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ABSTRACT

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

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 higher earnings, while leaving total working hours unchanged. The magnitudes of the own-sector and cross-sector earnings elasticities fall in the range of 0.21-0.54, and are larger for male than for female specialists. The labour supply response varies by doctors' age and medical specialty. Family circumstances such as the presence of young dependent children influence the hours worked by female specialists but not male specialists. We illustrate the relevance of our findings by simulating the impact of recent trends in earnings growth in the public and private sectors.

JEL Classification: I10, I11, J22, J24

Keywords: labour supply, elasticities, medical specialists, public-private mix

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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 and a low ability to pay for publicly-provided health care, have increased demand for private medical care. In high-income countries where the government is usually the main funder of health care services, fiscal pressures often lead 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 (Humphrey and Russell 2004), 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 (González 2005; Biglaiser and Ma 2007).

With a fixed number of physicians in the short and medium term due to long periods of medical training, policies that aim at changing the public-private mix have implications for physicians' allocation of working hours between the public and private sectors. 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 their working hours in the public sector. The extent of these responses depends on the own-wage elasticity of hours for the public sector, the private sector, and the cross-wage elasticity of hours. 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.

The aim of this paper is to investigate how pecuniary and non-pecuniary factors influence the allocation of time between public and private sectors 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 the public and private sectors. 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.

A number of 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. Rizzo and Blumental 1994; Showalter and Thurston 1997). The most recent research to date on physician labour supply has been conducted in Norway where the public and private sectors coexists (Midtunn 2007). Baltagi et al. (2005) estimate a dynamic labour supply model of hospital-salaried physicians in Norway and obtain short-run wage elasticities of around 0.3. Andreassen et al. (2013) exploits panel data in Norway which allows for doctors' labour supply choices to be persistent over time but do not allow for doctors to combine public and private work. Ikenwilo and Scott (2007) analyse the effects of pay and job satisfaction on the labour supply of hospital consultants in the Scottish National Health Service.

Our paper most closely relates to the work by Sæther (2005), 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 Sæther (2005) 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 is an essential extension when considering wage elasticities within each sector and across the sectors.

This paper is also relevant to the literature on dual or mixed practice which is widespread in many high-, middle- and low-income countries, and can have important implications for health care cost and quality. See García-Prado and González 2007 and Socha and Bech 2011 for recent reviews. However there is still however a lack of consensus on its effects, reflected in the large heterogeneity by which the practice is regulated across different countries (González and Macho-Stadler 2013), and the literature is dominated by theoretical models and descriptive

analyses.

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 0.21–0.54, 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 influence 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, followed by the results from a simulation analysis of recent trends in earnings growth in Section 6. Section 7 discusses the key findings of the paper and concludes.

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. 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 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. The salaries of specialists employed in the public sector are determined by employer bargaining agreements with State and Territory governments who

run public hospitals as the main employer. In addition to private practice in private hospitals and private consulting rooms, salaried hospital specialists can treat private patients in public hospitals. This is agreed with the hospital, who have varying rules about the distribution and use of the private income. Around 45 per cent of the total medical workforce in Australia are employed in public hospitals (Australian Institute of Health and Welfare 2012).

3 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, the number of hours worked in a public sector job, and hours worked in a private sector job. We adopt a flexible specification where the preference parameters in the utility function are allowed to differ by doctors' age and family circumstances.

The hours decision of public and and private labour supply is analysed as a discrete choice problem rather than a continuous choice, following for example Van Soest (1995). Each medical specialist i chooses between 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 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. We aggregate categories $35-49$ and $50+$ for the lower-hours sector into one category $35+$ given the very small number of data points that combine more than 34 hours in each sector. This specification leaves us with 11 different choices of public and private sector work for both male and female doctors, given that the combination $(0, 0)$ is never observed.

The utility function is approximated by a second-order polynomial of working hours and household income, and a random error term that is assumed to follow a type I extreme value distribution. Each specialist is assumed to choose the alternative with the highest utility. The probability that individual i chooses alternative j is given by

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

where

$$U_{ji} = \beta_0 y_{ji} + \beta_1 y_{ji}^2 + \sum_{x=hpu,hpr} (\beta_{2x} x_{ji} + \beta_{3x} x_{ji}^2 + \beta_{4x} x_{ji} y_{ji}) + \beta_5 hpu_{ji} hpr_{ji} + \varepsilon_{ji} \tag{2}$$

The estimation of (1) requires information on the household net income that corresponds to each choice j of public and private hours. Hourly earnings are predicted from separate earnings regressions of samples of specialists working solely in the public or private sectors. With the predicted hourly earnings, we calculate the expected gross labour income at different choices of public and private hours worked per week. Non-labour household income and partner's gross income are regarded as exogenous. The resultant net household income is calculated as the sum of 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).

4 The MABEL survey

The analysis uses data from the first wave (2008) of the "Medicine in Australia: Balancing Employment and Life (MABEL)" longitudinal survey of doctors. MABEL is a panel 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. 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 Joyce et al. (2010).

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 percent 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, 2,304 observations remained in the sample, consisting of 1,670 male and 634 female specialists.[1]

4.1 Hours worked

Dependent variables are the hours worked in public and private sectors, which are derived from 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 sector 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 based on the percentage of time spent in the public sector relative to total hours.

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 (40% vs 26%), while male specialists are more likely to be working in mixed practice (56% vs 42%), combining both public and private sector work. The percentage of female and male specialists working exclusively in the private sector is similar (18%). The sample means for total hours worked by sector is also shown in the table. Overall, the number of hours worked by male specialists is higher than that 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.

[1]The following are the variables (top five by frequency) and the corresponding number of observations (in brackets) dropped due either to exclusion criteria, or have missing or incomplete information: hours by work setting (748); specialties that are predominantly public or private (400); estimated wage; that is missing variables in the wage equation (528); partners' income and other sources of household income (203); weekly hours less than 4 and more than 80 (68).

4.2 Covariates in utility function

As indicated in equation (2), 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 and of dependent children, 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 from the 2008 cohort of specialists.[2] The data on annual earnings for years 2009–2011 are indexed to 2008 levels using the Professional Health Workers Wage Index (Australian Institute of Health and Welfare 2012). 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 random effects panel data regression.[3]

Doctors' earnings are expected to be influenced by human capital variables (Mincer 1997) such as their education, professional qualifications, experience and field of specialty, and by their location. In the earnings 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 an indicator measuring the socioeconomic status of the population in the location of doctors' work. These are similar to the variables used in Cheng et al. (2011).

[2]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 comprise largely of new entrants to the medical workforce.

[3]The random effects estimator is used instead of the fixed effects ('within') estimator because the key explanatory variables that predicts doctors' earnings such as gender, qualification, and specialty are either time-invariant or relatively constant across time.

5 Results

5.1 Estimates of earnings equations

Table 2 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, are more likely to be male and have undergone their basic medical training in an Australian medical school, and have more years of work experience. Private 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 using four waves of data are 2,088 and 1,347 for the public and private earnings regressions respectively. The pooled samples are considerably larger compared with the samples from Wave 1.

The estimation results from the log hourly earnings regression are shown in Table 3. All else being equal, earnings of female specialists are lower in both public and private sectors. Earnings are lower for public sector doctors with less than 15 years of experience, whereas private sector earnings are lower for those with 45 or more years of experience. Compared with Internal Medicine, earnings are higher for specialties such as Pathology, Anaesthetics, Diagnostic Radiology, Obstetrics and 'Other Specialty'. Earnings also vary by State and Territory, as well as by the socioeconomic characteristics of different geographical areas.

5.2 Estimates of utility function

The estimated coefficients of the utility function underlying the structural labour supply model, and the corresponding marginal effects are shown in Panel A and B of Table 4 respectively. Standard errors of the marginal effects estimates are obtained by bootstrap. The results conform with our expectations based on theory. As shown in Panel B, doctors' utility is decreasing in hours worked, and this relationship is strongly statistically significant for both males and females. For females, household income has a positive effect on utility whereas for males this is not statistically significant.

5.3 Goodness of fit

The estimated results presented in Table 4 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.[4]

As shown in Table A.1 in the Appendix, the LR ratio statistics is 241.74 and 99.58 (21 degrees of freedom) for the male and female samples respectively, rejecting the null hypothesis at conventional levels. These results indicate that doctors' labour market behaviour depends on their personal characteristics and family circumstances. Table A.1 also reports the observed and predicted distribution of doctors by sector of work which provides 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.

5.4 Marginal effects on hours worked

To understand the effects of family circumstances on doctors' labour supply decisions better, we estimate the marginal effects of these covariates on the expected public, private, and total hours worked. These results are shown in Table 5. All else being equal, the total number of hours worked is decreasing in age. Having young children significantly reduces the expected number of hours worked per week for female doctors, but not for male doctors. 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). Having a partner in employment has no effect on hours worked for both male and female doctors. 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 (Doiron and Kalb 2005).

5.5 Labour supply elasticity

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 a one-

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

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.

5.5.1 Sector elasticity

Panel A of Table 6 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 0.71 percent, and decreases the proportion working exclusively in the private sector by 0.77 percent. The size of the sector elasticities with respect to private earnings is larger than the elasticities with respect to public earnings.

Overall, the sector elasticity estimates for female specialists are smaller relative to those for male specialists. For instance, a one-percent increase in private earnings increases the proportion of female specialists in the private sector by 0.69 percent, and reduces the proportion working in the public sector by 0.43 percent. While a change in public earnings has an impact on the proportion working in the private sector, this does not have a statistically significant effect on the proportion working in the public sector. The proportion working in a mixed setting is not significantly affected by changes in hourly earnings in the public or private sector.

5.5.2 Earnings elasticity

Panel B of Table 6 presents the earnings 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 higher earnings. For male doctors, the own-sector and cross-sector earnings elasticities have the expected signs, and are strongly statistically significant. For instance, the estimate of the own-sector public earnings elasticity indicate that a one-percent increase in public sector hourly earnings is expected to increase public sector hours by 0.40 percent. 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 0.46 percent. A change in

public or private hourly earnings is not expected to have any effect on total hours (i.e public and private hours combined) worked. Finally, a simultaneous increase of both public and private earnings does not significantly change the number of public, private, or total hours worked.

For female doctors, the own-sector and cross-sector earnings elasticities also have the expected signs, but are considerably smaller compared with male doctors. For instance, the public and private earnings elasticities with respect to private earnings are -0.27 and 0.43 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 in the case of male specialists, changes in earnings do not have any effect on total hours.

5.5.3 Heterogeneity in labour supply response by age

The elasticity estimates in 5.5.1 and 5.5.2 describe the adjustment of labour supply for the sample as a whole and mask the heterogeneity in labour supply response to changes in earnings which might differ by doctors' personal and professional characteristics. We examine labour supply elasticity by age which is shown in Table 7. Males 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 0.39 to 0.77 and -0.42 to -0.62 respectively. Male specialists over 60 years of age, and female specialists over the age of 50 are not responsive to changes in earnings. Male specialists age between 40 and 49 years and female specialists aged between 30 and 39 years are most responsive to wage changes.

5.5.4 Heterogeneity in labour supply response 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 speciality are shown in Table 8. The results indicate that there is considerable variation across different specialties in how labour supply responds to changes in earnings. 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 specialities. For females, the sizes of the elasticities by specialty are considerably smaller compared to their male counterparts.

As discussed in Sections 5.5.1 to 5.5.3, 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 have no effect on total hours supplied. The elasticity estimates by specialty however 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. This is the case for Internal Medicine and Psychiatry, the elasticities are positive and statistically significant, but economically small.

6 Simulating trends in earnings growth

We use the structural model to simulate doctors' labour supply responses to recent changes in real earnings growth in the public and private health care sectors in Australia.[5] Earnings growth rates are proxied using two components of the Health Price Index in Australia for 2009-10 and 2010-11 (Australian Institute of Health and Welfare 2012). The nominal growth in public sector earnings is represented by the 'Professional health workers wage rates' index, which has increased on an annual basis by 4.1 percent in 2009-10 and 3.6 percent in 2010-11. Nominal earnings growth in the private sector is based on the 'Medicare medical services fees charged' index, which grew 2.4 percent (2009-10) and 1.5 percent (2010-11). Using 2008-09 as the base year and adjusting for inflation, these nominal growth rates translate to real public-private growth differentials of 1.7 percent in 2009-10, and 3.8 percent in 2010-11.[6]

The simulation results are shown in Table 9. We discuss the results for male specialists as the elasticities for female specialists are largely not statistically significant. Applying the growth rates in 2009-2010 is predicted to decrease (increase) the proportion of specialists working solely in the public (private) sector. Although earnings growth in public sector is higher than the private sector, the absolute increase in private earnings is higher because earnings in the private sector are on average higher than that in the public sector. Total hours are predicted to fall by 0.22 percent. Applying the differential growth rates in 2010-2011 is predicted to increase

[5] Accurate out-of-sample predictions are complex and hence the simulations presented here are illustrative only. They indicate how the models may be used in practice.

[6] Relative to 2008-09, the real growth in public and private sector earnings were 2.61% and 0.94% in 2009-10, and 3.08% and -0.68% in 2010-11.

the percentage of doctors working solely in the public sector by 1.58 percent. Correspondingly the percentage of doctors working solely in the private sector is predicted to decrease by 1.60 percent. Similarly, hours worked in the public sector is predicted to increase by 0.65 percent, and hours worked in the private sector is predicted to decrease by 0.96 percent.

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. The only other existing study to focus on public and private sector choice for doctors did not examine the extent of substitution between sectors for medical specialists (Sæther 2005). 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.

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 effect of an increase in the private sector wage is higher than the effect of an increase in the public sector wage. There is no effect on those working in both sectors. The effects of changes in relative earnings on the sector of work can be seen in our simulation analysis. For example, 26 percent of male specialists currently work exclusively in the public sector. Based on simulating a 3.8 percent earnings growth in the public sector, over and above private sector earnings growth, we estimate that the proportion working exclusively in the public sector would increase by 0.4 percentage points to 26.4 percent. For every 1,000 male specialists, an additional four doctors would move exclusively to the public sector, which is quite small and would certainly not have any discernible impact in a large teaching hospital

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.

There is also heterogeneity. Specialists who are most likely to re-allocate their hours in responses to a sector-specific wage increase are men between 40 and 49 years old and women between 30 and 39 years old. 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, diagnostic radiology, and internal medicine. Conversely, if private sector earnings were to increase, public sector hours would fall most in pathology, internal medicine, and obstetrics. An increase in private sector earnings would have least impact on public sector hours in psychiatry, surgery and anaesthetics. Interestingly, obstetrics, surgery and anaesthetics are more responsive to an increase in public sector earnings than an increase in private sector earnings. Whereas internal medicine, pathology, diagnostic radiology, and psychiatry are more responsive to changes in private sector earnings than changes in public sector 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 (Health Workforce Australia 2012).

The study has some limitations. Firstly, public sector work is defined by the number of hours worked in public hospitals. This classification does not capture private work undertaken in public hospitals by specialists with rights to private practice. These specialists, who are salaried employees in public hospitals, are entitled to treat private patients on a fee-for-service basis. This is not likely to significantly influence our results as a majority of these doctors do not see private patients in public hospitals. Although roughly one-half of all public sector specialists have private practice privileges, two-thirds of these doctors derive no income from private billings (Cheng et al. 2013). Secondly, we used cross-sectional data and hence are not able to capture the persistence of doctors' choice of work sector over time. This persistence may influence how the labour supply of doctors responds to changes in sector-specific earnings. Given the longitudinal nature of the MABEL survey, the potential exists to use panel data to analyse how doctors' choice of public and private labour supply change over time as more waves of data become available.

The ability of the public hospital sector to address shortages of specialists depends on the flexibility of their pay arrangements. Public hospitals do 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.

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 increases in the public sector are 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 wage or earnings elasticities of specialists within and between sectors provides important evidence on the potential effectiveness of changing earnings to help solve recruitment and retention difficulties.

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

	Male	Female	Diff.[a]
Sector and hours worked:			
Public sector	0.26 (0.44)	0.40 (0.49)	***
Private sector	0.18 (0.39)	0.18 (0.39)	
Mixed sector	0.56 (0.50)	0.42 (0.49)	***
Total hours for public sector	46.26 (11.54)	35.93 (13.83)	***
Total hours for private sector	41.10 (14.68)	33.77 (14.84)	***
Total hours for mixed sector	49.35 (10.82)	39.42 (12.48)	***
Covariates in utility function:			
Age in years	51.93 (10.17)	45.82 (8.02)	***
Has child 0-4 years	0.14 (0.35)	0.24 (0.43)	***
Has child 5-9 years	0.13 (0.34)	0.15 (0.36)	
Has child 10-15 years	0.16 (0.37)	0.15 (0.36)	
Partner works	0.59 (0.49)	0.69 (0.46)	***
Partner not working	0.26 (0.44)	0.09 (0.28)	***
Other covariates:			
Internal Medicine	0.33 (0.47)	0.35 (0.48)	
Pathology	0.04 (0.20)	0.05 (0.21)	
Surgery	0.19 (0.39)	0.06 (0.25)	***
Anaesthetics	0.20 (0.40)	0.22 (0.41)	
Diagnostic Radiology	0.07 (0.26)	0.05 (0.22)	*
Obstetrics/Gynaecology	0.06 (0.24)	0.07 (0.25)	
Psychiatry	0.09 (0.29)	0.15 (0.35)	***
Specialty - Other	0.02 (0.14)	0.04 (0.21)	***
No. of observations:	1,670	634	

Note: Standard deviation shown in parenthesis.

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

Table 2: Summary statistics of covariates in earnings regression (in proportions unless otherwise stated)

	Public	Private	Diff[a]
Log(hourly earnings)	4.65 (0.43)	5.02 (0.69)	***
Female	0.36 (0.48)	0.29 (0.45)	***
Australian medical school	0.77 (0.42)	0.86 (0.35)	***
Temporary visa	0.01 (0.11)	0.006 (0.08)	*
No. of postgrad qualifications	0.14 (0.42)	0.13 (0.39)	
Experience: Under 15 years	0.23 (0.42)	0.09 (0.29)	***
Experience: 15-19 years	0.18 (0.38)	0.11 (0.32)	***
Experience: 20-24 years	0.17 (0.37)	0.16 (0.36)	
Experience: 25-29 years	0.14 (0.35)	0.18 (0.39)	***
Experience: 30-34 years	0.10 (0.30)	0.14 (0.35)	***
Experience: 35-39 years	0.10 (0.30)	0.15 (0.36)	***
Experience: 40-44 years	0.06 (0.23)	0.09 (0.28)	***
Experience: 45+ years	0.02 (0.15)	0.08 (0.27)	***
Internal Medicine	0.47 (0.50)	0.16 (0.37)	***
Pathology	0.06 (0.24)	0.03 (0.16)	***
Surgery	0.05 (0.23)	0.14 (0.34)	***
Anaesthetics	0.16 (0.37)	0.24 (0.42)	***
Diagnostic Radiology	0.05 (0.21)	0.07 (0.25)	***
Obstetrics/Gynaecology	0.05 (0.22)	0.10 (0.30)	***
Psychiatry	0.11 (0.32)	0.24 (0.43)	***
Specialty - Other	0.05 (0.21)	0.04 (0.19)	
New South Wales	0.30 (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	0.12 (0.33)	0.09 (0.28)	***
Western Australia	0.06 (0.25)	0.09 (0.29)	***
Northern Territory	0.02 (0.12)	0.004 (0.07)	***
Tasmania	0.03 (0.18)	0.02 (0.14)	**
Australian Capital Territory	0.02 (0.14)	0.02 (0.14)	
Standardised SEIFA index	-0.13 (0.97)	0.30 (0.94)	***
No. of observations:			
Wave 1	707	439	
Wave 2	522	314	
Wave 3	465	322	
Wave 4	394	272	
Total	2,088	1,347	

Note: Standard deviation shown in parenthesis.

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

Table 3: Public and private log hourly earnings regression

	Public		Private	
Variables	Coeff	Std Err.	Coeff	Std Err.
Female	-0.06**	0.03	-0.17***	0.06
Australian medical school	-0.02	0.03	0.01	0.06
Temporary visa	-0.11	0.09	0.08	0.33
No. of postgrad qualifications	-0.03	0.02	0.11***	0.04
Experience (Ref: Under 15 years)				
15-19 years	0.11***	0.03	-0.003	0.09
20-24 years	0.09***	0.04	0.05	0.09
25-29 years	0.08**	0.04	-0.009	0.09
30-34 years	0.03	0.04	-0.11	0.09
35-39 years	0.06	0.04	-0.10	0.09
40-44 years	0.03	0.05	-0.11	0.10
45+ years	-0.10	0.05	-0.52***	0.11
Specialty (Ref: Internal Medicine)				
Pathology	0.17***	0.05	0.21*	0.13
Surgery	0.07	0.05	0.59***	0.08
Anaesthetics	0.23***	0.03	0.56***	0.07
Diagnostic Radiology	0.46***	0.05	0.45***	0.09
Obstetrics/Gynaecology	0.05	0.06	0.53***	0.09
Psychiatry	0.06	0.04	-0.13*	0.07
Specialty - Other	0.06	0.06	0.23*	0.13
State (Ref: New South Wales)				
Victoria	-0.01	0.03	0.03	0.06
Queensland	0.18***	0.03	0.02	0.06
South Australia	0.05	0.04	0.18**	0.09
Western Australia	0.11**	0.05	-0.02	0.09
Northern Territory	0.004	0.09	-0.19	0.39
Tasmania	-0.05	0.06	-0.15	0.16
Australian Capital Territory	0.05	0.09	0.09	0.17
Standardised SEIFA index	-0.02*	0.01	0.04*	0.03
Constant	4.49***	0.04	4.79***	0.11
σ_u	0.28		0.49	
σ_e	0.31		0.38	
No. of observations	2,088		1,347	
No. of ids	1,023		682	
Overall R-squared	0.13		0.26	

Significance: *** 1%; ** 5%; * 10%.

Table 4: Structural estimation of parameters in utility function

	Male		Female	
Variables	Coeff	Std Err.	Coeff	Std Err.
Panel A: Coefficient estimates				
Income (weekly net, in '000s of dollars)	-2.12	1.49	-0.45	4.35
Income ^{2}	-0.09***	0.03	-0.12	0.10
Public hours	0.10	0.11	-0.10	0.28
Public hours^2	-0.004***	0.003	-0.002	0.0006
Private hours	0.06	0.15	-0.26	0.36
Private hours^2	-0.004***	0.0004	-0.002***	0.009
Income x Public hours	0.003	0.005	-0.007	0.01
Income x Private hours	0.009	0.007	-0.007	0.02
Public hours x Private hours	-0.006	0.0007	-0.003*	0.001
Income x Age	1.45**	0.57	0.78	1.86
Income x Age^2	-0.16***	0.05	-0.11	0.19
Income x Child 0-4years	0.04	0.21	-0.05	0.39
Income x Child 5-9years	0.12	0.17	-0.23	0.36
Income x Child 10-14years	-0.02	0.16	-0.46	0.35
Income x Partner works	-0.11	0.17	0.08	0.30
Income x Partner not work	0.03	0.19	0.46	0.42
Public hours x Age	0.09**	0.04	0.10	0.12
Public hours x Age^2	-0.01***	0.004	-0.01	0.01
Public hours x Child 0-4years	-0.01	0.02	-0.07***	0.03
Public hours x Child 5-9years	-0.01	0.01	-0.03	0.02
Public hours x Child 10-14years	0.01	0.01	0.003	0.02
Public hours x Partner works	0.008	0.01	-0.02	0.02
Public hours x Partner not work	-0.002	0.01	-0.02	0.03
Private hours x Age	0.07	0.06	0.13	0.15
Private hours x Age^2	-0.007	0.005	-0.01	0.02
Private hours x Child 0-4years	-0.009	0.02	-0.06*	0.04
Private hours x Child 5-9years	-0.02	0.02	-0.02	0.03
Private hours x Child 10-14years	0.01	0.02	0.03	0.03
Private hours x Partner works	0.02	0.02	-0.009	0.03
Private hours x Partner not work	-0.007	0.02	-0.01	0.04
Number of observations	18,370		6,974	
Number of person-observations	1,670		634	
Log-likelihood	-3596.46		-1304.09	
χ^2 test of model significance (df)	816.05 (30)		432.35 (30)	
Panel B: Marginal effects				
Income	-0.001	0.0029	0.04*	0.03
Public hours	-0.001***	0.0002	-0.01***	0.002
Private hours	-0.001***	0.0002	-0.02***	0.002

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

Table 5: 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)	-4.04***	-0.07	-4.11***	-3.66***	2.24**	-1.42**
	(0.64)	(0.60)	(0.36)	(1.03)	(1.07)	(0.69)
Has child aged 0-4 years	-2.39	1.61	-0.78	-6.61***	-1.38	-7.99***
	(1.53)	(1.63)	(0.75)	(1.51)	(1.72)	(0.90)
Has child aged 5-9 years	-0.57	0.18	-0.39	-4.27***	-0.38	-4.65***
	(1.66)	(1.53)	(0.75)	(1.51)	(1.60)	(1.16)
Has child aged 10-15 years	-1.34	1.92	0.57	-4.00**	1.88	-2.13
	(1.46)	(1.48)	(0.68)	(1.91)	(1.77)	(1.34)
Partner is employed	-0.89	1.18	0.29	-2.33	1.39	-0.95
	(1.41)	(1.31)	(0.74)	(1.88)	(1.80)	(1.31)
Partner not employed	0.87	-1.00	-0.14	-2.33	4.20	1.87
	(1.64)	(1.48)	(0.76)	(2.30)	(3.01)	(2.12)

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

Table 6: 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	0.71***	-0.91***	-0.21	0.32	-0.43**	-0.12
	(0.18)	(0.14)	(0.15)	(0.22)	(0.18)	(0.14)
Private sector	-0.77***	0.93***	0.16	-0.55*	0.69***	0.13
	(0.16)	(0.14)	(0.20)	(0.33)	(0.25)	(0.30)
Mixed sector	-0.03	0.07	0.04	-0.05	0.09	0.04
	(0.02)	(0.05)	(0.03)	(0.05)	(0.10)	(0.09)
Panel B: Earnings elasticity						
Public hours	0.40***	-0.46***	-0.06	0.21	-0.27**	-0.06
	(0.11)	(0.07)	(0.12)	(0.19)	(0.11)	(0.18)
Private hours	-0.43***	0.54***	0.11	-0.35	0.43***	0.09
	(0.10)	(0.08)	(0.11)	(0.20)	(0.17)	(0.19)
Total hours	0.01	-0.01	-0.003	0.01	-0.01	0.003
	(0.01)	(0.01)	(0.02)	(0.04)	(0.02)	(0.06)

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

Table 7: Labour supply 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	0.39***	(0.13)	-0.42***	(0.12)	-0.03	(0.09)	0.31	(0.22)	-0.36**	(0.16)	-0.05	(0.15)
Age 40-49 years	0.56***	(0.12)	-0.62***	(0.08)	-0.07	(0.12)	0.25	(0.20)	-0.33***	(0.13)	-0.08	(0.20)
Age 50-59 years	0.48***	(0.12)	-0.55***	(0.10)	-0.08	(0.11)	0.12	(0.25)	-0.16	(0.18)	-0.05	(0.20)
Age 60+ years	0.12	(0.13)	-0.16	(0.12)	-0.05	(0.10)	0.14	(0.41)	0.08	(0.36)	-0.05	(0.18)
Private hours												
Age 30-39 years	-0.52***	(0.16)	0.63***	(0.18)	0.11	(0.12)	-0.55*	(0.32)	0.78**	(0.39)	0.23	(0.23)
Age 40-49 years	-0.60***	(0.12)	0.77***	(0.09)	0.17	(0.11)	-0.36	(0.23)	0.47**	(0.19)	0.11	(0.20)
Age 50-59 years	-0.45***	(0.11)	0.59***	(0.10)	0.14	(0.09)	-0.20	(0.25)	0.17	(0.24)	-0.04	(0.21)
Age 60+ years	-0.14	(0.09)	0.14	(0.12)	-0.0005	(0.03)	0.04	(0.35)	-0.19	(0.47)	-0.15	(0.22)
Total hours												
Age 30-39 years	0.02	(0.02)	-0.02	(0.01)	0.004	(0.03)	0.05	(0.06)	-0.001	(0.02)	0.04	(0.08)
Age 40-49 years	0.02	(0.01)	-0.01	(0.01)	0.008	(0.02)	0.01	(0.04)	-0.001	(0.03)	0.01	(0.06)
Age 50-59 years	0.01	(0.01)	-0.006	(0.01)	0.006	(0.02)	-0.01	(0.04)	-0.03	(0.03)	-0.04	(0.06)
Age 60+ years	-0.007	(0.01)	-0.02	(0.02)	-0.03	(0.03)	-0.04	(0.05)	-0.06	(0.06)	-0.10	(0.10)

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

Table 8: Labour supply 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.	0.44***	(0.10)	-0.61***	(0.09)	-0.17*	(0.09)	0.20	(0.18)	-0.22*	(0.11)	-0.02	(0.14)
Pathology	0.47***	(0.12)	-0.66***	(0.09)	-0.19	(0.12)	0.25	(0.20)	-0.29***	(0.11)	-0.03	(0.17)
Surgery	0.59***	(0.13)	-0.49**	(0.21)	0.10	(0.26)	0.30	(0.22)	-0.48	(0.30)	-0.18	(0.36)
Anaesthetic	0.57***	(0.13)	-0.53***	(0.17)	0.03	(0.21)	0.30	(0.23)	-0.42*	(0.24)	-0.11	(0.28)
Diag. radiology	0.40***	(0.15)	-0.58***	(0.10)	-0.18	(0.15)	0.25	(0.27)	-0.28*	(0.15)	-0.03	(0.24)
Obstetrics	0.62***	(0.13)	-0.61***	(0.18)	0.006	(0.24)	0.27	(0.23)	-0.44*	(0.25)	-0.17	(0.33)
Psychiatry	0.38***	(0.09)	-0.49***	(0.06)	-0.11	(0.08)	0.17	(0.19)	-0.17	(0.13)	-0.004	(0.17)
Other	0.49***	(0.11)	-0.68***	(0.12)	-0.19*	(0.11)	0.20	(0.20)	-0.26**	(0.12)	-0.05	(0.17)
Private hours												
Internal Med.	-0.59***	(0.13)	0.96***	(0.16)	0.36***	(0.13)	-0.36	(0.23)	0.45	(0.28)	0.09	(0.20)
Pathology	-0.60***	(0.15)	0.93***	(0.14)	0.32**	(0.14)	-0.44*	(0.26)	0.56**	(0.24)	0.11	(0.21)
Surgery	-0.41***	(0.08)	0.29	(0.18)	-0.11	(0.22)	-0.32*	(0.19)	0.51	(0.41)	0.19	(0.47)
Anaesthetic	-0.49***	(0.11)	0.43**	(0.18)	-0.06	(0.21)	-0.41*	(0.24)	0.57	(0.37)	0.16	(0.40)
Diag. radiology	-0.53***	(0.19)	0.71***	(0.15)	0.18	(0.15)	-0.50	(0.36)	0.55*	(0.30)	0.05	(0.28)
Obstetrics	-0.42***	(0.08)	0.39**	(0.15)	-0.03	(0.19)	-0.30	(0.19)	0.48	(0.32)	0.18	(0.40)
Psychiatry	-0.62***	(0.14)	0.97***	(0.18)	0.34**	(0.15)	-0.33	(0.23)	0.34	(0.28)	0.01	(0.25)
Other	-0.52***	(0.12)	0.75***	(0.20)	0.23	(0.16)	0.34	(0.23)	0.43**	(0.22)	0.10	(0.18)
Total hours												
Internal Med.	0.03***	(0.01)	0.02**	(0.01)	0.05**	(0.02)	0.02	(0.05)	-0.01	(0.02)	0.01	(0.07)
Pathology	0.02	(0.02)	0.01	(0.01)	0.03	(0.02)	0.02	(0.05)	-0.01	(0.02)	0.01	(0.07)
Surgery	0.01	(0.01)	-0.04	(0.03)	-0.03	(0.03)	0.01	(0.03)	-0.01	(0.06)	-0.004	(0.08)
Anaesthetic	0.01	(0.01)	-0.03	(0.02)	-0.03	(0.03)	0.01	(0.05)	-0.02	(0.05)	-0.003	(0.08)
Diag. radiology	-0.01	(0.02)	-0.01	(0.02)	-0.02	(0.03)	0.01	(0.08)	-0.02	(0.04)	-0.006	(0.10)
Obstetrics	0.01	(0.01)	-0.03	(0.03)	-0.02	(0.03)	0.01	(0.04)	-0.01	(0.06)	-0.002	(0.07)
Psychiatry	0.03*	(0.02)	0.03**	(0.01)	0.05**	(0.02)	0.01	(0.05)	-0.01	(0.03)	-0.001	(0.07)
Other	0.01	(0.01)	0.01	(0.01)	0.14	(0.02)	0.01	(0.05)	-0.01	(0.03)	-0.002	(0.07)

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

Table 9: Simulating labour supply response to real public and private earnings growth[1].

	Male		Female	
	2009-2010	2010-2011	2009-2010	2010-2011
Sector elasticity:				
Public sector	-0.26	1.58***	0.65	1.51
	(0.26)	(0.49)	(0.65)	(0.97)
Private sector	0.30	-1.60***	-0.86	-2.22
	(0.34)	(0.34)	(0.94)	(1.22)
Mixed sector	-0.16	-0.28**	-0.05	-0.22
	(0.13)	(0.14)	(0.17)	(0.22)
Earnings elasticity:				
Public hours	-0.30	0.65**	0.41	0.95
	(0.20)	(0.28)	(0.63)	(0.77)
Private hours	0.13	-0.96***	-0.56	-1.42*
	(0.22)	(0.26)	(0.64)	(0.84)
Total hours	-0.22*	-0.19	0.001	0.03
	(0.12)	(0.12)	(0.15)	(0.14)

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

[1]Relative to 2008-09, the real growth in public and private sector earnings were 2.61% and 0.94% in 2009-10, and 3.08% and -0.68% in 2010-11.

A Appendix

Table A.1: Actual versus predicted percentages by sector

		(1)		(2)	
		Without characteristics		With characteristics	
	Observed	Predicted	Difference	Predicted	Difference
Males					
Public-only	25.99	23.06	2.93	23.04	2.95
Private-only	18.15	20.98	-2.83	20.97	-2.82
Public and Private	55.86	55.95	-0.09	56.01	-0.15
Log-likelihood		-3717.33		-3596.46	
Likelihood ratio test (d.f.)				241.74 (21)	
Females					
Public-only	39.59	38.23	1.36	38.26	1.33
Private-only	18.13	21.43	-3.30	21.38	-3.25
Public and Private	42.27	40.33	1.94	40.35	1.92
Log-likelihood		-1353.88		-1304.09	
Likelihood ratio test (d.f.)				99.58 (21)	

Note: 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.