	4,904.86	5,320.21	4,078.86	6,115.50	5,763.74	4,935.41	4,672.61	4,375.20	4,049.31	3,525.22	4,586.08
Machinery & equipment - Other Transport Equipment	977.10	1,052.29	642.41	1,133.78	772.48	767.63	738.64	652.34	738.50	707.71	1,095.36
Machinery & equipment - Road Vehicles	4,065.48	4,218.88	4,402.98	4,623.35	4,378.40	5,286.15	5,885.29	6,240.79	5,788.72	5,703.32	6,166.51
Non-dwelling construction	10,354.51	11,335.62	12,300.12	18,728.23	15,374.71	21,406.79	17,738.49	19,631.68	19,539.32	20,254.28	18,891.59
Ownership transfer costs	596.49	1,089.47	2,957.93	578.32	674.60	2,050.63	1,733.55	1,298.72	1,068.56	1,022.01	1,542.80
Secondary (Unincorporated)											
Intellectual propery products - Computer software	1.50	1.59	1.36	1.19	1.18	1.42	1.43	1.69	1.46	1.02	0.99
Intellectual propery products - Research & development	0.32	0.31	0.38	0.40	0.45	0.51	0.56	0.67	0.66	0.71	0.68
Inventories - Non-farm	0.31	0.28	0.24	0.38	0.30	0.41	0.48	0.51	0.50	0.55	0.46
Land	0.21	0.20	0.29	0.29	0.26	0.32	0.36	0.48	0.47	0.51	0.46
Machinery & equipment - Computers	3.41	3.15	2.33	1.95	1.62	1.72	1.61	1.78	1.53	1.11	1.04
Machinery & equipment - Electrical & Electronic Eqt	0.97	0.97	0.77	0.77	0.76	0.85	0.76	0.74	0.71	0.55	0.73
Machinery & equipment - Industrial Machinery & Equip	0.54	0.57	0.44	0.49	0.57	0.62	0.63	0.57	0.69	0.46	0.62
Machinery & equipment - Other Plant & Equipment	0.61	0.65	0.53	0.66	0.64	0.71	0.71	0.78	0.71	0.66	0.83
Machinery & equipment - Other Transport Equipment	0.64	0.75	0.48	0.71	0.52	0.60	0.56	0.54	0.57	0.54	0.83
Machinery & equipment - Road Vehicles	0.61	0.65	0.68	0.54	0.50	0.61	0.65	0.73	0.64	0.59	0.64
Non-dwelling construction	0.31	0.26	0.35	0.40	0.34	0.51	0.49	0.59	0.56	0.60	0.54
Ownership transfer costs	0.24	0.30	0.63	0.23	0.24	0.61	0.59	0.59	0.53	0.57	0.70

Appendix A.9 - Rental Price of Capital Stock ($ million) - Services (Market) Sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Services - Market (Incorporated)												
Intellectual propery products - Artistic Originals	1.15	1.53	1.88	2.27	6.10	8.65	7.06	7.76	9.70	10.83	13.03	13.90
Intellectual propery products - Computer software	6,248.76	6,877.84	6,853.62	7,407.65	5,858.87	7,160.96	8,290.68	9,209.55	10,229.87	11,218.66	11,880.54	12,479.99
Intellectual propery products - Research & development	3,315.75	3,923.33	4,245.07	3,979.62	3,829.57	3,952.16	3,737.48	5,321.85	5,787.79	6,143.06	5,783.74	6,087.84
Inventories - Non-farm	5,116.31	6,710.59	8,443.99	5,972.64	5,958.45	6,363.08	8,827.30	9,123.08	10,243.33	12,244.01	10,587.74	7,709.86
Land	3,469.35	5,658.78	5,005.54	3,277.51	3,306.47	4,398.02	11,763.07	14,098.63	15,303.99	11,648.23	7,408.24	5,649.39
Machinery & equipment - Computers	3,459.88	3,587.83	4,017.41	2,989.45	3,470.02	5,061.19	4,278.65	4,928.82	6,653.08	7,586.06	6,291.79	6,269.97
Machinery & equipment - Electrical & Electronic Eqt	5,163.53	5,721.91	6,733.38	3,719.21	4,026.27	6,532.17	7,118.13	5,901.26	8,511.61	11,407.71	9,934.83	9,323.77
Machinery & equipment - Industrial Machinery & Equip	5,293.17	5,172.70	5,134.96	3,956.50	3,265.60	5,846.78	7,463.03	4,889.11	7,472.28	8,395.99	7,013.98	6,493.32
Machinery & equipment - Other Plant & Equipment	3,927.02	3,890.71	3,770.61	2,898.50	2,594.67	4,091.96	6,289.83	3,684.99	5,414.51	5,903.51	5,338.64	4,549.06
Machinery & equipment - Other Transport Equipment	9,766.66	9,099.23	9,194.99	5,181.73	5,235.14	9,759.67	8,481.51	9,463.88	12,397.71	14,581.78	11,478.14	10,156.16
Machinery & equipment - Road Vehicles	18,730.77	21,451.34	21,591.57	21,161.56	23,719.90	26,302.19	31,254.31	28,250.30	28,096.15	25,640.86	28,969.07	37,584.75
Non-dwelling construction	36,459.41	37,259.58	34,258.40	30,531.08	36,233.63	41,105.03	65,989.92	34,964.20	50,006.57	35,221.84	34,428.44	59,984.26
Ownership transfer costs	2,652.30	1,638.57	2,108.32	692.82	2,641.17	2,055.22	3,788.09	997.15	118.17	87.21	4,294.10	4,354.67
Services - Market (Unincorporated)												
Intellectual propery products - Artistic Originals	0.12	0.12	0.12	0.12	0.12	0.17	0.07	0.06	0.14	0.15	0.16	0.09
Intellectual propery products - Computer software	5.54	5.54	5.54	5.54	5.54	4.87	4.13	5.24	5.06	5.06	5.44	5.12
Intellectual propery products - Research & development	2.64	2.64	2.64	2.64	2.64	1.77	1.79	1.32	1.59	1.54	1.95	1.71
Inventories - Non-farm	0.50	0.50	0.50	0.50	0.50	0.34	0.40	0.45	0.54	0.54	0.45	0.35
Land	19.46	19.46	19.46	19.46	19.46	19.52	9.64	12.85	12.40	11.72	7.65	5.38
Machinery & equipment - Computers	34.09	34.09	34.09	34.09	34.09	24.06	14.38	15.94	15.89	14.02	11.15	8.97
Machinery & equipment - Electrical & Electronic Eqt	2.24	2.24	2.24	2.24	2.24	2.30	2.08	1.64	2.24	2.64	2.42	2.07
Machinery & equipment - Industrial Machinery & Equip	0.80	0.80	0.80	0.80	0.80	1.07	1.10	0.90	1.31	1.43	1.33	1.05
Machinery & equipment - Other Plant & Equipment	0.76	0.76	0.76	0.76	0.76	1.04	1.00	0.97	1.49	1.63	1.45	1.05
Machinery & equipment - Other Transport Equipment	0.95	0.95	0.95	0.95	0.95	1.30	1.07	1.34	1.66	1.91	1.82	1.42
Machinery & equipment - Road Vehicles	0.98	0.98	0.98	0.98	0.98	0.86	0.94	0.98	0.90	0.97	1.15	1.09
Non-dwelling construction	0.49	0.49	0.49	0.49	0.49	0.32	0.43	0.27	0.34	0.21	0.46	0.63
Ownership transfer costs	0.17	0.17	0.17	0.17	0.17	0.09	0.15	0.04	0.01	0.00	0.21	0.23

Appendix A.9 - Rental Price of Capital Stock ($ million) - Services (Market) Sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Services - Market (Incorporated)											
Intellectual propery products - Artistic Originals	15.73	17.65	16.69	17.35	19.00	17.64	16.51	16.88	20.00	22.32	24.83
Intellectual propery products - Computer software	13,517.67	14,749.00	14,275.75	14,993.27	16,315.02	16,887.76	18,394.07	19,861.88	20,432.70	20,241.90	21,893.07
Intellectual propery products - Research & development	6,875.51	6,944.54	7,703.77	8,989.57	10,810.22	10,907.01	12,885.72	14,762.17	16,137.48	17,420.60	18,773.57
Inventories - Non-farm	9,746.61	10,965.41	14,795.63	18,001.88	17,129.87	17,026.80	19,023.50	19,075.18	21,895.01	22,302.16	24,599.53
Land	7,310.63	10,414.26	16,644.44	19,456.18	18,497.55	11,521.59	14,818.80	21,365.35	20,185.00	19,356.07	20,288.32
Machinery & equipment - Computers	7,320.98	8,397.14	7,020.06	8,375.14	8,198.32	7,564.53	7,180.23	6,406.99	6,436.45	5,819.99	7,502.94
Machinery & equipment - Electrical & Electronic Eqt	11,140.93	12,120.09	8,385.45	11,699.31	12,972.35	11,429.89	10,227.98	7,327.21	8,470.46	6,969.10	13,652.60
Machinery & equipment - Industrial Machinery & Equip	9,435.21	10,453.86	7,521.18	11,566.88	14,162.40	11,933.98	12,375.00	9,548.15	12,581.20	9,861.95	16,342.15
Machinery & equipment - Other Plant & Equipment	6,921.67	7,939.04	4,717.28	10,596.13	10,679.52	8,951.69	9,054.52	8,534.47	7,681.68	6,572.15	11,810.16
Machinery & equipment - Other Transport Equipment	13,160.49	17,522.51	12,785.75	21,149.56	17,108.22	16,108.95	16,770.06	14,427.77	15,731.98	13,673.49	25,425.54
Machinery & equipment - Road Vehicles	35,428.94	38,084.81	48,710.10	59,408.31	57,067.38	65,126.95	64,684.68	69,073.50	71,117.96	73,921.22	77,672.44
Non-dwelling construction	39,944.11	40,558.53	63,286.94	118,190.66	93,766.05	102,656.38	109,248.89	129,771.44	111,566.23	113,929.25	129,838.01
Ownership transfer costs	2,153.89	6,407.74	20,728.71	2,677.26	3,842.72	13,578.51	11,949.39	8,571.61	6,514.02	6,035.46	10,980.89
Services - Market (Unincorporated)											
Intellectual propery products - Artistic Originals	0.09	0.12	0.08	0.09	0.08	0.11	0.09	0.08	0.12	0.11	0.09
Intellectual propery products - Computer software	5.27	5.53	4.63	4.74	4.61	4.26	4.03	4.18	6.10	4.77	4.73
Intellectual propery products - Research & development	2.02	2.21	1.60	1.82	1.93	1.91	1.81	1.84	3.31	2.63	2.75
Inventories - Non-farm	0.49	0.47	0.69	0.79	0.67	0.60	0.69	0.72	1.68	1.36	1.18
Land	5.16	5.10	3.86	4.07	3.09	2.68	2.46	2.32	2.68	2.24	2.27
Machinery & equipment - Computers	9.48	8.59	5.26	5.62	4.84	4.02	3.49	3.23	4.94	3.86	4.07
Machinery & equipment - Electrical & Electronic Eqt	2.33	2.48	1.50	1.98	2.20	1.85	1.58	1.12	2.04	1.44	2.55
Machinery & equipment - Industrial Machinery & Equip	1.54	1.69	1.04	1.77	1.93	1.59	1.49	1.14	2.05	1.33	2.32
Machinery & equipment - Other Plant & Equipment	1.67	1.97	1.09	2.32	1.87	1.60	1.43	1.21	1.84	1.36	2.49
Machinery & equipment - Other Transport Equipment	1.94	2.34	1.53	2.23	1.66	1.52	1.41	1.16	1.73	1.20	2.29
Machinery & equipment - Road Vehicles	1.31	1.32	1.35	1.41	1.26	1.27	1.22	1.26	1.75	1.48	1.72
Non-dwelling construction	0.40	0.63	1.19	0.70	0.66	1.20	1.04	0.98	1.23	1.16	1.43
Ownership transfer costs	0.14	0.36	1.00	0.14	0.22	0.74	0.65	0.54	0.71	0.66	1.12

Appendix A.10 - Rental Price of Capital Stock ($ million) - Distributive Services Sub-sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Distributive (Incorporated)												
Intellectual propery products - Computer software	2,889.45	3,307.27	3,296.34	3,258.04	2,681.06	3,158.98	3,282.05	3,532.29	3,693.91	3,891.41	3,932.02	4,137.01
Intellectual propery products - Research & development	2,532.48	3,090.75	3,204.17	3,375.61	2,323.04	2,610.36	3,066.68	3,745.39	3,864.57	4,040.49	4,111.41	4,175.56
Inventories - Non-farm	215.10	253.73	295.87	361.36	392.11	352.64	345.61	477.50	480.90	560.06	481.96	534.84
Land	491.34	2,375.32	1,512.38	427.42	179.13	180.72	7,181.84	8,401.34	8,263.47	4,494.14	1,801.00	193.21
Machinery & equipment - Computers	975.88	963.31	1,091.83	842.50	958.96	1,608.48	1,426.37	2,014.59	2,452.82	2,513.67	1,784.09	1,604.39
Machinery & equipment - Electrical & Electronic Eqt	3,513.78	3,966.17	4,743.55	2,575.20	2,792.83	4,580.97	4,993.60	4,368.75	6,033.28	8,153.90	7,101.67	6,371.74
Machinery & equipment - Industrial Machinery & Equip	1,690.61	1,620.49	1,517.22	1,062.37	772.67	1,746.17	2,156.48	1,245.87	2,084.45	2,333.46	1,756.36	1,311.39
Machinery & equipment - Other Plant & Equipment	2,530.46	2,447.77	2,313.21	1,754.25	1,501.27	2,420.45	3,697.93	2,029.81	3,009.86	3,173.92	2,883.55	2,235.96
Machinery & equipment - Other Transport Equipment	6,684.92	5,822.86	5,552.10	1,801.81	1,824.08	5,541.24	3,909.42	4,801.81	7,895.76	9,158.12	5,926.98	4,497.78
Machinery & equipment - Road Vehicles	1,941.95	2,126.61	2,296.86	1,801.91	1,767.67	2,389.79	2,919.43	2,598.53	2,207.25	2,828.13	2,935.59	2,732.48
Non-dwelling construction	29,941.83	29,240.64	26,434.29	24,910.61	27,735.50	32,416.32	53,678.45	24,791.72	40,513.97	28,579.28	24,442.55	42,995.70
Ownership transfer costs	2,207.15	1,350.63	1,738.68	556.11	2,164.44	1,670.44	3,105.24	851.79	70.87	72.51	3,507.44	3,522.16
Distributive (Unincorporated)												
Intellectual propery products - Computer software	1.23	1.23	1.23	1.23	1.23	0.96	0.80	0.89	1.02	0.92	1.18	1.11
Intellectual propery products - Research & development	2.07	2.07	2.07	2.07	2.07	1.23	1.41	0.77	0.88	0.80	1.24	1.07
Inventories - Non-farm	0.30	0.30	0.30	0.30	0.30	0.16	0.16	0.14	0.15	0.16	0.17	0.16
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.07	0.03	0.02	0.00
Machinery & equipment - Computers	18.25	18.25	18.25	18.25	18.25	10.80	6.78	5.64	6.29	5.28	4.97	3.59
Machinery & equipment - Electrical & Electronic Eqt	1.09	1.09	1.09	1.09	1.09	0.89	0.87	0.50	0.71	0.81	0.94	0.74
Machinery & equipment - Industrial Machinery & Equip	0.22	0.22	0.22	0.22	0.22	0.27	0.26	0.18	0.29	0.30	0.35	0.26
Machinery & equipment - Other Plant & Equipment	0.31	0.31	0.31	0.31	0.31	0.27	0.40	0.20	0.30	0.29	0.39	0.28
Machinery & equipment - Other Transport Equipment	0.31	0.31	0.31	0.31	0.31	0.40	0.35	0.30	0.51	0.50	0.58	0.38
Machinery & equipment - Road Vehicles	0.41	0.41	0.41	0.41	0.41	0.32	0.39	0.31	0.27	0.31	0.47	0.32
Non-dwelling construction	0.22	0.22	0.22	0.22	0.22	0.10	0.17	0.07	0.12	0.08	0.11	0.17
Ownership transfer costs	0.09	0.09	0.09	0.09	0.09	0.04	0.08	0.02	0.00	0.00	0.10	0.09

Appendix A.10 - Rental Price of Capital Stock ($ million) - Distributive Services Sub-sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Distributive (Incorporated)											
Intellectual propery products - Computer software	4,316.57	4,799.57	4,389.20	4,840.27	5,290.03	5,462.78	5,907.04	6,297.16	6,296.61	6,134.38	6,638.00
Intellectual propery products - Research & development	4,408.45	4,498.23	3,887.30	3,985.56	4,198.58	4,196.41	4,512.19	4,959.61	5,076.41	5,021.43	5,512.83
Inventories - Non-farm	671.77	604.82	894.82	1,086.73	1,137.85	992.10	1,067.96	1,103.25	1,263.06	1,296.05	1,085.79
Land	495.74	2,445.10	8,669.11	10,743.88	10,561.05	4,878.52	7,763.00	13,414.60	12,750.05	12,380.90	13,513.82
Machinery & equipment - Computers	1,794.90	2,011.77	1,649.71	1,944.43	1,744.99	1,657.01	1,656.71	1,584.26	1,452.33	1,341.94	1,281.81
Machinery & equipment - Electrical & Electronic Eqt	7,622.23	7,953.61	5,330.10	7,432.30	7,820.24	6,915.54	5,896.06	4,153.02	4,371.16	3,877.66	8,079.78
Machinery & equipment - Industrial Machinery & Equip	2,444.23	2,682.31	1,363.12	2,756.64	3,834.76	3,141.25	3,190.93	1,837.92	3,226.47	2,130.91	4,414.67
Machinery & equipment - Other Plant & Equipment	3,794.44	4,155.46	2,152.34	5,476.71	5,673.44	4,791.06	4,849.74	4,540.82	4,099.24	3,551.85	6,510.20
Machinery & equipment - Other Transport Equipment	6,711.46	9,736.28	4,081.38	12,486.44	8,290.34	7,242.19	6,665.70	4,038.27	5,303.38	2,950.78	11,902.83
Machinery & equipment - Road Vehicles	3,406.82	4,203.42	4,211.23	4,626.41	4,606.52	4,594.62	5,281.08	5,419.13	4,804.53	4,632.42	6,126.24
Non-dwelling construction	29,038.37	25,466.83	44,730.93	97,180.12	75,638.44	77,162.61	87,318.23	106,248.88	90,017.61	92,103.38	108,287.10
Ownership transfer costs	1,720.67	5,297.98	17,399.15	2,188.10	3,191.62	11,549.09	10,167.92	7,211.15	5,505.48	5,097.22	9,454.75
Distributive (Unincorporated)											
Intellectual propery products - Computer software	1.25	1.46	0.86	0.92	1.00	1.07	0.98	1.18	2.78	1.52	1.48
Intellectual propery products - Research & development	1.31	1.48	0.67	0.70	0.67	0.88	0.73	0.74	2.03	1.09	1.19
Inventories - Non-farm	0.28	0.20	0.29	0.30	0.21	0.25	0.29	0.26	1.11	0.71	0.48
Land	0.00	0.03	0.07	0.08	0.08	0.04	0.06	0.12	0.26	0.15	0.16
Machinery & equipment - Computers	4.19	3.99	1.65	1.76	1.48	1.47	1.23	1.33	2.85	1.49	1.34
Machinery & equipment - Electrical & Electronic Eqt	0.89	0.98	0.40	0.52	0.56	0.59	0.44	0.35	0.88	0.47	0.81
Machinery & equipment - Industrial Machinery & Equip	0.46	0.54	0.19	0.30	0.41	0.40	0.35	0.23	0.89	0.36	0.65
Machinery & equipment - Other Plant & Equipment	0.51	0.60	0.22	0.44	0.45	0.44	0.38	0.38	0.83	0.41	0.67
Machinery & equipment - Other Transport Equipment	0.70	0.85	0.27	0.57	0.39	0.42	0.33	0.23	0.70	0.29	0.68
Machinery & equipment - Road Vehicles	0.54	0.63	0.38	0.37	0.35	0.39	0.37	0.41	0.81	0.44	0.55
Non-dwelling construction	0.14	0.13	0.11	0.19	0.16	0.23	0.18	0.25	0.47	0.28	0.29
Ownership transfer costs	0.06	0.19	0.38	0.05	0.08	0.36	0.29	0.25	0.45	0.26	0.46

Appendix A.11 - Rental Price of Capital Stock ($ million) - Producer Services Sub-sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Producer (Incorporated)												
Intellectual propery products - Computer software	2,431.98	2,592.59	2,676.12	3,308.83	2,597.31	3,345.43	4,250.96	4,867.52	5,572.89	6,316.35	6,907.56	7,244.01
Intellectual propery products - Research & development	723.59	762.63	959.38	517.12	1,408.55	1,238.81	577.79	1,471.43	1,784.23	1,961.31	1,540.86	1,783.29
Inventories - Non-farm	3,573.27	4,607.69	6,333.57	4,155.14	3,790.11	4,306.97	5,943.18	6,397.23	7,346.19	8,928.40	8,326.93	5,751.76
Land	2,600.15	2,666.21	2,942.95	2,561.53	2,855.31	3,841.58	3,313.29	4,405.65	5,450.71	5,991.47	5,025.86	5,152.36
Machinery & equipment - Computers	1,503.60	1,556.61	1,747.21	1,317.64	1,478.35	1,957.76	1,601.97	1,669.01	2,246.22	2,900.61	2,710.67	2,908.60
Machinery & equipment - Electrical & Electronic Eqt	943.22	988.85	1,109.35	666.33	680.92	1,077.24	1,226.00	859.86	1,370.29	1,725.75	1,487.64	1,574.90
Machinery & equipment - Industrial Machinery & Equip	2,996.31	2,950.33	3,014.97	2,457.41	2,135.15	3,394.64	4,345.89	3,061.47	4,429.15	4,961.58	4,391.32	4,372.81
Machinery & equipment - Other Plant & Equipment	510.02	523.22	527.37	399.31	383.30	573.54	822.88	555.88	837.06	910.48	799.19	735.50
Machinery & equipment - Other Transport Equipment	2,682.84	2,833.16	3,190.03	3,024.37	3,011.13	3,648.02	3,981.39	4,067.02	3,662.79	4,596.01	4,813.58	5,027.08
Machinery & equipment - Road Vehicles	14,818.05	16,832.43	16,856.71	17,509.45	19,907.52	21,091.21	24,029.71	22,682.67	22,417.55	20,275.98	23,702.75	31,469.82
Non-dwelling construction	3,127.32	3,558.04	3,540.75	2,719.54	4,014.39	3,898.29	5,254.91	4,137.48	4,241.15	3,057.76	5,252.02	7,325.58
Ownership transfer costs	170.07	105.53	134.05	49.30	174.13	129.04	226.39	45.61	36.06	4.68	282.93	286.83
Producers (Unincorporated)												
Intellectual propery products - Computer software	1.38	1.38	1.38	1.38	1.38	1.22	1.04	1.45	1.20	1.26	1.41	1.54
Intellectual propery products - Research & development	0.20	0.20	0.20	0.20	0.20	0.20	0.13	0.21	0.25	0.23	0.24	0.27
Inventories - Non-farm	0.05	0.05	0.05	0.05	0.05	0.04	0.07	0.11	0.11	0.15	0.12	0.08
Land	6.90	6.90	6.90	6.90	6.90	7.03	3.76	5.15	4.36	3.75	2.83	2.40
Machinery & equipment - Computers	5.72	5.72	5.72	5.72	5.72	4.34	2.29	3.60	3.32	3.44	2.22	2.12
Machinery & equipment - Electrical & Electronic Eqt	0.41	0.41	0.41	0.41	0.41	0.47	0.40	0.41	0.53	0.69	0.55	0.56
Machinery & equipment - Industrial Machinery & Equip	0.20	0.20	0.20	0.20	0.20	0.27	0.31	0.28	0.35	0.41	0.38	0.38
Machinery & equipment - Other Plant & Equipment	0.15	0.15	0.15	0.15	0.15	0.26	0.20	0.31	0.43	0.50	0.42	0.39
Machinery & equipment - Other Transport Equipment	0.21	0.21	0.21	0.21	0.21	0.29	0.25	0.39	0.38	0.49	0.46	0.46
Machinery & equipment - Road Vehicles	0.20	0.20	0.20	0.20	0.20	0.17	0.17	0.25	0.20	0.24	0.25	0.33
Non-dwelling construction	0.09	0.09	0.09	0.09	0.09	0.06	0.08	0.07	0.06	0.04	0.13	0.19
Ownership transfer costs	0.03	0.03	0.03	0.03	0.03	0.01	0.02	0.01	0.00	0.00	0.04	0.05

Appendix A.11 - Rental Price of Capital Stock ($ million) - Producer Services Sub-sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Producer (Incorporated)											
Intellectual propery products - Computer software	8,027.80	8,640.88	8,674.09	8,825.40	9,574.03	9,896.31	10,741.47	11,504.86	12,014.67	12,218.39	13,241.87
Intellectual propery products - Research & development	2,312.14	2,276.57	3,614.86	4,744.08	6,294.75	6,416.87	8,024.40	9,380.66	10,592.83	11,865.40	12,679.17
Inventories - Non-farm	6,445.90	7,910.89	10,421.46	13,477.27	12,656.76	13,045.40	13,979.95	13,983.79	16,161.38	16,772.51	19,700.11
Land	6,353.29	7,023.65	6,321.59	6,756.16	6,060.41	5,353.66	5,458.44	5,713.81	5,321.97	4,927.02	4,632.28
Machinery & equipment - Computers	3,470.91	3,882.82	3,333.13	3,848.35	3,931.66	3,596.61	3,399.79	2,991.46	3,169.42	2,987.59	4,041.07
Machinery & equipment - Electrical & Electronic Eqt	1,943.39	2,295.07	1,671.09	2,396.67	3,092.79	2,676.30	2,668.31	1,947.34	2,694.29	1,999.70	3,475.96
Machinery & equipment - Industrial Machinery & Equip	5,809.38	6,350.80	5,211.81	7,179.77	8,212.27	7,022.95	7,369.28	6,467.77	7,544.97	6,568.78	9,685.92
Machinery & equipment - Other Plant & Equipment	991.37	1,120.83	742.60	1,416.15	1,292.76	1,061.18	1,072.69	1,038.17	917.65	777.39	1,339.82
Machinery & equipment - Other Transport Equipment	5,670.75	6,790.07	7,742.85	7,514.24	7,771.16	7,856.47	9,005.86	9,304.12	9,398.27	9,769.15	12,133.46
Machinery & equipment - Road Vehicles	28,268.97	32,037.92	39,113.21	46,245.24	45,423.69	52,893.93	51,561.76	54,337.43	58,393.97	60,848.70	61,945.52
Non-dwelling construction	5,755.37	6,848.26	10,210.09	8,050.84	7,484.74	10,599.63	9,676.86	10,405.23	9,120.06	9,234.96	9,175.81
Ownership transfer costs	194.21	330.22	1,018.24	139.49	183.86	574.97	524.55	450.75	307.20	288.24	417.11
Producers (Unincorporated)											
Intellectual propery products - Computer software	1.67	1.60	1.57	1.58	1.52	1.22	1.25	1.22	1.34	1.39	1.60
Intellectual propery products - Research & development	0.32	0.30	0.43	0.50	0.56	0.41	0.46	0.47	0.56	0.69	0.80
Inventories - Non-farm	0.07	0.11	0.18	0.25	0.22	0.15	0.16	0.19	0.24	0.28	0.39
Land	2.54	2.44	2.15	2.05	1.63	1.27	1.24	1.10	1.27	1.09	1.32
Machinery & equipment - Computers	2.16	1.75	1.30	1.51	1.31	0.87	0.78	0.68	0.74	0.97	1.32
Machinery & equipment - Electrical & Electronic Eqt	0.64	0.62	0.47	0.63	0.73	0.49	0.48	0.33	0.52	0.46	0.90
Machinery & equipment - Industrial Machinery & Equip	0.50	0.54	0.43	0.69	0.70	0.50	0.51	0.43	0.52	0.49	0.92
Machinery & equipment - Other Plant & Equipment	0.56	0.67	0.43	0.86	0.64	0.46	0.44	0.34	0.43	0.41	0.93
Machinery & equipment - Other Transport Equipment	0.56	0.64	0.64	0.72	0.58	0.45	0.48	0.43	0.48	0.45	0.79
Machinery & equipment - Road Vehicles	0.32	0.27	0.36	0.43	0.37	0.34	0.32	0.33	0.36	0.44	0.53
Non-dwelling construction	0.13	0.21	0.56	0.21	0.22	0.41	0.38	0.32	0.33	0.40	0.63
Ownership transfer costs	0.04	0.06	0.17	0.03	0.04	0.08	0.08	0.08	0.06	0.13	0.19

Appendix A.12 - Rental Price of Capital Stock ($ million) - Personal Services Sub-sector

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Social (Incorporated)												
Intellectual propery products - Artistic Originals	1.15	1.53	1.88	2.27	6.10	8.65	7.06	7.76	9.70	10.83	13.03	13.90
Intellectual propery products - Computer software	927.33	977.98	881.16	840.79	580.50	656.55	757.66	809.75	963.07	1,010.90	1,040.97	1,098.98
Intellectual propery products - Research & development	59.68	69.95	81.52	86.89	97.98	102.99	93.00	105.03	138.99	141.26	131.46	128.98
Inventories - Non-farm	1,327.94	1,849.17	1,814.55	1,456.14	1,776.23	1,703.47	2,538.51	2,248.35	2,416.24	2,755.56	1,778.85	1,423.25
Land	377.85	617.25	550.21	288.56	272.03	375.72	1,267.94	1,291.64	1,589.81	1,162.61	581.37	303.82
Machinery & equipment - Computers	980.40	1,067.91	1,178.37	829.31	1,032.70	1,494.95	1,250.32	1,245.21	1,954.05	2,171.78	1,797.04	1,756.99
Machinery & equipment - Electrical & Electronic Eqt	706.53	766.89	880.48	477.69	552.53	873.96	898.53	672.65	1,108.04	1,528.06	1,345.52	1,377.13
Machinery & equipment - Industrial Machinery & Equip	606.25	601.88	602.77	436.72	357.77	705.97	960.66	581.77	958.69	1,100.95	866.29	809.11
Machinery & equipment - Other Plant & Equipment	886.54	919.72	930.02	744.95	710.11	1,097.97	1,769.02	1,099.31	1,567.58	1,819.11	1,655.91	1,577.60
Machinery & equipment - Other Transport Equipment	398.91	443.20	452.86	355.55	399.93	570.40	590.71	595.05	839.15	827.66	737.58	631.29
Machinery & equipment - Road Vehicles	1,970.78	2,492.29	2,438.00	1,850.20	2,044.71	2,821.19	4,305.17	2,969.10	3,471.35	2,536.74	2,330.73	3,382.45
Non-dwelling construction	3,390.26	4,460.90	4,283.36	2,900.93	4,483.74	4,790.42	7,056.56	6,034.99	5,251.45	3,584.81	4,733.87	9,662.98
Ownership transfer costs	275.08	182.41	235.59	87.40	302.60	255.74	456.46	99.75	11.23	10.02	503.73	545.68
Social (Unincorporated)												
Intellectual propery products - Artistic Originals	0.12	0.12	0.12	0.12	0.12	0.17	0.07	0.06	0.14	0.15	0.16	0.09
Intellectual propery products - Computer software	2.92	2.92	2.92	2.92	2.92	2.70	2.29	2.90	2.84	2.88	2.85	2.47
Intellectual propery products - Research & development	0.36	0.36	0.36	0.36	0.36	0.34	0.24	0.33	0.46	0.51	0.47	0.38
Inventories - Non-farm	0.15	0.15	0.15	0.15	0.15	0.13	0.17	0.20	0.28	0.23	0.15	0.11
Land	12.56	12.56	12.56	12.56	12.56	12.49	5.81	7.63	7.97	7.94	4.80	2.98
Machinery & equipment - Computers	10.12	10.12	10.12	10.12	10.12	8.92	5.31	6.69	6.28	5.29	3.96	3.26
Machinery & equipment - Electrical & Electronic Eqt	0.75	0.75	0.75	0.75	0.75	0.94	0.81	0.72	1.01	1.14	0.93	0.77
Machinery & equipment - Industrial Machinery & Equip	0.37	0.37	0.37	0.37	0.37	0.53	0.53	0.44	0.67	0.72	0.60	0.41
Machinery & equipment - Other Plant & Equipment	0.30	0.30	0.30	0.30	0.30	0.51	0.40	0.45	0.76	0.84	0.64	0.37
Machinery & equipment - Other Transport Equipment	0.44	0.44	0.44	0.44	0.44	0.61	0.47	0.65	0.78	0.92	0.79	0.58
Machinery & equipment - Road Vehicles	0.38	0.38	0.38	0.38	0.38	0.37	0.39	0.43	0.43	0.42	0.43	0.44
Non-dwelling construction	0.18	0.18	0.18	0.18	0.18	0.15	0.18	0.14	0.17	0.10	0.22	0.26
Ownership transfer costs	0.05	0.05	0.05	0.05	0.05	0.03	0.05	0.01	0.00	0.00	0.07	0.08

Appendix A.12 - Rental Price of Capital Stock ($ million) - Personal Services Sub-sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Social (Incorporated)											
Intellectual propery products - Artistic Originals	15.73	17.65	16.69	17.35	19.00	17.64	16.51	16.88	20.00	22.32	24.83
Intellectual propery products - Computer software	1,173.30	1,308.55	1,212.47	1,327.60	1,450.96	1,528.68	1,745.55	2,059.86	2,121.43	1,889.13	2,013.19
Intellectual propery products - Research & development	154.92	169.75	201.60	259.94	316.89	293.73	349.13	421.90	468.24	533.77	581.57
Inventories - Non-farm	2,628.94	2,449.70	3,479.36	3,437.89	3,335.26	2,989.29	3,975.59	3,988.14	4,470.57	4,233.60	3,813.63
Land	461.60	945.51	1,653.74	1,956.15	1,876.10	1,289.41	1,597.36	2,236.94	2,112.98	2,048.15	2,142.22
Machinery & equipment - Computers	2,055.18	2,502.55	2,037.22	2,582.35	2,521.67	2,310.91	2,123.73	1,831.27	1,814.69	1,490.46	2,180.07
Machinery & equipment - Electrical & Electronic Eqt	1,575.31	1,871.42	1,384.26	1,870.34	2,059.32	1,838.06	1,663.61	1,226.85	1,405.01	1,091.73	2,096.87
Machinery & equipment - Industrial Machinery & Equip	1,181.60	1,420.76	946.26	1,630.47	2,115.37	1,769.78	1,814.79	1,242.46	1,809.76	1,162.26	2,241.56
Machinery & equipment - Other Plant & Equipment	2,135.86	2,662.76	1,822.33	3,703.26	3,713.32	3,099.45	3,132.09	2,955.48	2,664.79	2,242.90	3,960.14
Machinery & equipment - Other Transport Equipment	778.28	996.16	961.52	1,148.87	1,046.73	1,010.29	1,098.50	1,085.38	1,030.33	953.56	1,389.25
Machinery & equipment - Road Vehicles	3,753.15	1,843.47	5,385.65	8,536.67	7,037.16	7,638.41	7,841.83	9,316.95	7,919.47	8,440.11	9,600.68
Non-dwelling construction	5,150.36	8,243.44	8,345.92	12,959.70	10,642.88	14,894.14	12,253.80	13,117.32	12,428.56	12,590.91	12,375.10
Ownership transfer costs	239.01	779.53	2,311.32	349.66	467.24	1,454.45	1,256.92	909.70	701.34	650.00	1,109.03
Social (Unincorporated)											
Intellectual propery products - Artistic Originals	0.09	0.12	0.08	0.09	0.08	0.11	0.09	0.08	0.12	0.11	0.09
Intellectual propery products - Computer software	2.35	2.47	2.20	2.23	2.09	1.97	1.81	1.78	1.98	1.87	1.65
Intellectual propery products - Research & development	0.39	0.43	0.50	0.62	0.70	0.62	0.62	0.63	0.72	0.85	0.76
Inventories - Non-farm	0.14	0.16	0.22	0.24	0.25	0.20	0.24	0.28	0.32	0.37	0.31
Land	2.61	2.62	1.65	1.93	1.38	1.37	1.17	1.11	1.15	1.00	0.79
Machinery & equipment - Computers	3.13	2.85	2.31	2.35	2.05	1.68	1.47	1.23	1.35	1.39	1.41
Machinery & equipment - Electrical & Electronic Eqt	0.81	0.87	0.64	0.83	0.91	0.77	0.67	0.44	0.63	0.51	0.84
Machinery & equipment - Industrial Machinery & Equip	0.58	0.62	0.42	0.78	0.81	0.69	0.63	0.48	0.63	0.48	0.75
Machinery & equipment - Other Plant & Equipment	0.60	0.70	0.44	1.01	0.79	0.69	0.62	0.49	0.58	0.53	0.90
Machinery & equipment - Other Transport Equipment	0.68	0.85	0.62	0.94	0.70	0.65	0.61	0.50	0.55	0.46	0.81
Machinery & equipment - Road Vehicles	0.44	0.42	0.61	0.61	0.54	0.53	0.53	0.53	0.57	0.59	0.64
Non-dwelling construction	0.14	0.29	0.52	0.30	0.28	0.57	0.47	0.42	0.43	0.48	0.50
Ownership transfer costs	0.04	0.11	0.44	0.06	0.10	0.29	0.28	0.21	0.20	0.28	0.47

Appendix A.13 - Capital Stock Weights by Asset Type - Primary Sector

SMOOTHED WEIGHTS

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Primary (Incorporated)											
Cultivated biological resources - Livestock fixed assets	0.0139	0.0114	0.0052	0.0071	0.0086	0.0055	0.0045	0.0050	0.0046	0.0035	0.0027
Cultivated biological resources - Orchards, plantations & vineyards	0.0091	0.0102	0.0109	0.0129	0.0139	0.0123	0.0115	0.0067	0.0062	0.0098	0.0081
Intellectual propery products - Computer software	0.0051	0.0051	0.0065	0.0059	0.0047	0.0047	0.0050	0.0055	0.0059	0.0059	0.0049
Intellectual property products - Mineral & petroleum exploration	0.2078	0.1136	0.0585	0.0676	0.0594	0.0618	0.0846	0.0776	0.0723	0.0978	0.0864
Intellectual propery products - Research & development	0.0188	0.0219	0.0379	0.0472	0.0455	0.0347	0.0263	0.0288	0.0326	0.0341	0.0313
Inventories - farm	0.0019	0.0019	0.0025	0.0028	0.0026	0.0022	0.0022	0.0021	0.0021	0.0020	0.0017
Inventories - Non-farm	0.0097	0.0155	0.0115	0.0092	0.0154	0.0064	0.0059	0.0151	0.0220	0.0127	0.0001
Land	0.1268	0.1828	0.1299	0.1305	0.1115	0.1323	0.1650	0.1698	0.1531	0.1256	0.1070
Machinery & equipment - Computers	0.0038	0.0045	0.0063	0.0074	0.0078	0.0060	0.0046	0.0051	0.0055	0.0049	0.0034
Machinery & equipment - Electrical & Electronic Eqt	0.0088	0.0103	0.0128	0.0108	0.0124	0.0108	0.0084	0.0101	0.0142	0.0150	0.0115
Machinery & equipment - Industrial Machinery & Equip	0.1970	0.1936	0.2177	0.1756	0.2005	0.2185	0.1803	0.2167	0.2808	0.2644	0.2001
Machinery & equipment - Other Plant & Equipment	0.0375	0.0385	0.0472	0.0462	0.0478	0.0486	0.0449	0.0505	0.0603	0.0595	0.0479
Machinery & equipment - Other Transport Equipment	0.0121	0.0135	0.0111	0.0054	0.0129	0.0154	0.0142	0.0228	0.0307	0.0273	0.0171
Machinery & equipment - Road Vehicles	0.0266	0.0286	0.0338	0.0322	0.0313	0.0300	0.0288	0.0246	0.0236	0.0252	0.0206
Non-dwelling construction	0.3061	0.3358	0.3951	0.4212	0.4043	0.3907	0.4000	0.3571	0.2851	0.2969	0.4260
Ownership transfer costs	0.0142	0.0120	0.0121	0.0167	0.0201	0.0192	0.0133	0.0021	0.0006	0.0151	0.0308
Primary (Unincorporated)											
Cultivated biological resources - Livestock fixed assets	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cultivated biological resources - Orchards, plantations & vineyards	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Computer software	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
Intellectual property products - Mineral & petroleum exploration	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.0007	0.0007	0.0009	0.0009	0.0009	0.0007	0.0005	0.0003	0.0002	0.0001	0.0001
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.13 - Capital Stock Weights by Asset Type - Primary Sector

SMOOTHED WEIGHTS

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Primary (Incorporated)											
Cultivated biological resources - Livestock fixed assets	0.0020	0.0014	0.0010	0.0009	0.0005	0.0005	0.0007	0.0007	0.0005	0.0003	0.0003
Cultivated biological resources - Orchards, plantations & vineyards	0.0071	0.0065	0.0053	0.0027	0.0029	0.0067	0.0068	0.0055	0.0056	0.0043	0.0032
Intellectual propery products - Computer software	0.0042	0.0043	0.0039	0.0040	0.0043	0.0042	0.0046	0.0050	0.0047	0.0042	0.0040
Intellectual property products - Mineral & petroleum exploration	0.0665	0.0608	0.0638	0.0727	0.0583	0.0462	0.0433	0.0473	0.0543	0.0655	0.0549
Intellectual propery products - Research & development	0.0297	0.0291	0.0315	0.0376	0.0407	0.0387	0.0380	0.0402	0.0386	0.0376	0.0362
Inventories - farm	0.0015	0.0015	0.0014	0.0013	0.0013	0.0013	0.0015	0.0016	0.0015	0.0014	0.0014
Inventories - Non-farm	0.0041	0.0143	0.0103	0.0276	0.0276	0.0042	0.0240	0.0290	0.0302	0.0329	0.0119
Land	0.1089	0.1183	0.1431	0.1394	0.1244	0.1098	0.0796	0.0995	0.1118	0.1064	0.1069
Machinery & equipment - Computers	0.0030	0.0034	0.0029	0.0026	0.0025	0.0020	0.0020	0.0020	0.0017	0.0013	0.0011
Machinery & equipment - Electrical & Electronic Eqt	0.0100	0.0102	0.0083	0.0070	0.0073	0.0064	0.0057	0.0046	0.0036	0.0031	0.0039
Machinery & equipment - Industrial Machinery & Equip	0.1989	0.2185	0.1758	0.1438	0.1757	0.1736	0.1551	0.1209	0.1048	0.1001	0.1064
Machinery & equipment - Other Plant & Equipment	0.0451	0.0491	0.0396	0.0389	0.0446	0.0370	0.0330	0.0314	0.0259	0.0209	0.0250
Machinery & equipment - Other Transport Equipment	0.0156	0.0187	0.0142	0.0129	0.0134	0.0086	0.0073	0.0056	0.0042	0.0035	0.0054
Machinery & equipment - Road Vehicles	0.0169	0.0170	0.0162	0.0145	0.0129	0.0109	0.0115	0.0121	0.0102	0.0085	0.0090
Non-dwelling construction	0.4570	0.4143	0.4197	0.4456	0.4663	0.5086	0.5286	0.5437	0.5650	0.5787	0.5879
Ownership transfer costs	0.0293	0.0326	0.0629	0.0486	0.0171	0.0413	0.0584	0.0509	0.0373	0.0310	0.0425
Primary (Unincorporated)											
Cultivated biological resources - Livestock fixed assets	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cultivated biological resources - Orchards, plantations & vineyards	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Computer software	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual property products - Mineral & petroleum exploration	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.14 - Capital Stock Weights by Asset Type - Secondary Sector

SMOOTHED WEIGHTS

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Secondary (Incorporated)											
Intellectual propery products - Computer software	0.0409	0.0400	0.0420	0.0379	0.0299	0.0302	0.0322	0.0314	0.0296	0.0312	0.0320
Intellectual propery products - Research & development	0.0321	0.0358	0.0464	0.0552	0.0562	0.0476	0.0410	0.0469	0.0480	0.0489	0.0521
Inventories - Non-farm	0.0677	0.0841	0.0875	0.1073	0.0847	0.0513	0.0825	0.0892	0.0795	0.0502	0.0244
Land	0.0125	0.0141	0.0142	0.0136	0.0102	0.0208	0.0312	0.0325	0.0294	0.0235	0.0183
Machinery & equipment - Computers	0.0496	0.0520	0.0529	0.0534	0.0570	0.0492	0.0434	0.0462	0.0459	0.0433	0.0377
Machinery & equipment - Electrical & Electronic Eqt	0.0378	0.0396	0.0353	0.0307	0.0345	0.0330	0.0283	0.0313	0.0401	0.0456	0.0455
Machinery & equipment - Industrial Machinery & Equip	0.4122	0.3846	0.3715	0.3268	0.3442	0.3748	0.3459	0.3656	0.4035	0.3987	0.3548
Machinery & equipment - Other Plant & Equipment	0.0810	0.0800	0.0827	0.0825	0.0829	0.0888	0.0893	0.0903	0.0937	0.0971	0.0912
Machinery & equipment - Other Transport Equipment	0.0120	0.0126	0.0102	0.0079	0.0123	0.0138	0.0137	0.0187	0.0219	0.0205	0.0167
Machinery & equipment - Road Vehicles	0.0681	0.0711	0.0725	0.0717	0.0734	0.0747	0.0740	0.0651	0.0624	0.0721	0.0755
Non-dwelling construction	0.1763	0.1780	0.1769	0.2026	0.2028	0.2043	0.2100	0.1794	0.1432	0.1584	0.2338
Ownership transfer costs	0.0092	0.0076	0.0073	0.0099	0.0112	0.0111	0.0081	0.0029	0.0025	0.0103	0.0177
Secondary (Unincorporated)											
Intellectual propery products - Computer software	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.0005	0.0005	0.0005	0.0005	0.0005	0.0003	0.0002	0.0002	0.0002	0.0001	0.0001
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.14 - Capital Stock Weights by Asset Type - Secondary Sector

SMOOTHED WEIGHTS

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Secondary (Incorporated)											
Intellectual propery products - Computer software	0.0312	0.0308	0.0309	0.0291	0.0269	0.0278	0.0287	0.0312	0.0310	0.0269	0.0242
Intellectual propery products - Research & development	0.0585	0.0619	0.0751	0.0878	0.0925	0.0971	0.0988	0.1150	0.1226	0.1305	0.1327
Inventories - Non-farm	0.0306	0.0407	0.0282	0.0445	0.0637	0.0460	0.0579	0.0516	0.0401	0.0506	0.0496
Land	0.0155	0.0181	0.0303	0.0368	0.0309	0.0265	0.0249	0.0348	0.0417	0.0434	0.0435
Machinery & equipment - Computers	0.0370	0.0382	0.0357	0.0309	0.0273	0.0254	0.0247	0.0249	0.0225	0.0175	0.0133
Machinery & equipment - Electrical & Electronic Eqt	0.0468	0.0464	0.0417	0.0378	0.0363	0.0364	0.0354	0.0342	0.0327	0.0299	0.0304
Machinery & equipment - Industrial Machinery & Equip	0.3498	0.3712	0.3336	0.2898	0.3190	0.3199	0.2844	0.2525	0.2497	0.2377	0.2299
Machinery & equipment - Other Plant & Equipment	0.0877	0.0914	0.0834	0.0803	0.0825	0.0737	0.0656	0.0653	0.0611	0.0560	0.0605
Machinery & equipment - Other Transport Equipment	0.0168	0.0182	0.0149	0.0138	0.0132	0.0106	0.0103	0.0100	0.0101	0.0107	0.0134
Machinery & equipment - Road Vehicles	0.0761	0.0742	0.0771	0.0731	0.0625	0.0663	0.0764	0.0878	0.0873	0.0853	0.0889
Non-dwelling construction	0.2356	0.1939	0.2117	0.2441	0.2365	0.2518	0.2670	0.2707	0.2838	0.2957	0.2943
Ownership transfer costs	0.0142	0.0149	0.0371	0.0318	0.0087	0.0185	0.0258	0.0218	0.0172	0.0155	0.0191
Secondary (Unincorporated)											
Intellectual propery products - Computer software	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.15 - Capital Stock Weights by Asset Type - Services (Market) Sector

SMOOTHED WEIGHTS

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Services - Market (Incorporated)											
Intellectual propery products - Artistic Originals	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Intellectual propery products - Computer software	0.0611	0.0617	0.0711	0.0696	0.0584	0.0540	0.0600	0.0671	0.0693	0.0788	0.0780
Intellectual propery products - Research & development	0.0337	0.0367	0.0407	0.0408	0.0352	0.0273	0.0315	0.0384	0.0385	0.0406	0.0380
Inventories - Non-farm	0.0549	0.0681	0.0704	0.0622	0.0557	0.0523	0.0612	0.0668	0.0727	0.0777	0.0595
Land	0.0422	0.0479	0.0403	0.0343	0.0344	0.0531	0.0890	0.1016	0.0865	0.0646	0.0424
Machinery & equipment - Computers	0.0328	0.0342	0.0343	0.0336	0.0379	0.0334	0.0316	0.0396	0.0460	0.0472	0.0403
Machinery & equipment - Electrical & Electronic Eqt	0.0507	0.0560	0.0505	0.0403	0.0467	0.0479	0.0438	0.0491	0.0645	0.0726	0.0619
Machinery & equipment - Industrial Machinery & Equip	0.0488	0.0463	0.0446	0.0378	0.0401	0.0461	0.0410	0.0420	0.0513	0.0524	0.0435
Machinery & equipment - Other Plant & Equipment	0.0365	0.0344	0.0327	0.0287	0.0296	0.0355	0.0329	0.0310	0.0366	0.0383	0.0319
Machinery & equipment - Other Transport Equipment	0.0881	0.0822	0.0695	0.0543	0.0659	0.0651	0.0615	0.0748	0.0872	0.0886	0.0698
Machinery & equipment - Road Vehicles	0.1869	0.1935	0.2121	0.2336	0.2255	0.2006	0.2013	0.1956	0.1730	0.1864	0.2111
Non-dwelling construction	0.3436	0.3215	0.3199	0.3470	0.3483	0.3647	0.3308	0.2896	0.2733	0.2373	0.2957
Ownership transfer costs	0.0202	0.0168	0.0132	0.0169	0.0216	0.0197	0.0151	0.0042	0.0007	0.0153	0.0277
Services - Market (Unincorporated)											
Intellectual propery products - Artistic Originals	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Computer software	0.0001	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
Machinery & equipment - Computers	0.0003	0.0003	0.0003	0.0004	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.15 - Capital Stock Weights by Asset Type - Services (Market) Sector

SMOOTHED WEIGHTS

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Services - Market (Incorporated)											
Intellectual propery products - Artistic Originals	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Intellectual propery products - Computer software	0.0780	0.0814	0.0714	0.0561	0.0536	0.0578	0.0587	0.0602	0.0623	0.0641	0.0609
Intellectual propery products - Research & development	0.0389	0.0399	0.0358	0.0317	0.0340	0.0378	0.0396	0.0435	0.0478	0.0529	0.0523
Inventories - Non-farm	0.0525	0.0596	0.0623	0.0621	0.0600	0.0595	0.0600	0.0600	0.0634	0.0696	0.0677
Land	0.0390	0.0506	0.0649	0.0686	0.0648	0.0526	0.0438	0.0567	0.0642	0.0623	0.0574
Machinery & equipment - Computers	0.0408	0.0452	0.0382	0.0292	0.0283	0.0275	0.0246	0.0215	0.0198	0.0193	0.0191
Machinery & equipment - Electrical & Electronic Eqt	0.0615	0.0670	0.0513	0.0377	0.0423	0.0426	0.0361	0.0278	0.0244	0.0243	0.0290
Machinery & equipment - Industrial Machinery & Equip	0.0480	0.0573	0.0449	0.0355	0.0442	0.0456	0.0405	0.0347	0.0343	0.0353	0.0372
Machinery & equipment - Other Plant & Equipment	0.0346	0.0427	0.0319	0.0278	0.0364	0.0343	0.0300	0.0277	0.0250	0.0224	0.0260
Machinery & equipment - Other Transport Equipment	0.0701	0.0878	0.0757	0.0629	0.0651	0.0579	0.0548	0.0493	0.0466	0.0463	0.0552
Machinery & equipment - Road Vehicles	0.2188	0.2118	0.2106	0.2048	0.1990	0.2126	0.2163	0.2105	0.2166	0.2284	0.2194
Non-dwelling construction	0.2982	0.2324	0.2495	0.3333	0.3607	0.3418	0.3529	0.3755	0.3723	0.3552	0.3515
Ownership transfer costs	0.0194	0.0240	0.0631	0.0501	0.0112	0.0300	0.0426	0.0325	0.0233	0.0198	0.0240
Services - Market (Unincorporated)											
Intellectual propery products - Artistic Originals	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Computer software	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.16 - Capital Stock Weights by Asset Type - Distributive Services Sub-sector

SMOOTHED WEIGHTS

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Distributive (Incorporated)											
Intellectual propery products - Computer software	0.0552	0.0597	0.0686	0.0678	0.0566	0.0452	0.0483	0.0529	0.0508	0.0603	0.0602
Intellectual propery products - Research & development	0.0501	0.0570	0.0691	0.0652	0.0480	0.0393	0.0489	0.0558	0.0529	0.0628	0.0620
Inventories - Non-farm	0.0042	0.0050	0.0070	0.0086	0.0073	0.0049	0.0060	0.0070	0.0070	0.0080	0.0076
Land	0.0254	0.0350	0.0190	0.0070	0.0035	0.0415	0.1114	0.1226	0.0835	0.0470	0.0161
Machinery & equipment - Computers	0.0173	0.0186	0.0200	0.0205	0.0243	0.0216	0.0251	0.0323	0.0332	0.0327	0.0255
Machinery & equipment - Electrical & Electronic Eqt	0.0666	0.0789	0.0740	0.0611	0.0700	0.0668	0.0649	0.0745	0.0958	0.1169	0.1014
Machinery & equipment - Industrial Machinery & Equip	0.0295	0.0284	0.0265	0.0210	0.0234	0.0269	0.0226	0.0235	0.0296	0.0312	0.0233
Machinery & equipment - Other Plant & Equipment	0.0444	0.0430	0.0419	0.0372	0.0373	0.0412	0.0378	0.0359	0.0414	0.0465	0.0388
Machinery & equipment - Other Transport Equipment	0.1115	0.1028	0.0725	0.0413	0.0674	0.0690	0.0626	0.0898	0.1146	0.1144	0.0791
Machinery & equipment - Road Vehicles	0.0362	0.0400	0.0423	0.0407	0.0399	0.0366	0.0383	0.0358	0.0340	0.0444	0.0426
Non-dwelling construction	0.5274	0.5030	0.5360	0.5987	0.5835	0.5751	0.5095	0.4620	0.4561	0.4061	0.4907
Ownership transfer costs	0.0318	0.0280	0.0226	0.0305	0.0382	0.0315	0.0245	0.0077	0.0010	0.0294	0.0526
Distributive (Unincorporated)											
Intellectual propery products - Computer software	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.0003	0.0003	0.0004	0.0004	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.16 - Capital Stock Weights by Asset Type - Distributive Services Sub-sector

SMOOTHED WEIGHTS

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Distributive (Incorporated)											
Intellectual propery products - Computer software	0.0603	0.0650	0.0547	0.0379	0.0357	0.0406	0.0411	0.0400	0.0414	0.0437	0.0400
Intellectual propery products - Research & development	0.0613	0.0636	0.0501	0.0326	0.0288	0.0317	0.0315	0.0311	0.0330	0.0355	0.0329
Inventories - Non-farm	0.0087	0.0091	0.0086	0.0080	0.0078	0.0081	0.0074	0.0071	0.0078	0.0090	0.0076
Land	0.0050	0.0203	0.0604	0.0786	0.0747	0.0584	0.0453	0.0686	0.0859	0.0883	0.0810
Machinery & equipment - Computers	0.0243	0.0271	0.0220	0.0146	0.0129	0.0129	0.0120	0.0107	0.0100	0.0098	0.0083
Machinery & equipment - Electrical & Electronic Eqt	0.1002	0.1112	0.0808	0.0510	0.0536	0.0557	0.0465	0.0333	0.0281	0.0290	0.0359
Machinery & equipment - Industrial Machinery & Equip	0.0272	0.0366	0.0251	0.0158	0.0234	0.0264	0.0229	0.0168	0.0169	0.0188	0.0197
Machinery & equipment - Other Plant & Equipment	0.0436	0.0567	0.0390	0.0286	0.0392	0.0396	0.0349	0.0309	0.0283	0.0269	0.0304
Machinery & equipment - Other Transport Equipment	0.0808	0.1164	0.0866	0.0610	0.0717	0.0587	0.0504	0.0357	0.0309	0.0289	0.0431
Machinery & equipment - Road Vehicles	0.0440	0.0541	0.0498	0.0363	0.0324	0.0348	0.0356	0.0352	0.0335	0.0331	0.0332
Non-dwelling construction	0.5078	0.3909	0.3988	0.5404	0.6005	0.5775	0.5936	0.6329	0.6425	0.6399	0.6239
Ownership transfer costs	0.0366	0.0488	0.1239	0.0952	0.0192	0.0556	0.0788	0.0577	0.0415	0.0372	0.0440
Distributive (Unincorporated)											
Intellectual propery products - Computer software	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.17 - Capital Stock Weights by Asset Type - Producer Services Sub-sector

SMOOTHED WEIGHTS

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Producer (Incorporated)											
Intellectual propery products - Computer software	0.0661	0.0635	0.0738	0.0733	0.0651	0.0727	0.0831	0.0918	0.0981	0.1042	0.1021
Intellectual propery products - Research & development	0.0196	0.0207	0.0178	0.0233	0.0294	0.0180	0.0188	0.0286	0.0309	0.0277	0.0239
Inventories - Non-farm	0.1071	0.1312	0.1272	0.0983	0.0890	0.0978	0.1124	0.1208	0.1343	0.1362	0.1029
Land	0.0694	0.0675	0.0673	0.0667	0.0732	0.0694	0.0704	0.0865	0.0945	0.0871	0.0735
Machinery & equipment - Computers	0.0403	0.0398	0.0373	0.0344	0.0376	0.0346	0.0298	0.0343	0.0424	0.0443	0.0405
Machinery & equipment - Electrical & Electronic Eqt	0.0254	0.0252	0.0215	0.0166	0.0191	0.0221	0.0190	0.0195	0.0255	0.0254	0.0221
Machinery & equipment - Industrial Machinery & Equip	0.0784	0.0719	0.0668	0.0569	0.0601	0.0741	0.0673	0.0655	0.0775	0.0739	0.0633
Machinery & equipment - Other Plant & Equipment	0.0136	0.0127	0.0113	0.0097	0.0104	0.0133	0.0125	0.0122	0.0144	0.0135	0.0111
Machinery & equipment - Other Transport Equipment	0.0726	0.0725	0.0761	0.0745	0.0731	0.0734	0.0733	0.0683	0.0681	0.0742	0.0710
Machinery & equipment - Road Vehicles	0.4157	0.4062	0.4220	0.4607	0.4518	0.4335	0.4253	0.3978	0.3531	0.3461	0.3953
Non-dwelling construction	0.0878	0.0856	0.0763	0.0824	0.0875	0.0874	0.0854	0.0738	0.0605	0.0650	0.0900
Ownership transfer costs	0.0037	0.0029	0.0022	0.0027	0.0034	0.0034	0.0025	0.0007	0.0003	0.0022	0.0041
Producers (Unincorporated)											
Intellectual propery products - Computer software	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
Machinery & equipment - Computers	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.17 - Capital Stock Weights by Asset Type - Producer Services Sub-sector

SMOOTHED WEIGHTS

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Producer (Incorporated)											
Intellectual propery products - Computer software	0.1025	0.1039	0.0947	0.0841	0.0826	0.0836	0.0844	0.0886	0.0894	0.0885	0.0876
Intellectual propery products - Research & development	0.0275	0.0287	0.0317	0.0399	0.0496	0.0546	0.0590	0.0693	0.0758	0.0820	0.0845
Inventories - Non-farm	0.0819	0.0891	0.0994	0.1141	0.1174	0.1104	0.1105	0.1114	0.1144	0.1202	0.1253
Land	0.0772	0.0833	0.0733	0.0628	0.0576	0.0492	0.0442	0.0445	0.0420	0.0374	0.0330
Machinery & equipment - Computers	0.0428	0.0458	0.0397	0.0344	0.0350	0.0324	0.0286	0.0255	0.0234	0.0225	0.0241
Machinery & equipment - Electrical & Electronic Eqt	0.0236	0.0263	0.0219	0.0194	0.0246	0.0249	0.0219	0.0184	0.0176	0.0172	0.0186
Machinery & equipment - Industrial Machinery & Equip	0.0683	0.0757	0.0637	0.0590	0.0691	0.0657	0.0589	0.0552	0.0532	0.0516	0.0555
Machinery & equipment - Other Plant & Equipment	0.0116	0.0131	0.0103	0.0102	0.0122	0.0102	0.0087	0.0084	0.0075	0.0062	0.0072
Machinery & equipment - Other Transport Equipment	0.0718	0.0774	0.0792	0.0734	0.0687	0.0672	0.0689	0.0729	0.0711	0.0700	0.0751
Machinery & equipment - Road Vehicles	0.4015	0.3751	0.3867	0.4084	0.4119	0.4214	0.4273	0.4218	0.4283	0.4353	0.4232
Non-dwelling construction	0.0880	0.0783	0.0921	0.0884	0.0698	0.0772	0.0830	0.0800	0.0744	0.0670	0.0635
Ownership transfer costs	0.0032	0.0032	0.0071	0.0058	0.0015	0.0032	0.0045	0.0039	0.0029	0.0022	0.0024
Producers (Unincorporated)											
Intellectual propery products - Computer software	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.18 - Capital Stock Weights by Asset Type - Personal Services Sub-sector

SMOOTHED WEIGHTS

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Social (Incorporated)											
Intellectual propery products - Artistic Originals	0.0001	0.0001	0.0002	0.0004	0.0005	0.0004	0.0004	0.0005	0.0005	0.0007	0.0007
Intellectual propery products - Computer software	0.0726	0.0645	0.0712	0.0634	0.0442	0.0384	0.0400	0.0465	0.0508	0.0567	0.0539
Intellectual propery products - Research & development	0.0049	0.0053	0.0070	0.0081	0.0072	0.0054	0.0051	0.0064	0.0072	0.0075	0.0066
Inventories - Non-farm	0.1195	0.1270	0.1333	0.1403	0.1252	0.1128	0.1210	0.1227	0.1333	0.1245	0.0820
Land	0.0371	0.0405	0.0330	0.0246	0.0229	0.0410	0.0652	0.0755	0.0703	0.0477	0.0233
Machinery & equipment - Computers	0.0779	0.0779	0.0810	0.0808	0.0891	0.0767	0.0635	0.0831	0.1063	0.1094	0.0899
Machinery & equipment - Electrical & Electronic Eqt	0.0561	0.0571	0.0537	0.0448	0.0501	0.0487	0.0394	0.0462	0.0682	0.0793	0.0687
Machinery & equipment - Industrial Machinery & Equip	0.0462	0.0418	0.0420	0.0352	0.0369	0.0447	0.0382	0.0400	0.0531	0.0542	0.0425
Machinery & equipment - Other Plant & Equipment	0.0689	0.0641	0.0682	0.0639	0.0635	0.0757	0.0712	0.0695	0.0873	0.0959	0.0819
Machinery & equipment - Other Transport Equipment	0.0320	0.0311	0.0329	0.0329	0.0342	0.0319	0.0302	0.0374	0.0428	0.0432	0.0349
Machinery & equipment - Road Vehicles	0.1686	0.1710	0.1740	0.1699	0.1719	0.1891	0.1815	0.1690	0.1534	0.1344	0.1409
Non-dwelling construction	0.2960	0.3032	0.2888	0.3169	0.3320	0.3153	0.3303	0.2990	0.2253	0.2309	0.3476
Ownership transfer costs	0.0178	0.0145	0.0124	0.0162	0.0202	0.0186	0.0132	0.0031	0.0005	0.0146	0.0264
Social (Unincorporated)											
Intellectual propery products - Artistic Originals	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Computer software	0.0002	0.0002	0.0002	0.0003	0.0002	0.0001	0.0001	0.0002	0.0001	0.0002	0.0001
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0010	0.0009	0.0010	0.0011	0.0009	0.0005	0.0003	0.0004	0.0004	0.0003	0.0002
Machinery & equipment - Computers	0.0008	0.0007	0.0008	0.0009	0.0007	0.0004	0.0003	0.0003	0.0003	0.0003	0.0002
Machinery & equipment - Electrical & Electronic Eqt	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.18 - Capital Stock Weights by Asset Type - Personal Services Sub-sector

SMOOTHED WEIGHTS

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Social (Incorporated)											
Intellectual propery products - Artistic Originals	0.0007	0.0007	0.0006	0.0005	0.0005	0.0005	0.0004	0.0004	0.0005	0.0006	0.0006
Intellectual propery products - Computer software	0.0517	0.0535	0.0463	0.0370	0.0365	0.0389	0.0415	0.0479	0.0527	0.0525	0.0484
Intellectual propery products - Research & development	0.0065	0.0070	0.0068	0.0067	0.0076	0.0080	0.0081	0.0097	0.0112	0.0132	0.0138
Inventories - Non-farm	0.0930	0.1102	0.1070	0.1016	0.0887	0.0828	0.0884	0.1005	0.1067	0.1140	0.1005
Land	0.0175	0.0296	0.0465	0.0524	0.0502	0.0417	0.0366	0.0482	0.0548	0.0545	0.0520
Machinery & equipment - Computers	0.0869	0.0978	0.0838	0.0667	0.0669	0.0632	0.0561	0.0500	0.0459	0.0432	0.0450
Machinery & equipment - Electrical & Electronic Eqt	0.0673	0.0740	0.0603	0.0468	0.0516	0.0510	0.0443	0.0366	0.0332	0.0326	0.0387
Machinery & equipment - Industrial Machinery & Equip	0.0455	0.0559	0.0441	0.0364	0.0494	0.0509	0.0454	0.0387	0.0386	0.0388	0.0413
Machinery & equipment - Other Plant & Equipment	0.0848	0.1029	0.0834	0.0771	0.0972	0.0893	0.0789	0.0768	0.0707	0.0642	0.0755
Machinery & equipment - Other Transport Equipment	0.0321	0.0380	0.0359	0.0306	0.0287	0.0269	0.0267	0.0276	0.0266	0.0260	0.0287
Machinery & equipment - Road Vehicles	0.1625	0.1246	0.1270	0.1977	0.2034	0.1912	0.1960	0.2161	0.2169	0.2146	0.2232
Non-dwelling construction	0.3334	0.2842	0.3036	0.3030	0.3082	0.3309	0.3431	0.3199	0.3217	0.3280	0.3106
Ownership transfer costs	0.0176	0.0211	0.0543	0.0432	0.0108	0.0245	0.0343	0.0274	0.0203	0.0177	0.0214
Social (Unincorporated)											
Intellectual propery products - Artistic Originals	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Computer software	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Electrical & Electronic Eqt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Industrial Machinery & Equip	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Plant & Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Other Transport Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Road Vehicles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Non-dwelling construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ownership transfer costs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A.19 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Primary Sector

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Primary (Incorporated)											
Cultivated biological resources - Livestock fixed assets	-0.0470	-0.0128	-0.1247	-0.1195	-0.0220	-0.1467	-0.0822	-0.1982	-0.1215	-0.1271	-0.1245
Cultivated biological resources - Orchards, plantations & vineyards	0.0411	0.0561	0.0605	0.0673	0.0699	0.0507	0.0417	0.0310	0.0242	0.0229	0.0178
Intellectual propery products - Computer software	0.0987	0.1281	0.1456	0.1335	0.2072	0.1192	0.1522	0.1263	0.1283	0.1173	0.0703
Intellectual property products - Mineral & petroleum exploration	0.0312	0.0358	0.0343	0.0254	0.0146	0.0182	0.0132	0.0146	0.0128	0.0150	0.0180
Intellectual propery products - Research & development	0.0943	0.0659	0.0503	0.0358	0.0253	0.0409	0.0622	0.0634	0.0733	0.0789	0.0503
Inventories - farm	0.1012	-0.0071	0.0342	-0.0063	0.0202	0.1026	0.0318	-0.0460	-0.0021	0.0148	0.0971
Inventories - Non-farm	0.1860	0.1079	-0.0602	-0.0584	-0.0245	-0.1762	0.1971	0.0182	0.0204	-0.0492	-0.0746
Land	0.0119	0.0119	0.0159	0.0213	0.0039	0.0015	0.0105	0.0170	0.0145	0.0162	0.0360
Machinery & equipment - Computers	0.3182	0.3427	0.6103	0.2104	0.1373	0.0589	0.1057	0.2046	0.2806	0.2009	0.2020
Machinery & equipment - Electrical & Electronic Eqt	0.0553	0.0629	0.2018	0.0409	0.0361	0.0234	0.0499	0.1273	0.1605	0.1333	0.1331
Machinery & equipment - Industrial Machinery & Equip	0.0191	0.0354	0.0681	0.0120	-0.0034	0.0003	0.0155	0.0270	0.0387	0.0408	0.0681
Machinery & equipment - Other Plant & Equipment	0.0972	0.1037	0.1544	0.0353	0.0132	0.0130	0.0285	0.0317	0.0465	0.0322	0.0492
Machinery & equipment - Other Transport Equipment	0.2900	0.2231	0.1417	0.0404	0.0238	0.0526	-0.0028	-0.0041	0.0368	0.0176	0.0204
Machinery & equipment - Road Vehicles	0.0059	0.0154	0.0574	0.0162	0.0084	-0.0182	-0.0091	-0.0016	0.0029	0.0093	0.0175
Non-dwelling construction	0.0391	0.0384	0.0489	0.0633	0.0204	0.0127	0.0354	0.0515	0.0461	0.0499	0.0961
Ownership transfer costs	0.0262	0.0263	0.0400	0.0504	0.0183	0.0134	0.0433	0.0573	0.0469	0.0339	0.0647
Primary (Unincorporated)											
Cultivated biological resources - Livestock fixed assets	-0.0127	-0.0132	-0.0496	-0.0655	-0.0583	-0.0550	-0.0428	-0.0989	-0.0131	-0.0201	0.0086
Cultivated biological resources - Orchards, plantations & vineyards	0.0411	0.0561	0.0605	0.0673	0.0699	0.0507	0.0417	0.0310	0.0242	0.0229	0.0178
Intellectual propery products - Computer software	0.0989	0.1172	0.1502	0.0755	0.1228	0.0532	0.0669	-0.0282	-0.0009	0.0151	0.0195
Intellectual property products - Mineral & petroleum exploration	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - farm	0.0596	-0.0074	0.0690	-0.0185	0.0212	0.1077	0.0347	-0.0565	0.0050	0.0158	0.0965
Inventories - Non-farm	0.1740	0.0911	-0.0119	-0.0726	-0.0711	-0.1886	0.1965	-0.0210	-0.0347	-0.0986	-0.1084
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.2595	0.2733	0.4549	0.3065	0.2388	0.1671	0.1310	0.2393	0.2409	0.2285	0.1425
Machinery & equipment - Electrical & Electronic Eqt	0.0188	0.0216	0.1057	0.0408	0.0508	0.0512	0.0539	0.1492	0.1546	0.1587	0.1125
Machinery & equipment - Industrial Machinery & Equip	-0.0207	-0.0165	-0.0142	-0.0070	-0.0073	0.0140	0.0028	0.0204	0.0154	0.0432	0.0338
Machinery & equipment - Other Plant & Equipment	0.0367	0.0347	0.0456	0.0273	0.0222	0.0428	0.0281	0.0388	0.0355	0.0472	0.0317
Machinery & equipment - Other Transport Equipment	0.2228	0.1527	0.0624	0.0449	0.0414	0.1087	-0.0022	0.0009	0.0308	0.0323	0.0077
Machinery & equipment - Road Vehicles	-0.0146	-0.0065	0.0161	0.0101	0.0101	-0.0124	-0.0125	-0.0005	-0.0014	0.0158	0.0090
Non-dwelling construction	0.0123	0.0104	0.0207	0.0322	0.0336	0.0179	0.0309	0.0438	0.0430	0.0418	0.0373
Ownership transfer costs	-0.0006	-0.0016	0.0119	0.0194	0.0316	0.0186	0.0389	0.0498	0.0439	0.0259	0.0060

Appendix A.19 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Primary Sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Primary (Incorporated)											
Cultivated biological resources - Livestock fixed assets	-0.1903	-0.2328	-0.2637	-0.2556	0.0490	0.0162	-0.0355	-0.0984	-0.1264	-0.1785	0.0528
Cultivated biological resources - Orchards, plantations & vineyards	0.0348	0.0254	0.0312	0.0272	0.0343	0.0227	0.0312	0.0259	0.0115	0.0179	0.0157
Intellectual propery products - Computer software	0.0768	0.2168	0.2204	0.1943	0.0705	0.2336	0.0793	0.0601	0.1001	0.0624	0.0936
Intellectual property products - Mineral & petroleum exploration	0.0348	0.0477	0.0499	0.0437	0.0443	0.0474	0.0491	0.0373	0.0244	0.0075	0.0047
Intellectual propery products - Research & development	0.1073	0.1273	0.1182	0.0812	0.0618	0.0638	0.0308	0.0024	-0.0225	-0.0468	-0.0426
Inventories - farm	0.0636	0.1176	0.0381	-0.0312	0.0917	0.0621	0.0612	0.0522	0.0085	-0.0258	0.0096
Inventories - Non-farm	0.1865	-0.0487	0.0864	0.0430	-0.0047	0.2558	0.1007	0.0866	-0.0279	-0.0140	-0.0442
Land	0.0399	0.0399	0.0465	0.0341	0.0455	0.0796	0.0822	0.0637	0.0380	0.0200	0.0078
Machinery & equipment - Computers	0.2690	0.3735	0.1515	0.1679	0.1321	0.1604	0.1642	-0.0079	-0.0785	-0.1494	-0.1719
Machinery & equipment - Electrical & Electronic Eqt	0.1544	0.1359	0.0809	0.0496	0.0507	0.0708	0.1138	0.0373	0.0141	-0.0118	-0.0111
Machinery & equipment - Industrial Machinery & Equip	0.0636	0.0992	0.0851	0.0500	0.0591	0.1122	0.0885	0.0308	0.0182	-0.0067	-0.0109
Machinery & equipment - Other Plant & Equipment	0.0541	0.0906	0.0497	0.0419	0.0463	0.0708	0.0991	0.0195	0.0025	-0.0261	-0.0265
Machinery & equipment - Other Transport Equipment	-0.0063	0.0449	0.0371	-0.0062	0.0118	0.0012	0.1159	0.0149	0.0044	-0.0265	-0.0095
Machinery & equipment - Road Vehicles	0.0482	0.1070	0.0343	0.0811	0.0654	0.0606	0.0801	0.0443	0.0184	0.0117	0.0143
Non-dwelling construction	0.1060	0.1073	0.1253	0.0929	0.1188	0.1931	0.1994	0.1597	0.1033	0.0633	0.0365
Ownership transfer costs	0.0764	0.0659	0.0642	0.0412	0.0587	0.1126	0.1229	0.0854	0.0436	0.0180	-0.0011
Primary (Unincorporated)											
Cultivated biological resources - Livestock fixed assets	-0.0285	-0.0270	-0.0296	-0.0501	0.0117	-0.0180	-0.0186	-0.0384	-0.0713	-0.0753	0.0058
Cultivated biological resources - Orchards, plantations & vineyards	0.0348	0.0254	0.0312	0.0272	0.0343	0.0227	0.0312	0.0259	0.0115	0.0179	0.0157
Intellectual propery products - Computer software	0.0453	-0.1299	-0.1590	-0.2234	-0.1884	-0.0815	0.0619	-0.0081	0.0430	0.0508	0.0609
Intellectual property products - Mineral & petroleum exploration	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - farm	0.0518	0.1133	-0.0219	-0.0377	0.0889	0.0650	0.0560	0.0226	0.0032	-0.0266	0.0138
Inventories - Non-farm	0.1324	-0.1919	0.0533	0.0254	-0.0106	0.1828	-0.0533	-0.0004	-0.1240	-0.0517	-0.1363
Land	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Machinery & equipment - Computers	0.2642	0.2545	0.1488	0.0597	0.0843	0.0780	0.1011	0.0263	0.0046	-0.0522	-0.0576
Machinery & equipment - Electrical & Electronic Eqt	0.1607	0.0937	0.0754	0.0092	0.0219	0.0231	0.0639	0.0325	0.0332	0.0098	0.0170
Machinery & equipment - Industrial Machinery & Equip	0.0543	0.0501	0.0658	0.0064	0.0179	0.0367	0.0274	0.0278	0.0350	0.0224	0.0218
Machinery & equipment - Other Plant & Equipment	0.0567	0.0474	0.0408	0.0040	0.0177	0.0163	0.0291	0.0150	0.0165	-0.0009	0.0048
Machinery & equipment - Other Transport Equipment	-0.0059	0.0124	0.0280	-0.0355	-0.0148	-0.0377	0.0331	0.0056	0.0162	-0.0038	0.0297
Machinery & equipment - Road Vehicles	0.0450	0.0699	0.0310	0.0307	0.0476	0.0395	0.0617	0.0392	0.0408	0.0368	0.0439
Non-dwelling construction	0.0392	0.0217	0.0192	0.0233	-0.0003	0.0076	-0.0062	-0.0095	-0.0055	-0.0042	-0.0030
Ownership transfer costs	0.0097	-0.0196	-0.0421	-0.0283	-0.0604	-0.0728	-0.0827	-0.0838	-0.0652	-0.0495	-0.0406

Appendix A.20 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Secondary Sector

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Secondary (Incorporated)											
Intellectual propery products - Computer software	0.1047	0.1178	0.1369	0.1025	0.0757	0.0673	0.0827	0.0826	0.1011	0.0905	0.0706
Intellectual propery products - Research & development	0.1037	0.0758	0.0556	0.0379	0.0257	0.0389	0.0590	0.0666	0.0738	0.0761	0.1141
Inventories - Non-farm	0.0708	-0.0061	0.0507	0.0945	0.0274	0.0027	0.0340	0.0051	0.0180	-0.0189	-0.0132
Land	0.0091	0.0119	0.0245	0.0077	0.0157	0.0052	-0.0005	0.0226	0.0277	0.0399	0.0382
Machinery & equipment - Computers	0.2907	0.2251	0.3496	0.2213	0.2191	0.0891	0.1145	0.2070	0.2640	0.1935	0.1878
Machinery & equipment - Electrical & Electronic Eqt	0.0745	0.0448	0.1104	0.0317	0.0526	0.0272	0.0515	0.1367	0.1627	0.1485	0.1429
Machinery & equipment - Industrial Machinery & Equip	0.0057	0.0007	-0.0086	-0.0091	-0.0014	-0.0029	-0.0033	0.0108	0.0168	0.0272	0.0446
Machinery & equipment - Other Plant & Equipment	0.0983	0.0623	0.0488	0.0187	0.0243	0.0134	0.0107	0.0129	0.0223	0.0132	0.0224
Machinery & equipment - Other Transport Equipment	0.2996	0.1379	0.0393	0.0213	0.0314	0.0651	-0.0202	-0.0227	0.0124	0.0089	-0.0009
Machinery & equipment - Road Vehicles	0.0390	0.0193	0.0326	0.0185	0.0252	-0.0129	-0.0039	0.0019	0.0068	0.0140	0.0259
Non-dwelling construction	0.0170	0.0210	0.0394	0.0158	0.0272	0.0120	0.0036	0.0373	0.0453	0.0642	0.0633
Ownership transfer costs	0.0041	0.0090	0.0305	0.0029	0.0251	0.0127	0.0115	0.0431	0.0461	0.0482	0.0319
Secondary (Unincorporated)											
Intellectual propery products - Computer software	0.0989	0.0666	0.1127	0.0815	0.0617	0.0594	0.0758	0.0690	0.0892	0.0862	0.0665
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	0.0354	-0.0347	0.0310	0.0736	0.0141	-0.0084	0.0165	-0.0017	-0.0024	-0.0438	-0.0370
Land	0.0017	-0.0011	0.0045	0.0175	0.0065	-0.0029	-0.0009	-0.0033	-0.0030	0.0040	0.0038
Machinery & equipment - Computers	0.2991	0.1585	0.3165	0.2346	0.2296	0.1576	0.1827	0.2877	0.2961	0.2614	0.2251
Machinery & equipment - Electrical & Electronic Eqt	0.0961	0.0237	0.1042	0.0370	0.0561	0.0584	0.0867	0.1994	0.2061	0.2081	0.1833
Machinery & equipment - Industrial Machinery & Equip	0.0230	-0.0086	-0.0108	-0.0036	0.0026	0.0311	0.0325	0.0545	0.0499	0.0881	0.0989
Machinery & equipment - Other Plant & Equipment	0.0957	0.0437	0.0348	0.0170	0.0226	0.0370	0.0348	0.0429	0.0456	0.0516	0.0576
Machinery & equipment - Other Transport Equipment	0.3922	0.1260	0.0449	0.0340	0.0396	0.1089	0.0019	0.0034	0.0421	0.0494	0.0346
Machinery & equipment - Road Vehicles	0.0576	0.0130	0.0335	0.0250	0.0304	0.0034	0.0150	0.0253	0.0251	0.0458	0.0546
Non-dwelling construction	0.0118	0.0054	0.0152	0.0374	0.0184	0.0045	0.0074	0.0022	0.0020	0.0116	0.0104
Ownership transfer costs	-0.0011	-0.0066	0.0062	0.0246	0.0162	0.0051	0.0152	0.0079	0.0027	-0.0046	-0.0212

Appendix A.20 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Secondary Sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Secondary (Incorporated)											
Intellectual propery products - Computer software	0.0732	0.1014	0.1116	0.1207	0.0576	0.0649	0.0592	0.0092	0.0332	0.0657	0.0731
Intellectual propery products - Research & development	0.0991	0.1077	0.0681	0.0567	0.0609	0.0505	0.0448	0.0396	0.0128	-0.0110	-0.0066
Inventories - Non-farm	0.0141	0.0403	-0.0546	-0.0209	0.0099	-0.0346	0.0083	-0.0521	-0.0376	-0.0637	-0.0083
Land	0.0233	0.0209	0.0194	0.0129	0.0188	0.0233	0.0051	0.0014	-0.0015	-0.0064	-0.0015
Machinery & equipment - Computers	0.1714	0.2562	0.0720	0.1820	0.1338	0.0832	0.0679	-0.0246	-0.0409	-0.0866	-0.0763
Machinery & equipment - Electrical & Electronic Eqt	0.1197	0.1058	0.0534	0.0658	0.0568	0.0409	0.0718	0.0194	0.0253	-0.0004	0.0129
Machinery & equipment - Industrial Machinery & Equip	0.0172	0.0276	0.0102	-0.0012	0.0005	0.0116	-0.0131	-0.0177	-0.0152	-0.0168	-0.0164
Machinery & equipment - Other Plant & Equipment	0.0026	0.0190	-0.0217	-0.0102	-0.0131	-0.0198	-0.0138	-0.0321	-0.0305	-0.0372	-0.0283
Machinery & equipment - Other Transport Equipment	-0.0402	0.0043	-0.0027	-0.0080	0.0038	-0.0383	0.0591	0.0068	0.0314	0.0023	0.0523
Machinery & equipment - Road Vehicles	0.0248	0.0823	0.0203	0.1177	0.0997	0.0623	0.0745	0.0348	0.0434	0.0368	0.0490
Non-dwelling construction	0.0420	0.0387	0.0368	0.0271	0.0362	0.0435	0.0154	0.0098	0.0054	-0.0021	0.0051
Ownership transfer costs	0.0124	-0.0026	-0.0243	-0.0246	-0.0239	-0.0369	-0.0611	-0.0645	-0.0543	-0.0474	-0.0325
Secondary (Unincorporated)											
Intellectual propery products - Computer software	0.0696	-0.1017	-0.0757	-0.0628	0.1959	-0.0404	0.0042	-0.0603	-0.0308	-0.0052	0.0381
Intellectual propery products - Research & development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Inventories - Non-farm	-0.0063	0.0007	-0.0360	0.0087	-0.0136	-0.0819	0.0187	-0.0532	-0.0553	-0.0566	-0.0228
Land	-0.0002	-0.0171	-0.0012	0.0043	-0.0040	-0.0107	-0.0165	-0.0159	-0.0190	-0.0156	-0.0166
Machinery & equipment - Computers	0.2067	0.2058	0.1157	0.1193	-0.0079	-0.0135	-0.0108	-0.0119	-0.0035	-0.0138	-0.0191
Machinery & equipment - Electrical & Electronic Eqt	0.1582	0.0815	0.0587	0.0210	-0.0113	-0.0116	-0.0116	-0.0055	0.0185	0.0078	0.0146
Machinery & equipment - Industrial Machinery & Equip	0.0676	0.0568	0.0710	0.0286	-0.0089	0.0048	-0.0166	0.0009	0.0187	0.0198	0.0139
Machinery & equipment - Other Plant & Equipment	0.0341	0.0336	0.0301	0.0148	-0.0338	-0.0420	-0.0105	-0.0162	-0.0249	-0.0236	-0.0203
Machinery & equipment - Other Transport Equipment	-0.0147	0.0048	0.0161	-0.0334	-0.0514	-0.0688	-0.0328	-0.0208	0.0218	0.0127	0.0561
Machinery & equipment - Road Vehicles	0.0548	0.0706	0.0281	0.0607	0.0206	0.0157	0.0058	0.0173	0.0389	0.0496	0.0529
Non-dwelling construction	0.0077	-0.0121	0.0057	0.0126	0.0023	-0.0071	-0.0152	-0.0164	-0.0219	-0.0184	-0.0204
Ownership transfer costs	-0.0221	-0.0539	-0.0557	-0.0393	-0.0579	-0.0876	-0.0917	-0.0908	-0.0814	-0.0636	-0.0580

Appendix A.21 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Services (Market) Sector

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Services - Market (Incorporated)											
Intellectual propery products - Artistic Originals	0.1846	0.1844	0.1240	0.1014	0.1708	0.1843	0.1102	0.1404	0.1307	0.1019	0.0657
Intellectual propery products - Computer software	0.0893	0.1651	0.1395	0.1527	0.1432	0.1301	0.0993	0.0980	0.1174	0.0860	0.0715
Intellectual propery products - Research & development	0.1110	0.0849	0.0434	0.0415	0.0295	0.0452	0.0595	0.0579	0.0609	0.0630	0.0679
Inventories - Non-farm	0.0214	0.0447	0.0337	0.0517	0.0324	0.0291	-0.0032	0.0443	0.0368	0.0350	0.0295
Land	0.0113	0.0101	0.0094	0.0116	0.0120	0.0066	0.0098	0.0095	0.0125	0.0160	0.0170
Machinery & equipment - Computers	0.0694	0.1035	0.1374	0.1095	0.1340	0.1529	0.1341	0.1874	0.2114	0.1998	0.1921
Machinery & equipment - Electrical & Electronic Eqt	0.0431	0.0624	0.0567	0.0685	0.1218	0.1489	0.1098	0.1210	0.1140	0.1220	0.1206
Machinery & equipment - Industrial Machinery & Equip	-0.0154	-0.0055	-0.0135	0.0095	0.0293	0.0523	0.0333	0.0315	0.0349	0.0574	0.0711
Machinery & equipment - Other Plant & Equipment	0.0096	0.0233	0.0138	0.0472	0.0684	0.0825	0.0582	0.0464	0.0513	0.0498	0.0584
Machinery & equipment - Other Transport Equipment	0.0055	0.0127	-0.0014	0.0068	0.0010	-0.0239	0.0083	0.0357	0.0447	0.0379	0.0576
Machinery & equipment - Road Vehicles	0.0238	0.0348	0.0363	0.0365	0.0306	0.0245	0.0180	0.0175	0.0197	0.0191	0.0178
Non-dwelling construction	0.0216	0.0199	0.0189	0.0222	0.0225	0.0142	0.0186	0.0175	0.0206	0.0247	0.0254
Ownership transfer costs	0.0089	0.0077	0.0097	0.0093	0.0203	0.0145	0.0262	0.0232	0.0215	0.0094	-0.0047
Services - Market (Unincorporated)											
Intellectual propery products - Artistic Originals	-0.0956	0.1407	0.1355	0.1535	0.1476	0.1775	0.0941	0.0645	0.0438	0.0433	0.0454
Intellectual propery products - Computer software	0.0341	0.0844	0.1359	0.1239	0.1144	0.1326	0.0962	0.1784	0.1668	0.1365	0.0969
Intellectual propery products - Research & development	0.0597	0.0872	0.0642	0.0454	0.0176	0.0284	0.0524	0.0951	0.1120	0.1480	0.1797
Inventories - Non-farm	0.0065	0.0216	0.0124	0.0284	0.0227	0.0237	0.0009	0.0206	0.0129	0.0151	0.0146
Land	0.0324	0.0217	0.0195	0.0348	0.0417	0.0241	0.0183	0.0295	0.0419	0.0441	0.0493
Machinery & equipment - Computers	0.0891	0.1159	0.1681	0.1260	0.1470	0.1510	0.1536	0.2350	0.2681	0.2409	0.2198
Machinery & equipment - Electrical & Electronic Eqt	0.0292	0.0516	0.0332	0.0434	0.0560	0.1024	0.0839	0.1029	0.1132	0.1380	0.1461
Machinery & equipment - Industrial Machinery & Equip	0.0369	0.0560	0.0337	0.0429	0.0517	0.0948	0.0770	0.0719	0.0759	0.0984	0.1083
Machinery & equipment - Other Plant & Equipment	0.0733	0.0726	0.0519	0.0783	0.0713	0.1004	0.0737	0.0770	0.0935	0.0981	0.0969
Machinery & equipment - Other Transport Equipment	0.0585	0.0861	0.0616	0.0810	0.0754	0.0701	0.0558	0.0745	0.0967	0.0981	0.1106
Machinery & equipment - Road Vehicles	0.0167	0.0322	0.0272	0.0344	0.0478	0.0352	0.0257	0.0288	0.0290	0.0298	0.0265
Non-dwelling construction	0.0298	0.0276	0.0226	0.0353	0.0521	0.0311	0.0236	0.0242	0.0203	0.0139	0.0041
Ownership transfer costs	0.0368	0.0194	0.0162	0.0333	0.0546	0.0254	0.0236	0.0232	0.0147	0.0008	-0.0150

Appendix A.21 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Services (Market) Sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Services - Market (Incorporated)											
Intellectual propery products - Artistic Originals	0.1240	0.1312	0.1105	0.0897	0.0679	-0.0177	-0.0312	-0.0007	0.0341	0.0531	0.0550
Intellectual propery products - Computer software	0.0776	0.0899	0.0760	0.0782	0.0720	0.0985	0.0831	0.0589	0.0663	0.0843	0.0892
Intellectual propery products - Research & development	0.0742	0.0791	0.0735	0.0976	0.1004	0.1088	0.0941	0.0865	0.0622	0.0515	0.0426
Inventories - Non-farm	0.0196	0.0504	-0.0071	0.0040	0.0155	0.0218	0.0045	0.0008	0.0227	0.0215	0.0227
Land	0.0193	0.0226	0.0253	0.0223	0.0168	0.0159	0.0140	0.0135	0.0108	0.0102	0.0123
Machinery & equipment - Computers	0.1684	0.1521	0.1058	0.0867	0.0656	0.0732	0.0592	0.0373	0.0274	0.0175	0.0187
Machinery & equipment - Electrical & Electronic Eqt	0.1083	0.0996	0.0835	0.0555	0.0513	0.0571	0.0473	0.0364	0.0280	0.0317	0.0287
Machinery & equipment - Industrial Machinery & Equip	0.0492	0.0636	0.0756	0.0365	0.0332	0.0527	0.0291	0.0279	0.0269	0.0335	0.0220
Machinery & equipment - Other Plant & Equipment	0.0474	0.0669	0.0622	0.0560	0.0542	0.0614	0.0442	0.0341	0.0229	0.0211	0.0175
Machinery & equipment - Other Transport Equipment	0.0365	0.0691	0.0712	0.0870	0.0749	0.0664	0.0646	0.0512	0.0458	0.0426	0.0376
Machinery & equipment - Road Vehicles	0.0220	0.0239	0.0165	0.0258	0.0262	0.0246	0.0194	0.0178	0.0185	0.0235	0.0214
Non-dwelling construction	0.0289	0.0328	0.0386	0.0336	0.0275	0.0256	0.0240	0.0246	0.0212	0.0211	0.0255
Ownership transfer costs	0.0004	-0.0070	-0.0204	-0.0165	-0.0312	-0.0531	-0.0510	-0.0485	-0.0376	-0.0236	-0.0116
Services - Market (Unincorporated)											
Intellectual propery products - Artistic Originals	0.0329	0.0278	0.0343	0.0511	0.0554	0.0041	0.0092	0.0383	0.0614	0.0709	0.0721
Intellectual propery products - Computer software	0.0853	0.0619	0.0134	0.0574	0.1245	0.1847	0.1095	0.0359	0.0716	-0.0001	0.0526
Intellectual propery products - Research & development	0.1546	0.1467	0.1056	0.0812	0.0739	0.0811	0.0904	0.0926	0.0731	0.0545	0.0452
Inventories - Non-farm	0.0129	0.0192	0.0022	0.0050	0.0056	-0.0035	0.0005	-0.0049	0.0151	0.0113	0.0097
Land	0.0630	0.0313	0.0380	-0.0082	-0.0124	-0.0126	-0.0067	-0.0280	-0.0172	-0.0050	-0.0026
Machinery & equipment - Computers	0.1916	0.0832	0.0780	-0.0001	-0.0133	-0.0094	0.0070	-0.0238	0.0076	-0.0302	-0.0235
Machinery & equipment - Electrical & Electronic Eqt	0.1167	0.0535	0.0889	0.0015	0.0056	0.0212	0.0073	-0.0054	0.0112	-0.0017	-0.0070
Machinery & equipment - Industrial Machinery & Equip	0.0802	0.0336	0.0529	-0.0066	-0.0112	0.0027	-0.0132	-0.0290	-0.0095	-0.0247	-0.0255
Machinery & equipment - Other Plant & Equipment	0.0655	0.0255	0.0369	-0.0077	-0.0132	-0.0216	-0.0139	-0.0252	-0.0013	-0.0300	-0.0169
Machinery & equipment - Other Transport Equipment	0.0976	0.0736	0.0645	0.0064	0.0091	0.0030	0.0234	-0.0043	-0.0055	-0.0116	-0.0052
Machinery & equipment - Road Vehicles	0.0328	0.0367	0.0272	0.0150	0.0249	0.0147	0.0177	0.0122	0.0256	0.0238	0.0221
Non-dwelling construction	0.0159	-0.0020	-0.0150	-0.0065	-0.0091	-0.0292	-0.0247	-0.0288	-0.0069	0.0181	0.0190
Ownership transfer costs	0.0001	-0.0405	-0.0634	-0.0354	-0.0520	-0.0856	-0.0801	-0.0847	-0.0513	-0.0073	-0.0017

Appendix A.22 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Distributive Services Sub-sector

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Services - Market (Incorporated)											
Intellectual propery products - Artistic Originals	0.1846	0.1844	0.1240	0.1014	0.1708	0.1843	0.1102	0.1404	0.1307	0.1019	0.0657
Intellectual propery products - Computer software	0.0893	0.1651	0.1395	0.1527	0.1432	0.1301	0.0993	0.0980	0.1174	0.0860	0.0715
Intellectual propery products - Research & development	0.1110	0.0849	0.0434	0.0415	0.0295	0.0452	0.0595	0.0579	0.0609	0.0630	0.0679
Inventories - Non-farm	0.0214	0.0447	0.0337	0.0517	0.0324	0.0291	-0.0032	0.0443	0.0368	0.0350	0.0295
Land	0.0113	0.0101	0.0094	0.0116	0.0120	0.0066	0.0098	0.0095	0.0125	0.0160	0.0170
Machinery & equipment - Computers	0.0694	0.1035	0.1374	0.1095	0.1340	0.1529	0.1341	0.1874	0.2114	0.1998	0.1921
Machinery & equipment - Electrical & Electronic Eqt	0.0431	0.0624	0.0567	0.0685	0.1218	0.1489	0.1098	0.1210	0.1140	0.1220	0.1206
Machinery & equipment - Industrial Machinery & Equip	-0.0154	-0.0055	-0.0135	0.0095	0.0293	0.0523	0.0333	0.0315	0.0349	0.0574	0.0711
Machinery & equipment - Other Plant & Equipment	0.0096	0.0233	0.0138	0.0472	0.0684	0.0825	0.0582	0.0464	0.0513	0.0498	0.0584
Machinery & equipment - Other Transport Equipment	0.0055	0.0127	-0.0014	0.0068	0.0010	-0.0239	0.0083	0.0357	0.0447	0.0379	0.0576
Machinery & equipment - Road Vehicles	0.0238	0.0348	0.0363	0.0365	0.0306	0.0245	0.0180	0.0175	0.0197	0.0191	0.0178
Non-dwelling construction	0.0216	0.0199	0.0189	0.0222	0.0225	0.0142	0.0186	0.0175	0.0206	0.0247	0.0254
Ownership transfer costs	0.0089	0.0077	0.0097	0.0093	0.0203	0.0145	0.0262	0.0232	0.0215	0.0094	-0.0047
Services - Market (Unincorporated)											
Intellectual propery products - Artistic Originals	-0.0956	0.1407	0.1355	0.1535	0.1476	0.1775	0.0941	0.0645	0.0438	0.0433	0.0454
Intellectual propery products - Computer software	0.0341	0.0844	0.1359	0.1239	0.1144	0.1326	0.0962	0.1784	0.1668	0.1365	0.0969
Intellectual propery products - Research & development	0.0597	0.0872	0.0642	0.0454	0.0176	0.0284	0.0524	0.0951	0.1120	0.1480	0.1797
Inventories - Non-farm	0.0065	0.0216	0.0124	0.0284	0.0227	0.0237	0.0009	0.0206	0.0129	0.0151	0.0146
Land	0.0324	0.0217	0.0195	0.0348	0.0417	0.0241	0.0183	0.0295	0.0419	0.0441	0.0493
Machinery & equipment - Computers	0.0891	0.1159	0.1681	0.1260	0.1470	0.1510	0.1536	0.2350	0.2681	0.2409	0.2198
Machinery & equipment - Electrical & Electronic Eqt	0.0292	0.0516	0.0332	0.0434	0.0560	0.1024	0.0839	0.1029	0.1132	0.1380	0.1461
Machinery & equipment - Industrial Machinery & Equip	0.0369	0.0560	0.0337	0.0429	0.0517	0.0948	0.0770	0.0719	0.0759	0.0984	0.1083
Machinery & equipment - Other Plant & Equipment	0.0733	0.0726	0.0519	0.0783	0.0713	0.1004	0.0737	0.0770	0.0935	0.0981	0.0969
Machinery & equipment - Other Transport Equipment	0.0585	0.0861	0.0616	0.0810	0.0754	0.0701	0.0558	0.0745	0.0967	0.0981	0.1106
Machinery & equipment - Road Vehicles	0.0167	0.0322	0.0272	0.0344	0.0478	0.0352	0.0257	0.0288	0.0290	0.0298	0.0265
Non-dwelling construction	0.0298	0.0276	0.0226	0.0353	0.0521	0.0311	0.0236	0.0242	0.0203	0.0139	0.0041
Ownership transfer costs	0.0368	0.0194	0.0162	0.0333	0.0546	0.0254	0.0236	0.0232	0.0147	0.0008	-0.0150

Appendix A.22 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Distributive Services Sub-sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Services - Market (Incorporated)											
Intellectual propery products - Artistic Originals	0.1240	0.1312	0.1105	0.0897	0.0679	-0.0177	-0.0312	-0.0007	0.0341	0.0531	0.0550
Intellectual propery products - Computer software	0.0776	0.0899	0.0760	0.0782	0.0720	0.0985	0.0831	0.0589	0.0663	0.0843	0.0892
Intellectual propery products - Research & development	0.0742	0.0791	0.0735	0.0976	0.1004	0.1088	0.0941	0.0865	0.0622	0.0515	0.0426
Inventories - Non-farm	0.0196	0.0504	-0.0071	0.0040	0.0155	0.0218	0.0045	0.0008	0.0227	0.0215	0.0227
Land	0.0193	0.0226	0.0253	0.0223	0.0168	0.0159	0.0140	0.0135	0.0108	0.0102	0.0123
Machinery & equipment - Computers	0.1684	0.1521	0.1058	0.0867	0.0656	0.0732	0.0592	0.0373	0.0274	0.0175	0.0187
Machinery & equipment - Electrical & Electronic Eqt	0.1083	0.0996	0.0835	0.0555	0.0513	0.0571	0.0473	0.0364	0.0280	0.0317	0.0287
Machinery & equipment - Industrial Machinery & Equip	0.0492	0.0636	0.0756	0.0365	0.0332	0.0527	0.0291	0.0279	0.0269	0.0335	0.0220
Machinery & equipment - Other Plant & Equipment	0.0474	0.0669	0.0622	0.0560	0.0542	0.0614	0.0442	0.0341	0.0229	0.0211	0.0175
Machinery & equipment - Other Transport Equipment	0.0365	0.0691	0.0712	0.0870	0.0749	0.0664	0.0646	0.0512	0.0458	0.0426	0.0376
Machinery & equipment - Road Vehicles	0.0220	0.0239	0.0165	0.0258	0.0262	0.0246	0.0194	0.0178	0.0185	0.0235	0.0214
Non-dwelling construction	0.0289	0.0328	0.0386	0.0336	0.0275	0.0256	0.0240	0.0246	0.0212	0.0211	0.0255
Ownership transfer costs	0.0004	-0.0070	-0.0204	-0.0165	-0.0312	-0.0531	-0.0510	-0.0485	-0.0376	-0.0236	-0.0116
Services - Market (Unincorporated)											
Intellectual propery products - Artistic Originals	0.0329	0.0278	0.0343	0.0511	0.0554	0.0041	0.0092	0.0383	0.0614	0.0709	0.0721
Intellectual propery products - Computer software	0.0853	0.0619	0.0134	0.0574	0.1245	0.1847	0.1095	0.0359	0.0716	-0.0001	0.0526
Intellectual propery products - Research & development	0.1546	0.1467	0.1056	0.0812	0.0739	0.0811	0.0904	0.0926	0.0731	0.0545	0.0452
Inventories - Non-farm	0.0129	0.0192	0.0022	0.0050	0.0056	-0.0035	0.0005	-0.0049	0.0151	0.0113	0.0097
Land	0.0630	0.0313	0.0380	-0.0082	-0.0124	-0.0126	-0.0067	-0.0280	-0.0172	-0.0050	-0.0026
Machinery & equipment - Computers	0.1916	0.0832	0.0780	-0.0001	-0.0133	-0.0094	0.0070	-0.0238	0.0076	-0.0302	-0.0235
Machinery & equipment - Electrical & Electronic Eqt	0.1167	0.0535	0.0889	0.0015	0.0056	0.0212	0.0073	-0.0054	0.0112	-0.0017	-0.0070
Machinery & equipment - Industrial Machinery & Equip	0.0802	0.0336	0.0529	-0.0066	-0.0112	0.0027	-0.0132	-0.0290	-0.0095	-0.0247	-0.0255
Machinery & equipment - Other Plant & Equipment	0.0655	0.0255	0.0369	-0.0077	-0.0132	-0.0216	-0.0139	-0.0252	-0.0013	-0.0300	-0.0169
Machinery & equipment - Other Transport Equipment	0.0976	0.0736	0.0645	0.0064	0.0091	0.0030	0.0234	-0.0043	-0.0055	-0.0116	-0.0052
Machinery & equipment - Road Vehicles	0.0328	0.0367	0.0272	0.0150	0.0249	0.0147	0.0177	0.0122	0.0256	0.0238	0.0221
Non-dwelling construction	0.0159	-0.0020	-0.0150	-0.0065	-0.0091	-0.0292	-0.0247	-0.0288	-0.0069	0.0181	0.0190
Ownership transfer costs	0.0001	-0.0405	-0.0634	-0.0354	-0.0520	-0.0856	-0.0801	-0.0847	-0.0513	-0.0073	-0.0017

Appendix A.23 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Producer Services Sub-sector

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Producer (Incorporated)											
Intellectual propery products - Computer software	0.0609	0.2123	0.2500	0.2304	0.2328	0.2021	0.1463	0.1599	0.1370	0.1079	0.0793
Intellectual propery products - Research & development	0.1116	0.0885	0.0376	0.0288	0.0121	0.0048	0.0270	0.0396	0.0630	0.0657	0.0775
Inventories - Non-farm	0.0156	0.0256	0.0393	0.0307	0.0399	0.0142	0.0053	0.0462	0.0419	0.0420	0.0292
Land	-0.0017	0.0054	0.0099	0.0107	0.0146	0.0120	0.0116	0.0188	0.0297	0.0433	0.0434
Machinery & equipment - Computers	0.0396	0.0630	0.1457	0.0846	0.1019	0.1183	0.1059	0.2049	0.2541	0.2376	0.2192
Machinery & equipment - Electrical & Electronic Eqt	0.0180	0.0492	0.0566	0.0479	0.0481	0.0887	0.0648	0.0978	0.1205	0.1432	0.1552
Machinery & equipment - Industrial Machinery & Equip	-0.0028	0.0153	0.0014	0.0053	0.0123	0.0324	0.0207	0.0169	0.0265	0.0619	0.0736
Machinery & equipment - Other Plant & Equipment	0.0472	0.0664	0.0439	0.0325	0.0308	0.0492	0.0194	0.0145	0.0385	0.0551	0.0601
Machinery & equipment - Other Transport Equipment	0.0165	0.0420	0.0472	0.0474	0.0548	0.0401	0.0277	0.0347	0.0515	0.0700	0.0846
Machinery & equipment - Road Vehicles	0.0118	0.0216	0.0280	0.0233	0.0296	0.0229	0.0146	0.0132	0.0129	0.0133	0.0085
Non-dwelling construction	0.0005	0.0081	0.0120	0.0083	0.0135	0.0071	0.0080	0.0063	0.0026	0.0025	-0.0088
Ownership transfer costs	-0.0122	-0.0047	0.0002	-0.0055	0.0057	0.0005	0.0095	0.0062	-0.0017	-0.0114	-0.0342
Producers (Unincorporated)											
Intellectual propery products - Computer software	0.1355	0.1603	0.1984	0.1273	0.1135	0.1497	0.0997	0.2317	0.2033	0.1596	0.1099
Intellectual propery products - Research & development	0.0590	0.0895	0.0643	0.0465	0.0181	0.0276	0.0559	0.0990	0.1157	0.1511	0.1859
Inventories - Non-farm	0.0068	0.0165	0.0140	0.0170	0.0263	0.0174	0.0088	0.0164	0.0160	0.0157	0.0109
Land	0.0044	0.0212	0.0369	0.0485	0.0530	0.0622	0.0586	0.1086	0.1606	0.1490	0.1548
Machinery & equipment - Computers	0.0663	0.1024	0.1529	0.0908	0.1126	0.1339	0.1283	0.2224	0.2593	0.2334	0.2213
Machinery & equipment - Electrical & Electronic Eqt	0.0248	0.0534	0.0276	0.0403	0.0522	0.1099	0.0803	0.0798	0.0840	0.1194	0.1366
Machinery & equipment - Industrial Machinery & Equip	0.0622	0.0899	0.0556	0.0492	0.0600	0.1093	0.0791	0.0641	0.0729	0.0919	0.1017
Machinery & equipment - Other Plant & Equipment	0.1710	0.1686	0.0587	0.0677	0.0630	0.1620	0.0338	0.0408	0.1008	0.0940	0.0881
Machinery & equipment - Other Transport Equipment	0.0395	0.0766	0.0677	0.0876	0.0763	0.0629	0.0558	0.0795	0.1003	0.1026	0.1198
Machinery & equipment - Road Vehicles	0.0177	0.0336	0.0272	0.0336	0.0472	0.0376	0.0248	0.0253	0.0264	0.0261	0.0206
Non-dwelling construction	0.0016	0.0160	0.0139	0.0157	0.0356	0.0293	0.0254	0.0242	0.0208	0.0078	-0.0108
Ownership transfer costs	-0.0240	-0.0174	-0.0121	-0.0172	-0.0054	-0.0093	-0.0001	-0.0028	-0.0100	-0.0198	-0.0416

Appendix A.23 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Producer Services Sub-sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Producer (Incorporated)											
Intellectual propery products - Computer software	0.0748	0.0942	0.0504	0.0749	0.0577	0.0715	0.0732	0.0566	0.0981	0.0968	0.1016
Intellectual propery products - Research & development	0.0936	0.1083	0.1043	0.1230	0.1049	0.1151	0.0976	0.0832	0.0674	0.0536	0.0419
Inventories - Non-farm	0.0176	0.0575	-0.0162	-0.0085	0.0137	0.0349	-0.0012	-0.0021	0.0111	0.0190	0.0216
Land	0.0432	0.0540	0.0270	0.0398	0.0209	0.0275	0.0174	0.0048	-0.0006	0.0045	-0.0061
Machinery & equipment - Computers	0.1813	0.1241	0.0741	0.0773	0.0507	0.0464	0.0498	0.0200	0.0238	0.0201	0.0218
Machinery & equipment - Electrical & Electronic Eqt	0.1210	0.1129	0.0875	0.1019	0.0626	0.0729	0.0388	0.0309	0.0359	0.0373	0.0333
Machinery & equipment - Industrial Machinery & Equip	0.0483	0.0524	0.0564	0.0251	0.0154	0.0359	0.0177	0.0129	0.0220	0.0329	0.0217
Machinery & equipment - Other Plant & Equipment	0.0337	0.0504	0.0380	0.0256	0.0155	0.0138	0.0237	0.0022	0.0121	0.0141	0.0241
Machinery & equipment - Other Transport Equipment	0.0774	0.1037	0.0382	0.1204	0.0840	0.0638	0.0548	0.0406	0.0448	0.0610	0.0660
Machinery & equipment - Road Vehicles	0.0142	0.0085	0.0016	0.0103	0.0115	0.0067	0.0057	0.0077	0.0116	0.0154	0.0136
Non-dwelling construction	-0.0097	-0.0106	-0.0197	-0.0195	-0.0206	-0.0184	-0.0210	-0.0181	-0.0155	-0.0017	0.0003
Ownership transfer costs	-0.0368	-0.0423	-0.0652	-0.0626	-0.0703	-0.0797	-0.0814	-0.0781	-0.0659	-0.0390	-0.0306
Producers (Unincorporated)											
Intellectual propery products - Computer software	0.0920	0.0237	0.0804	0.0956	0.1643	0.2442	0.1477	0.0317	0.0516	-0.0221	0.0316
Intellectual propery products - Research & development	0.1560	0.1516	0.1091	0.0862	0.0760	0.0844	0.0903	0.0927	0.0715	0.0542	0.0441
Inventories - Non-farm	0.0135	0.0221	0.0096	0.0011	0.0125	0.0062	0.0048	-0.0001	0.0105	0.0098	0.0098
Land	0.1586	0.0957	0.1156	-0.0466	-0.0512	-0.0298	-0.0146	-0.0740	-0.0740	-0.0765	-0.0734
Machinery & equipment - Computers	0.1892	0.0762	0.0951	-0.0012	-0.0021	-0.0024	0.0083	-0.0362	-0.0337	-0.0468	-0.0486
Machinery & equipment - Electrical & Electronic Eqt	0.1052	0.0486	0.0898	-0.0098	-0.0041	0.0256	-0.0086	-0.0269	-0.0170	-0.0129	-0.0286
Machinery & equipment - Industrial Machinery & Equip	0.0809	0.0381	0.0628	-0.0087	-0.0100	0.0018	-0.0111	-0.0379	-0.0264	-0.0344	-0.0391
Machinery & equipment - Other Plant & Equipment	0.0347	0.0290	0.0675	-0.0256	-0.0260	-0.0498	-0.0061	-0.0434	-0.0427	-0.0575	-0.0417
Machinery & equipment - Other Transport Equipment	0.1124	0.0858	0.0755	0.0064	0.0090	0.0033	0.0213	-0.0100	-0.0185	-0.0171	-0.0144
Machinery & equipment - Road Vehicles	0.0281	0.0330	0.0286	0.0112	0.0240	0.0136	0.0158	0.0109	0.0244	0.0235	0.0213
Non-dwelling construction	-0.0036	-0.0115	-0.0291	-0.0394	-0.0348	-0.0601	-0.0527	-0.0548	-0.0315	-0.0179	-0.0137
Ownership transfer costs	-0.0436	-0.0672	-0.0731	-0.0829	-0.0864	-0.1095	-0.0919	-0.0930	-0.0763	-0.0490	-0.0416

Appendix A.24 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Personal Services Sub-sector

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Social (Incorporated)											
Intellectual propery products - Artistic Originals	0.1846	0.1844	0.1240	0.1014	0.1708	0.1843	0.1102	0.1404	0.1307	0.1019	0.0657
Intellectual propery products - Computer software	0.0196	0.0630	0.0927	0.1138	0.1014	0.1202	0.1021	0.1338	0.1376	0.1129	0.0826
Intellectual propery products - Research & development	0.0838	0.0642	0.0484	0.0363	0.0273	0.0320	0.0438	0.0629	0.0566	0.0549	0.0581
Inventories - Non-farm	0.0241	0.0729	0.0250	0.0925	0.0193	0.0504	-0.0191	0.0370	0.0263	0.0209	0.0285
Land	0.0257	0.0145	0.0142	0.0300	0.0363	0.0154	0.0120	0.0142	0.0104	0.0086	0.0090
Machinery & equipment - Computers	0.1055	0.1381	0.1183	0.1113	0.1084	0.1377	0.1267	0.1541	0.1767	0.1760	0.1678
Machinery & equipment - Electrical & Electronic Eqt	0.0419	0.0492	0.0827	0.0908	0.0880	0.0854	0.0855	0.1288	0.1579	0.1607	0.1536
Machinery & equipment - Industrial Machinery & Equip	0.0211	0.0092	0.0084	0.0468	0.0340	0.0537	0.0444	0.0460	0.0573	0.0874	0.0926
Machinery & equipment - Other Plant & Equipment	0.0602	0.0597	0.0553	0.0909	0.0907	0.0754	0.0628	0.0535	0.0688	0.0794	0.0808
Machinery & equipment - Other Transport Equipment	0.0992	0.0950	0.0426	0.0724	0.0718	0.0710	0.0479	0.0316	0.0475	0.0514	0.0625
Machinery & equipment - Road Vehicles	0.0856	0.0929	0.0739	0.0853	0.0307	0.0225	0.0245	0.0236	0.0359	0.0271	0.0319
Non-dwelling construction	0.0522	0.0352	0.0326	0.0567	0.0639	0.0312	0.0256	0.0286	0.0224	0.0184	0.0182
Ownership transfer costs	0.0377	0.0202	0.0216	0.0427	0.0640	0.0322	0.0330	0.0343	0.0223	0.0030	-0.0120
Social (Unincorporated)											
Intellectual propery products - Artistic Originals	-0.0956	0.1407	0.1355	0.1535	0.1476	0.1775	0.0941	0.0645	0.0438	0.0433	0.0454
Intellectual propery products - Computer software	-0.0406	0.0247	0.0952	0.1318	0.1191	0.1320	0.1009	0.1448	0.1410	0.1190	0.0864
Intellectual propery products - Research & development	0.0407	0.0187	0.0419	-0.0102	-0.0637	-0.0544	-0.0933	-0.0073	0.0199	0.1150	0.0759
Inventories - Non-farm	0.0047	0.0521	0.0028	0.0925	0.0037	0.0582	-0.0425	0.0434	-0.0046	0.0125	0.0357
Land	0.0360	0.0191	0.0141	0.0315	0.0400	0.0153	0.0076	0.0094	0.0046	0.0056	0.0071
Machinery & equipment - Computers	0.1225	0.1310	0.1833	0.1591	0.1771	0.1673	0.1637	0.2153	0.2632	0.2451	0.2132
Machinery & equipment - Electrical & Electronic Eqt	0.0404	0.0500	0.0396	0.0472	0.0565	0.0878	0.0740	0.0962	0.1308	0.1493	0.1422
Machinery & equipment - Industrial Machinery & Equip	0.0118	0.0162	0.0097	0.0396	0.0439	0.0799	0.0684	0.0666	0.0725	0.1025	0.1100
Machinery & equipment - Other Plant & Equipment	0.0606	0.0563	0.0560	0.0860	0.0748	0.0885	0.0734	0.0696	0.0861	0.0955	0.0938
Machinery & equipment - Other Transport Equipment	0.0808	0.0967	0.0546	0.0627	0.0758	0.0699	0.0532	0.0349	0.0493	0.0631	0.0663
Machinery & equipment - Road Vehicles	0.0191	0.0277	0.0458	0.0538	0.0643	0.0199	0.0222	0.0417	0.0382	0.0518	0.0612
Non-dwelling construction	0.0656	0.0392	0.0310	0.0580	0.0720	0.0314	0.0183	0.0216	0.0107	0.0112	0.0131
Ownership transfer costs	0.0530	0.0267	0.0213	0.0453	0.0696	0.0318	0.0260	0.0262	0.0113	-0.0047	-0.0180

Appendix A.24 - Log of Growth in Productive Capital Stock (Kt/Kt-1) - Personal Services Sub-sector

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Social (Incorporated)											
Intellectual propery products - Artistic Originals	0.1240	0.1312	0.1105	0.0897	0.0679	-0.0177	-0.0312	-0.0007	0.0341	0.0531	0.0550
Intellectual propery products - Computer software	0.0799	0.0994	0.0916	0.1194	0.1115	0.1426	0.1790	0.1601	0.0746	0.0821	0.0659
Intellectual propery products - Research & development	0.0904	0.0739	0.0720	0.0814	0.0564	0.0987	0.1371	0.1549	0.1205	0.0955	0.0791
Inventories - Non-farm	0.0101	0.0333	0.0020	0.0332	0.0163	-0.0008	0.0173	0.0083	0.0486	0.0293	0.0303
Land	0.0091	0.0104	0.0079	0.0037	0.0040	0.0028	0.0021	0.0051	0.0058	0.0004	0.0023
Machinery & equipment - Computers	0.1550	0.1589	0.1220	0.0941	0.0586	0.0787	0.0676	0.0711	0.0573	0.0178	0.0246
Machinery & equipment - Electrical & Electronic Eqt	0.1280	0.1207	0.0999	0.0556	0.0437	0.0479	0.0577	0.0585	0.0516	0.0331	0.0372
Machinery & equipment - Industrial Machinery & Equip	0.0632	0.0966	0.1050	0.0541	0.0441	0.0533	0.0378	0.0593	0.0543	0.0428	0.0363
Machinery & equipment - Other Plant & Equipment	0.0667	0.0930	0.0740	0.0486	0.0334	0.0246	0.0353	0.0426	0.0355	0.0214	0.0260
Machinery & equipment - Other Transport Equipment	0.0522	0.0972	0.0698	0.0903	0.0600	0.0722	0.0587	0.0707	0.0670	0.0525	0.0588
Machinery & equipment - Road Vehicles	0.0328	0.0474	0.0375	0.0435	0.0402	0.0398	0.0366	0.0317	0.0320	0.0360	0.0382
Non-dwelling construction	0.0178	0.0170	0.0123	0.0058	0.0080	0.0030	0.0046	0.0080	0.0107	0.0066	0.0098
Ownership transfer costs	-0.0108	-0.0233	-0.0467	-0.0448	-0.0505	-0.0752	-0.0697	-0.0639	-0.0473	-0.0379	-0.0273
Social (Unincorporated)											
Intellectual propery products - Artistic Originals	0.0329	0.0278	0.0343	0.0511	0.0554	0.0041	0.0092	0.0383	0.0614	0.0709	0.0721
Intellectual propery products - Computer software	0.0797	0.0578	-0.0415	0.0319	0.1054	0.1305	0.0720	0.0420	0.1123	0.0322	0.0842
Intellectual propery products - Research & development	0.1818	0.0816	0.0565	0.0616	0.0288	0.0643	0.1237	0.1592	0.1227	0.0954	0.0787
Inventories - Non-farm	0.0098	0.0039	-0.0411	0.0281	-0.0341	-0.0630	-0.0274	-0.0375	0.0460	0.0208	0.0093
Land	0.0108	-0.0015	-0.0003	0.0125	0.0011	-0.0043	-0.0017	-0.0063	0.0084	0.0254	0.0249
Machinery & equipment - Computers	0.1938	0.0966	0.0782	0.0043	-0.0172	-0.0276	-0.0017	-0.0046	0.0505	-0.0024	0.0132
Machinery & equipment - Electrical & Electronic Eqt	0.1231	0.0674	0.1141	0.0249	0.0314	0.0173	0.0311	0.0362	0.0577	0.0231	0.0307
Machinery & equipment - Industrial Machinery & Equip	0.0751	0.0264	0.0448	-0.0054	-0.0130	-0.0030	-0.0229	-0.0165	0.0132	-0.0089	-0.0027
Machinery & equipment - Other Plant & Equipment	0.0683	0.0250	0.0375	-0.0039	-0.0078	-0.0194	-0.0184	-0.0205	0.0068	-0.0230	-0.0082
Machinery & equipment - Other Transport Equipment	0.0680	0.0543	0.0516	0.0353	0.0455	0.0273	0.0497	0.0475	0.0623	0.0356	0.0522
Machinery & equipment - Road Vehicles	0.0661	0.0899	0.0339	0.0627	0.0523	0.0175	0.0352	0.0396	0.0390	0.0499	0.0481
Non-dwelling construction	0.0175	0.0015	-0.0019	0.0271	0.0066	-0.0023	-0.0006	-0.0070	0.0142	0.0498	0.0465
Ownership transfer costs	-0.0125	-0.0430	-0.0633	-0.0265	-0.0554	-0.0826	-0.0780	-0.0827	-0.0453	0.0042	0.0089

Appendix A.25 - Capital Services Index

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Smoothed Capital Income Shares x Log in Growth of Capital Stock											
Primary	0.03727	0.04029	0.05857	0.04071	0.01477	0.00916	0.02606	0.03417	0.03826	0.03781	0.06916
Secondary	0.04950	0.03280	0.04648	0.03242	0.03018	0.01211	0.01445	0.03248	0.04366	0.04570	0.05737
Services (Market)	0.02747	0.03875	0.03569	0.04092	0.04092	0.03655	0.03154	0.04015	0.04800	0.04925	0.04599
Distributive	0.03558	0.05326	0.05122	0.05105	0.05389	0.05074	0.03649	0.05064	0.05825	0.05992	0.05200
Producer	0.01634	0.03725	0.04839	0.04057	0.04451	0.03963	0.02906	0.04134	0.04855	0.05196	0.04223
Social	0.05523	0.06197	0.05303	0.07755	0.05954	0.05109	0.03525	0.05057	0.06299	0.06451	0.05637
Exponential Growth											
Primary	1.03798	1.04111	1.06032	1.04155	1.01488	1.00920	1.02641	1.03476	1.03900	1.03854	1.07160
Secondary	1.05075	1.03334	1.04758	1.03296	1.03064	1.01218	1.01455	1.03301	1.04463	1.04676	1.05905
Services (Market)	1.02785	1.03952	1.03633	1.04177	1.04176	1.03723	1.03204	1.04097	1.04917	1.05048	1.04707
Distributive	1.03623	1.05471	1.05256	1.05238	1.05537	1.05205	1.03716	1.05195	1.05998	1.06175	1.05338
Producer	1.01647	1.03796	1.04958	1.04141	1.04552	1.04043	1.02949	1.04220	1.04974	1.05333	1.04314
Social	1.05678	1.06393	1.05446	1.08063	1.06135	1.05242	1.03588	1.05187	1.06502	1.06663	1.05799
Compounded											
Primary	1.03798	1.0807	1.1458	1.1934	1.2112	1.2223	1.2546	1.2982	1.3489	1.4008	1.5012
Secondary	1.05075	1.0858	1.1374	1.1749	1.2109	1.2257	1.2435	1.2846	1.3419	1.4046	1.4876
Services (Market)	1.02785	1.0685	1.1073	1.1535	1.2017	1.2465	1.2864	1.3391	1.4049	1.4759	1.5453
Distributive	1.03623	1.0929	1.1504	1.2106	1.2776	1.3441	1.3941	1.4665	1.5545	1.6505	1.7386
Producer	1.01647	1.0551	1.1074	1.1532	1.2057	1.2545	1.2914	1.3459	1.4129	1.4883	1.5525
Social	1.05678	1.1243	1.1856	1.2812	1.3598	1.4310	1.4824	1.5593	1.6607	1.7713	1.8740
Index (1996/97=100.0)											
Primary	96.1	100.0	110.4	115.0	116.7	117.8	120.9	125.1	130.0	135.0	144.6
Secondary	96.8	100.0	108.3	111.8	115.2	116.6	118.3	122.3	127.7	133.7	141.6
Services (Market)	96.2	100.0	107.7	112.2	116.9	121.3	125.2	130.3	136.7	143.6	150.3
Distributive	94.8	100.0	111.0	116.8	123.3	129.7	134.5	141.5	150.0	159.3	167.8
Producer	96.3	100.0	108.9	113.5	118.6	123.4	127.1	132.4	139.0	146.4	152.7
Social	94.0	100.0	112.2	121.2	128.7	135.4	140.3	147.5	157.1	167.6	177.3

Appendix A.25 - Capital Services Index

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Smoothed Capital Income Shares x Log in Growth of Capital Stock											
Primary	0.07977	0.08961	0.09104	0.06683	0.08173	0.14208	0.14523	0.10747	0.06645	0.03639	0.01889
Secondary	0.03838	0.05213	0.02243	0.02931	0.02782	0.02556	0.01515	0.00007	-0.00004	-0.00900	0.00023
Services (Market)	0.04429	0.05329	0.04019	0.03786	0.03642	0.03714	0.02918	0.02575	0.02512	0.02738	0.02782
Distributive	0.05309	0.06325	0.04449	0.03740	0.03525	0.03401	0.02521	0.02101	0.02317	0.02760	0.02579
Producer	0.03964	0.04605	0.01868	0.03008	0.02631	0.02873	0.02019	0.01701	0.02437	0.02907	0.02813
Social	0.04931	0.06332	0.04091	0.03435	0.02959	0.02740	0.02892	0.03114	0.03096	0.02442	0.02618
Exponential Growth											
Primary	1.08304	1.09375	1.09531	1.06912	1.08516	1.15267	1.15631	1.11345	1.06870	1.03706	1.01907
Secondary	1.03913	1.05351	1.02269	1.02974	1.02822	1.02589	1.01526	1.00007	0.99996	0.99104	1.00023
Services (Market)	1.04529	1.05474	1.04101	1.03859	1.03709	1.03784	1.02961	1.02609	1.02544	1.02776	1.02821
Distributive	1.05452	1.06529	1.04549	1.03811	1.03588	1.03459	1.02553	1.02123	1.02344	1.02799	1.02612
Producer	1.04044	1.04712	1.01885	1.03054	1.02666	1.02915	1.02039	1.01715	1.02467	1.02949	1.02853
Social	1.05055	1.06537	1.04175	1.03495	1.03003	1.02778	1.02935	1.03163	1.03144	1.02472	1.02652
Compounded											
Primary	1.6258	1.7782	1.9477	2.0823	2.2597	2.6046	3.0118	3.3535	3.5838	3.7167	3.7875
Secondary	1.5458	1.6285	1.6654	1.7150	1.7634	1.8090	1.8366	1.8368	1.8367	1.8202	1.8207
Services (Market)	1.6153	1.7037	1.7736	1.8420	1.9104	1.9827	2.0414	2.0946	2.1479	2.2075	2.2698
Distributive	1.8334	1.9531	2.0419	2.1197	2.1958	2.2717	2.3297	2.3792	2.4350	2.5031	2.5685
Producer	1.6152	1.6913	1.7232	1.7759	1.8232	1.8764	1.9146	1.9475	1.9955	2.0544	2.1130
Social	1.9688	2.0975	2.1850	2.2614	2.3293	2.3940	2.4643	2.5422	2.6221	2.6870	2.7582
Index (1996/97=100.0)											
Primary	156.6	171.3	187.6	200.6	217.7	250.9	290.2	323.1	345.3	358.1	364.9
Secondary	147.1	155.0	158.5	163.2	167.8	172.2	174.8	174.8	174.8	173.2	173.3
Services (Market)	157.2	165.8	172.6	179.2	185.9	192.9	198.6	203.8	209.0	214.8	220.8
Distributive	176.9	188.5	197.1	204.6	211.9	219.2	224.8	229.6	235.0	241.6	247.9
Producer	158.9	166.4	169.5	174.7	179.4	184.6	188.4	191.6	196.3	202.1	207.9
Social	186.3	198.5	206.8	214.0	220.4	226.5	233.2	240.6	248.1	254.3	261.0

Appendix A.26 - Hours Worked Index

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Hours Worked (Actual '000 hours)											
Primary	82,156	83,829	86,097	84,108	87,275	85,126	87,392	77,539	77,016	76,693	77,507
Secondary	255,451	255,695	256,557	255,980	268,321	265,852	262,834	272,322	275,251	285,161	286,386
Services (Market)	603,580	605,321	612,951	624,653	641,883	654,595	648,247	662,491	672,002	693,872	709,642
Distributive	108,648	108,294	105,831	107,316	111,723	118,275	112,979	115,902	118,078	123,623	125,799
Producer	237,312	239,525	247,576	253,757	258,898	264,570	258,028	264,049	269,330	276,337	288,397
Social	257,619	257,502	259,545	263,580	271,262	271,751	277,241	282,539	284,593	293,911	295,446
Hours Worked Index (1996/97=100.0)											
Primary		100.0	102.7	100.3	104.1	101.5	104.3	92.5	91.9	91.5	92.5
Secondary		100.0	100.3	100.1	104.9	104.0	102.8	106.5	107.6	111.5	112.0
Services (Market)		100.0	101.3	103.2	106.0	108.1	107.1	109.4	111.0	114.6	117.2
Distributive		100.0	97.7	99.1	103.2	109.2	104.3	107.0	109.0	114.2	116.2
Producer		100.0	103.4	105.9	108.1	110.5	107.7	110.2	112.4	115.4	120.4
Social		100.0	100.8	102.4	105.3	105.5	107.7	109.7	110.5	114.1	114.7
Hours Worked Growth Rate											
Primary		1.0204	1.0271	0.9769	1.0376	0.9754	1.0266	0.8873	0.9933	0.9958	1.0106
Secondary		1.0010	1.0034	0.9977	1.0482	0.9908	0.9886	1.0361	1.0108	1.0360	1.0043
Services (Market)		1.0029	1.0126	1.0191	1.0276	1.0198	0.9903	1.0220	1.0144	1.0325	1.0227
Distributive		0.9967	0.9773	1.0140	1.0411	1.0586	0.9552	1.0259	1.0188	1.0470	1.0176
Producer		1.0093	1.0336	1.0250	1.0203	1.0219	0.9753	1.0233	1.0200	1.0260	1.0436
Social		0.9995	1.0079	1.0155	1.0291	1.0018	1.0202	1.0191	1.0073	1.0327	1.0052

Appendix A.26 - Hours Worked Index

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Hours Worked (Actual '000 hours)										
Primary	81,546	82,494	88,080	88,617	91,663	97,101	96,617	98,779	89,655	92,130
Secondary	297,164	306,767	301,863	297,961	298,925	293,907	291,948	295,221	293,813	288,697
Services (Market)	727,693	751,691	747,311	751,344	765,997	777,084	785,203	779,500	802,392	814,094
Distributive	128,844	134,260	139,335	135,696	138,938	139,023	140,140	138,594	142,279	143,942
Producer	300,383	303,375	301,006	314,835	319,353	329,962	334,047	329,000	338,822	344,074
Social	298,467	314,055	306,969	300,814	307,705	308,100	311,017	311,907	321,290	326,079
Hours Worked Index (1996/97=100.0)										
Primary	97.3	98.4	105.1	105.7	109.3	115.8	115.3	117.8	107.0	109.9
Secondary	116.2	120.0	118.1	116.5	116.9	114.9	114.2	115.5	114.9	112.9
Services (Market)	120.2	124.2	123.5	124.1	126.5	128.4	129.7	128.8	132.6	134.5
Distributive	119.0	124.0	128.7	125.3	128.3	128.4	129.4	128.0	131.4	132.9
Producer	125.4	126.7	125.7	131.4	133.3	137.8	139.5	137.4	141.5	143.6
Social	115.9	122.0	119.2	116.8	119.5	119.6	120.8	121.1	124.8	126.6
Hours Worked Growth Rate										
Primary	1.0521	1.0116	1.0677	1.0061	1.0344	1.0593	0.9950	1.0224	0.9076	1.0276
Secondary	1.0376	1.0323	0.9840	0.9871	1.0032	0.9832	0.9933	1.0112	0.9952	0.9826
Services (Market)	1.0254	1.0330	0.9942	1.0054	1.0195	1.0145	1.0104	0.9927	1.0294	1.0146
Distributive	1.0242	1.0420	1.0378	0.9739	1.0239	1.0006	1.0080	0.9890	1.0266	1.0117
Producer	1.0416	1.0100	0.9922	1.0459	1.0144	1.0332	1.0124	0.9849	1.0299	1.0155
Social	1.0102	1.0522	0.9774	0.9799	1.0229	1.0013	1.0095	1.0029	1.0301	1.0149

Appendix A.27 - Smoothed Income Shares split by Capital and Labour

	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Labour income shares											
Primary	0.344	0.375	0.369	0.341	0.309	0.285	0.288	0.302	0.292	0.266	0.263
Secondary	0.631	0.625	0.627	0.622	0.622	0.628	0.618	0.599	0.599	0.606	0.605
Services (Market)	0.544	0.544	0.537	0.535	0.534	0.536	0.534	0.528	0.532	0.543	0.541
Distributive	0.508	0.492	0.467	0.466	0.472	0.478	0.475	0.461	0.460	0.478	0.475
Producer	0.502	0.521	0.540	0.536	0.528	0.525	0.518	0.525	0.541	0.550	0.557
Social	0.792	0.805	0.797	0.782	0.770	0.768	0.778	0.770	0.761	0.752	0.737
Capital income shares											
Primary	0.656	0.625	0.631	0.659	0.691	0.715	0.712	0.698	0.708	0.734	0.737
Secondary	0.369	0.375	0.373	0.378	0.378	0.372	0.382	0.401	0.401	0.394	0.395
Services (Market)	0.456	0.456	0.463	0.465	0.466	0.464	0.466	0.472	0.468	0.457	0.459
Distributive	0.492	0.508	0.533	0.534	0.528	0.522	0.525	0.539	0.540	0.522	0.525
Producer	0.498	0.479	0.460	0.464	0.472	0.475	0.482	0.475	0.459	0.450	0.443
Social	0.208	0.195	0.203	0.218	0.230	0.232	0.222	0.230	0.239	0.248	0.263

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Labour income shares										
Primary	0.267	0.246	0.239	0.237	0.228	0.249	0.260	0.277	0.304	0.269
Secondary	0.614	0.624	0.621	0.627	0.648	0.666	0.674	0.671	0.674	0.671
Services (Market)	0.537	0.536	0.529	0.525	0.519	0.510	0.512	0.518	0.519	0.518
Distributive	0.467	0.471	0.472	0.467	0.462	0.457	0.461	0.470	0.466	0.460
Producer	0.557	0.549	0.535	0.528	0.521	0.509	0.506	0.505	0.508	0.508
Social	0.739	0.737	0.725	0.730	0.727	0.713	0.720	0.731	0.744	0.756
Capital income shares										
Primary	0.733	0.754	0.761	0.763	0.772	0.751	0.740	0.723	0.696	0.731
Secondary	0.386	0.376	0.379	0.373	0.352	0.334	0.326	0.329	0.326	0.329
Services (Market)	0.463	0.464	0.471	0.475	0.481	0.490	0.488	0.482	0.481	0.482
Distributive	0.533	0.529	0.528	0.533	0.538	0.543	0.539	0.530	0.534	0.540
Producer	0.443	0.451	0.465	0.472	0.479	0.491	0.494	0.495	0.492	0.492
Social	0.261	0.263	0.275	0.270	0.273	0.287	0.280	0.269	0.256	0.244

Appendix A.28 - Tonquist weighted average of Capital and Labor input

	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Tornquist weighted average of Capital and Labor input											
Primary	1.0339	1.0477	1.0172	1.0226	0.9986	1.0265	0.9899	1.0250	1.0259	1.0550	1.0748
Secondary	1.0128	1.0197	1.0107	1.0415	0.9988	0.9982	1.0349	1.0242	1.0403	1.0255	1.0382
Services (Market)	1.0194	1.0234	1.0295	1.0342	1.0279	1.0095	1.0308	1.0306	1.0409	1.0338	1.0345
Distributive	1.0248	1.0148	1.0343	1.0487	1.0552	0.9971	1.0395	1.0408	1.0549	1.0361	1.0400
Producer	1.0235	1.0412	1.0325	1.0319	1.0306	1.0007	1.0324	1.0340	1.0385	1.0434	1.0411
Social	1.0126	1.0168	1.0285	1.0361	1.0132	1.0238	1.0263	1.0203	1.0407	1.0181	1.0207
Compounded											
Primary	1.0339	1.0833	1.1019	1.1268	1.1253	1.1551	1.1433	1.1719	1.2022	1.2683	1.3632
Secondary	1.0128	1.0328	1.0439	1.0872	1.0859	1.0840	1.1218	1.1490	1.1953	1.2258	1.2727
Services (Market)	1.0194	1.0432	1.0740	1.1107	1.1417	1.1525	1.1880	1.2244	1.2745	1.3175	1.3630
Distributive	1.0248	1.0400	1.0757	1.1280	1.1903	1.1869	1.2337	1.2840	1.3545	1.4034	1.4596
Producer	1.0235	1.0657	1.1003	1.1354	1.1702	1.1710	1.2089	1.2500	1.2981	1.3545	1.4101
Social	1.0126	1.0297	1.0590	1.0972	1.1117	1.1382	1.1681	1.1918	1.2403	1.2627	1.2888
K/L Index (1997 = 100.0)											
Primary	100.0	104.8	106.6	109.0	108.8	111.7	110.6	113.3	116.3	122.7	131.9
Secondary	100.0	102.0	103.1	107.3	107.2	107.0	110.8	113.4	118.0	121.0	125.7
Services (Market)	100.0	102.3	105.4	109.0	112.0	113.1	116.5	120.1	125.0	129.2	133.7
Distributive	100.0	101.5	105.0	110.1	116.1	115.8	120.4	125.3	132.2	136.9	142.4
Producer	100.0	104.1	107.5	110.9	114.3	114.4	118.1	122.1	126.8	132.3	137.8
Social	100.0	101.7	104.6	108.4	109.8	112.4	115.4	117.7	122.5	124.7	127.3

Appendix A.28 - Tonquist weighted average of Capital and Labor input

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Tornquist weighted average of Capital and Labor input									
Primary	1.0712	1.0884	1.0537	1.0729	1.1307	1.1138	1.0890	1.0214	1.0342
Secondary	1.0405	0.9984	1.0030	1.0125	0.9980	1.0006	1.0076	0.9968	0.9853
Services (Market)	1.0430	1.0156	1.0209	1.0278	1.0256	1.0198	1.0089	1.0275	1.0209
Distributive	1.0544	1.0419	1.0073	1.0303	1.0187	1.0175	1.0062	1.0249	1.0204
Producer	1.0263	1.0041	1.0387	1.0201	1.0313	1.0163	1.0007	1.0273	1.0224
Social	1.0556	0.9940	0.9948	1.0248	1.0085	1.0151	1.0108	1.0304	1.0174
Compounded									
Primary	1.4603	1.5895	1.6748	1.7969	2.0318	2.2630	2.4644	2.5173	2.6033
Secondary	1.3242	1.3220	1.3260	1.3426	1.3400	1.3408	1.3509	1.3466	1.3268
Services (Market)	1.4216	1.4438	1.4740	1.5150	1.5539	1.5846	1.5987	1.6426	1.6769
Distributive	1.5390	1.6034	1.6151	1.6640	1.6951	1.7248	1.7356	1.7788	1.8150
Producer	1.4471	1.4531	1.5094	1.5398	1.5879	1.6138	1.6149	1.6590	1.6961
Social	1.3606	1.3523	1.3453	1.3787	1.3903	1.4113	1.4266	1.4701	1.4956
K/L Index (1997 = 100.0)									
Primary	141.2	153.7	162.0	173.8	196.5	218.9	238.4	243.5	251.8
Secondary	130.7	130.5	130.9	132.6	132.3	132.4	133.4	133.0	131.0
Services (Market)	139.5	141.6	144.6	148.6	152.4	155.4	156.8	161.1	164.5
Distributive	150.2	156.5	157.6	162.4	165.4	168.3	169.3	173.6	177.1
Producer	141.4	142.0	147.5	150.4	155.2	157.7	157.8	162.1	165.7
Social	134.4	133.5	132.8	136.1	137.3	139.4	140.9	145.2	147.7

Appendix A.29 - Index of Industry Gross Values Added ($ real)

	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
IGVA-Constant											
Primary	71908	73557	76,491	80,464	85,460	87,047	78,967	84,705	89,223	91,247	90,281
Secondary	147629	156093	164,232	170,284	162,793	172,490	187,259	193,826	197,252	202,087	207,875
Services (Market)	392,497	408,451	433,159	452,189	468,316	487,808	505,121	526,212	543,711	561,392	587,597
Distributive	96209	100262	103,980	107,089	110,363	113,651	118,261	121,431	125,958	129,325	135,626
Producer	208306	217072	232,543	244,412	253,101	266,200	274,345	286,588	295,339	308,145	322,210
Social	87982	91117	96,636	100,688	104,852	107,957	112,515	118,193	122,414	123,922	129,761
IGVA-Index (1997 = 100.0)											
Primary	100.0	102.3	106.4	111.9	118.8	121.1	109.8	117.8	124.1	126.9	125.6
Secondary	100.0	105.7	111.2	115.3	110.3	116.8	126.8	131.3	133.6	136.9	140.8
Services (Market)	100.0	104.1	110.4	115.2	119.3	124.3	128.7	134.1	138.5	143.0	149.7
Distributive	100.0	104.2	108.1	111.3	114.7	118.1	122.9	126.2	130.9	134.4	141.0
Producer	100.0	104.2	111.6	117.3	121.5	127.8	131.7	137.6	141.8	147.9	154.7
Social	100.0	103.6	109.8	114.4	119.2	122.7	127.9	134.3	139.1	140.8	147.5

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
IGVA-Constant										
Primary	95,050	103,218	107,090	109,444	115,004	120,992	129,138	135,422	137,993	145,689
Secondary	218,471	216,191	217,220	219,633	233,256	234,386	238,934	234,170	230,598	223,447
Services (Market)	609,543	615,112	624,755	643,557	668,099	685,301	697,213	718,363	745,515	766,472
Distributive	141,412	142,913	145,363	149,545	152,982	155,780	155,933	159,806	165,305	167,983
Producer	333,817	336,878	343,290	355,173	371,291	384,762	393,325	405,908	422,642	439,730
Social	134,314	135,321	136,102	138,839	143,826	144,759	147,955	152,649	157,568	158,759
IGVA-Index (1997 = 100.0)										
Primary	132.2	143.5	148.9	152.2	159.9	168.3	179.6	188.3	191.9	202.6
Secondary	148.0	146.4	147.1	148.8	158.0	158.8	161.8	158.6	156.2	151.4
Services (Market)	155.3	156.7	159.2	164.0	170.2	174.6	177.6	183.0	189.9	195.3
Distributive	147.0	148.5	151.1	155.4	159.0	161.9	162.1	166.1	171.8	174.6
Producer	160.3	161.7	164.8	170.5	178.2	184.7	188.8	194.9	202.9	211.1
Social	152.7	153.8	154.7	157.8	163.5	164.5	168.2	173.5	179.1	180.4

Appendix A.30 - Productivity Indexes

	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
MFP - Output Index / Input Index											
Primary	100.0	97.6	99.8	102.7	109.2	108.4	99.3	103.9	106.7	103.4	95.2
Secondary	100.0	103.7	107.9	107.5	102.8	109.2	114.5	115.7	113.2	113.1	112.1
Services (Market)	100.0	101.7	104.7	105.7	106.5	109.9	110.4	111.6	110.8	110.7	112.0
Distributive	100.0	102.7	103.0	101.1	98.8	102.0	102.1	100.7	99.1	98.2	99.0
Producer	100.0	100.1	103.8	105.8	106.3	111.7	111.5	112.6	111.8	111.8	112.3
Personal	100.0	101.8	105.0	105.6	108.6	109.2	110.9	114.1	113.6	113.0	115.9
LP - Output Index / Labour Index											
Primary	100.0	99.6	106.0	107.5	117.0	116.1	118.7	128.2	135.6	137.2	129.1
Secondary	100.0	105.4	111.1	109.9	106.1	113.7	119.1	122.0	119.8	122.2	121.2
Services (Market)	100.0	102.8	106.9	108.6	110.3	116.1	117.6	120.8	120.8	122.0	124.5
Distributive	100.0	106.6	109.1	107.9	105.0	113.2	114.9	115.8	114.7	115.7	118.5
Producer	100.0	100.8	105.4	108.6	110.0	118.6	119.5	122.4	122.9	122.9	123.3
Social	100.0	102.7	107.3	108.6	112.9	114.0	116.6	121.5	121.9	122.8	127.2
KP - Output Index / Capital Services Index											
Primary	100.0	92.7	92.5	95.9	100.9	100.2	87.8	90.6	91.9	87.7	80.2
Secondary	100.0	97.7	99.5	100.1	94.5	98.7	103.8	102.8	99.9	96.7	95.7
Services (Market)	100.0	96.6	98.3	98.5	98.4	99.3	98.8	98.1	96.5	95.1	95.3
Distributive	100.0	93.9	92.5	90.3	88.4	87.8	86.9	84.1	82.2	80.1	79.7
Producer	100.0	95.7	98.4	98.9	98.5	100.6	99.5	99.0	96.8	96.9	97.3
Social	100.0	92.3	90.6	88.9	88.0	87.5	86.7	85.5	83.0	79.4	79.2

Appendix A.30 - Productivity Indexes

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
MFP - Output Index / Input Index									
Primary	93.6	93.4	91.9	87.6	81.4	76.9	75.3	77.4	76.2
Secondary	113.2	112.2	112.4	112.2	119.4	119.9	121.3	119.3	119.2
Services (Market)	111.4	110.7	110.1	110.3	111.7	112.3	113.3	113.6	115.5
Distributive	97.9	94.9	95.9	95.7	96.1	96.2	95.7	95.7	97.0
Producer	113.3	113.9	111.7	113.3	114.9	117.1	119.7	120.2	122.4
Personal	113.6	115.2	116.4	115.9	119.1	118.0	119.4	119.5	121.3
LP - Output Index / Labour Index									
Primary	134.3	136.6	140.9	139.2	138.1	146.0	152.4	176.1	174.6
Secondary	123.3	124.0	126.3	127.3	137.5	139.1	140.2	138.0	138.3
Services (Market)	125.1	126.9	128.2	129.6	132.6	134.6	137.9	138.1	141.2
Distributive	118.6	115.5	120.6	121.2	123.9	125.1	126.6	126.4	129.3
Producer	126.5	128.7	125.4	127.9	129.4	132.4	137.5	137.8	141.2
Social	125.2	129.0	132.4	132.1	136.6	136.2	138.8	139.1	141.4
KP - Output Index / Capital Services Index									
Primary	77.2	76.5	74.2	69.9	63.7	58.0	55.6	54.5	53.6
Secondary	95.5	92.4	90.2	88.7	91.8	90.8	92.6	90.7	90.2
Services (Market)	93.7	90.8	88.8	88.2	88.2	87.9	87.2	87.6	88.4
Distributive	78.0	75.4	73.9	73.4	72.5	72.0	70.6	70.7	71.1
Producer	96.3	95.4	94.3	95.1	96.6	98.1	98.6	99.3	100.4
Social	76.9	74.4	72.3	71.6	72.2	70.6	69.9	69.9	70.4

Appendix B Long time-series data

Estimates of Australian GDP, 1788 - 2016 (1990, Int. GK$)

Year	$'000 per annum	Estimated Population	$ per capita per annum
1788	9	859	10,447
1789	7	645	11,269
1790	9	2056	4,365
1791	12	2873	4,204
1792	15	3264	4,568
1793	18	3514	4,996
1794	22	3579	6,277
1795	26	3466	7,568
1796	29	4100	6,953
1797	31	4344	7,085
1798	33	4588	7,271
1799	37	5088	7,297
1800	40	5217	7,587
1801	45	5945	7,559
1802	45	7014	6,366
1803	47	7238	6,489
1804	52	7598	6,863
1805	55	7707	7,143
1806	59	7910	7,451
1807	62	8794	7,011
1808	61	10263	5,949
1809	65	11560	5,596
1810	83	11566	7,189
1811	79	11875	6,669
1812	81	12630	6,391
1813	83	13957	5,959
1814	86	14086	6,088
1815	99	15063	6,580
1816	94	17553	5,367
1817	102	21192	4,826
1818	113	25859	4,368
1819	121	31472	3,844
1820	173	33543	5,158
1821	173	35492	4,874
1822	177	37364	4,737
1823	183	40632	4,504
1824	195	48072	4,056
1825	205	52505	3,904
1826	207	53882	3,842
1827	212	56300	3,766
1828	216	58197	3,712
1829	228	61934	3,681
1830	280	70039	3,998
1831	292	75981	3,843
1832	303	83937	3,610
1833	314	98095	3,201
1834	335	105556	3,174
1835	410	113354	3,617
1836	413	125120	3,301
1837	440	134488	3,272
1838	452	151868	2,976
1839	438	169939	2,577

Estimates of Australian GDP, 1788 - 2016 (1990, Int. GK$)

Year	$'000 per annum	Estimated Population	$ per capita per annum
1840	577	190408	3,030
1841	525	220968	2,376
1842	497	240984	2,062
1843	585	250848	2,332
1844	679	264287	2,569
1845	716	279148	2,565
1846	809	293249	2,759
1847	960	308797	3,109
1848	1,141	332328	3,433
1849	1,207	373362	3,233
1850	1,195	405356	2,948
1851	1,491	437665	3,407
1852	1,952	513796	3,799
1853	2,393	600992	3,982
1854	2,338	694917	3,364
1855	2,459	793260	3,100
1856	3,251	876729	3,708
1857	3,114	970287	3,209
1858	2,837	1050828	2,700
1859	3,793	1097305	3,457
1860	3,838	1145585	3,350
1861	3,837	1168149	3,285
1862	3,786	1206918	3,137
1863	3,910	1259292	3,105
1864	4,329	1325183	3,267
1865	4,303	1390043	3,096
1866	4,575	1443955	3,168
1867	5,120	1483848	3,450
1868	5,366	1539552	3,485
1869	5,414	1592157	3,400
1870	5,810	1647756	3,526
1871	5,525	1700888	3,248
1872	6,119	1742847	3,511
1873	6,764	1794520	3,769
1874	6,987	1849392	3,778
1875	7,755	1898223	4,085
1876	7,730	1958679	3,947
1877	8,052	2031130	3,964
1878	8,820	2092164	4,216
1879	8,944	2162343	4,136
1880	9,415	2231531	4,219
1881	10,108	2306736	4,382
1882	9,539	2388082	3,994
1883	10,951	2505736	4,370
1884	11,000	2605725	4,221
1885	11,719	2694518	4,349
1886	11,867	2788050	4,256
1887	13,131	2881362	4,557
1888	13,205	2981677	4,429
1889	14,345	3062477	4,684
1890	13,850	3151355	4,395
1891	14,914	3240985	4,602

Estimates of Australian GDP, 1788 - 2016 (1990, Int. GK$)

Year	$'000 per annum	Estimated Population	$ per capita per annum
1892	13,081	3305753	3,957
1893	12,362	3361895	3,677
1894	12,784	3426760	3,731
1895	12,066	3491621	3,456
1896	12,982	3553098	3,654
1897	12,264	3617783	3,390
1898	14,172	3664715	3,867
1899	14,172	3715988	3,814
1900	15,014	3765339	3,987
1901	14,568	3824913	3,809
1902	14,717	3875318	3,798
1903	15,881	3916592	4,055
1904	16,947	3974150	4,264
1905	17,145	4032977	4,251
1906	18,309	4091485	4,475
1907	19,052	4161722	4,578
1908	19,697	4232278	4,654
1909	21,307	4323960	4,928
1910	22,793	4425083	5,151
1911	22,967	4573786	5,021
1912	23,764	4746589	5,007
1913	24,861	4893741	5,080
1914	24,797	4971778	4,988
1915	24,341	4969457	4,898
1916	24,172	4917949	4,915
1917	23,716	4982063	4,760
1918	23,155	5080912	4,557
1919	24,488	5303574	4,617
1920	25,534	5411297	4,719
1921	26,818	5510944	4,866
1922	28,225	5637286	5,007
1923	29,579	5755986	5,139
1924	31,524	5882002	5,359
1925	33,002	6003027	5,498
1926	33,792	6124020	5,518
1927	34,305	6251016	5,488
1928	34,368	6355770	5,407
1929	33,662	6436213	5,230
1930	30,458	6500751	4,685
1931	28,416	6552606	4,337
1932	30,025	6603785	4,547
1933	32,110	6656695	4,824
1934	33,810	6707247	5,041
1935	35,798	6755662	5,299
1936	37,414	6810413	5,494
1937	39,306	6871492	5,720
1938	40,639	6935909	5,859
1939	40,749	7004912	5,817
1940	43,422	7077586	6,135
1941	48,271	7143598	6,757
1942	53,837	7201096	7,476
1943	55,738	7269658	7,667

Estimates of Australian GDP, 1788 - 2016 (1990, Int. GK$)

Year	$'000 per annum	Estimated Population	$ per capita per annum
1944	53,809	7347024	7,324
1945	51,109	7430197	6,879
1946	49,291	7517981	6,556
1947	50,503	7637963	6,612
1948	53,754	7792465	6,898
1949	57,308	8045570	7,123
1950	61,274	8307481	7,376
1951	63,892	8527907	7,492
1952	64,470	8739569	7,377
1953	66,481	8902686	7,468
1954	70,614	9089936	7,768
1955	74,471	9311825	7,997
1956	77,034	9530871	8,083
1957	78,577	9744087	8,064
1958	82,351	9947358	8,279
1959	87,421	10160968	8,604
1960	91,085	10391920	8,765
1961	91,713	10642654	8,617
1962	97,444	10846059	8,984
1963	103,413	11055482	9,354
1964	110,488	11280429	9,795
1965	116,131	11505408	10,094
1966	119,363	11704843	10,198
1967	127,422	11912253	10,697
1968	134,913	12145582	11,108
1969	143,118	12407217	11,535
1970	152,220	12663469	12,020
1971	158,992	13198380	12,046
1972	163,453	13409288	12,190
1973	172,314	13614344	12,657
1974	176,586	13831978	12,767
1975	181,367	13968881	12,984
1976	188,678	14110107	13,372
1977	190,653	14281533	13,350
1978	196,184	14430830	13,595
1979	206,515	14602481	14,142
1980	210,642	14807370	14,225
1981	218,780	15054117	14,533
1982	218,512	15288891	14,292
1983	218,539	15483496	14,114
1984	233,618	15677282	14,902
1985	245,444	15900566	15,436
1986	250,539	16138769	15,524
1987	262,925	16394641	16,037
1988	274,737	16687082	16,464
1989	286,820	16936723	16,935
1990	291,180	17169768	16,959
1991	291,916	17378981	16,797
1992	302,571	17557133	17,233
1993	314,360	17719090	17,741
1994	327,595	17893433	18,308
1995	341,575	18119616	18,851

Estimates of Australian GDP, 1788 - 2016 (1990, Int. GK$)

Year	$'000 per annum	Estimated Population	$ per capita per annum
1996	354,521	18330079	19,341
1997	370,333	18510004	20,007
1998	390,635	18705620	20,883
1999	406,196	18919210	21,470
2000	414,058	19141036	21,632
2001	429,694	19386461	22,165
2002	443,202	19605441	22,606
2003	461,200	19827155	23,261
2004	472,265	20046003	23,559
2005	485,488	20311543	23,902
2006	499,082	20627547	24,195
2007	519,045	21016121	24,697
2008	531,503	21475625	24,749
2009	541,134	21865623	24,748
2010	551,988	22172469	24,895
2011	565,086	22527401	25,084
2012	585,622	22942164	25,526
2013	600,672	23321715	25,756
2014	616,346	23672621	26,036
2015	631,272	24012830	26,289
2016	648,731	24385635	26,603

Estimates of the size of the Primary, Secondary and Services sectors as a proportion of Australian GDP (excl dwelling services, taxes and statistical discrepency)

	Annual				5-year average		
Year	Primary	Secondary	Services	Year	Primary	Secondary	Services
1795	32.1%	0.9%	66.9%	1795			
1796	32.4%	0.8%	66.8%	1796			
1797	34.7%	0.0%	65.3%	1797			
1798	26.1%	8.0%	65.9%	1798			
1799	33.3%	6.3%	60.4%	1799	31.7%	3.2%	65.1%
1800	35.9%	2.6%	61.5%	1800	32.5%	3.6%	64.0%
1801	45.6%	2.7%	51.7%	1801	35.1%	3.9%	61.0%
1802	46.9%	0.9%	52.2%	1802	37.6%	4.1%	58.3%
1803	42.6%	6.7%	50.7%	1803	40.9%	3.8%	55.3%
1804	50.3%	2.2%	43.0%	1804	44.3%	3.0%	51.8%
1805	50.8%	1.7%	41.2%	1805	47.2%	2.8%	47.8%
1806	52.1%	0.3%	40.0%	1806	48.5%	2.3%	45.4%
1807	49.0%	2.6%	39.4%	1807	49.0%	2.7%	42.9%
1808	45.1%	2.0%	42.0%	1808	49.4%	1.8%	41.1%
1809	47.2%	2.2%	38.8%	1809	48.8%	1.8%	40.3%
1810	61.6%	4.6%	33.8%	1810	51.0%	2.3%	38.8%
1811	58.0%	2.0%	40.0%	1811	52.2%	2.7%	38.8%
1812	55.8%	2.4%	41.8%	1812	53.5%	2.6%	39.3%
1813	55.0%	1.5%	43.5%	1813	55.5%	2.5%	39.6%
1814	51.8%	3.7%	44.6%	1814	56.4%	2.8%	40.7%
1815	55.9%	4.1%	40.0%	1815	55.3%	2.7%	42.0%
1816	48.0%	5.7%	46.3%	1816	53.3%	3.5%	43.2%
1817	49.1%	3.5%	47.4%	1817	52.0%	3.7%	44.3%
1818	50.9%	5.4%	43.7%	1818	51.1%	4.5%	44.4%
1819	53.7%	2.8%	43.6%	1819	51.5%	4.3%	44.2%
1820	54.0%	2.9%	43.2%	1820	51.1%	4.1%	44.8%
1821	56.1%	4.2%	39.7%	1821	52.7%	3.8%	43.5%
1822	54.7%	4.8%	40.6%	1822	53.9%	4.0%	42.1%
1823	52.0%	4.7%	43.2%	1823	54.1%	3.9%	42.1%
1824	50.2%	4.7%	45.1%	1824	53.4%	4.3%	42.4%
1825	49.2%	5.0%	45.8%	1825	52.4%	4.7%	42.9%
1826	48.7%	5.0%	46.2%	1826	51.0%	4.8%	44.2%
1827	45.5%	4.9%	49.0%	1827	49.1%	4.9%	45.9%
1828	47.0%	4.3%	48.2%	1828	48.1%	4.8%	46.9%
1829	44.1%	5.3%	50.2%	1829	46.9%	4.9%	47.9%
1830	42.9%	6.9%	50.0%	1830	45.6%	5.3%	48.7%
1831	42.0%	6.5%	51.0%	1831	44.3%	5.6%	49.7%
1832	36.7%	7.4%	52.2%	1832	42.5%	6.1%	50.3%
1833	41.6%	7.9%	49.7%	1833	41.5%	6.8%	50.6%
1834	50.3%	6.6%	42.6%	1834	42.7%	7.1%	49.1%
1835	56.9%	6.1%	36.4%	1835	45.5%	6.9%	46.4%
1836	54.5%	5.1%	39.1%	1836	48.0%	6.6%	44.0%
1837	48.1%	6.0%	45.2%	1837	50.3%	6.4%	42.6%
1838	43.0%	8.0%	48.4%	1838	50.5%	6.4%	42.3%
1839	42.5%	8.8%	48.1%	1839	49.0%	6.8%	43.5%
1840	43.3%	12.2%	43.9%	1840	46.3%	8.0%	44.9%
1841	42.6%	8.1%	48.6%	1841	43.9%	8.6%	46.8%
1842	38.4%	8.4%	52.5%	1842	42.0%	9.1%	48.3%
1843	36.3%	6.4%	56.2%	1843	40.6%	8.8%	49.9%
1844	33.9%	6.8%	57.8%	1844	38.9%	8.4%	51.8%
1845	35.5%	6.6%	56.1%	1845	37.4%	7.3%	54.2%

Estimates of the size of the Primary, Secondary and Services sectors as a proportion of Australian GDP (excl dwelling services, taxes and statistical discrepency)

		Annual				5-year average	
Year	Primary	Secondary	Services	Year	Primary	Secondary	Services
1846	37.2%	7.3%	53.9%	1846	36.3%	7.1%	55.3%
1847	34.6%	8.7%	55.1%	1847	35.5%	7.1%	55.8%
1848	37.5%	9.9%	50.9%	1848	35.8%	7.8%	54.8%
1849	34.8%	10.0%	53.6%	1849	35.9%	8.5%	53.9%
1850	37.4%	10.2%	50.9%	1850	36.3%	9.2%	52.9%
1851	38.5%	10.7%	48.9%	1851	36.6%	9.9%	51.9%
1852	51.9%	7.5%	39.3%	1852	40.0%	9.7%	48.7%
1853	43.7%	8.6%	46.6%	1853	41.3%	9.4%	47.8%
1854	35.7%	10.2%	52.9%	1854	41.4%	9.4%	47.7%
1855	43.3%	7.9%	47.5%	1855	42.6%	9.0%	47.0%
1856	45.9%	8.2%	44.8%	1856	44.1%	8.5%	46.2%
1857	42.7%	12.1%	44.0%	1857	42.2%	9.4%	47.2%
1858	42.6%	12.4%	43.8%	1858	42.0%	10.2%	46.6%
1859	41.5%	11.5%	45.9%	1859	43.2%	10.4%	45.2%
1860	40.4%	12.8%	45.7%	1860	42.6%	11.4%	44.8%
1861	34.0%	16.0%	50.1%	1861	40.2%	13.0%	45.9%
1862	31.8%	14.4%	53.8%	1862	38.0%	13.4%	47.8%
1863	30.3%	19.0%	50.6%	1863	35.6%	14.7%	49.2%
1864	32.3%	16.4%	51.3%	1864	33.8%	15.7%	50.3%
1865	30.9%	17.8%	51.3%	1865	31.9%	16.7%	51.4%
1866	30.1%	16.8%	53.0%	1866	31.1%	16.9%	52.0%
1867	34.0%	16.6%	49.4%	1867	31.5%	17.3%	51.1%
1868	32.1%	20.5%	47.4%	1868	31.9%	17.6%	50.5%
1869	30.2%	20.4%	49.4%	1869	31.5%	18.4%	50.1%
1870	34.2%	18.4%	47.4%	1870	32.1%	18.5%	49.3%
1871	32.5%	19.3%	48.2%	1871	32.6%	19.0%	48.4%
1872	32.6%	20.0%	47.4%	1872	32.3%	19.7%	48.0%
1873	33.0%	17.8%	49.2%	1873	32.5%	19.2%	48.3%
1874	32.7%	19.5%	47.9%	1874	33.0%	19.0%	48.0%
1875	32.5%	22.5%	45.0%	1875	32.7%	19.8%	47.5%
1876	30.3%	24.2%	45.6%	1876	32.2%	20.8%	47.0%
1877	26.8%	28.9%	44.3%	1877	31.1%	22.6%	46.4%
1878	30.4%	24.9%	44.7%	1878	30.5%	24.0%	45.5%
1879	30.3%	23.1%	46.5%	1879	30.1%	24.7%	45.2%
1880	32.8%	24.1%	43.1%	1880	30.1%	25.1%	44.8%
1881	29.9%	27.8%	42.3%	1881	30.0%	25.8%	44.2%
1882	26.1%	27.7%	46.2%	1882	29.9%	25.5%	44.6%
1883	28.5%	27.1%	44.4%	1883	29.5%	26.0%	44.5%
1884	24.5%	29.0%	46.5%	1884	28.4%	27.1%	44.5%
1885	25.5%	27.8%	46.7%	1885	26.9%	27.9%	45.2%
1886	24.3%	30.6%	45.1%	1886	25.8%	28.5%	45.8%
1887	28.0%	28.8%	43.2%	1887	26.2%	28.7%	45.2%
1888	24.8%	30.0%	45.1%	1888	25.4%	29.3%	45.3%
1889	26.1%	28.2%	45.7%	1889	25.7%	29.1%	45.2%
1890	28.8%	25.3%	45.9%	1890	26.4%	28.6%	45.0%
1891	31.2%	26.7%	42.1%	1891	27.8%	27.8%	44.4%
1892	32.1%	23.0%	44.9%	1892	28.6%	26.6%	44.7%
1893	34.9%	21.4%	43.6%	1893	30.6%	24.9%	44.4%
1894	36.2%	21.8%	42.0%	1894	32.7%	23.6%	43.7%
1895	31.2%	22.8%	46.0%	1895	33.1%	23.1%	43.7%
1896	29.5%	23.8%	46.7%	1896	32.8%	22.6%	44.7%

Estimates of the size of the Primary, Secondary and Services sectors as a proportion of Australian GDP (excl dwelling services, taxes and statistical discrepency)

	Annual				5-year average		
Year	Primary	Secondary	Services	Year	Primary	Secondary	Services
1897	29.1%	21.3%	49.6%	1897	32.2%	22.2%	45.6%
1898	28.7%	21.8%	49.6%	1898	30.9%	22.3%	46.8%
1899	32.1%	21.7%	46.2%	1899	30.1%	22.3%	47.6%
1900	31.7%	19.5%	48.8%	1900	30.2%	21.6%	48.2%
1901	28.3%	19.3%	52.4%	1901	30.0%	20.7%	49.3%
1902	23.8%	23.9%	52.4%	1902	28.9%	21.2%	49.9%
1903	26.6%	22.1%	51.3%	1903	28.5%	21.3%	50.2%
1904	35.7%	17.2%	47.1%	1904	29.2%	20.4%	50.4%
1905	35.2%	16.8%	48.0%	1905	29.9%	19.9%	50.2%
1906	34.2%	17.4%	48.5%	1906	31.1%	19.5%	49.4%
1907	34.6%	18.9%	46.5%	1907	33.2%	18.5%	48.3%
1908	32.8%	19.3%	47.9%	1908	34.5%	17.9%	47.6%
1909	33.8%	18.6%	47.6%	1909	34.1%	18.2%	47.7%
1910	33.6%	18.3%	48.1%	1910	33.8%	18.5%	47.7%
1911	32.1%	20.0%	47.9%	1911	33.4%	19.0%	47.6%
1912	27.8%	22.8%	49.3%	1912	32.0%	19.8%	48.2%
1913	29.0%	23.1%	47.9%	1913	31.3%	20.6%	48.2%
1914	27.7%	23.8%	48.4%	1914	30.0%	21.6%	48.3%
1915	20.0%	25.2%	54.8%	1915	27.3%	23.0%	49.7%
1916	29.0%	20.1%	51.0%	1916	26.7%	23.0%	50.3%
1917	31.4%	17.7%	50.9%	1917	27.4%	22.0%	50.6%
1918	31.6%	16.7%	51.7%	1918	27.9%	20.7%	51.4%
1919	27.7%	18.0%	54.4%	1919	27.9%	19.5%	52.6%
1920	22.7%	21.6%	55.8%	1920	28.5%	18.8%	52.7%
1921	30.9%	18.0%	51.2%	1921	28.8%	18.4%	52.8%
1922	26.8%	21.3%	51.9%	1922	27.9%	19.1%	53.0%
1923	23.5%	23.1%	53.4%	1923	26.3%	20.4%	53.3%
1924	23.1%	23.0%	53.9%	1924	25.4%	21.4%	53.2%
1925	26.1%	21.4%	52.5%	1925	26.1%	21.3%	52.6%
1926	23.8%	22.1%	54.1%	1926	24.7%	22.2%	53.2%
1927	24.0%	23.0%	53.0%	1927	24.1%	22.5%	53.4%
1928	22.6%	24.3%	53.1%	1928	23.9%	22.7%	53.3%
1929	24.5%	24.1%	51.4%	1929	24.2%	23.0%	52.8%
1930	26.4%	21.5%	52.1%	1930	24.2%	23.0%	52.8%
1931	28.1%	19.5%	52.3%	1931	25.1%	22.5%	52.4%
1932	31.0%	17.4%	51.6%	1932	26.5%	21.4%	52.1%
1933	29.8%	17.5%	52.6%	1933	28.0%	20.0%	52.0%
1934	29.5%	18.0%	52.4%	1934	29.0%	18.8%	52.2%
1935	27.1%	20.8%	52.1%	1935	29.1%	18.7%	52.2%
1936	26.2%	20.7%	53.1%	1936	28.7%	18.9%	52.4%
1937	27.5%	20.5%	52.0%	1937	28.0%	19.5%	52.5%
1938	26.8%	21.3%	52.0%	1938	27.4%	20.3%	52.3%
1939	25.0%	22.2%	52.8%	1939	26.5%	21.1%	52.4%
1940	24.2%	22.7%	53.1%	1940	25.9%	21.5%	52.6%
1941	22.3%	22.4%	55.3%	1941	25.1%	21.8%	53.0%
1942	18.9%	21.7%	59.4%	1942	23.4%	22.1%	54.5%
1943	16.3%	21.3%	62.3%	1943	21.3%	22.1%	56.6%
1944	15.9%	21.3%	62.7%	1944	19.5%	21.9%	58.6%
1945	16.4%	21.3%	62.3%	1945	18.0%	21.6%	60.4%
1946	18.1%	23.1%	58.8%	1946	17.1%	21.7%	61.1%
1947	19.0%	27.8%	53.2%	1947	17.1%	23.0%	59.9%

Estimates of the size of the Primary, Secondary and Services sectors as a proportion of Australian GDP (excl dwelling services, taxes and statistical discrepency)

	Annual		
Year	Primary	Secondary	Services
1948	18.3%	29.3%	52.4%
1949	17.6%	30.1%	52.3%
1950	17.1%	30.9%	52.0%
1951	16.5%	32.1%	51.5%
1952	16.0%	32.0%	52.0%
1953	16.2%	30.8%	53.0%
1954	15.9%	31.7%	52.4%
1955	15.3%	32.8%	51.8%
1956	14.9%	33.0%	52.1%
1957	14.6%	32.8%	52.5%
1958	14.3%	33.1%	52.6%
1959	13.8%	33.4%	52.8%
1960	13.1%	34.2%	52.7%
1961	12.5%	34.3%	53.2%
1962	12.3%	33.8%	53.9%
1963	11.9%	34.3%	53.7%
1964	11.7%	33.9%	54.4%
1965	11.2%	34.8%	54.0%
1966	10.0%	34.7%	55.3%
1967	11.4%	33.8%	54.8%
1968	9.8%	34.7%	55.5%
1969	11.3%	34.5%	54.2%
1970	10.9%	34.6%	54.5%
1971	11.5%	33.9%	54.6%
1972	11.9%	33.7%	54.4%
1973	11.0%	33.7%	55.2%
1974	11.1%	33.8%	55.1%
1975	11.9%	31.8%	56.3%
1976	12.0%	31.3%	56.8%
1977	12.0%	30.8%	57.3%
1978	11.6%	29.7%	58.5%
1979	12.3%	29.1%	58.6%
1980	10.8%	28.9%	60.0%
1981	9.6%	28.6%	61.2%
1982	9.8%	28.1%	61.6%
1983	9.0%	26.2%	64.0%
1984	10.7%	25.0%	63.9%
1985	10.6%	24.8%	64.3%
1986	10.5%	24.1%	65.2%
1987	10.0%	23.6%	66.2%
1988	9.7%	23.5%	66.6%
1989	9.2%	23.4%	67.3%
1990	9.4%	22.4%	68.2%
1991	8.6%	21.0%	70.4%
1992	8.4%	20.1%	71.5%
1993	8.6%	20.1%	71.4%
1994	8.3%	20.6%	71.1%
1995	8.0%	20.9%	71.2%
1996	8.7%	20.4%	70.9%
1997	8.2%	20.0%	71.8%
1998	8.0%	20.0%	72.0%

	5-year average		
Year	Primary	Secondary	Services
1948	17.5%	24.6%	57.9%
1949	17.9%	26.3%	55.8%
1950	18.0%	28.2%	53.7%
1951	17.7%	30.0%	52.3%
1952	17.1%	30.9%	52.0%
1953	16.7%	31.2%	52.1%
1954	16.3%	31.5%	52.2%
1955	16.0%	31.9%	52.1%
1956	15.7%	32.1%	52.3%
1957	15.4%	32.2%	52.4%
1958	15.0%	32.7%	52.3%
1959	14.6%	33.0%	52.4%
1960	14.1%	33.3%	52.6%
1961	13.7%	33.6%	52.8%
1962	13.2%	33.8%	53.0%
1963	12.7%	34.0%	53.3%
1964	12.3%	34.1%	53.6%
1965	11.9%	34.2%	53.8%
1966	11.4%	34.3%	54.3%
1967	11.3%	34.3%	54.4%
1968	10.8%	34.4%	54.8%
1969	10.7%	34.5%	54.8%
1970	10.7%	34.5%	54.9%
1971	11.0%	34.3%	54.7%
1972	11.1%	34.3%	54.6%
1973	11.3%	34.1%	54.6%
1974	11.3%	33.9%	54.8%
1975	11.5%	33.4%	55.1%
1976	11.6%	32.8%	55.6%
1977	11.6%	32.3%	56.1%
1978	11.7%	31.5%	56.8%
1979	12.0%	30.5%	57.5%
1980	11.7%	30.0%	58.2%
1981	11.3%	29.5%	59.1%
1982	10.8%	28.9%	60.0%
1983	10.3%	28.2%	61.1%
1984	10.0%	27.4%	62.1%
1985	10.0%	26.5%	63.0%
1986	10.1%	25.6%	63.8%
1987	10.2%	24.7%	64.7%
1988	10.3%	24.2%	65.2%
1989	10.0%	23.9%	65.9%
1990	9.7%	23.4%	66.7%
1991	9.4%	22.8%	67.7%
1992	9.1%	22.1%	68.8%
1993	8.8%	21.4%	69.7%
1994	8.7%	20.8%	70.5%
1995	8.4%	20.5%	71.1%
1996	8.4%	20.4%	71.2%
1997	8.4%	20.4%	71.3%
1998	8.2%	20.4%	71.4%

Estimates of the size of the Primary, Secondary and Services sectors as a proportion of Australian GDP (excl dwelling services, taxes and statistical discrepency)

	Annual				5-year average		
Year	Primary	Secondary	Services	Year	Primary	Secondary	Services
1999	7.8%	19.6%	72.6%	1999	8.1%	20.2%	71.7%
2000	8.0%	19.5%	72.5%	2000	8.2%	19.9%	72.0%
2001	9.3%	17.7%	73.0%	2001	8.3%	19.3%	72.4%
2002	9.6%	17.8%	72.6%	2002	8.6%	18.9%	72.5%
2003	8.2%	18.6%	73.2%	2003	8.6%	18.6%	72.8%
2004	7.7%	19.1%	73.2%	2004	8.6%	18.5%	72.9%
2005	8.6%	18.6%	72.8%	2005	8.7%	18.4%	73.0%
2006	10.1%	18.0%	71.8%	2006	8.9%	18.4%	72.7%
2007	10.1%	17.6%	72.3%	2007	8.9%	18.4%	72.7%
2008	10.2%	17.5%	72.3%	2008	9.4%	18.2%	72.5%
2009	12.2%	16.7%	71.1%	2009	10.3%	17.7%	72.1%
2010	10.3%	16.5%	73.2%	2010	10.6%	17.3%	72.1%
2011	12.4%	15.7%	71.9%	2011	11.0%	16.8%	72.2%
2012	11.9%	15.7%	72.4%	2012	11.4%	16.4%	72.2%
2013	10.6%	15.5%	73.9%	2013	11.5%	16.0%	72.5%
2014	11.3%	15.4%	73.3%	2014	11.3%	15.7%	72.9%
2015	9.7%	15.4%	75.0%	2015	11.2%	15.5%	73.3%
2016	8.9%	14.9%	76.1%	2016	10.5%	15.4%	74.1%