Public, Private or Both? Analysing Factors Influencing the Labour Supply of Medical Specialists

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Abstract

This paper investigates the factors influencing the allocation of time between public and private sectors by medical specialists. A discrete choice structural labour supply model is estimated, where specialists choose from a set of job packages that are characterised by the number of working hours in the public and private sectors. The results show that medical specialists respond to changes in earnings by reallocating working hours to the sector with relatively increased earnings, while leaving total working hours unchanged. The magnitudes of the own-sector and cross-sector hours elasticities fall in the range of 0.16–0.51. The labour supply response varies by gender, doctor's age and medical specialty. Family circumstances such as the presence of young dependent children reduce the hours worked by female specialists but not male specialists.

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1 Introduction

The balance between public and private sector financing and provision of health care remains a key policy issue in many countries. In low- and middle-income countries, rising household incomes brought about by economic growth have increased demand for private medical care. In high-income countries like Canada and the UK where the government is the main funder of health care services, fiscal pressures have led to consideration of expanded roles for the private sector in health care finance and provision (**?**).

Such expansions are often controversial. Doctors are drawn to private practice, attracted by better remuneration and other reasons such as professional autonomy, status, and recognition (**?**), making recruitment and retention of public sector doctors more difficult. In health systems where doctors can combine public and private practice (often referred to as dual practice), the problem of 'cream-skimming' may arise where private providers have incentives to select patients with less severe conditions and attract patients with a higher ability to pay, leaving public hospitals with more complex patients (**?**; **?**).

Dual practice is widespread in many high-, middle- and low-income countries, and can have important implications for health care cost and quality. See **?** and **?** for recent reviews. There is however a lack of consensus on its effects, reflected in the large differences in the extent to which the practice is regulated across different countries (**?**). In countries such as the UK and France, there have been restrictions on how much public sector doctors are allowed to earn from private practice; in others (e.g. Spain), doctors are provided with monetary incentives not to engage in dual practice and work exclusively for the public system. In a number of countries, including Canada, dual practice is prohibited.

In Canada, the involvement of physicians and hospital services in a parallel private system is limited through a combination of prohibitions and regulatory disincentives. These include constraints on whether and how much physicians and hospitals can charge fees to private patients, as well as measures that prohibit the subsidisation of the private sector by the public sector (**?**). In some provinces, dual practice is prohibited as physicians who opt into the public system are not allowed to bill private patients directly; in others those who opted-in cannot 'extra-bill', or charge a fee that is higher than that under the public plan limiting the incentives for doctors to engage in dual practice. Physicians can choose to opt-out of the public system (giving up the right to bill public insurance plans) and take up private practice, although the regulations severely limit their incentives to do so. 'Duplicative' private health insurance, or private insurance plans for physician and hospitals services that are covered under public plans, is also prohibited.

These regulations often are the subject of legal proceedings (e.g. the court case *Cambie Surgeries Corporation v. British Columbia*), which draw on evidence from Canada and internationally on the benefits and consequences of public and private financing and provision on public sector waiting times, public and private service provision, and health care costs.

The aim of this paper is to investigate how pecuniary and non-pecuniary factors influence the allocation of time between public and private sector location by medical specialists. We analyse cross-sectional data from a nationally representative longitudinal survey of medical doctors in Australia. A discrete choice structural labour supply model is estimated, where specialists choose from a set of job packages that are characterised by the number of working hours in publicly and privately owned locations. The model can then be used to simulate the impact of changes in sector-specific earnings on the supply of labour in the public and private sectors.

Knowledge on how physicians make decisions on the choices of whether, and how much, to work in the public and private health care sectors is an essential step towards understanding the supply-side effects of expanding (or contracting) private sector involvement in health care.

With a fixed number of physicians in the short and medium term due to long periods of medical training, policies that aim to change the public-private mix have implications for physicians' allocation of working hours between the public and private sectors. Although private sector doctors are not price setters, private sector employment and self-employment allow for more flexibility in influencing the level of earnings in response to changes in demand, compared to public sector employers who are often constrained by bargaining agreements and pay regulation. A shift in the demand curve for private sector health care leads to higher earnings, and spending more working hours in the private sector, while reducing working hours in the public sector. The extent of these responses depends on the own-wage elasticity of hours for the public sector and for the private sector, and the cross-wage elasticity of these hours.

Dual practice in the medical labour market also makes an interesting case study on multiple job holding (**?**). Constraints in working hours, where workers are willing to work more in their primary job but are not being offered the opportunity, is not likely to be relevant for medical doctors as a motive for taking up a second job given the general shortage in the public sector. However, doctors may be motivated to take up a second job if they derive different levels of satisfaction from public and private medical work, which is consistent with the heterogeneity motive (**?**; **?**). Furthermore, public sector doctors in the early stages of their medical careers might decide to undertake some work in the private sector to acquire new skills in preparation and anticipation of a move into full-time private practice in the future (**?**).

Our study also contributes towards understanding the labour supply response of highly qualified professionals on high incomes and long hours who have invested many years in their human capital. Existing studies focus on differences in labour market outcomes between men and women, specifically documenting and explaining the gender earnings gap among similarly well-educated individuals. **?** finds that male MBA graduates have higher earnings compared to females, and this difference is largely explained by differences in training prior to MBA graduation, career interruptions, and weekly working hours. Similar patterns in earning differentials have been documented in fields such as law, corporate management, academia (**?**; **?**; **?**). A recent study of General Practitioners (GPs) in Australia not only finds significant gender differences in earnings, but also that female GPs with children earn substantially less than comparable female GPs without children (**?**). This is because female GPs with children work fewer hours and are less attached to the labour force.

A number of Canadian and US papers have examined the labour supply of physicians, albeit within an institutional context where public and private sectors of health care are not explicitly distinguished (e.g. **?**; **?**; **?**; **?**). The most recent research on physician labour supply where public and private sectors coexist has been for Norway. **?** estimate a dynamic labour supply model of hospital-salaried physicians in Norway and obtain short-run wage elasticities of around 0.3. **?** exploit panel data in Norway allowing doctors' labour supply choices to be persistent over time but not allowing for doctors to combine public and private work.

Our paper is most closely related to the work by **?**, who estimates a structural labour supply model that is similar to our specification, where Norwegian doctors choose from a set of discrete alternatives of working hours in different sectors or practice types (e.g. hospitals, public primary care, private practice). The author finds that doctors allocate a larger number of working hours to the sector or practice type with higher wages, with estimates of elasticity of total hours in the range of 0.18 to 0.28. Our paper extends **?** by allowing the disutility associated with hours of work to differ by whether the hours are worked in the public or private sector. This distinction in preferences for public sector hours versus private sector hours, and the way in which this changes as hours in either sector increase or decrease, may differ between doctors with different characteristics. It is an essential extension when considering wage elasticities within each sector and across the sectors since it allows doctors to react differently to wage changes depending on their characteristics and on how many hours they currently work in each sector, with some doctors likely to respond strongly while others may hardly respond at all.

Our results show that medical specialists respond to changes in earnings by reallocating working hours to the sector with relatively higher earnings. The magnitudes of the own-sector and cross-sector hours elasticities fall in the range of 0.16–0.51, and are larger for male than for female specialists. On the whole, changes in earnings have no effect on total labour supply. Labour supply response further varies by doctors' age and medical specialty. The results also suggest that family circumstances such as the presence of young dependent children reduce the hours worked by female specialists but not male specialists.

The remainder of the paper is organised as follows. Section 2 describes the institutional context in Australia. Section 3 presents the econometric framework as well as the estimation strategies. Section 4 describes the sample and variables used in the analysis. The results from the econometric analysis are discussed in Section 5. The main limitations of the paper are discussed in Section 6, followed by a summary of the key findings, policy implications and conclusion in Section 7.

2 Institutional Context

Medicare is Australia's tax-financed health care system, providing free care in public hospitals and subsidised medical services and pharmaceuticals to all residents of Australia. Medicare provides around half of the funding for public hospitals, with States and Territories providing the rest - this includes funds to employ salaried specialists in public hospitals. Specialists and General Practitioners in private practice are paid by fee-for-service. All public hospitals are owned by State governments. Only public hospitals receive direct public funding. Private hospitals are funded through private health insurance premiums which are subsidised by the federal government. Medicare subsidises the out-of-pocket costs for patients seen by private medical practitioners, either in private hospitals (where specialists have admitting rights), in private consulting rooms, or where private patients are seen in public hospitals. These subsidies are determined by the Medicare Benefits Schedule (MBS) and are fixed for each item/procedure.

Specialists in private practice are free to charge patients a price higher than the MBS fee, resulting in a patient co-payment. There are no restrictions on the level of prices charged, and so co-payments vary. Specialists can also be directly employed on a salary by public hospitals with or without rights to private practice (RPP). The base salaries of specialists employed in the public sector are determined by employer bargaining agreements with each of the eight State and Territory governments which run public hospitals, though individual hospitals can pay more than this to aid recruitment and retention.

Salaried hospital specialists with RPP can treat patients in private hospitals and private consulting rooms, and can treat private patients in public hospitals. The revenue for the treatment of private patients in public hospitals is usually considered as revenue earned by the hospital, not direct income to the physician. However, physicians do receive additional remuneration from hospitals for participating in this work. This extra income can be delivered in a variety of ways determined through negotiation. Public hospital specialists can choose to receive a salary loading from their employers under the RPP contracts. Another arrangement is for specialists to retain their private billings subject to income caps and limits, and a fee is paid to the public hospital for the use of facilities.[1] Each State health department has rules about how public

[1]Using the same data as in this study, **?** find that roughly two-thirds (63%) of public hospital specialists with RPP received a salary loading under their RPP contracts. The remaining 37% chose to retain their private billings, which amounts to an average of 20% of the annual income of these doctors.

hospitals can use the private income they receive, which might include salary loadings and payments for continuing professional development, such as conferences and courses, and other 'in kind' benefits. Around 45% of the total medical workforce in Australia are employed in public hospitals (**?**).

Australia like many other countries has been experiencing medical workforce shortages; these have particularly affected rural and remote areas of the country, and public hospitals. In addition to imbalances across the public and private sectors, the issue of shortages and surpluses of medical specialists across different specialties has also recently been raised in Australia (**?**). There is an increasing recognition that the distribution of specialists across geography, sector, and specialty will be a key future policy issue. While national medical workforce planning and policy has devoted extensive time and energy to rural and remote shortages, little consideration has been given to the distribution of doctors between the public and private sectors. This paper aims to investigate doctors' labour supply choices in the public and private sectors.

3 Econometric Model

3.1 A structural model of public and private labour supply

We estimate a structural model of labour supply that is based on an underlying utility function to obtain estimates of labour supply elasticities with respect to public and private sector hourly earnings. The utility function takes three arguments: household net income (y), the number of hours worked in a public sector job (hpu), and hours worked in a private sector job (hpr). Each specialist is assumed to choose the alternative associated with the highest utility subject to the budget constraint that they face:

$$\max U(hpu, hpr, y) \tag{1}$$

$$\text{subject to } y = hpu * wpu + hpr * wpr + y_p + y_{nc} - \tau(hpu * wpu + hpr * wpr + y_p + y_{nc}; hc) \tag{2}$$

where wpu and wpr are gross hourly earnings in the public and private sector; y_p is the partner's total gross income, y_{nc} is the specialist's non-clinical gross income, and $\tau(.)$ is a tax and transfer function which calculates tax paid and transfers received for a given gross household income and household composition hc

The hours decision of public and private labour supply is analysed as a discrete choice problem rather than a continuous choice, following for example **?**. Each medical specialist i chooses an alternative j from a set of combinations of income and working hours in public and private sector jobs: $\{(y_{ji}, hpu_{ji}, hpr_{ji}; j = 1, \ldots, m)\}$ where hpu_{ji} and hpr_{ji} denote the specialist's working hours in public and private jobs respectively; and y_{ji} the household net income that corresponds to the relevant choice (j) of public and private hours combinations.

We observe between 0 and 80 working hours per week in each sector, measured in integers. These observed values inform our choice of discrete labour supply points that are considered available for male and female specialists. We allow doctors to choose one of the following four intervals of working hours per week in both public and private sectors: $\{0, 1-34, 35-49, 50+\}$. The discrete hours points are set to the mean number of hours worked in each of these intervals for males and females separately. The mean number of hours worked is then used to determine the labour income for every given labour supply point. The hours combination $(0, 0)$ is never observed since wave 1 of our survey only covers doctors who work non-zero hours in clinical practice. This specification leaves us with 12 different choices of public and private sector work for male doctors, which covers the observed choices well. For females, we exclude the option of working 35-49 hours in both sectors as no doctors are observed in this hours combination, resulting in 11 different choices of public and private work.[2]

The utility function is approximated by a second-order polynomial of working hours and household income:

$$U_{ji} = \gamma_0 y_{ji} + \gamma_1 y_{ji}^2 + \sum_{x=hpu,hpr} (\gamma_{2x} x_{ji} + \gamma_{3x} x_{ji}^2 + \gamma_{4x} x_{ji} y_{ji}) + \gamma_5 hpu_{ji} hpr_{ji} + \eta_{ji} \tag{3}$$

where η_{ji} is the random utility component which covers optimisation errors and unobserved heterogeneity.

We adopt a flexible specification where the preference parameters in the utility function are allowed to differ by doctors' age and family circumstances.[3] We assume that the random utility term (η) follows a type I extreme value distribution, and are independent across j. Under the assumption of utility maximisation, the probability that the individual i chooses alternative j is given by

$$Pr(U_{ji} > U_{ki}, k \neq j) = \frac{exp(U_{ji})}{\sum_{k=1}^{m} exp(U_{ki})} \tag{4}$$

We estimate the parameters of the utility function as a multinomial logit model by maximum likelihood, where the probabilities of the doctors being at their observed labour supply point form the likelihood function to be maximised.

The estimation of (4) requires information on the household net income that corresponds to each choice j of public and private hours. Household net income for each possible hours choice is obtained by calculating the expected gross labour income at different choices of public and private hours worked per week. Gross labour income is obtained by multiplying gross hourly earnings in the public and private sector with the relevant hours in the public and private sector. For practical reasons we need to make the non-trivial assumption that non-labour household income and partner's gross income are exogenous.[4] The resultant net household income is calculated as the sum of gross labour and non-labour income less any taxes paid and family payments received, which are computed using the tax and transfer rules in Australia for 2008 (the year that the data were collected).

3.2 Dealing with partially unobserved earnings

In estimating the labour supply model outlined in Section 3.1, we have to overcome the issue of unobserved hourly earnings in the public or private sector for a substantial number of specialists who only work in the public sector or only work in the private sector. Ideally, we would estimate the parameters of the utility function jointly with the two (public and private) earnings equations, and integrate out the unobserved earnings. However, this is computationally very demanding, so we follow the labour supply literature in using a two-step approach similar to what is commonly used to deal with unobserved wages of non-participants in the labour market;

[2]For female doctors we also estimated the model with the same set of 12 hours-combination choices as for male doctors and found that the model with 11 choices produced better goodness of fit given the data. The estimated elasticities in both cases are very similar.

[3]We have chosen to interact the linear terms of income, public hours, and private hours by doctors' characteristics but not the quadratic terms. Additional interactions usually do not add much, and would complicate the estimation unnecessarily while making effects even more difficult to interpret. Hence, it is very common in the literature to limit interactions to the linear terms only.

[4]Our data does not include sufficient information on the doctors' partners to allow us to estimate a joint labour supply model for partnered doctors.

e.g. see ?, ?, or ?.[5] This two-step approach involves first estimating two separate models of public and private sector earnings, followed by estimating the labour supply model as specified in Section 3.1 using imputed hourly earnings instead of observed hourly earnings for all doctors in the model. Following ?, we assume that the errors of the wage equation and the random utility component η_{ji} in (3) are independent.[6]

We use four years of data to predict hourly earnings from separate earnings regressions of samples of specialists working solely in the public or private sectors. Panel data are used to incorporate additional information and obtain better earnings imputations. The models for public and private hourly earnings are written as follows:

$$wpu_{it} = \mathbf{x}'_{1it}\alpha_1 + \mathbf{x}'_{2i}\alpha_1 + c_{1i} + \varepsilon_{1it} \quad (5)$$
$$wpr_{it} = \mathbf{x}'_{1it}\beta_1 + \mathbf{x}'_{2i}\beta_2 + c_{2i} + \varepsilon_{2it} \quad (6)$$

where wpu_{it} and wpr_{it} are the observed public and private hourly earnings of individual i in time t; $\mathbf{z}'_{it}$, $\mathbf{x}_{1it}$ and $\mathbf{x}_{2i}$ are vectors of time-varying and time-invariant exogenous regressors; and c_{1i} and c_{2i} denote unobserved individual-specific effects (or heterogeneity).

In the presence of c_i, the parameters of the earnings equations can be consistently estimated using fixed effects or first differenced estimators. However, these methods are not practical in the context of our application as they do not permit the estimation of coefficients on time-invariant characteristics such as medical specialty and gender. These characteristics have been shown to be important predictors of doctors' earnings (?). Therefore to accommodate both individual heterogeneity and time-invariant covariates, we use the Correlated Random Effects (CRE) model, proposed originally by ?, and extended by ?. Suppose we decompose the individual heterogeneity term $c_{ki} = \psi_k + \bar{\mathbf{x}}'_i\xi_k + a_{ki}$ where $k = 1, 2$ and $\bar{\mathbf{x}}_i = T^{-1}\Sigma_{t=1}^{T}\mathbf{x}_{1it}$, then wpu_{it} and wpr_{it} can be written as

$$wpu_{it} = \psi_1 + \mathbf{x}'_{1it}\alpha_1 + \mathbf{x}'_{2i}\alpha_2 + \bar{\mathbf{x}}'_i\xi_1 + a_{1i} + \varepsilon_{1it} \quad (7)$$
$$wpr_{it} = \psi_2 + \mathbf{x}'_{1it}\beta_1 + \mathbf{x}'_{2i}\beta_2 + \bar{\mathbf{x}}'_i\xi_2 + a_{2i} + \varepsilon_{2it} \quad (8)$$

where it is usually assumed that $E(a_{ki}|\mathbf{x}) = 0$ and $E(\varepsilon_{2it}|\mathbf{x}) = E(\varepsilon_{3it}|\mathbf{x}) = 0$. Assuming $\rho(\varepsilon_{1it}, \varepsilon_{2it}) = 0$, wpu_{it} and wpr_{it} may be estimated separately using the pooled ordinary least squared estimator, which produces fixed effects estimates of the time-varying coefficients, as well as estimates of the time-invariant variables (?). For unbalanced panels, which applies in our context, $\bar{\mathbf{x}}_i$ is calculated as the time-averages of $\mathbf{x}_{it}$ for the number of time periods that are observed for each individual i (?).

Based on these regressions, we impute public and private hourly earnings for all specialists in the sample.

4 The MABEL survey

The analysis centres around data from the first wave (2008) of the "Medicine in Australia: Balancing Employment and Life (MABEL)" longitudinal survey of doctors. MABEL is a panel

[5]Keane and Moffitt use an approach estimating the wage equation and the labour supply choice model jointly as well as a two-step approach similar to what is proposed here. They find that using a two-step approach considerably reduces the computational burden while the results using the two approaches are very similar.

[6]We empirically test for selectivity bias in the public and private earnings equations using a generalised Roy model. This is described in Appendix B. We use a two-step estimation approach, which involves first estimating a model of sector choice to obtain an estimate of the inverse Mills ratio $\hat{\lambda}_{it}$, and subsequently adding $\hat{\lambda}_{it}$ into the earnings equations as additional covariates. The coefficients on $\hat{\lambda}_{it}$ are not statistically significant for either public or private earnings, and indicate that we cannot reject the null hypothesis of no selectivity bias.

survey of workforce participation and its determinants among Australian doctors. All Australian doctors undertaking clinical practice (n = 54,750) were invited to participate, including 19,579 specialists. A total of 10,498 doctors (overall response rate of 19.4%) form the baseline cohort, including 4,597 specialists, who constitute approximately 23% of the population of medical specialists in Australia. Respondents were broadly representative of the population in terms of age, gender, doctor type, geographical location and hours worked. A detailed description of the survey methods is given in **?**.

In the construction of the analysis sample, we exclude doctors working less than 4 hours and more than 80 hours a week, and doctors who spend more than 50% of their hours in a work setting other than a public hospital, private hospital, or a private consultation room. Given our interest in the allocation of work hours across sectors, we excluded medical specialties that are predominantly public or private (e.g. public health, palliative medicine, emergency medicine), since once doctors choose these specialties they no longer have a genuine choice between public and private employment options. After excluding observations with missing responses, 2,138 observations remained in the analysis sample, consisting of 1,540 male and 598 female specialists.[7] Doctors in the analysis sample are very similar to the full sample with respect to characteristics such as age, gender, age of dependent child, and their partners' employment status.

4.1 Hours worked

Dependent variables are the hours worked in public and private sectors, which are derived from wave 1 information on weekly hours worked in public and private hospitals, private consultation rooms and other settings (e.g. community health centre, tertiary education institution). We define public and private sectors of work based on the ownership of the health care institutions where doctors work. Hours worked in public hospitals are classified as public sector work, while those in private hospitals and private rooms are considered private sector work. The reported hours worked in the remaining settings are assigned to either public or private work according to the proportion of time spent in the public sector and the proportion of time in the private sector.

The distribution of specialists by sector of work is shown in Table 1. Female specialists are more likely to work exclusively in the public sector (39% vs 25%), while male specialists are more likely to work in mixed practice (56% vs 43%), combining both public and private sector work. The percentage of female and male specialists working exclusively in the private sector is approximately similar.

The actual distribution of working hours is shown in Figures 1 and 2 for male and female specialists respectively. The sample means for total hours worked by sector are also shown in Table 1. Overall, the number of hours worked by male specialists is higher than for female specialists. Hours worked is highest for doctors in mixed practice, followed by public-only practice, and then private-only practice. Compared with male specialists, female specialists are younger, and they are more likely to have young dependent children between the age of 0 and 4 years, and a partner in employment.

[7] The following are the key variables and the corresponding number of observations dropped (in brackets) due either to exclusion criteria, or having missing or incomplete information: missing hours by work setting (748); specialties that are predominantly public or private (400); estimated wage: that is, missing variables in the wage equation (528); missing partners' income and other sources of household income (203); doctor working more than 50%) of their time in "Other" (e.g. tertiary institution) work settings (367); weekly hours less than 4 and more than 80 (68).

4.2 Covariates in the utility function

As indicated in equation (3), the utility function is approximated by a second-order polynomial of public hours, private hours, and net household income. The coefficients on the linear terms of these variables are allowed to vary by doctors' personal characteristics and family circumstances. This is achieved by interacting hours worked and income with covariates such as age, the presence of a partner, the presence of dependent children in different age categories, and the partner's employment status.

4.3 Public and private wage equations

To estimate the structural labour supply model, we require information on the net household income that corresponds to each choice of public and private hours. This requires predicting public and private sector hourly earnings for each observation in the sample. Wage equations are estimated based on data from the first four waves (2008–2011) of the MABEL survey. Using four waves instead of one wave maximises the size of the estimation sample and statistical power. We use 2008–2011 data for the 2008 cohort of specialists.[8] The data on annual earnings for years 2009–2011 are indexed to 2008 levels using the Professional Health Workers Wage Index (**?**). The model for public sector earnings is estimated on specialists who are employed exclusively in the public sector, and the model for private sector earnings is estimated on specialists who are employed exclusively in the private sector. These models are estimated using the correlated random effects model as described in Section 3.2.

Doctors' earnings are expected to be influenced by human capital variables (**?**) such as their education, professional qualifications, experience and field of specialty, and by their location. In the wage equations, we include variables on whether doctors completed their basic medical degree in Australia or overseas, fellowships, number of postgraduate medical qualifications, work experience and clinical specialty. We also include a set of State and Territory dummy variables, and the Socio-Economic Indexes for Areas (SEIFA), an indicator measuring the socioeconomic status of the population in the location of doctors' work. These are similar to the variables used in **?**.

5 Results

We first discuss the auxiliary results for the earnings equations (5.1) to be used to impute doctors' earnings in the public and the private sector. This is followed by the results from the labour supply model (5.2) and the associated elasticity estimates (5.3).

5.1 Earnings

Table A.1 in Appendix A reports the means of the covariates used in the estimation of log hourly public and private wages. Compared with those working exclusively in the public sector, private sector specialists have higher hourly earnings, have more years of work experience, are more likely to be male and have done their basic medical training in an Australian medical school. Private sector specialists comprise a smaller proportion of internalists and a larger proportion of surgeons, obstetricians and psychologists, and they are more likely to practice in geographical areas that are socioeconomically advantaged. The estimation sample sizes when

[8]From the second and subsequent waves, annual top-up samples of doctors were added to the original 2008 cohort to maintain the cross-sectional representativeness of the MABEL survey. We exclude the top-up samples in predicting the wage equations given that these samples are comprised largely of new entrants to the medical workforce.

using four waves of data are 2,013 and 1,311 for the public and private earnings regressions respectively.

As discussed in Section 3.2, the model specification used in estimating the sector-specific wage equations is the CRE model.[9] The estimation results from the log hourly earnings regressions are shown in Table A.2 in Appendix A. All else being equal, earnings of female specialists are lower in both public and private sectors. For public sector doctors, earnings are influenced by the number of years of work experience, whereas for private sector doctors, earnings do not appear to be significantly affected by work experience.

The results indicate that there is considerable variation in earnings by medical specialty. For doctors in private practice, earnings are higher for specialties such as Pathology, Anaesthetics and 'Other Specialty' compared with Internal Medicine. For doctors in public practice, earnings are higher in Diagnostic Radiology and Psychiatry.

We also included geographical variables such as State and Territory identifiers and a measure of socioeconomic characteristics of local areas. The results show that earnings vary by geography; for brevity, these coefficients estimates are omitted from the table.

5.2 Labour suppply

5.2.1 Goodness of fit

The estimated coefficients of the utility function underlying the structural labour supply model are shown in Table A.3 in Appendix A.[10] These results are derived from a specification where the variables income and hours worked are fully interacted with the set of individual characteristics. We tested this specification against a more restrictive specification where the utility function only included income and hours worked variables using the loglikelihood ratio (LR) test.[11]

As shown in Table A.4 in Appendix A, the LR ratio statistics is 228.10 and 109.30 (21 degrees of freedom) for the male and female samples respectively, rejecting the null hypothesis at conventional levels. These results suggest that doctors' labour market behaviour is affected by their personal characteristics and family circumstances. Table A.4 also reports the observed and predicted distribution of doctors by sector of work and by hours combinations which provide an indication of how well the model fits the data. Overall, the predicted frequency of sector of work corresponds closely with the observed frequency, suggesting that the model fits the data well.

We also calculated the percentage of observations that fulfil the coherency requirements of positive marginal utility from income and quasi-concavity of utility (**?**). These conditions check whether the estimated coefficients imply a quasi-concave utility function as economic theory requires. In the basic specification, 90.3% of males and 26.7% of females in the sample fulfil the coherency requirement. In the specification where income and hours worked are fully interacted with individual characteristics, 77.7% of males and 76.6% of females in the sample fulfil the coherency requirements.

[9] We have also used the Hausman test to compare between the RE and FE models for the earnings model. For public earnings, the test rejects the null hypothesis and indicates that the individual effects model is the preferred model. This result validates our choice of using the CRE model to account for unobserved heterogeneity. For private earnings, the null hypothesis is not rejected and both RE and FE are consistent. To be consistent in our empirical approach we used the CRE to estimate both public and private earnings equations.

[10] These structural coefficients are not so informative on their own, since they interact in complicated ways to translate to marginal effects on hours worked and wage elasticities, which are the key results of interest.

[11] The null hypothesis is that the coefficients on the doctors' characteristics interacted with income and hours worked are jointly equal to zero.

5.2.2 Marginal effects on hours worked

To understand the effects of family circumstances on doctors' labour supply decisions, we estimate the marginal effects of these covariates on the expected public, private, and total hours worked. We compute individual marginal effects at the observed values and average over the sample. Standard errors of the marginal effect estimates are obtained by a bootstrapping procedure to account for the imputed hourly earnings covariate in the structural estimation. These results are shown in Table 2.

The marginal effects on public and private hours of work are clearly different. All else being equal, the total number of hours worked is decreasing in age, with this effect being driven by the significant negative effect on public hours. With regard to private hours of work, there is no significant effect of age for men and a positive significant effect for women. Having young children significantly reduces the expected number of total hours worked per week for female doctors, but not for male doctors. Again this effect is driven by the marginal effect on public hours, while the marginal effect on private hours is insignificant for men and women. The reduction in hours worked is larger for younger children (ages 0-4 years and 5-9 years) compared with older children (10-15 years). With regard to the effect of having children on labour supply, female specialists behave in a similar manner as other women in the Australian population, reducing their labour supply particularly when pre-school aged children are present (**?**). Relative to single doctors, having a partner in employment has only a significant negative effect on hours worked for female doctors, while having a non-employed partner has no effect on hours worked for male and female doctors.

5.3 Labour supply elasticities

The econometric estimates are used to investigate the effects of a change in hourly earnings on public and private labour supply. We estimate elasticity measures by simulating the effect of a one-percent increase in public, private, and total hourly earnings on two sets of outcomes. The first outcome is the proportion of specialists working in the public, private, or mixed sectors. The second outcome is weekly public, private and total (combined public and private) hours.

5.3.1 Sector elasticity

Panel A of Table 3 presents the sector elasticity, which is the percentage change in the proportion of specialists working in the three sectors (public, private and both) given a one-percent change in sector-specific earnings. The results show that changes in hourly earnings influence the proportion of doctors working in a given sector. More specifically, for male specialists, a one-percent increase in public earnings increases the proportion of doctors working exclusively in the public sector by 0.47%, and decreases the proportion working exclusively in the private sector by 0.30%. An increase in public earnings also leads to a small increase in the proportion working in both public and private sectors by 0.03%.

Compared with male specialists, the sector elasticity estimates for female specialists are smaller in magnitude with respect to working in the public sector, and larger in relation to working in the private sector. For instance, a one-percent increase in private earnings reduces the proportion of female specialists working solely in the public sector by 0.44% (0.80% for males), and increases the proportion working in the private sector by 0.58% (0.45% for males).

5.3.2 Hours elasticity

Panel B of Table 3 presents the hours elasticities, which is the percentage change in public, private and total hours given a one-percent change in earnings. The results show that specialists respond to changes in earnings by allocating more working hours to the sector with increased earnings. The effect of an increase in the private sector wage is higher than the effect of an increase in the public sector wage.

For male doctors, the own-sector and cross-sector hours elasticities have the expected signs, and are strongly statistically significant. For instance, the estimate of the own-sector public hours elasticity indicate that a one-percent increase in public sector hourly earnings is expected to increase public sector hours by 0.33%. The cross-sector elasticities are negative as expected. A one-percent increase in private hourly earnings for example is expected to decrease weekly hours worked in the public sector by 0.45%. A change in public or private hourly earnings is not expected to have any effect on total hours worked (i.e public and private hours combined). Finally, a simultaneous increase of both public and private earnings does not significantly change the number of public or total hours worked, while it affects private hours at the 10% significance level only to a relatively small extent (elasticity of 0.16)[12].

For female doctors, the own-sector and cross-sector hours elasticities also have the expected signs, but are considerably smaller compared with male doctors. For instance, the public and private hours elasticities with respect to private earnings are -0.27 and 0.46 respectively. In addition, a change in public earnings is not expected to have any effect on public or private hours given that these elasticity estimates are not statistically different from zero. As is the case for male specialists, changes in earnings do not have any effect on total hours.

We performed two sets of sensitivity checks. The first considers an alternative specification of the hours band where doctors choose one of five intervals of working hours {0, 1-20, 21-34, 35-49, 50+} in each sector. In a second set of sensitivity checks we used random effects regressions to estimate the sector-specific earnings regressions. Overall the elasticity estimates from both sets of sensitivity checks are similar to those reported in Table 3.[13]

5.3.3 Heterogeneity in hours elasticity by age

The elasticity estimates in 5.3.2 describe the adjustment of hours worked for the sample as a whole and mask the heterogeneity in hours response to changes in earnings which might differ by doctors' personal and professional characteristics. We examine hours elasticity by age. This is shown in Table 4. Male specialists under the age of 60 years are most responsive to changes in public and private earnings, with own- and cross-sector elasticities ranging between 0.54 to 0.75 and -0.40 to -0.73 respectively. An increase in public earnings is also expected to lead to a small increase in total hours worked by males under the age of 60 years, but not for females or when private earnings increase. Female specialists over the age of 50 are not responsive to changes in earnings. Male specialists and female specialists aged between 40 and 49 years are most responsive to wage changes. A simultaneous increase in both earnings has no effect on total hours.

5.3.4 Heterogeneity in hours elasticity by specialty

Understanding how public and private labour supply respond to changes in earnings for different specialties is valuable information when designing and implementing government policies seeking to address shortages and surpluses of particular specialties across the public and private health sectors. The elasticity estimates by specialty are shown in Table 5. The results indicate that there is considerable variation across different specialties in how labour supply responds to

[12]Our results are similar to the overall wage elasticities for specialists reported by **?** who compare the estimates from a structural discrete choice model using a number of alternative utility specifications, but who do not distinguish hours worked in the public and private sectors.

[13]These results are available upon request.

changes in earnings.[14] This is especially so for male doctors. For instance, there is larger variation in the own-price elasticity with respect to private earnings compared with public earnings. In addition, specialties which are more responsive to changes in public earnings may be less responsive to changes in private earnings, and vice versa. This may be due to the public and private earnings differentials being larger in certain specialties. For females, the elasticities by specialty are considerably smaller compared to the elasticities for their male counterparts.

Specialties in which public sector hours are most likely to increase in response to an increase in public sector earnings, are obstetrics, surgery and anaesthetics. Those least responsive are psychiatry and internal medicine. Conversely, if private sector earnings were to increase, public sector hours would fall most in anaesthetics and obstetrics. An increase in private sector earnings would have least impact on public sector hours in psychiatry. Interestingly, surgery is more responsive to an increase in public sector earnings than an increase in private sector earnings, whereas internal medicine, pathology and psychiatry are much more responsive to changes in private sector earnings than changes in public sector earnings. Interestingly, these are also the specialties where there is a substantial female response to private earnings increases and where private labour supply is most affected by both public and private earnings.

As discussed in Sections 5.3.1 to 5.3.3, the aggregate elasticity estimates and those broken down by age indicate that changes in earnings influence the allocation of labour supply in favour of the sector with higher earnings, but these changes have a small effect on total hours supplied and only among males aged 30-59 years and only when increasing public earnings. These estimates however mask the heterogeneity by specialty. The elasticity estimates by specialty show that for a small number of specialties, an increase in sector-specific earnings or earnings in both sectors, can lead to an increase in total hours worked but again only for male specialists. This is the case for Internal Medicine and Psychiatry: the elasticities are positive and statistically significant, but economically small.

6 Potential limitations

In practice, there is a complex mix of public and private ownership and financing in the Australian health care system. For example, patients treated in private hospitals by private specialists can claim a subsidy from Medicare. In addition, private health insurance is subsidised by the federal government, such that payments by private insurers to private hospitals also include some public funding. We define hours worked as those within the setting in which they occur: a public hospital, private hospital or private rooms. This is regardless of whether the private or public sector funds that patient. If a specialist with rights to private practice also treats some private patients in public hospitals, then some proportion of their reported public hours would have been spent on treating private patients.

There is a potential issue in this definition of private and public sector in that treatment of private patients in public hospitals is attributed to public rather than private activity. The distinction between defining public and private activity by setting (as we do here) or by sources of finance is important, as much of the policy debate focuses on the allocation of doctors' time to treat publicly versus privately funded patients.[15] It may be the case that our elasticity

[14] A referee highlighted that there appears to be little heterogeneity across specialties and that this may be because choice of specialty, by assumption, affects labour supply only through its effect on income which in our case is substantial. We agree that there are arguments for including specialty information directly into the utility function. For example, there may be professional norms with regard to hours of work which differ across specialties. However, adding specialty information into the utility function would further complicate the model as it requires estimating an additional set of 24 parameters.

[15] We thank the referee for highlighting this issue.

estimates on public hours are conservative when time allocated to public and private patients by specialists within public hospitals is not separately documented. However, the magnitude by which the public hours elasticity is understated is likely to be small given that fees for private patients in public hospitals are generally lower compared with fees in the private sector. This is because public hospitals are required to charge private patients fees based on the Medicare Benefit Schedule, whereas fees in the private sector are set at the discretion of doctors.

Data on the type of patients seen was not collected in Wave 1 (2008), but was collected from specialists from Wave 4 (2011). Specialists in public hospitals with rights to private practice saw an average of 48.7 patients in a usual week, and an average of 5.9 private patients in public hospitals, around 12.1% of the total. However, this does not influence our results if our model is interpreted as intended, as capturing the movements of specialists between private and publicly owned settings. Our model is not designed to capture the specialist's choice of whether to treat a public or a private patient. This would certainly be another angle to pursue in further research but would require data on hours spent with public and private patients which is not available in MABEL and so is beyond the scope of this paper.

A second and potentially serious limitation is in the assumption that the error terms of the wage equation and the random utility component are independent. Selectivity bias may arise if unobserved characteristics influence both doctors' earnings and labour supply (via the utility function) in each sector. While a test of selectivity bias using a generalised Roy model (see Appendix B) yields no evidence of bias, we cannot be fully certain that our instrument – the number of children – is valid. If it is not, identification of the selection model depends on functional form only. In addition, the generalised Roy model implies a different set of assumptions on the covariates and errors to that of the structural model we aim to estimate.

A third limitation of the study is that we used cross-sectional data and hence do not capture the persistence of doctors' choice of work sector over time and different stages of their life. This persistence may influence how responsive the labour supply of doctors is to changes in sector-specific earnings. Given the nature of the data, our results may be interpreted as representing a long-term equilibrium to which specialists converge. The MABEL survey is longitudinal and hence the potential exists to use panel data to analyse how doctors' choices of public and private labour supply change over time as more waves of data become available and sufficient transitions are observed.

7 Conclusion

This paper investigates how pecuniary and non-pecuniary factors influence the allocation of hours worked by medical specialists between public and private sectors. We estimate a discrete choice structural labour supply model where specialists choose from a set of job packages that are characterised by the number of working hours in public and private sectors. Individual characteristics that are associated with lower working hours are the presence and age of children for women, particularly when young children who are not yet attending school, are present. For men, these relationships are not significant. This latter finding is consistent with studies of highly qualified professions such as lawyers and corporate executives in that family responsibilities affect engagement with the labour market more for females than for males.

The results show that medical specialists respond to changes in relative earnings between the private and public sectors at both the extensive and intensive margins. At the extensive margin, public (private) sector wage increases are likely to increase the proportion of specialists working exclusively in the public (private) sector.

The effects at the intensive margin are that increases in public (private) sector earnings encourage specialists to reduce their working hours in the private (public) sector and increase their working hours in the public (private) sector. However, there is no effect of a sector-specific wage increase on total hours worked across both sectors. Total hours worked across both sectors is also unresponsive to an increase in wage across both sectors.

The results show some heterogeneity by specialists' characteristics. Specialists who are most likely to re-allocate their hours in response to a sector-specific wage increase are men and women between 40 and 49 years old. There is also considerable heterogeneity by specialty. The strongest effects are observed for private hours in internal medicine, pathology and psychiatry which are also the specialties where there is a substantial female response to private earnings increases (whereas otherwise female specialists are quite non-responsive) and where private labour supply is most affected by both public and private earnings. These are specialties where more demand may be expected from the private sector and also where there have been concerns about current or future shortages (**?**).

Currently, Canada prohibits a parallel private system for physician and hospital services that are publicly provided through the universal public health insurance system. There have however been calls to allow the private sector to be involved in the financing (viz-á-viz private health insurance) and provision of these services (e.g. **?**; **?**). Proponents have argued that an expanded private system can take capacity and cost pressures off the public system which is crucial in the face of escalating health care spending and constraints in government budgets. Critics have raised questions on whether a parallel system diverts valuables resource away from the public sector, and creates a two-tier system that compromises equity in access to health care. Others have called for caution, arguing that the potential for cost savings from private financing is likely to be limited particularly if government subsidies are required to encourage take up of private health insurance. (**?**)

The introduction or expansion of a parallel system of private provision is likely to affect the level of service provision in the public system given that both public and private providers depend on a common pool of health care resources (e.g. physicians, nurses). Given that the supply of doctors is inelastic in the short run, competition among public and private sectors will likely lead to an increase in doctors' remuneration. Our analysis shows that when there is a change in relative earnings across sectors, doctors reallocate working hours to the sector with relatively increased earnings. Private sector earnings are documented in a number of countries to be much higher than earnings in the public sector, and constraints in budgets would imply that the public system is less likely to be able to compete on remuneration. Allowing private provision is therefore likely to increase the supply of physician working hours to the private system and lead to a lower level of public services in the short run.

More broadly, the ability of the public hospital sector to address shortages of specialists depends on the flexibility of their pay arrangements. In the case of Australia for instance, public hospitals have some flexibility to pay more than the basic salaries in the bargaining agreement through additional allowances and the use of revenue from the treatment of private patients, which is at the discretion of public hospitals. In addition, the response of public hospitals also depends on whether the shortage is general; that is, affects both sectors with evidence of rising waiting times and wages in both, or whether the shortage in the public sector is the result of a mal-distribution of specialists between sectors. In the case of a general shortage, any pay increase in the public sector is likely to be accompanied by fee rises in the private sector, with no net effect on supply to the public sector and no effect on supply overall.

Where the public sector shortage is a result of mal-distribution between sectors, increasing public sector earnings may be more effective at increasing the supply of labour to public hospitals from existing specialists. This situation would arise if waiting times are long and rising in the public sector, with the private sector experiencing stable or falling waiting times. In both cases, information on the labour supply elasticities of specialists within and between sectors provides important evidence on the potential effectiveness of changing earnings to help solve recruitment and retention difficulties.

References

Table 1: Sample means (in proportions unless otherwise stated)

	Male	Female	Diff.[a]
Sector and hours worked:			
Public sector	0.25 (0.43)	0.39 (0.49)	***
Private sector	0.19 (0.39)	0.18 (0.39)	
Mixed sector	0.56 (0.50)	0.43 (0.49)	***
Total hours for public sector	46.41 (11.63)	36.35 (13.66)	***
Total hours for private sector	41.37 (14.58)	34.51 (14.72)	***
Total hours for mixed sector	49.52 (10.93)	39.29 (12.62)	***
Covariates in utility function:			
Age in years	52.03 (10.08)	45.85 (7.88)	***
Has child 0-4 years	0.16 (0.37)	0.25 (0.43)	***
Has child 5-9 years	0.15 (0.35)	0.16 (0.37)	
Has child 10-15 years	0.17 (0.38)	0.16 (0.37)	
Partner works	0.64 (0.48)	0.73 (0.44)	***
Partner not working	0.29 (0.45)	0.09 (0.28)	***
Other covariates:			
Internal Medicine	0.33 (0.47)	0.36 (0.48)	
Pathology	0.04 (0.20)	0.05 (0.21)	
Surgery	0.19 (0.39)	0.07 (0.25)	***
Anaesthetics	0.20 (0.40)	0.22 (0.41)	
Diagnostic Radiology	0.07 (0.26)	0.05 (0.21)	**
Obstetrics/Gynaecology	0.06 (0.24)	0.07 (0.26)	
Psychiatry	0.09 (0.29)	0.15 (0.36)	***
Specialty - Other	0.02 (0.14)	0.04 (0.20)	***
No. of observations:	1,540	598	

Note: Standard deviation shown in parentheses.

[a]Two sample mean comparison test. Significance: *** 1%; ** 5%; * 10%.

Figure 1: Distribution of working hours for male specialists

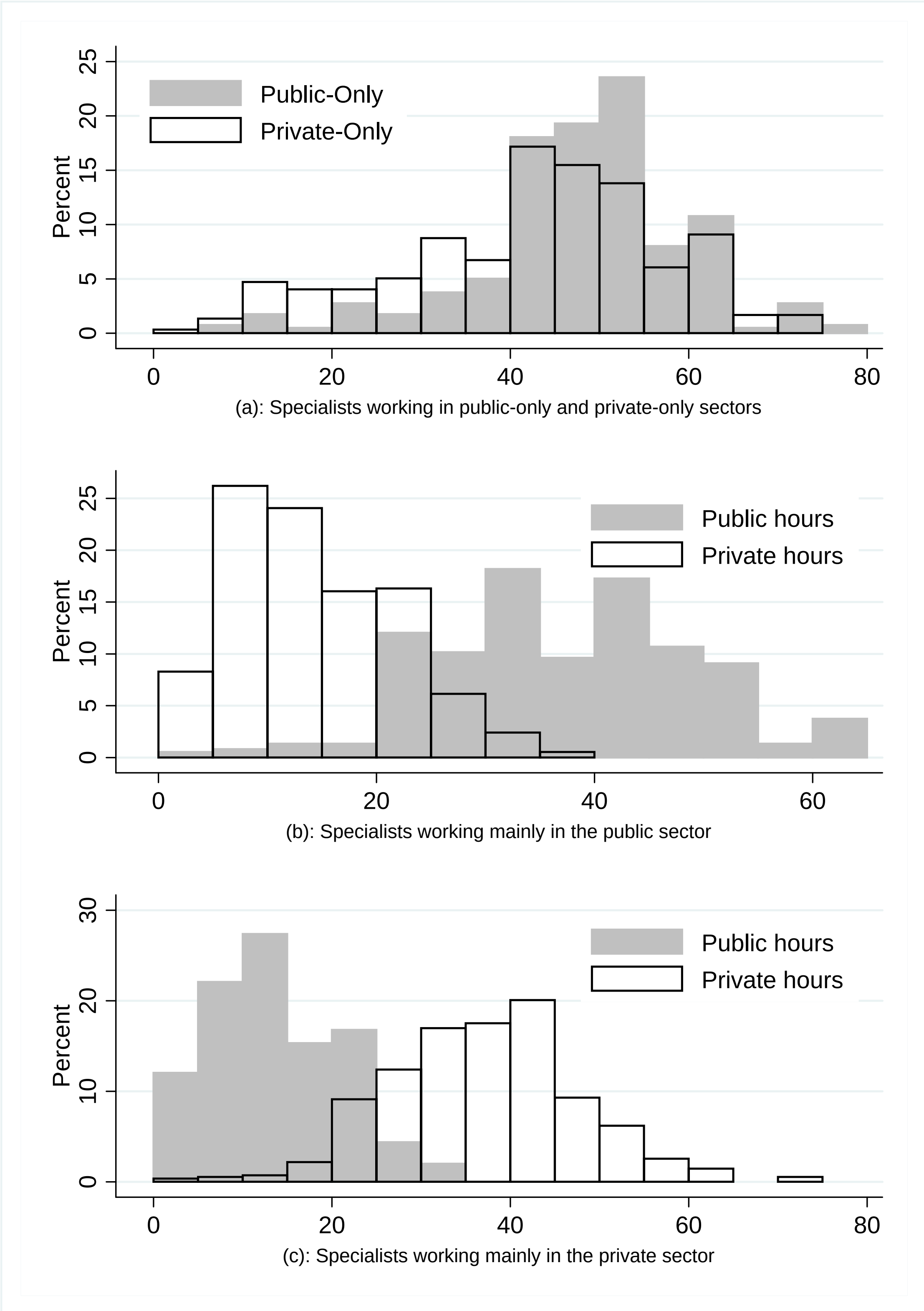

Figure 2: Distribution of working hours for female specialists

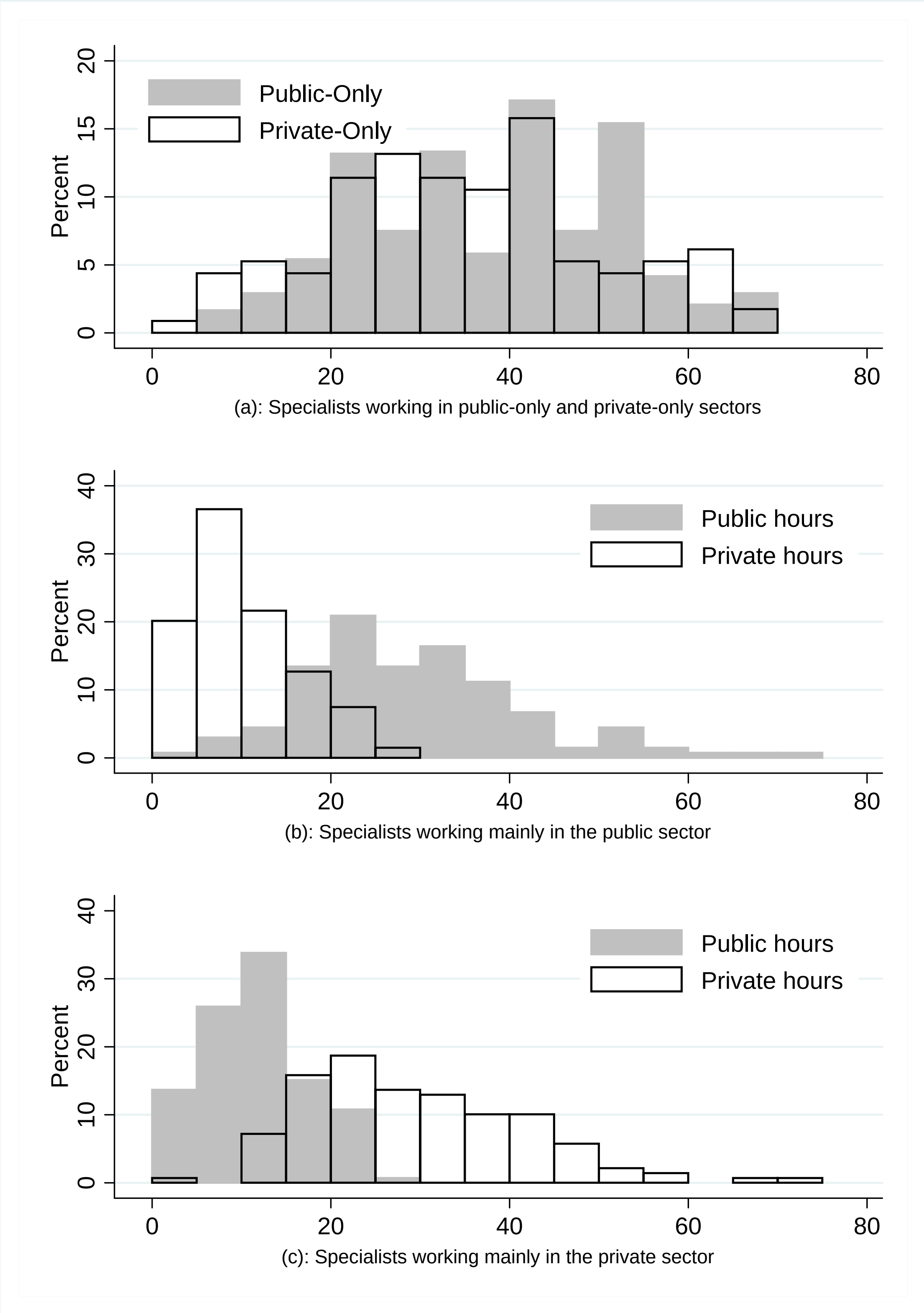

Table 2: Marginal effects of covariates on weekly hours worked (in hours)

	Male			Female		
Covariates	Public Hours	Private Hours	Total Hours	Public Hours	Private Hours	Total Hours
Age (in years)	-0.40***	0.02	-0.39***	-0.42***	0.26***	-0.15**
	(0.05)	(0.06)	(0.04)	(0.11)	(0.10)	(0.08)
Has child aged 0-4 years	-2.09	1.90	-0.19	-6.88***	-1.70	-8.58***
	(1.79)	(1.82)	(0.85)	(1.81)	(1.82)	(1.04)
Has child aged 5-9 years	-0.34	0.06	-0.28	-4.90**	-0.04	-4.94***
	(1.56)	(1.52)	(0.79)	(2.11)	(2.08)	(1.29)
Has child aged 10-15 years	-1.21	1.83	0.62	-4.58**	2.32	-2.35*
	(1.51)	(1.45)	(0.75)	(2.10)	(1.98)	(1.27)
Partner is employed	-0.09	1.21	1.11	-3.69*	1.42	-2.27*
	(1.91)	(1.75)	(0.97)	(2.09)	(1.72)	(1.26)
Partner not employed	1.59	-0.87	0.73	-2.97	4.06	1.08
	(2.18)	(2.00)	(0.98)	(2.88)	(2.91)	(1.91)

Note: Bootstrap standard errors shown in parentheses. Significance: *** 1%; ** 5%; * 10%.

Table 3: Labour supply elasticities with regard to sector-specific hourly earnings

	Male			Female		
Elasticities	△ Public earnings	△ Private earnings	△ Both earnings	△ Public earnings	△ Private earnings	△ Both earnings
Panel A: Sector elasticity						
Public sector	0.47***	-0.80***	-0.33***	0.30*	-0.44*	-0.13
	(0.11)	(0.13)	(0.10)	(0.17)	(0.17)	(0.10)
Private sector	-0.30***	0.45***	0.15**	-0.43**	0.58***	0.14
	(0.06)	(0.08)	(0.06)	(0.21)	(0.21)	(0.15)
Mixed sector	0.03***	-0.02	0.02	-0.01	0.08	0.06
	(0.01)	(0.03)	(0.03)	(0.04)	(0.08)	(0.93)
Panel B: Hours elasticity						
Public hours	0.33***	-0.45***	-0.12	0.20	-0.27***	-0.07
	(0.09)	(0.08)	(0.10)	(0.16)	(0.10)	(0.16)
Private hours	-0.34***	0.51***	0.16*	-0.32	0.46***	0.13
	(0.09)	(0.08)	(0.09)	(0.20)	(0.16)	(0.16)
Total hours	0.01	-0.01	0.001	0.01	-0.01	-0.003
	(0.01)	(0.01)	(0.02)	(0.03)	(0.02)	(0.05)

Note: Bootstrap standard errors shown in parentheses. Significance: *** 1%; ** 5%; * 10%.

Table 4: Hours elasticities with regard to hourly earnings by age

	Male						Female					
Elasticities	△ Public earnings	Std Err	△ Private earnings	Std Err	△ Both earnings	Std Err	△ Public earnings	Std Err	△ Private earnings	Std Err	△ Both earnings	Std Err
Public hours												
Age 30-39 years	0.55***	(0.12)	-0.40***	(0.13)	-0.07	(0.11)	0.26	(0.18)	-0.32**	(0.14)	-0.05	(0.14)
Age 40-49 years	0.68***	(0.10)	-0.62***	(0.10)	-0.16	(0.12)	0.30*	(0.17)	-0.36***	(0.10)	-0.06	(0.17)
Age 50-59 years	0.60***	(0.11)	-0.53***	(0.10)	-0.14	(0.11)	0.09	(0.21)	-0.18	(0.16)	-0.09	(0.18)
Age 60+ years	0.24*	(0.13)	-0.15	(0.11)	-0.06	(0.09)	-0.40	(0.41)	0.24	(0.36)	-0.16	(0.18)
Private hours												
Age 30-39 years	-0.68***	(0.15)	0.56***	(0.18)	0.15	(0.14)	-0.45	(0.28)	0.65**	(0.34)	0.20	(0.20)
Age 40-49 years	-0.73***	(0.12)	0.75***	(0.10)	0.25	(0.10)	-0.41**	(0.21)	0.58***	(0.17)	0.17	(0.16)
Age 50-59 years	-0.55***	(0.10)	0.54***	(0.09)	0.19**	(0.09)	-0.18	(0.21)	0.23	(0.23)	0.05	(0.21)
Age 60+ years	-0.22**	(0.09)	0.13	(0.12)	0.02	(0.09)	0.24	(0.32)	-0.35	(0.44)	-0.11	(0.24)
Total hours												
Age 30-39 years	0.03**	(0.01)	-0.02	(0.01)	0.001	(0.02)	0.03	(0.05)	-0.01	(0.02)	0.02	(0.06)
Age 40-49 years	0.03***	(0.01)	-0.001	(0.01)	0.02	(0.02)	0.02	(0.04)	-0.002	(0.02)	0.02	(0.05)
Age 50-59 years	0.02**	(0.01)	-0.001	(0.01)	0.01	(0.02)	-0.01	(0.03)	-0.02	(0.02)	-0.04	(0.05)
Age 60+ years	0.004	(0.01)	-0.02	(0.02)	-0.02	(0.03)	-0.05	(0.04)	-0.07	(0.06)	-0.13	(0.09)

Note: Bootstrap standard errors shown in parentheses. Significance: *** 1%; ** 5%; * 10%.

Table 5: Hours elasticities with regard to hourly earnings by specialty

	Male						Female					
Elasticities	△ Public earnings	Std Err	△ Private earnings	Std Err	△ Both earnings	Std Err	△ Public earnings	Std Err	△ Private earnings	Std Err	△ Both earnings	Std Err
Public hours												
Internal Med.	0.34***	(0.08)	-0.51***	(0.06)	-0.17**	(0.07)	0.23	(0.15)	-0.32***	(0.12)	-0.09	(0.11)
Pathology	0.38***	(0.11)	-0.58***	(0.06)	-0.20*	(0.11)	0.22	(0.18)	-0.36*	(0.12)	-0.14	(0.16)
Surgery	0.47***	(0.10)	-0.53**	(0.24)	-0.06	(0.24)	0.34*	(0.19)	-0.28	(0.34)	-0.06	(0.41)
Anaesthetic	0.48***	(0.12)	-0.61***	(0.17)	-0.13	(0.17)	0.26	(0.20)	-0.28	(0.24)	-0.02	(0.27)
Diag. radiology	0.39***	(0.15)	-0.58***	(0.11)	-0.19	(0.14)	0.02	(0.27)	-0.20	(0.18)	-0.17	(0.22)
Obstetrics	0.50***	(0.11)	-0.67***	(0.17)	-0.18	(0.17)	0.32	(0.21)	-0.32	(0.23)	-0.01	(0.30)
Psychiatry	0.31***	(0.08)	-0.42***	(0.05)	-0.11	(0.08)	0.19	(0.16)	-0.27**	(0.13)	-0.08	(0.16)
Other	0.41***	(0.10)	-0.64***	(0.12)	-0.23**	(0.10)	0.22	(0.19)	-0.32**	(0.14)	-0.10	(0.15)
Private hours												
Internal Med.	-0.47***	(0.11)	0.82***	(0.12)	0.35***	(0.12)	-0.39	(0.22)	0.72**	(0.33)	0.33	(0.24)
Pathology	-0.51***	(0.16)	0.85***	(0.12)	0.34***	(0.13)	-0.40*	(0.26)	0.72**	(0.30)	0.32	(0.26)
Surgery	-0.31***	(0.06)	0.32*	(0.17)	0.01	(0.19)	-0.33**	(0.15)	0.13	(0.44)	-0.21	(0.50)
Anaesthetic	-0.41***	(0.10)	0.51***	(0.16)	0.10	(0.16)	-0.35*	(0.21)	0.26	(0.35)	-0.10	(0.38)
Diag. radiology	-0.47**	(0.19)	0.66***	(0.17)	0.19	(0.13)	-0.23	(0.32)	0.27	(0.36)	0.04	(0.26)
Obstetrics	-0.36***	(0.07)	0.50***	(0.13)	0.14	(0.13)	-0.34**	(0.17)	0.26	(0.29)	-0.08	(0.35)
Psychiatry	-0.49***	(0.13)	0.81***	(0.13)	0.31**	(0.13)	-0.35	(0.22)	0.66**	(0.34)	0.31	(0.31)
Other	-0.42***	(0.11)	0.71***	(0.17)	0.29**	(0.13)	-0.32	(0.22)	0.50*	(0.26)	0.18	(0.20)
Total hours												
Internal Med.	0.02**	(0.01)	0.02*	(0.01)	0.04**	(0.02)	0.03	(0.04)	0.02	(0.03)	0.05	(0.07)
Pathology	0.01	(0.01)	0.01	(0.01)	0.03	(0.02)	0.01	(0.04)	0.01	(0.03)	0.02	(0.06)
Surgery	0.01	(0.01)	-0.03	(0.03)	-0.02	(0.03)	0.01	(0.02)	-0.07	(0.06)	-0.06	(0.07)
Anaesthetic	0.01	(0.01)	-0.02	(0.02)	-0.01	(0.03)	-0.003	(0.03)	-0.05	(0.05)	-0.05	(0.07)
Diag. radiology	-0.002	(0.02)	-0.01	(0.02)	-0.02	(0.03)	-0.05	(0.06)	-0.05	(0.04)	-0.10	(0.09)
Obstetrics	0.01	(0.01)	-0.01	(0.02)	0.001	(0.03)	0.01	(0.03)	-0.04	(0.04)	-0.03	(0.05)
Psychiatry	0.03**	(0.01)	0.01	(0.01)	0.04**	(0.02)	0.03	(0.04)	-0.03	(0.04)	0.06	(0.07)
Other	0.01	(0.01)	0.01	(0.01)	0.02	(0.02)	0.01	(0.04)	-0.001	(0.03)	0.01	(0.06)

Note: Bootstrap standard errors shown in parentheses. Significance: *** 1%; ** 5%; * 10%.

A Appendix Tables

Table A.1: Summary statistics of covariates in earnings regression (in proportions unless otherwise stated)

	Public	Private	Diff[a]
Log(hourly earnings)	4.65 (0.43)	5.01 (0.70)	***
Female	0.37 (0.48)	0.29 (0.45)	***
Australian medical school	0.77 (0.42)	0.86 (0.35)	***
Temporary visa	0.01 (0.10)	0.005 (0.07)	*
No. of postgrad qualifications	0.14 (0.41)	0.13 (0.39)	
Years since basic degree:			
Under 15 years	0.23 (0.42)	0.09 (0.29)	***
15-19 years	0.18 (0.38)	0.11 (0.32)	***
20-24 years	0.17 (0.38)	0.16 (0.36)	
25-29 years	0.15 (0.35)	0.19 (0.39)	***
30-34 years	0.10 (0.30)	0.14 (0.35)	***
35-39 years	0.10 (0.30)	0.15 (0.36)	***
40-44 years	0.05 (0.28)	0.09 (0.28)	***
45+ years	0.02 (0.14)	0.08 (0.26)	***
Internal Medicine	0.47 (0.50)	0.16 (0.37)	***
Pathology	0.05 (0.22)	0.14 (0.34)	***
Surgery	0.06 (0.23)	0.14 (0.34)	***
Anaesthetics	0.16 (0.37)	0.23 (0.42)	***
Diagnostic Radiology	0.04 (0.21)	0.07 (0.25)	***
Obstetrics/Gynaecology	0.05 (0.22)	0.10 (0.29)	***
Psychiatry	0.11 (0.32)	0.24 (0.43)	***
Specialty - Other	0.05 (0.21)	0.04 (0.19)	
New South Wales	0.31 (0.46)	0.24 (0.43)	***
Victoria	0.25 (0.43)	0.28 (0.45)	**
Queensland	0.19 (0.39)	0.26 (0.44)	***
South Australia	0.13 (0.33)	0.08 (0.28)	***
Western Australia	0.06 (0.24)	0.09 (0.29)	***
Northern Territory	0.02 (0.12)	0.005 (0.07)	***
Tasmania	0.03 (0.18)	0.02 (0.14)	**
Australian Capital Territory	0.02 (0.14)	0.02 (0.14)	
Std. SEIFA index	-0.13 (0.97)	0.30 (0.94)	***
No. of observations:			
Wave 1	639	411	
Wave 2	520	310	
Wave 3	461	320	
Wave 4	393	270	
Total	2,013	1,311	

Note: Standard deviation shown in parentheses.

[a] Two-sample mean comparison test. Significance: *** 1%; ** 5%; * 10%.

Table A.2: Public and private log hourly earnings regression

	Public		Private	
Variables	Coeff	Std Err.	Coeff	Std Err.
Female	-0.06***	0.02	-0.18***	0.04
Australian medical school	-0.01	0.02	0.03	0.05
Temporary visa	-0.18	0.18	0.19	0.24
No. of postgrad qualifications	-0.03	0.02	0.09	0.08
Years since basic degree (Ref: Under 15 years)				
15-19 years	-0.15	0.11	0.10	0.43
20-24 years	-0.34**	0.15	0.19	0.50
25-29 years	-0.44**	0.19	0.14	0.54
30-34 years	-0.57***	0.22	0.10	0.59
35-39 years	-0.66**	0.27	-0.44	0.72
40-44 years	-0.72**	0.34	-0.28	0.78
45+ years	-1.42***	0.41	-0.04	0.87
Specialty (Ref: Internal Medicine)				
Pathology	0.03	0.27	0.22*	0.12
Surgery	0.05	0.41	-0.44	0.72
Anaesthetics	-0.45	1.59	0.57***	0.06
Diagnostic Radiology	0.48***	0.04	-0.37	0.71
Obstetrics/Gynaecology	0.07	0.04	0.09	1.11
Psychiatry	0.06**	0.03	-0.49	1.40
Specialty - Other	-0.12	0.53	0.31***	0.10
Constant	4.49***	0.03	4.81***	0.09
Time-averages of covariates				
Temporary visa	0.26	0.22		
No. of postgrad qualifications	-0.01	0.05	0.02	0.09
Experience: 15-19 years	0.26**	0.11	-0.18	0.44
Experience: 20-24 years	0.46***	0.16	-0.23	0.51
Experience: 25-29 years	0.50***	0.19	-0.18	0.55
Experience: 30-34 years	0.61***	0.22	-0.31	0.60
Experience: 35-39 years	0.73***	0.27	0.28	0.72
Experience: 40-44 years	0.68**	0.35	0.16	0.78
Experience: 45+ years	1.46***	0.42	-0.57	0.87
Specialty: Pathology	0.16	0.27		
Specialty: Surgery			1.09	0.72
Specialty: Anaesthetics	0.67	1.59		
Specialty: Diagnostic Radiology			0.90	0.71
Specialty: Obstetrics/Gynaecology			0.45	1.11
Specialty: Psychiatry			0.38	1.40
Specialty: Specialty - Other	0.21	0.54		
No. of observations	2,013		1,311	

Note: Significance: *** 1%; ** 5%; * 10%. Wage equations are based on the correlated random effects model, and estimated using ordinary least squares (see Section 3.2). For brevity, coefficients on geographical-based variables and their time-averages are not reported in the table.

Table A.3: Structural estimation of parameters in utility function

	Male		Female	
Variables	Coeff	Std Err.	Coeff	Std Err.
Coefficient estimates				
Income (weekly net, in '000s of dollars)	-1.14	1.23	-3.83	4.14
Income ^{2}	-0.06**	0.02	-0.10	0.09
Public hours	0.04	0.11	0.17	0.27
Public hours^2	-0.004***	0.0002	-0.003***	0.0006
Private hours	-0.02	0.15	0.13	0.38
Private hours^2	-0.004***	0.0004	-0.003***	0.001
Income x Public hours	0.001	0.004	0.004	0.01
Income x Private hours	0.006	0.005	0.011	0.02
Public hours x Private hours	-0.007***	0.0006	-0.004***	0.001
Income x Age	0.95**	0.46	2.25	1.79
Income x Age^2	-0.11**	0.04	-0.26	0.19
Income x Child 0-4years	-0.09	0.17	0.02	0.35
Income x Child 5-9years	0.12	0.15	-0.12	0.32
Income x Child 10-14years	0.02	0.14	-0.44	0.32
Income x Partner works	-0.11	0.19	0.04	0.28
Income x Partner not work	0.03	0.20	0.51	0.40
Public hours x Age	0.12***	0.04	0.001	0.12
Public hours x Age^2	-0.01***	0.004	0.0002	0.01
Public hours x Child 0-4years	0.0001	0.02	-0.08***	0.02
Public hours x Child 5-9years	-0.01	0.01	-0.04	0.02
Public hours x Child 10-14years	0.004	0.01	-0.0003	0.02
Public hours x Partner works	0.02	0.02	-0.02	0.02
Public hours x Partner not work	0.008	0.02	-0.03	0.03
Private hours x Age	0.11*	0.05	-0.03	0.16
Private hours x Age^2	-0.01**	0.05	0.006	0.02
Private hours x Child 0-4years	0.01	0.02	-0.07**	0.04
Private hours x Child 5-9years	-0.02	0.02	-0.03	0.03
Private hours x Child 10-14years	0.01	0.02	0.03	0.03
Private hours x Partner works	0.03	0.02	-0.02	0.03
Private hours x Partner not work	0.003	0.02	-0.03	0.04
Number of observations	18,480		7,176	
Number of person-observations	1,540		598	
Log-likelihood	-3341.44		-1227.26	
χ^2 test of model significance (df)	970.63 (30)		517.43 (30)	

Note: Bootstrap standard errors. Significance: *** 1%; ** 5%; * 10%.

Table A.4: Actual versus predicted percentages by public and private hours combination

		(1)		(2)	
		Without characteristics		With characteristics	
	Observed	Predicted	Difference	Predicted	Difference
Males					
Public-only	**25.26**	**23.39**	**1.87**	**23.25**	**2.01**
(1) Pub:1-34h, Pvt:0h	2.79	3.27	-0.48	3.29	-0.50
(2) Pub:35-49h, Pvt:0h	10.78	12.83	-2.05	12.64	-1.86
(3) Pub:50+h, Pvt:0h	11.69	7.29	4.40	7.32	4.37
Private-only	**18.56**	**21.98**	**-3.42**	**21.86**	**-3.30**
(1) Pub:0h, Pvt:1-34h	5.19	3.84	1.35	3.99	1.20
(2) Pub:0h, Pvt:35-49h	7.27	12.75	-5.48	12.43	-5.16
(3) Pub:0h, Pvt:50+h	6.10	5.39	0.71	5.44	0.66
Public and Private	**56.08**	**54.62**	**1.46**	**54.90**	**1.18**
(1) Pub:1-34h, Pvt:1-34h	22.89	18.51	4.58	18.30	4.59
(2) Pub:1-34h, Pvt:35-49h	16.3	13.04	3.26	13.46	2.84
(3) Pub:1-34h, Pvt:50+h	3.64	3.41	0.23	3.37	0.27
(4) Pub:35-49h, Pvt:1-34h	9.81	14.28	-4.47	14.55	-4.74
(5) Pub:35-49h, Pvt:35-49h	0.19	0.96	-0.77	0.88	-0.69
(6) Pub:50+h, Pvt:1-34h	3.25	4.42	-1.17	4.34	-1.09
Log-likelihood		-3455.49		-3341.44	
Likelihood ratio test (d.f.)		228.10 (21)			
Females					
Public-only	**39.30**	**37.94**	**1.36**	**37.89**	**1.41**
(1) Pub:1-34h, Pvt:0h	17.56	18.24	-0.68	18.32	-0.76
(2) Pub:35-49h, Pvt:0h	12.21	14.91	-2.70	14.77	-2.56
(3) Pub:50+h, Pvt:0h	9.53	4.79	4.74	4.80	4.73
Private-only	**18.06**	**21.81**	**-3.75**	**21.69**	**-3.63**
(1) Pub:0h, Pvt:1-34h	9.20	11.70	-2.50	11.59	-2.39
(2) Pub:0h, Pvt:35-49h	5.52	8.28	-2.76	8.32	-2.80
(3) Pub:0h, Pvt:50+h	3.34	1.83	1.51	1.78	1.56
Public and Private	**42.64**	**40.24**	**2.40**	**40.41**	**2.23**
(1) Pub:1-34h, Pvt:1-34h	29.43	19.55	9.88	19.55	9.88
(2) Pub:1-34h, Pvt:35-49h	6.02	6.28	-0.26	6.37	-0.35
(3) Pub:1-34h, Pvt:50+h	1.00	1.21	-0.21	1.25	-0.25
(4) Pub:35-49h, Pvt:1-34h	4.35	10.87	-6.52	10.92	-6.57
(5) Pub:50+h, Pvt:1-34h	1.84	2.26	-0.42	2.25	-0.41
Log-likelihood		-1281.91		-1227.26	
Likelihood ratio test (d.f.)		109.30 (21)			

Legend: *Pub*-Public hours; *Pvt*-Private hours. *Note*: Percentages in bold represent the fraction of doctors in public-only, private-only and both public and private sectors. For model specification in (1), the utility function includes only income and hours worked. For the specification in (2), income and hours worked are fully interacted with age, presence of dependent children, and partner's employment status.

B Panel earnings model with selectivity

This Appendix describes an empirical test for the presence of sample selection in the public and private hourly earnings models. We specify an earnings model similar to that of the classical Roy model:

$$
\begin{aligned}
pu^*_{it} &= \mathbf{z}'_{it}\gamma + c_{0i} + \varepsilon_{0it} && \text{(B.1)}\\
wpu^*_{it} &= \mathbf{x}'_{1it}\alpha_1 + \mathbf{x}'_{2i}\alpha_2 + c_{1i} + \varepsilon_{1it} && \text{(B.2)}\\
wpr^*_{it} &= \mathbf{x}'_{1it}\beta_1 + \mathbf{x}'_{2i}\beta_2 + c_{2i} + \varepsilon_{2it} && \text{(B.3)}
\end{aligned}
$$

where $(pu^*_{it}, wpu^*_{it}, wpr^*_{it})$ are latent variables; $\mathbf{z}'_{it}$, $\mathbf{x}_{1it}$ and $\mathbf{x}_{2i}$ are vectors of time-varying and time-invariant exogenous regressors; the components in $\mathbf{x}$ are a subset of those in $\mathbf{z}$. c_{0i}, c_{1i} and c_{2i} denote unobserved individual-specific effects (or heterogeneity). The latent variable pu^*_{1it} reflects propensity for public or private sector work (i.e. the selection equation), and wpu^*_{it} and wpr^*_{it} capture latent earnings in the public and private sectors respectively. Depending on whether pu^*_{it} is positive or negative, we observe the doctor in the public or the private sector:

$$
pu_{it} = \begin{cases} 1 & \text{if } pu^*_{it} > 0 \\ 0 & \text{if } pu^*_{it} \leq 0 \end{cases} \tag{B.4}
$$

where $pu_{it} = 1$ if the doctor works in the public sector, and 0 if he or she works in the private sector. We also observe exactly one of wpu_{it} and wpr_{it} according to

$$
wpu_{it} = \begin{cases} wpu^*_{it} & \text{if } pu^*_{it} > 0 \\ \textit{unobserved} & \text{if } pu^*_{it} \leq 0 \end{cases} \tag{B.5}
$$

$$
wpr_{it} = \begin{cases} \textit{unobserved} & \text{if } pu^*_{it} > 0 \\ wpr^*_{it} & \text{if } pu^*_{it} \leq 0 \end{cases} \tag{B.6}
$$

where wpu_{it} and wpr_{it} are the observed earnings in the public and the private sector.

If the correlation between $(\varepsilon_{0it}, \varepsilon_{1it}, \varepsilon_{2it})$ is zero, then $(pu^*_{it}, wpu^*_{it}, wpr^*_{it})$ are conditionally uncorrelated, in which case the outcome equations wpu_{it} and wpr_{it} can be consistently estimated independent of the sector choice equation. If $(\varepsilon_{0it}, \varepsilon_{1it}, \varepsilon_{2it})$ are correlated, ignoring this correlation may result in selectivity bias. Selectivity in panel data can be accommodated using a number of methods (**?**, Chapter 19.9). The two most common approaches are the parametric estimator, which assumes that $(\varepsilon_{0it}, \varepsilon_{1it}, \varepsilon_{2it})$ have a joint normal distribution and the semiparametric two-step estimator. We use a variant of the Heckman two-step estimator, extended to the context of panel data with unobserved effects (**?**). This is described in detail in **?** (Chapter 19.9.2).

The approach involves first estimating the sector choice equation for pu_{it}, using a probit regression; that is, $\Pr[pu_{it} = 1 | \mathbf{z}_{it} + c_{1i}] = \Phi[\mathbf{z}'_{it}\gamma + c_{1i}]$. The estimated probit regression is used to generate $\hat{\lambda}_i$, an estimate of the inverse Mills ratio, $\lambda(\mathbf{z}'_{it}\gamma + c_{1i})$, where $\lambda(\mathbf{z}'_{it}\gamma + c_{1i}) = \phi(\mathbf{z}'_{it}\gamma + c_{1i})/\Phi(\mathbf{z}'_{it}\gamma + c_{1i})$.

Estimation of the probit model with individual effects is not feasible due to the incidental parameters problem. Instead, we accommodate individual heterogeneity using an approach proposed originally by **?**, and extended by **?**. This approach, often referred to as the Correlated Random Effects (CRE) model, expresses c_{1i} as a function of the time averages of $\mathbf{z}$. Specifically, we represent the individual heterogeneity term $c_{0i} = \psi_1 + \bar{\mathbf{z}}'_i\gamma + a_{0i}$ where $\bar{\mathbf{z}}_i = T^{-1}\Sigma_{t=1}^{T}\mathbf{z}_{it}$, and $(a_{1i}|\mathbf{z}) \sim Normal(0, \sigma_a^2)$.

There are two further considerations in estimating the sector choice equation. First, γ may be allowed to vary across the different waves of data by estimating the choice equation separately for each time period t, which is in turn used to generate a time-varying estimate of the Mills ratio $\hat{\lambda}_{it}$.

Second, robust identification of the parameters in the wage equation requires that the sector choice equation contains some non-trivial regressors ("instruments") that do not directly affect earnings. We use the number of dependent children as an instrument. Our choice of the exclusion restriction is based on evidence from empirical studies that have shown that family characteristics, such as the presence and age of children, are an important determinant in the choice to be self-employed. See **?** for a review of the empirical literature. In the context of Australia's health system, the decision of working in public versus private practice is closely related to the choice of wage and salary employment versus self employment.

We test whether selectivity bias is present by estimating the earnings functions wpu_{it} and

wpr_{it} separately using fixed-effects estimation to eliminate the individual-specific effect c_{si} ($s = 2, 3$) combined with the inclusion of $\hat{\lambda}_{it}$ as an additional covariate. A test of the null hypothesis of no selectivity bias against the alternative of selectivity bias is based on the t statistic for $\hat{\lambda}_{it}$. The standard errors are estimated via bootstrap procedures as $\hat{\lambda}_{it}$ is an imputed regressor. In the estimation, we find that the estimates $\hat{\lambda}_{it}$ are not statistically significant for either public or private earnings. These results indicate that we cannot reject the null hypothesis of no selectivity bias.