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Monetary and Non-monetary Determinants of Nurses' Labour Supply*

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Abstract

Australia faces a severe and increasing shortage in nurses' labour supply. Previous research suggests that nurses respond only weakly to changes in wages, and that other, non-monetary factors might be more important for nurses' labour supply. The high incidence of shift work, which might impede the balancing of work and family life, and the high level of emotional and personal involvement required in the profession suggest that the labour supply of nurses might depend on their personality and their family circumstances.

We estimate a structural model of nurses' labour supply. The structural approach allows us to model the labour force participation decision and the decision about hours worked as a joint outcome following from maximizing the utility function. Disutility from work is allowed to vary by shift type in the utility function. Furthermore, we allow the preference parameters in the utility function to vary by certain family characteristics and personality. We find that the labour supply elasticities with respect to income are higher for nurses with children, while elasticities with respect to wages are higher for low qualified, older and childless nurses. Our results suggest that average wage elasticities might be higher than previous research has found. This is mainly due to larger effects of wages on the decision to enter or exit the profession, rather than from their effect on increased working hours for those who already work in the profession.

1. Introduction

Australia, as well as other western countries like the UK, faces a severe shortage in nurses' labour supply. The Australian Health Workforce Advisory Committee estimated a shortfall of nurses between 10,000 and 13,000 in 2010 (AHWAC, 2004). The problem is likely to grow in the future, with both demand and supply factors contributing to the problem. An ageing population will increase the demand for health services. At the same time, the nursing workforce also ages and a high number of nurses will leave the profession when the 'baby boomers' retire. This trend is aggravated by relatively low numbers of young graduates who enter the profession. As a consequence, the average age of nurses in Australia increased by about three years between 2001 and 2005, and around 17 percent of registered or enrolled nurses were not working as nurses in 2005 (Australian Institute of Health and Welfare (AIHW), 2008). That implies that the stock of potential nurses who could in principle work in the profession is relatively high. Raising wages in order to attract them back to the profession is one possible option to tackle the problem.

There is a large literature analysing the labour supply of nurses that aims at estimating labour supply elasticities with respect to income and wages. Antonazzo et al. (2003) and Shields (2004) provide extensive reviews of the literature. The majority of studies find that nurses' labour supply is fairly unresponsive to wages, at an elasticity of around 0.3 (Shields, 2004). A major methodological challenge in modelling labour supply in the highly female-dominated profession of nursing is to model the participation decision together with the decision about the number of hours worked. Previous studies have applied a broad range of methods to deal with the endogeneity of the participation decision. Early studies estimated equation systems in the framework of 2SLS- or 3SLS-estimators based on regional data, where a continuous hours equation is estimated simultaneously with an equation representing the labour force participation rate in the region (Benham, 1971; Link and Settle, 1981b). Some studies based on individual data apply Tobit-models for the estimation of working hours (Sloan and Richupan, 1975; Link and Settle, 1979; Link and Settle, 1981a). In later studies, Heckman selection models are used to estimate the number of supplied working hours while accounting for the participation decision (Link, 1992; Ault and Rutmann, 1994; Chiha and Link, 2003). The use of panel data is rare, given the scarcity of panel data on nurses. Among the first studies using panel data are Askildsen et al. (2003) and Rice (2005). While Rice (2005) used data from the British Household Panel Study, Askildsen et al. (2003) drew upon a large panel data set of registered nurses in Norway. Askildsen et al. estimate the number of supplied

hours following a participation equation, while both equations account for unobserved heterogeneity through correlated error terms. Another approach is to use a structural model, where the participation decision and the hours decision are the solutions to an individual's utility maximization which has leisure (or its complement, hours of work) and consumption (assumed to be equivalent to net income) as its arguments. One example of a study using this approach is di Tommaso et al. (2009), who estimate a structural model of nurses' labour supply in a discrete choice setting. Regardless of the applied estimation methods, with few exceptions (e.g. Sloan and Richupan, 1975; Link and Settle, 1985), previous literature found the elasticity of working hours as well as the elasticity of labour force participation to be well below one, i.e. nurses' labour supply appears to be inelastic with respect to wages.

Recent research has therefore paid more attention to other, non-monetary, factors that might drive nurses' labour supply, such as relations with colleagues, degree of autonomy, or intrinsic rewards (e.g. Clark, 2001). Shields and Ward (2001) investigate the role of job satisfaction for nurses' intentions to quit the profession, and find that satisfaction with promotion and training opportunities are of higher importance than, for example, satisfaction with wages. This has also been investigated using discrete choice experiments (Lagarde and Blaauw, 2009; Lagarde, 2010). The range of job characteristics that might be relevant for nurses' labour supply is broad. One job characteristic that seems to distinguish nursing jobs from most other profession is the high incidence of shift-work. Only two studies have examined shift work in a labour supply context. Askildsen et al. (2003) use the shift type in a nurses' work contract as an explanatory variable for the number of supplied hours and find it to be an important determinant that influences the size of the wage elasticity. Di Tommaso et al. (2009) are the first to model shift type as a choice together with supplied hours. In their structural model, hours worked in different types of jobs (day shifts versus rotating shifts, and hospitals versus primary care facilities) enter the utility function as separate arguments. While they find the overall elasticity of labour supply to be rather low, they find strong *inter-job-type* responses to wages. Moreover, work in irregular shifts responds more strongly to a wage increase than work in regular day shifts. However, the above two studies rely on data about registered nurses, and thus cannot analyse the behaviour of nursing qualification holders who work in other occupations.

We build on the work of Askildsen et al. (2003) and Di Tommaso et al. (2009) by examining the role of shift type (distinguishing regular day shifts, regular night shifts and irregular shifts) in nurses' labour supply. Similar to the approach of Di Tommaso et al., we apply a

structural approach, with working hours in different types of employment entering the utility function as separate arguments. We contribute to the literature by considering a sample of *nursing qualification holders*, rather than working or registered nurses only, which allows us to analyse the decision to work in nursing or in another occupation, and to examine the response to wages in competing professions together with the response to wages in nursing. This should give us some insight into the question to what extent qualified nurses currently working in other occupations could potentially be attracted back to the profession. Furthermore, we investigate the interdependency between nurses' labour supply and their personality and family circumstances, as these are expected to play a major role in the amount of utility derived from income and the disutility derived from working hours in nursing jobs with different shift types or a non-nursing occupation.

We find that childless nursing qualification holders are fairly unresponsive to their partners' employment status and income, while nursing qualification holders with children adjust their labour supply behaviour in complex ways to their partners' employment status and income. Personality appears to play an important role in nurses' labour market behaviour. Furthermore, the results suggest that nurses' labour supply might be more responsive to changes in wages than earlier research concluded, as we find an average elasticity of hours worked in nursing with respect to nursing wages of 1.3. Work in night shifts turns out to result in higher disutility from work than work in other shift patterns, and thus the responsiveness to wages is considerably smaller. Estimating labour supply elasticities for different groups of nurses with different family circumstances and personality traits, it is found that the labour supply elasticity with respect to other non-labour income is considerably higher for nursing qualification holders with children and for those with a higher qualification. The reverse is true for the labour supply elasticity with respect to nursing wages: lower qualified, childless, and older nursing qualification holders appear to respond stronger to a given wage increase than their counterparts.

The paper continues as follows. Section 2 briefly discusses the proposed estimation strategy. This is followed in Section 3 by a description of the data, including some summary statistics. The results are presented in Section 4: first for a descriptive model exploring correlations only, and then for the structural models. Section 5 concludes.

2. Estimation Strategy

The analysis is done in two parts. In the first, purely descriptive, part we estimate two separate multinomial logit models for i) the level of employment and ii) the shift type conditional on being employed as a nurse to examine correlation patterns between nursing qualification holders' characteristics and their observed work arrangements. In addition to socio-demographic characteristics such as age and education we include the presence of young children and a partner, partner's employment status, education, income and interactions between children and partner's characteristics to explore correlations between the labour supply of nursing qualification holders and their family circumstances. Moreover, we include variables describing the nursing qualification holders' personality, measured in five dimensions: extroversion, emotional stability, openness to new experiences, agreeableness and conscientiousness (the "Big Five"). These five dimensions provide a common mapping of individual differences in personality traits in the field of personality psychology (Spielberger, 2004: 569-573).

In the second part of the analysis, we estimate a structural model of individual labour supply, directly based on an underlying utility function, to obtain estimates of labour supply elasticities with respect to income and wage. The utility function has household net income (assumed to represent household consumption) and four different types of working hours as its arguments: working hours in non-nursing jobs, and working hours in nursing jobs in the three different shift types 'regular day shifts', 'regular night shifts' and 'irregular shifts'. We estimate various specifications where we allow the preference parameters in the utility function to differ by family status and personality. Labour supply is treated as a discrete choice problem rather than a continuous choice, similar to the approach by Van Soest (1995). In each period, each nursing qualification holder *i* can choose between alternatives *j* from a set of combinations of income and working hours in different employment types: $\{(y_{ji}, hd_{ji}, hn_{ji}, hi_{ji}, ho_{ji}); j = 1, 2, ..., m\}$ where hd_{ji}, hn_{ji} and hi_{ji} denote the individuals' working hours in nursing jobs, either in regular day shifts (*hd*), regular night shifts (*hn*) or in irregular shifts (*hi*), and *ho* are working hours in non-nursing jobs. *y* is the household net income associated with the choice of working hours and employment type.

We observe between 0 and 80 working hours per week, measured in integers. Individuals can hold more than one job, and thus different combinations of working hours in different hours-types are possible. To maintain computational tractability, we apply two simplifying assumptions: i) for each alternative, only one of the variables *hd, hn, hi, ho* is allowed to be

positive,[1] and ii) we allow three discrete labour supply choices (which means we approximate actual labour supply by one of the choices).[2] The discrete labour supply points are chosen in such a way that the actual labour supply is represented as well as possible. This leaves us with twelve different choices of employment, and we add a thirteenth alternative "non-employment", where hours in each of the four different work arrangements and labour income is set to zero.

The utility function is approximated by a second-order polynomial of working hours and household income (that is, the function consists of a linear and quadratic term of each argument, and an interaction term of both arguments), plus a random disturbance that is assumed to follow a type I extreme value distribution. Every individual is assumed to choose the alternative that leads to the highest utility. The probability that individual *i* chooses alternative *j* (from the 13 alternatives) is thus:

$$Pr(U_{ji} > U_{ki}, k \neq j) = {exp(U_{ji})}\Big/{\sum_{k=1}^{m} exp(U_{ki})}\text{, with}$$

$$U_{ji} = \beta_0 y_{ji} + \beta_1 y_{ji}^2 + \sum_{x=d,n,i,o} \left(\beta_{2x} hx_{ji} + \beta_{3x} hx_{ji}^2 + \beta_{4x} hx_{ji}\, y_{ji}\right) + \varepsilon_{ji}$$

To estimate these probabilities, we need to know the budget constraint in order to determine the household net income associated with each choice *j*. Hourly gross wages for the different shift types in nursing and for working in non-nursing jobs are predicted using wage regressions.[3] We can then calculate the expected gross labour income at different choices of

[1] 89.7% of the observations in the used data do not hold more than one job and are thus not affected by this restriction. For those who hold more than one job, the shift pattern in the main job is considered to determine the chosen alternative. Hours worked in all jobs are added together.

[2] The intervals of working hours per week are [4, 25], [26, 37] and [38, 80]. The discrete hours points hd_j, hn_j, hi_j *or* ho_j are set to the average number of hours worked observed in each of these intervals, and the average number of hours worked is used to determine the associated labour income. Individuals working less than 4 hours per week are considered to be non-employed.

[3] We regress wages in non-nursing occupations on tenure (as a proxy for job-specific human capital), age (as a proxy for labour market experience and thus general human capital), and state and year dummies. Age and tenure enter the model in linear, quadratic and cubic terms. Age, tenure, state and year dummies were fully interacted with a dummy variable indicating tertiary education. A separate regression equation for nurses' wages has the same functional form, but additionally includes a dummy-variable that indicates the shift type, which is again interacted with tertiary education. To account for selection into employment and into nursing, we apply a two-step heckman selection model. The participation decisions for employment in nursing and for employment in other occupations are estimated as a function of age, education, gender, state and year, the family circumstances (presence of a partner and partner's employment status, as well as the presence of children and interactions between children and partner's characteristics), and the individual's personality (the "Big Five"). As a robustness check, we have repeated the estimation with predicted wages from a simple OLS regression

hours worked per week. Non-work household income and partner's gross income are treated as exogenous. The sum of resulting labour income, other non-labour income and partner's income is used to compute taxes paid and family payments received by both partners based on the relevant tax and transfer system (which were different for each of the years observed in the data).[4] The resulting net household income is adjusted for inflation using the CPI depending on the year of observation.

The most important advantages of this model-type for our analysis are i) that we fully incorporate the participation decision and the hours decision in the same modelling framework and thus our results are not biased by endogenous sample selection into working as a nurse, ii) that the choice for different shift types and occupations can be incorporated in the model easily, and iii) that the direct estimation of the utility function allows us to simulate response to different wage policies. On the other hand, some drawbacks are i) that estimated wages for the different work arrangements are an imperfect measure of the actually feasible wage, and consequently there is measurement error in the household net income, ii) that the model does not allow for any forward-looking behaviour and maximization of life-time utility, and iii) that the partner's labour supply is treated as exogenous. Although the model in principle allows estimating partner's labour supply jointly by extending the set of choices for couple families (requiring separate models for single-adult and two-adult families), this is not a feasible strategy given the size of the data set (see Section 3) and is particularly infeasible since subdivision of the sample is required for this approach. Although not ideal, this approach of treating partner's labour supply as exogenous is often used for partnered women, and nurses are to a large extent women.

3. Data

In this analysis, we use pooled data from nine waves (2001-2009) of the Household, Income and Labour Dynamics in Australia Survey (HILDA). HILDA is an annual household survey that is representative of all Australian households; individual interviews are conducted with all members of selected households who are aged 15 or over. In their first interview, respondents are asked whether they hold a nursing qualification. In subsequent waves,

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without control for selection into employment. The results are very similar and are available from the authors upon request.

[4] Included in the calculation of payable taxes and government payments are income tax, low income rebates, dependent spouse rebates, Medicare levy and Medicare levy surcharge, as well as family tax benefit part A and family tax benefit part B. See http://www.centrelink.gov.au/internet/internet.nsf/publications/co029.htm for an overview of the current (and recent) Australian social security system and http://www.ato.gov.au for the Australian tax system.

respondents are asked whether they gained any further qualifications since the last interview. It is not known, however, whether any of these further qualifications were obtained in nursing. We assume that a qualification gained after the first interview is a nursing qualification, if the individual works in nursing within two years of gaining the additional qualification. Whether an individual works in a nursing occupation is determined based on the 4-digit ANZSCO-Code. Nursing occupations include Midwifery and Nursing Professionals, Enrolled Nurses, Nursing Support Workers and Personal Care Workers. 4,933 observations of 788 individuals with a nursing qualification are available in HILDA across waves 1 to 9.

The dependent variable of interest is hours worked in nursing occupations in different shift types and hours worked in other occupations. Explanatory variables include, besides socio-demographics controls such as age, gender and highest educational degree, the family circumstances and personality. The family situation is represented in the model by the presence of a partner and of young children up to age 4, as well as partner's employment status, partner's income and partner's education. Furthermore, we include the level of the respondent's satisfaction with their partner and a variable that indicates if they feel a lack of support. We exclude all observations after they reach age 65, observations of individuals with missing information on hours worked, on their shift type or on their partners, and individuals with a reported weekly net household income higher than $10,000 or lower than $200. The remaining sample contains information on 696 nursing qualification holders (3,974 person-year observations), of whom 474 are observed working in a nursing occupation at least once during the observation period (2,042 person-year observations). Information on personality is collected only in wave 5 of HILDA. However, psychological research concludes that personality is relatively stable even over long time intervals (McCrae, 1993; Soldz and Vaillant, 1999). We therefore assume that the information collected in 2005 describes the personality of the individuals in our sample for the entire observation period.[5]

Table 1 shows descriptive statistics for the nursing qualification holders. The vast majority is female, less than 10% are male. The individuals in our sample are 45 years old on average, one out of five has a tertiary educational degree, and they work 25 hours per week on average. Those who have a job in nursing are about three years younger, work 6 hours per

[5] If individuals are not interviewed in wave 5, no information on their personality is available. For specifications that include personality variables, we exclude these observations from the sample. This reduces the sample size by 15%.

week more and hold a bachelor degree more often. The partner characteristics of those who work in nursing and the average nursing qualification holder appear to be similar: about two thirds live with a partner, the vast majority of partners is employed, about 40% of them hold bachelor degrees, and partners' income is comparable for both groups. However, those who work in nursing are more likely to have young children below age 5. This is in line with Dockery and Barns (2005), who find that flexible working arrangements in nursing jobs are an important motivation to study nursing for young women who intend to have children.

4. Results

First the descriptive multinomial logit analyses of the choice of employment type and shift type are discussed in Section 4.1. This is followed in Section 4.2 by the results from the structural labour supply models allowing for three hours choices, as well as three shift types within nursing or an occupation outside of nursing, and the choice to be non-employed.

4.1. Correlation Patterns Between Employment Type, Shift Types, Family Situation and Personality

In the first part of the analysis we estimate two separate multinomial logit models for different employment types and different shift types on the pooled HILDA data in order to investigate correlation patterns between family situation and personality on the one hand, and the choice of employment type and shift types on the other hand. Table 2 shows marginal effects of individual characteristics on the probability of full-time employment in nursing, part-time-employment in nursing, employment in other occupations, or no employment. Observations on the same individual are clustered to allow for the panel nature of the data, in a limited way, by correcting the bias in standard errors arising from correlation between observations on the same person.

Personality seems to play a role mostly in the dimension “Openness to new experiences". Individuals who score low on openness are more cautious and conservative and less curious and imaginative than an average person (Spielberger 2004: 707-709). Nursing qualification holders who score high on openness are more likely to be employed in other occupations or to be non-employed, while (full-time) nurses are more likely to belong to the lower 50%-quantile of openness to new experiences. This finding matches intuitive expectations about individuals who choose to work in the occupation for which they were originally trained.

While the comparison of individual characteristics in Table 1 did not yield any strong differences in the family situation between those who work in nursing and those who do not,

the results are different when we distinguish between not working at all and working in other occupations, and between working as a nurse in full-time jobs or in part-time jobs. Furthermore, including interaction terms between the partner's characteristics and the presence of a young child reveals that the seemingly similar family situation of nurses and non-nurses is indeed very different. The effects of many family characteristics depend heavily on other family characteristics: for example, having a partner is not related to the probability of choosing one of the non-nursing outcomes vs. one of the nursing outcomes, but having an employed partner is significantly and positively related to working as a nurse, particularly for part-time nursing. Yet, the positive relation between working in a nursing job and the partner's employment decreases and eventually becomes negative when the partner's income increases, particularly for full-time work as a nurse. Having children does not seem to be related to working as a nurse in general, but significantly changes the probability of working part-time vs. full-time, with full-time nursing becoming less likely with the presence of young children (as one would expect). Again, the relation between the presence of children and the supply of work in nursing depends strongly on other characteristics, namely the presence, employment status and income of partners. Nursing qualification holders with a child are about 7 percentage points more likely to work as part-time nurse and 9 percentage points less likely to work as a full-time nurse than their childless counterparts. This effect is almost twice as high for individuals without a partner, but much smaller when there is an employed partner in the household. It then increases with the partner's income.

These complicated patterns are illustrated in Figure 1. It shows predicted probabilities of different employment types, evaluated at different individual characteristics: with and without young children, without partners, and with employed partners at different levels of the partner's income. For nursing qualification holders without children, we see almost no variation in the probability of being in a nursing job or not when the partner's income increases and only a slightly decreasing probability of being full-time employed as a nurse instead of being part-time employed. For nursing qualification holders with children, the picture is very different. Without a partner, working as a nurse is unlikely for those with children compared to those without children. If there is a partner, but with a low income, working in nursing jobs becomes more likely. With increasing partner's income, nursing appears to become less attractive, and there is a large shift from full-time nursing towards part-time nursing. Figure 1 suggests that a) income effects are important in pushing nursing qualification holders out of the profession, and particularly out of full-time nursing, b) that

these income effects are more important when children are present, and c) that working as a nurse and raising a child might be easier to organize when there is a partner (and in fact that, in that case, nursing might be a slightly preferred option compared to other occupations).

The latter finding immediately leads to the question whether nurses in different family circumstances work different shift-patterns. Table 3 shows the marginal effects of a multinomial logit model that we estimated for the sub-sample of nursing qualification holders who work as a nurse. The model includes three different outcomes: regular day shifts, regular night shifts and irregular shifts. Among the personality variables, openness seems to play an important role again, with those in the upper 50%-quantile for openness being about 12 percentage points more likely to work irregular shift patterns, and about 12 percentage points less likely to work regular day shifts. The effect is high in magnitude, with more open nurses being 12.3 percentage points more likely to work in irregular shifts.

With respect to family situation, and similar to our findings with respect to employment type, we see that the effect of having children depends strongly on the presence of a non-employed or employed partner with high or low income. Generally, having children decreases the probability of working irregular shifts and increases the probability of regular shift patterns, be it night or day. This correlation is much stronger for single parents, and much weaker for those with employed partners on a low income. However, when the partner's income increases, the effect grows.

Figure 2 shows predicted probabilities for different shift types depending on the family situation. Similar to the findings above, the graph suggests that it is the presence of a partner that allows for coordination of working times among parents and thus for irregular shift schedules, which are in turn chosen more often. On the other hand, income effects might decrease the relative attractiveness of the comparatively high-paid irregular shifts, and thus increase the probability to work according to a standard schedule when the partner's income is high enough. Both effects seem to be important for nurses with young children, but play a minor role for their childless counterparts.

4.2. A Structural Model of Labour Supply – Estimating Labour Supply Elasticities

In the second part of our analysis, we estimate a structural model of nurses' labour supply as outlined in Section 2 to obtain estimates of the elasticity of nurses' labour supply in different

shift types with respect to their wages and incomes.[6]Table 4 shows the coefficients of the estimation, as well as the marginal effects of income and hours worked in the different shift types or a non-nursing occupation on the utility averaged over all individuals. Standard errors of marginal effects are bootstrapped. All observations are clustered at the individual level.[7] As expected from theory, utility increases significantly in household net income, and decreases in hours worked. The strongest disutility from work occurs for regular night shifts, although the 95%-confidence intervals for disutility from work overlap for all types of working hours.

4.2.1. Income Elasticity

After estimating the utility function, we run several simulations to explore the expected labour supply response of nursing qualification holders to different scenarios with respect to income. First, while holding their net labour income constant, we increase the net non-labour income and net partner's income by 1% to predict the resulting changes in their labour market behaviour. The results can be seen in Column 1 of Table 5. If we examine the changes in the probability to work in specific shift types or outside nursing jobs, we see that nursing qualification holders are more likely to stop working or to switch into regular day shifts when their non-work income increases.

The second panel of the table gives the expected working hours in day shifts, night shifts, irregular shifts or non-nursing jobs, conditional on being in one of these working arrangements. As one would expect, working hours decrease as a result of the increase in other net income. However, the effects are very small in magnitude, and the resulting elasticities are, although significant, close to zero. We get a similar result for expected hours in nursing jobs conditional on working in a nursing job – the resulting elasticity is only -0.04. However, when we look at the unconditional elasticity of working hours in nursing, this is more than twice as high as the conditional elasticity (although still relatively small). This result implies that most of the changes in expected working hours in nursing are not because working nurses supply less hours when other net income increases, but mainly because

[6] For the calculation of net income, we estimated hourly wages in different shift types (cf. Section 2). We excluded observations with an hourly wage rate below $10 or above $85 from the auxiliary wage regression sample. Furthermore, observations were not used for the wage regressions when a wage growth of more than 100% was observed from one year to the next, followed by an immediate decrease to less than 50%. (cf. Munasinghe et al., 2008) The wage regression results are available from the authors upon request.

[7] To test the robustness of the results, we have repeated the estimation using only the first observation year per individual. There were no substantial changes in the magnitude nor in the significance level of estimated coefficients or elasticities. The results are available from the authors upon request.

nursing qualification holders stop working. Finally, the overall income elasticity of expected working hours (i.e. in nursing jobs and in non-nursing jobs) amounts to -0.12, which is comparable to labour supply elasticities with respect to income that were found in the literature for nurses and for females in general before (see for example Skatun et al., 2005; Phillips, 1995 for nurses, and Killingsworth, 1983: 193-199 or Blundell and MaCurdy, 1999: 1649-1651 for the general female population).

4.2.2. Labour Supply Elasticity With Respect to Wages

The second panel of the table shows the adjustment of labour market behaviour to an increase in all hourly gross wages (regardless of the occupation and shift type) by 1%.[8] As one would expect, the probability of being non-employed decreases, while the probability of employment increases in all working arrangements. Moreover, supplied hours given a certain work arrangement increase, with elasticities ranging between 0.21 (irregular shifts in nursing) and 0.27 (regular night shifts in nursing). Supplied hours of work *conditional on working in nursing* increase by only 0.07 hours per week which translates into a wage elasticity of about 0.2, which is at the lower end of the range of previously found wage elasticities for nurses (Shields, 2004), for women in general in Australia and New Zealand (Birch, 2005; Kalb, 2010), for women in general (Blundell and MaCurdy, 1999) and in an overview by Hotz and Scholz (2003) focussing on lower and middle income earners. However, the *unconditional* elasticity of working hours in nursing with regard to the gross wage is about 0.4. This is because, in addition to longer working hours, former non-employed nursing qualification holders now also enter the occupation.

The same phenomenon is observed for a third scenario, which is also the most interesting one from a policy perspective. Column 3 shows estimated labour supply changes if only the wage rates in nursing occupations increase, while other wage rates are held constant. Not only are former non-employed nursing qualification holders now predicted to enter the occupation, but also nursing qualification holders who worked in different occupations. While the conditional elasticity that ignores this possibility by construction remains at 0.2, the unconditional elasticity now increases to 1.3. This elasticity is not readily comparable to those in other studies since it allows for entry of nursing qualification holders currently working in other occupations into nursing. Therefore, even if overall hours worked do not change much, a shift from other occupations into nursing may take place, resulting in a high elasticity. Naturally,

[8] For full-time emlpoyed individuals, an increase in gross wages by 1% translates into an average increase in nominal weekly household net income by 14.42$ in 2009.

the reverse pattern is found when only wages in competing jobs are raised, which leads to a decline in labour supply in nursing. The labour supply elasticity in nursing with respect to non-nursing wages is estimated around -0.9.

While the labour supply elasticity with respect to wage in the profession is relatively high, there are two reasons to look at this result with some caution. First, the relatively small sample size did not allow us to define more than three hour intervals per employment type, which does not represent the full set of choices a nursing qualification holders faces. Second, there is substantial measurement error in wages, as we do not know exactly the feasible wage if a nursing qualification holder was to exit or enter the profession. Both issues lead to imprecise estimates. However, while the magnitude of the point estimate is not very reliable, there is an important conclusion that can be drawn. It appears that the number of supplied working hours is fairly unresponsive to wages, yet the decision to enter the occupation, be it from non-employment or from other occupations, is far more responsive. Therefore, if policy makers aim to increase nursing labour supply, nursing qualification holders who currently do not work in nursing appear to be an important target group.

Figure 3 shows the whole distribution of labour supply elasticities for the different wage and income changes described before, rather than just the average elasticities as shown in Table 5. We observe that each individual in the data set has a negative labour supply elasticity with respect to net non-labour income, and a positive elasticity with respect to wages, be it nursing wages, non-nursing wages or both. The picture gets somewhat more complicated if we look at the elasticity of labour supply *in nursing jobs only*: while the vast majority of nursing qualification holders in the dataset decrease their expected hours in nursing when other net income increases, a small proportion will *increase* their labour supply in nursing. These are individuals who currently work in non-nursing jobs and decide to change the occupation due to an increase in other net income, in most cases into regular day shifts. Likewise, an increase in wages regardless of the occupation, i.e. an overall wage growth in real terms, leads to an increase in labour supply in nursing for most qualification holders as expected, although a small group will exit nursing and enter other occupations in response to such an economic development. If wages are increased in nursing occupations only, an incentive is provided to increase working hours in nursing jobs unambiguously. Of course, the reverse pattern is found if wages grow in competing jobs.

4.2.3. Labour Supply Elasticity With Respect to Wages in Certain Shift Types

To examine whether and to what extent a shortage in nurses' labour supply in a particular shift type could be addressed by a wage increase in that particular shift type, we ran three additional simulations: hourly gross wages in a given shift type were increased by 1%, holding wages constant for all other work patterns, non-nursing jobs and other household income constant. The results are presented in the three last columns of Table 5. In each case, as one would expect, the probability of working in the now higher-paid shift type increases, while the probabilities of working in any other work arrangement and of non-employment decrease. This effect is substantially smaller for night shifts than for day shifts and irregular shifts, reflecting the previously found higher disutility from work in night shifts. Conditional on shift type, expected working hours increase by about 0.06 to 0.08 hours per week, which translates into a labour supply elasticity of about 0.2. Overall working hours in nursing conditional on working in nursing increase by only about 0.1% in case of a 1% wage increase for day shifts and irregular shifts, and stay almost unchanged when wages for night shifts are increased. However, when changes in the probability of working in a specific shift type are taken into account, labour supply elasticities range between 0.14 (night shifts) and 0.77 (irregular shifts). Again, this demonstrates i) the higher responsiveness of the participation decision over the hours decision, and ii) the higher disutility of work in night shifts that results in smaller responses of labour supply behaviour resulting from a given wage increase. Our result is in line with Di Tommaso et al. (2009), who find that increasing wages lead to substantial shifts of labour supply between job types.

4.2.4. Heterogeneity in Nurses' Labour Supply Elasticities

We estimated two additional specifications: one alternative includes income and hours worked as in the base model, but additionally allows the coefficients on the linear terms to vary by age, presence of young children below age 5, presence of a partner, and educational degree. The second alternative specification also includes interactions of the linear terms of income and hours with the five personality variables. This allows the preferences for income and for hours of work in the different job types to vary by individual characteristics of the nursing qualification holders. Table 6 shows the coefficients of the additional interaction terms. Almost none of them appear to be individually significant at the five-percent level. However, when tested jointly, the presence of children, age and education appear to be highly significant. This implies that the optimal choice of labour supply, as well as the response of labour supply to changes in wages and income, varies with personal characteristics. When

personality variables are also included, we find a significant effect of openness and extroversion on the utility from income and disutility from work.

The elasticities of labour supply with respect to income and with respect to nurses' wages respectively are shown in Table 7 and Table 8 for eight subgroups. Although the standard errors are, again, large and thus none of the elasticities are significantly different from each other across groups, some interesting patterns are found. First, considerable difference in responses to increased non-labour income can be seen for nurses with and without children. While nursing qualification holders without children will increase the probability of supplying labour in day shifts along with the probability of quitting work, nursing qualification holders with children are expected to increase their probability of non-employment by a larger amount. Consequently, the elasticity of working hours in nursing and overall working hours is nearly twice as high for individuals with children compared to their childless counterparts. The reverse is true for the response to increased wages. Childless nursing qualification holders increase their expected working hours in nursing by nearly twice as much as nursing qualification holders with children, and the corresponding labour supply elasticity is 1.6 for those without children, and only 0.8 for those with children. As the total response to a wage increase consists of the sum of the negative income effect and the positive substitution effect, the stronger, negative income elasticity of nursing qualification holders contributes to their lower wage responsiveness.

The second columns of Table 7 and Table 8 show the income elasticity and wage elasticity by educational level. Highly qualified nurses respond less to wage incentives than lower-qualified nurses, although their responsiveness to other income is comparable. This might be due to higher intrinsic rewards from work for nurses who work in higher positions. For lower-qualified nurses, the probability of non-employment decreases particularly strongly when the nursing wage increases, while their response with respect to employment in other occupations is comparable to that of highly qualified nurses. This might reflect a generally weaker labour market attachment of individuals with a lower qualification level. When we examine differences in the wage elasticity, a similar pattern is found for older vs. younger nurses: for older nurses, the probability of being non-employed or being employed in another occupation is much more responsive to a given wage increase than for younger nurses, which is (considering that their responsiveness to other income is comparable) in line with a weaker labour market attachment of the older population.

5. Conclusions

We have estimated a structural model of labour supply for nursing qualification holders that distinguishes explicitly between working in different shift types and in different occupations. The responsiveness of nursing qualification holders with respect to wages in nursing jobs appears to be higher than previous research suggested, which is mainly driven by the decision to enter and exit the occupation rather than by changes in the number of hours worked. Wage increases for non-nursing jobs are expected to draw individuals out of nursing occupations to almost the same extent as increases in nursing wages might attract nursing qualification holders, who currently work in another occupation, back to nursing. Our results thus suggest that it is crucial to include nursing qualification holders who currently do not work in the occupation into the analysis, and that they may be an important group to target from a policy perspective. Furthermore, we find that changes in wages for certain shift types result in considerable shifts in labour supply between shift patterns, which is in line with previous research. Working in regular night shifts causes substantially higher disutility than working in other shift arrangements. Consequently, the response to wage increases for this shift type is much lower, and a given increase in wages is likely to cause a smaller increase in labour supply than in other shift types.

We have further explored the relation between labour supply and family circumstances and personality traits. Consistent with our expectations, personality appears to have a considerable impact on labour market behaviour, in particular for the personality dimension "openness to new experiences". Descriptive analysis suggests moreover that family circumstances have a rather complex impact on labour market behaviour, i.e. it is the interplay between several dimensions of the family situation – the presence of children and a partner, the partner's income, education and employment status – that influences the labour supply decision of nursing qualification holders. The small sample size did not allow us to verify these findings in the structural estimations. However, comparing wage and income elasticities for different groups of nurses, shows that wage elasticities are higher for low qualified, older and childless nursing qualification holders. At the same time, available non-labour income plays a particularly important role for nursing qualification holders with young children.

References

Antonazzo, E., Scott, A., Skatun, D. and Elliot, R. (2003), 'The labour market for nursing: a review of the labour supply literature', *Health Economics* 12(), 465–78.

Askildsen, J., Baltagi B. and T. Holmas (2003), 'Wage Policy in the health care sector: a panel data analysis of nurses' labour supply', *Health Economics* 12, 705-719.

Ault, D. and Rutman, G. (1994), 'On selecting a measure of labour activity: evidence from registered nurses, 1981 and 1989', *Applied Economics* 26(), 851–63.

Australian Health Workforce Advisory Committee (2004), 'The Australian Nursing Workforce – An Overview of Workforce Planning 2001-2004', AHWAC Report 2004.2, Sydney.

Australian Institute of Health and Welfare (2008), 'Nursing and midwifery labour force 2005', *National health labour force series* No. 39, AIHW, Canberra.

Benham, L. (1971), 'The labor market for registered nurses: a three-equation model', *Review of Economics and Statistics*, 53(3), 246–52.

Birch, E., (2005), 'Studies of the Labour Supply of Australian Women: What have we Learned?', *Economic Record*, 81(252), pp. 65-84.

Blundell, R. and MaCurdy, T. (1999), 'Labor supply: a review of alternative approaches', in *Handbook of Labor Economics*, Vol. 3 (ed. by O.C. Ashenfelter and D. Card), 1559-1695, Amsterdam: North-Holland.

Chiha, Y. and Link, C. (2003), 'The shortage of registered nurses and some new estimates of the effects of wages on registered nurses labour supply: a look at the past and a preview of the 21st century', *Health Policy* 64(), 349–75.

Clark, A. (2001), 'What really matters in a job? Hedonic measurement using quit data', *Labour Economics* 8(), 223–42.

Di Tommaso M., Strom, S. and E. Saether (2009), 'Nurses wanted: Is the job too harsh or is the wage too low?' *Journal of Health Economics* 28, 748-4757.

Dockery, A.M. and Barns, A. (2005), 'Who'd be a Nurse? Some Evidence on Career Choice in Australia', *Australian Bulletin of Labour* 31(4), 350-383.

Hotz, V.J. and Scholz, J.K. (2003), 'The earned income tax credit', in *Means-Tested Transfer Programs in the United States* (ed. by R. Moffitt), 141-197, Chicago: The University of Chicago Press.

Kalb, G. (2010), 'Modelling Labour Supply Responses in Australia and New Zealand', Chapter 8 in I. Claus, N. Gemmell, M. Harding, and D. White (eds.) *Tax Reform in Open Economies: International and Country Perspectives*, 166-193, Cheltenham: Edward Elgar.

Killingsworth, M.R. (1983), *Labor Supply*, Cambridge University Press: New York.

Lagarde, M. and D. Blaauw (2009), 'A review of the application and contribution of discrete choice experiments to inform human resources policy interventions' *Human Resources and Health* 7:62.

Lagarde, M. (2010), 'Choosing to care: the determinants of nurses' job preferences in South Africa', Health Services Research Unit, London School of Hygiene and Tropical Medicine. London, University of London. PhD (unpublished manuscript).

Link, C. (1992), 'Labour supply behavior of registered nurses', *Research in Labor Economics* 13(), 287–320.

Link, C. and Settle, R. (1979), 'Labour supply responses of married professional nurses: new evidence', *Southern Economic Journal* 41(2), 649–56.

Link, C. and Settle, R. (1981a), 'Wage incentives and married professional nurses: a case of backward bending supply?', *Economic Inquiry* 19(), 144–56.

Link, C. and Settle, R. (1981b), 'A simultaneous-equation model of labor supply, fertility and earnings of married women: the case of registered nurses', *Southern Economic Journal* 47(4), 977–88.

Link, C. and Settle, R. (1985), 'Labour supply responses of licensed practical nurses: a partial solution to a nurse shortage', *Journal of Economics and Business* 37(), 49–57.

McCrae, R. (1993), 'Moderated Analysis of Longitudinal Personality Stability', *Journal of Personality and Social Psychology* 65(3), 577-585.

Munasinghe L., Reif, T. and Henriques, A. (2008), 'Gender gap in wage returns to job tenure and experience', *Labour Economics* 15(), 1296- 1316.

Phillips, V. (1995), 'Participation, hours of work and discontinuities in the supply function', *Journal of Health Economics* 14(), 567-582.

Rice, N. (2005), 'The labour supply of nurses in the UK: evidence from the British Household Panel Study', *HEDG Working Paper 05/10*, York.

Shields, M. (2004), 'Addressing Nurse Shortages: What Can Policy Makers Learn From The Econometric Evidence On Nurse Labour Supply? *The Economic Journal* 114(), F464-F498.

Shields, M. and Ward, M. (2001), 'Improving nurse retention in the National Health Service in England: the impact of job satisfaction in intentions to quit', *Journal of Health Economics* 20(), 677–701.

Skatun, D., E. Antonazzo, A. Scott and R. Elliott (2005), 'The supply of qualified nurses: a classical model of labour supply', *Applied Economics* 37(), 57-65.

Sloan, F. and Richupan, S. (1975), 'Short-run supply responses of professional nurses: a microanalysis', *Journal of Human Resources* 10(2), 241–57.

Spielberger, C. (2004), ed., '*Encyclopedia of Applied Psychology'*, Elsevier Academic Press: Oxford.

Soldz, S. and G. Vaillant (1999), 'The Big Five Personality Traits and the Life Course: A 45 Year Longitudinal Study', Journal of Research in Personality 33(), 208-232.

Van Soest, A. (1995), ' Structural Models of Family Labor Supply: A Discrete Choice Approach', *The Journal of Human Resources* 30(1), 63-88.

Table 1 Descriptive Statistics

	Nursing qualification holders	Working in nursing occupations
	Mean (Std. Dev.)	
Female	90.7%	91.5%
Age (in years)	44.93 (10.82)	42.35 (10.55)
Holds a Bachelor Degree	19.2%	27.0%
Number of Hours Worked Per Week	25.74 (17.37)	31.83 (11.12)
Family Situation		
Has Child <=4 Years	10.4%	12.0%
Has Partner	68.0%	67.9%
Has Child <=4 Years and No Partner	1.9%	2.0%
If Partner		
Partner is Employed	81.8%	88.3%
Partner's Annual Net Income (in 10,000 AUD)	4.74 (3.09)	4.80 (2.97)
Partner Holds a Bachelor Degree	39.5%	41.2%
Personality Variables (scale 0-7)		
Extroversion	4.56 (1.08)	4.56 (1.03)
Emotional Stability	5.23 (1.06)	5.15 (1.03)
Agreeableness	5.68 (0.77)	5.70 (0.75)
Openness to New Experiences	4.28 (0.98)	4.13 (0.94)
Conscientiousness	5.29 (1.01)	5.25 (1.03)
Social Relationships		
Satisfaction with Relationship to Partner (0: completely dissatisfied-10: completely satisfied)	8.02 (1.71)	7.97 (1.70)
Often Needs Help But Can't Get It (0: Strongly Disagree, 7: Strongly Agree)	2.32 (1.49)	2.32 (1.44)
# person-year observations	3974	
# p-y obs., not employed	856	
# p-y obs., employed in non-nursing	1076	
# p-y obs., employed in nursing, <38hrs/week	1266	
# p-y obs., employed in nursing, >=38hrs/week	776	
# person observations	696	
# p obs., not employed	260	
# p obs., employed in non-nursing	293	
# p obs., employed in nursing, <38hrs/week	367	
# p obs., employed in nursing, >=38hrs/week	259	
# person-year observations		2042
# p-y obs., day shifts		643
# p-y obs., night shifts		242
# p-y obs., irregular shifts		1157
# person observations		474
# p obs., day shifts		234
# p obs., night shifts		98
# p obs., irregular shifts		343

Table 2 Probability of Employment Type in Nursing: Multinomial Logit Model

Variable	No Employment			Other Occupation			Part-Time Nursing			Full-Time Nursing		
	Marg. Eff.	Std. Err.		Marg. Eff.	Std. Err.		Marg. Eff.	Std. Err.		Marg. Eff.	Std. Err.	
is female	-0.022	0.055		-0.028	0.063		0.168	0.046	**	-0.118	0.057	*
age	0.080	0.015	**	0.005	0.014		-0.061	0.015	**	-0.025	0.012	*
holds a bachelor degree	-0.126	0.028	**	-0.065	0.045		0.027	0.041		0.165	0.040	**
Family Situation												
has partner	0.094	0.035	**	-0.085	0.051	°	0.008	0.056		-0.017	0.039	
partner is employed	-0.268	0.039	**	0.149	0.040	**	0.095	0.047	*	0.024	0.032	
has child <=4 years	0.047	0.040		-0.030	0.040		0.068	0.040	°	-0.085	0.026	**
Marginal Effect of child if…												
no partner	0.010	0.109		0.045	0.093		0.114	0.088		-0.168	0.040	**
non-employed partner	0.074	0.088		0.021	0.088		-0.126	0.089		0.031	0.092	
employed partner	0.067	0.046		-0.109	0.056	°	0.052	0.055		-0.010	0.060	
partner's annual net income (in 10,000 AUD)	0.023	0.006	**	-0.013	0.008	°	0.001	0.006		-0.011	0.006	°
Marginal effect of partners' income if…												
does not have child <= 4 years	0.021	0.006	**	-0.012	0.008		0.000	0.006		-0.008	0.006	
has child <=4 years	0.042	0.010	**	-0.027	0.017		0.013	0.015		-0.029	0.015	°
partner holds a bachelor degree	-0.045	0.031		0.029	0.044		0.011	0.043		0.004	0.037	
Personality Variables (0=lower 50%-Quantile, 1=upper 50%-Quantile)												
Extroversion	-0.052	0.028	°	0.048	0.035		0.006	0.036		-0.002	0.027	
Emotional Stability	0.009	0.031		0.051	0.037		-0.024	0.036		-0.036	0.029	
Agreeableness	-0.018	0.031		-0.018	0.037		0.008	0.037		0.028	0.028	
Openness to New Experiences	0.057	0.028	*	0.053	0.035		-0.026	0.034		-0.083	0.028	**
Conscientiousness	0.011	0.029		-0.010	0.037		0.002	0.036		-0.003	0.027	
Social Relationships (0=lower 50%-Quantile, 1=upper 50%-Quantile)												
Satisfaction with Relationship to Partner	0.029	0.020		0.016	0.030		-0.021	0.028		-0.024	0.024	
Feels Lack of Support when Needed	0.015	0.023		-0.013	0.023		0.038	0.027		-0.040	0.020	*

Information on Estimation Model:	
# person-year observations	3331
# person observations	491
log-Likelihood	-4083.80
Wald-Test of Model Significance ($\chi 2$ (dF))	258.62 (57)

Wald-Tests of Joint Significance	$\chi2$ (dF)	p-value			$\chi2$ (dF)	p-value		$\chi2$ (dF)	p-value	
Family Situation	66.62 (8)	0.000	**	Base outcome	13.77 (8)	0.088	°	9.10 (8)	0.334	
Personality Variables	6.08 (5)	0.299			4.73 (5)	0.450		10.96 (5)	0.052	°
Social Relationships	0.95 (2)	0.621			2.07 (2)	0.355		1.96 (2)	0.375	

*Notes: **, * and ° indicate statistical significance at the 1, 5 and 10 percent level. The standard errors were calculated using the Delta-method.*

Table 3 Probability of Shift type in Nursing, Multinomial Logit Model, Marginal Effects

	Day Shift			Night Shift			Irregular Shift		
Variable	Marg. Eff.	Std. Err.		Marg. Eff.	Std. Err.		Marg. Eff.	Std. Err.	
is female	0.011	0.090		0.059	0.045		-0.071	0.091	
age	0.015	0.019		0.029	0.016	°	-0.044	0.021	*
holds a bachelor degree	-0.041	0.047		-0.039	0.031		0.079	0.050	
Family Situation									
has partner	-0.006	0.072		-0.007	0.039		0.013	0.073	
partner is employed	-0.003	0.067		-0.057	0.047		0.060	0.064	
has child <=4 years	0.018	0.047		0.078	0.045	°	-0.096	0.047	*
Marginal Effect of child if…									
no partner	0.143	0.154		0.217	0.155		-0.359	0.084	**
non-employed partner	-0.137	0.143		-0.229	0.062	**	0.366	0.142	**
employed partner	-0.036	0.046		0.041	0.046		-0.005	0.055	
partner's annual net income (in 10,000 AUD)	0.013	0.007	°	0.001	0.007		-0.015	0.007	*
Marginal effect of partners' income if…									
does not have child <= 4 years	0.013	0.008	°	0.000	0.007		-0.012	0.007	°
has child <=4 years	0.014	0.018		0.015	0.020		-0.029	0.019	
partner holds a bachelor degree	0.030	0.053		-0.028	0.041		-0.002	0.054	
Personality Variables (0=lower 50%-Quantile, 1=upper 50%-Quantile)									
Extroversion	0.082	0.045	°	-0.028	0.034		-0.054	0.046	
Emotional Stability	-0.031	0.045		0.038	0.038		-0.006	0.047	
Agreeableness	0.055	0.046		0.012	0.035		-0.067	0.047	
Openness to New Experiences	-0.115	0.043	**	-0.008	0.034		0.123	0.045	**
Conscientiousness	0.008	0.044		-0.026	0.036		0.018	0.046	
Social Relationships									
Satisfaction with Relationship to Partner	-0.007	0.039		0.018	0.029		-0.011	0.039	
Feels Lack of Support when Needed	-0.019	0.032		0.023	0.024		-0.004	0.034	
				Information on Estimation Model:					
# observations				1742					
# person observations				349					
log-Likelihood				-1553.00					
Wald-Test of Model Significance (χ2 (dF))				1004.39 (38)					
Wald-Tests of Joint Significance	Base outcome			χ2 (dF)	p-value		χ2 (dF)	p-value	

Family Situation	137.93 (8)	0.000	**	13.62 (8)	0.092	°
Personality Variables	3.58 (5)	0.612		14.16 (5)	0.015	*
Social Relationships	1.25 (2)	0.535		0.12 (2)	0.942	

*Notes: **, * and ° indicate statistical significance at the 1, 5 and 10 percent level. The standard errors were calculated using the Delta-method.*

Table 4 Structural Model of Labour Supply, Estimation of Utility Function

Model (1)

U=F(B)=F(w, h, hn, hi)

Coefficients			
Variable	**Coeff.**	**Std. Err.**	
income (weekly net income in 1,000 AUD)	6.976	0.854	**
income^2	-0.747	0.365	*
hours (non-nursing)	-0.237	0.021	**
hours (non-nursing)^2	0.002	0.000	**
income * hours (non-nursing)	0.015	0.016	
hours (day)	-0.211	0.017	**
hours (day)^2	0.002	0.000	**
income* hours (day)	0.014	0.011	
hours (night)	-0.256	0.025	**
hours (night)^2	0.002	0.000	**
income* hours (night)	0.011	0.019	
hours (irregular)	-0.162	0.018	**
hours (irregular)^2	0.001	0.000	**
income* hours (irregular)	0.003	0.013	
# observations	3972		
# person observations	696		
log-Likelihood	-9045.12		
Wald-Test of Model Significance (χ2 (dF))	505.44 (14)		
Marginal Effects			
Variable	**Marg. Eff.**	**Std. Err.**	
income	5.049	0.484	**
hours (non-nursing)	-0.183	0.014	**
hours (day)	-0.161	0.012	**
hours (night)	-0.206	0.015	**
hours (irregular)	-0.136	0.011	**

*Notes: **, * and ° indicate statistical significance at the 1, 5 and 10 percent level.*

Table 5 Predicted Changes in Probability of Shift type and Expected Working Hours for Changes in Income and Wages

	Increase in other net income by 1%			Increase in gross wage for all occupations by 1%			Increase in gross wage for nursing occupations by 1%			Increase in gross wage for non-nursing occupations by 1%		
	Pred.	Std. Err.		Pred.	Std. Err.		Pred.	Std. Err.		Pred.	Std. Err.	
Δ Prob (No Employment) (in %-points)	0.062	0.012	**	-0.373	0.047	**	-0.218	0.028	**	-0.159	0.023	**
Δ Prob (Day Shift) (in %-points)	0.010	0.008		0.041	0.013	**	0.183	0.025	**	-0.142	0.020	**
Δ Prob (Night Shift) (in %-points)	-0.001	0.007		0.008	0.009		0.067	0.012	**	-0.058	0.010	**
Δ Prob (Irregular Shift) (in %-points)	-0.041	0.009	**	0.043	0.021	*	0.321	0.043	**	-0.279	0.037	**
Δ Prob (Other Occupation) (in %-points)	-0.030	0.010	**	0.281	0.036	**	-0.353	0.043	**	0.638	0.075	**
Δ E(Hours in Day Shift| Day Shift)	-0.007	0.003	*	0.078	0.009	**	0.078	0.009	**	0.0	0.0	
Δ E(Hours in Night Shift| Night Shift)	-0.011	0.006	°	0.078	0.012	**	0.078	0.012	**	0.0	0.0	
Δ E(Hours in Irregular Shift| Irregular Shift)	-0.016	0.003	**	0.066	0.009	**	0.066	0.009	**	0.0	0.0	
Δ E(Hours in Other Occupation| Other Occupation)	-0.012	0.003	**	0.084	0.011	**	0.0	0.0		0.084	0.011	**
Elasticity (Hours in Day Shift| Day Shift)	-0.021	0.010	*	0.245	0.029	**	0.245	0.029	**	0.0	0.0	
Elasticity (Hours in Night Shift| Night Shift)	-0.038	0.025		0.268	0.042	**	0.268	0.042	**	0.0	0.0	
Elasticity (Hours in Irregular Shift| Irregular Shift)	-0.051	0.011	**	0.205	0.030	**	0.205	0.030	**	0.0	0.0	
Elasticity (Hours in Other Occupation| Other Occupation)	-0.036	0.010	**	0.252	0.037	**	0.0	0.0		0.252	0.037	**
Δ E(Hours in Nursing Occupation| Nursing Occupation)	-0.012	0.003	**	0.072	0.009	**	0.072	0.009	**	0.0	0.0	
Elasticity (Hours in Nursing Occupation| Nursing Occupation)	-0.037	0.010	**	0.226	0.029	**	0.226	0.029	**	0.0	0.0	
Δ E(Hours in Nursing Occupation)	-0.016	0.005	**	0.066	0.012	**	0.222	0.026	**	-0.156	0.020	**
Elasticity (Hours in Nursing Occupation)	-0.100	0.038	**	0.396	0.075	**	1.332	0.169	**	-0.935	0.130	**
Δ E(Total Hours)	-0.029	0.005	**	0.184	0.022	**	0.100	0.014	**	0.087	0.012	**
Elasticity of Total Hours	-0.124	0.028	**	0.741	0.104	**	0.401	0.062	**	0.348	0.057	**

Table 5 – continued

	Increase in gross wage (day shifts) by 1%			Increase in gross wage (night shifts) by 1%			Increase in gross wage (irregular shifts) by 1%		
	Pred.	Std. Err.		Pred.	Std. Err.		Pred.	Std. Err.	
Δ Prob (No Employment) (in %-points)	-0.071	0.011	**	-0.026	0.005	**	-0.122	0.018	**
Δ Prob (Day Shift) (in %-points)	0.338	0.046	**	-0.027	0.004	**	-0.126	0.021	**
Δ Prob (Night Shift) (in %-points)	-0.028	0.005	**	0.148	0.022	**	-0.052	0.009	**
Δ Prob (Irregular Shift) (in %-points)	-0.131	0.022	**	-0.052	0.009	**	0.505	0.065	**
Δ Prob (Other Occupation) (in %-points)	-0.108	0.015	**	-0.043	0.007	**	-0.205	0.029	**
Δ E(Hours in Day Shift| Day Shift)	0.078	0.009	**	0.0	0.0		0.0	0.0	
Δ E(Hours in Night Shift| Night Shift)	0.0	0.0		0.078	0.012	**	0.0	0.0	
Δ E(Hours in Irregular Shift| Irregular Shift)	0.0	0.0		0.0	0.0		0.066	0.009	**
Δ E(Hours in Other Occupation| Other Occupation)	0.0	0.0		0.0	0.0		0.0	0.0	
Elasticity (Hours in Day Shift| Day Shift)	0.245	0.029	**	0.0	0.0		0.0	0.0	
Elasticity (Hours in Night Shift| Night Shift)	0.0	0.0		0.268	0.042	**	0.0	0.0	
Elasticity (Hours in Irregular Shift| Irregular Shift)	0.0	0.0		0.0	0.0		0.205	0.030	**
Elasticity (Hours in Other Occupation| Other Occupation)	0.0	0.0		0.0	0.0		0.0	0.0	
Δ E(Hours in Nursing Occupation| Nursing Occupation)	0.027	0.006	**	0.002	0.003		0.044	0.008	**
Elasticity (Hours in Nursing Occupation| Nursing Occupation)	0.085	0.018	**	0.006	0.010		0.138	0.025	**
Δ E(Hours in Nursing Occupation)	0.072	0.010	**	0.023	0.004	**	0.129	0.017	**
Elasticity (Hours in Nursing Occupation)	0.432	0.065	**	0.138	0.027	**	0.772	0.114	**
Δ E(Total Hours)	0.034	0.006	**	0.008	0.002	**	0.058	0.009	**
Elasticity of Total Hours	0.139	0.026	**	0.034	0.010	**	0.231	0.041	**

*Notes: **, * and ° indicate statistical significance at the 1, 5 and 10 percent level. The standard errors were bootstrapped with 100 draws from the original sample. All predictions are based on the Model presented in Table 4.*

Table 6 Structural Model of Labour Supply, Estimation of Utility Function by Groups

Model (2)				Model (3)		
U= F(Income, Hours(non-nursing), Hours(day), Hours(night), Hours(irregular), Age, Children, Partner, Bachelor Degree)				U= F(Income, Hours(non-nursing), Hours(day), Hours(night), Hours(irregular), Age, Children, Partner, Bachelor Degree, 5 Personality Variables)		
Variable	**Coeff.**	**Std. Err.**		**Variable**	**Coeff.**	**Std. Err.**
Model (1), as in Table 4, plus Interactions:				**Model (2), plus Interactions:**		
Income times ...				*Income times ...*		
Age (1=upper 50%-Quantile)	4.109	1.196	**	Extroversion (1=upper 50%-Quantile)	1.116	1.003
Children <=4 years (1=yes)	-0.878	1.130		Openness (1=upper 50%-Quantile)	-0.408	0.998
Has Partner (1=yes)	0.746	1.279		Agreeableness (1=upper 50%-Quantile)	-0.013	1.010
Holds Bachelor Degree (1=yes)	-0.243	1.252		Conscientiousness (1=upper 50%-Quantile)	1.241	1.035
Hours(non-nursing) times ...				Emotional Stability (1=upper 50%-Quantile)	-0.644	1.017
Age (1=upper 50%-Quantile)	-0.101	0.025	**	*Hours(non-nursing) times ...*		
Children <=4 years (1=yes)	-0.006	0.025		Extroversion (1=upper 50%-Quantile)	-0.006	0.019
Has Partner (1=yes)	-0.019	0.026		Openness (1=upper 50%-Quantile)	0.003	0.019
Holds Bachelor Degree (1=yes)	0.011	0.031		Agreeableness (1=upper 50%-Quantile)	0.010	0.019
Hours(day) times...				Conscientiousness (1=upper 50%-Quantile)	-0.028	0.020
Age (1=upper 50%-Quantile)	-0.090	0.019	**	Emotional Stability (1=upper 50%-Quantile)	0.006	0.019
Children <=4 years (1=yes)	-0.002	0.018		*Hours(day) times ...*		
Has Partner (1=yes)	-0.018	0.018		Extroversion (1=upper 50%-Quantile)	0.003	0.018
Holds Bachelor Degree (1=yes)	0.023	0.022		Openness (1=upper 50%-Quantile)	-0.026	0.019
Hours(night) times...				Agreeableness (1=upper 50%-Quantile)	0.018	0.018
Age (1=upper 50%-Quantile)	-0.104	0.021	**	Conscientiousness (1=upper 50%-Quantile)	-0.026	0.019
Children <=4 years (1=yes)	-0.010	0.019		Emotional Stability (1=upper 50%-Quantile)	-0.006	0.018
Has Partner (1=yes)	-0.016	0.020		*Hours(night) times ...*		
Holds Bachelor Degree (1=yes)	0.037	0.023		Extroversion (1=upper 50%-Quantile)	-0.020	0.022
Hours(irregular) times...				Openness (1=upper 50%-Quantile)	-0.019	0.020
Age (1=upper 50%-Quantile)	-0.093	0.025	**	Agreeableness (1=upper 50%-Quantile)	-0.001	0.020
Children <=4 years (1=yes)	0.007	0.022		Conscientiousness (1=upper 50%-Quantile)	-0.034	0.022
Has Partner (1=yes)	-0.015	0.026		Emotional Stability (1=upper 50%-Quantile)	0.016	0.022
Holds Bachelor Degree (1=yes)	0.013	0.027		*Hours(irregular) times ...*		
				Extroversion (1=upper 50%-Quantile)	-0.009	0.018

				Openness (1=upper 50%-Quantile)	-0.015	0.018	
				Agreeableness (1=upper 50%-Quantile)	0.002	0.018	
				Conscientiousness (1=upper 50%-Quantile)	-0.026	0.019	
				Emotional Stability (1=upper 50%-Quantile)	0.003	0.018	
Wald-Tests of Joint Significance	**χ2 (dF)**	**p-value**		**Wald-Tests of Joint Significance**	**χ2 (dF)**	**p-value**	
Interactions: Income, Hours(non-nursing), Hours(day),Hours(night), Hours (irregular) times:...				*Interactions: Income, Hours(non-nursing), Hours(day),Hours(night), Hours (irregular) times:...*			
Age	49.89 (5)	0.000	**	Extroversion (1=upper 50%-Quantile)	14.38 (5)	0.013	*
Children <=4 years	27.72 (5)	0.000	**	Openness (1=upper 50%-Quantile)	30.62 (5)	0.000	**
Has Partner	1.90 (5)	0.863		Agreeableness (1=upper 50%-Quantile)	4.91 (5)	0.427	
Holds Bachelor Degree	31.93 (5)	0.000	**	Conscientiousness (1=upper 50%-Quantile)	5.50 (5)	0.358	
				Emotional Stability (1=upper 50%-Quantile)	0.33 (5)	0.997	

*Notes: **, * and ° indicate statistical significance at the 1, 5 and 10 percent level. The standard errors were bootstrapped with 100 draws from the original sample. Model 2 is estimated on the full sample (3,974 observations). Model (3) is estimated on the sub-sample with non-missing values in the personality variables (3,331 observations).*

Table 7 Predicted Changes in Probability of Shift type and Expected Working Hours for Increase in Other Net Income by 1%

	Children			Bachelor			Age			Openness to New Experiences		
	No			No			Lower 50%-Quantile			Lower 50%-Quantile		
	Pred.	Std. Err.		Pred.	Std. Err.		Pred.	Std. Err.		Pred.	Std. Err.	
Δ Prob (No Employment) (in %-points)	0.054	0.012	**	0.056	0.014	**	0.059	0.014	**	0.064	0.016	**
Δ Prob (Day Shift) (in %-points)	0.013	0.009		0.010	0.008		0.019	0.011	°	0.021	0.012	°
Δ Prob (Night Shift) (in %-points)	-0.002	0.009		-0.002	0.010		0.000	0.011		-0.003	0.012	
Δ Prob (Irregular Shift) (in %-points)	-0.044	0.009	**	-0.039	0.009	**	-0.054	0.012	**	-0.065	0.015	**
Δ Prob (Other Occupation) (in %-points)	-0.022	0.011	°	-0.025	0.011	*	-0.023	0.014	°	-0.016	0.017	
Δ E(Hours in Nursing Occupation)	-0.016	0.005	**	-0.014	0.005	*	-0.018	0.007	**	-0.022	0.007	**
Elasticity (Hours in Nursing Occupation)	-0.100	0.043	*	-0.100	0.050	*	-0.104	0.051	*	-0.133	0.053	*
Δ E(hours)	-0.026	0.005	**	-0.025	0.006	**	-0.029	0.007	**	-0.030	0.007	**
Elasticity of Working hours	-0.109	0.028	**	-0.112	0.033	**	-0.116	0.032	**	-0.126	0.040	**
	Children			Bachelor			Age			Openness to New Experiences		
	Yes			Yes			Upper 50%-Quantile			Upper 50%-Quantile		
	Pred.	Std. Err.		Pred.	Std. Err.		Pred.	Std. Err.		Pred.	Std. Err.	
Δ Prob (No Employment) (in %-points)	0.089	0.025	**	0.065	0.015	**	0.055	0.012	**	0.048	0.012	**
Δ Prob (Day Shift) (in %-points)	0.013	0.013		0.026	0.014	°	0.004	0.007		0.015	0.009	°
Δ Prob (Night Shift) (in %-points)	-0.006	0.015		0.000	0.011		-0.004	0.008		-0.002	0.009	
Δ Prob (Irregular Shift) (in %-points)	-0.068	0.017	**	-0.079	0.017	**	-0.034	0.008	**	-0.049	0.012	**
Δ Prob (Other Occupation) (in %-points)	-0.028	0.013	*	-0.012	0.014		-0.021	0.009	*	-0.012	0.012	
Δ E(Hours in Nursing Occupation)	-0.027	0.010	**	-0.029	0.008	**	-0.014	0.004	**	-0.016	0.005	**
Elasticity (Hours in Nursing Occupation)	-0.167	0.078	*	-0.138	0.044	**	-0.113	0.043	**	-0.102	0.042	*
Δ E(hours)	-0.039	0.010	**	-0.036	0.007	**	-0.023	0.005	**	-0.022	0.005	**
Elasticity of Working hours	-0.183	0.059	**	-0.134	0.034	**	-0.117	0.032	**	-0.096	0.029	**

*Notes: **, * and ° indicate statistical significance at the 1, 5 and 10 percent level. The standard errors were bootstrapped with 100 draws from the original sample. Elasticities by Children, Bachelor Degree and Age are estimated based on Model (2) and the full sample (3,974 observations). Elasticties by openness to new experiences are estimated based on Model (3) and the sub-sample with non-missing values in the personality variables (3,331 observations).*

Table 8 Predicted Changes in Probability of Shift type and Expected Working Hours for 1% Increase in Gross Wages in Nursing

	Children			Bachelor			Age			Openness		
	No			No			Lower 50%-Quantile			Lower 50%-Quantile		
	Coeff.	Std. Err.		Coeff.	Std. Err.		Coeff.	Std. Err.		Coeff.	Std. Err.	
Δ Prob (No Employment) (in %-points)	-0.217	0.027	**	-0.237	0.029	**	-0.150	0.027	**	-0.230	0.036	**
Δ Prob (Day Shift) (in %-points)	0.212	0.036	**	0.217	0.039	**	0.148	0.027	**	0.201	0.041	**
Δ Prob (Night Shift) (in %-points)	0.082	0.016	**	0.089	0.016	**	0.048	0.012	**	0.086	0.018	**
Δ Prob (Irregular Shift) (in %-points)	0.327	0.046	**	0.308	0.045	**	0.246	0.048	**	0.309	0.048	**
Δ Prob (Other Occupation) (in %-points)	-0.405	0.052	**	-0.377	0.051	**	-0.293	0.050	**	-0.367	0.048	**
Δ E(Hours in Nursing Occupation)	0.236	0.028	**	0.227	0.028	**	0.175	0.029	**	0.225	0.030	**
Elasticity (Hours in Nursing Occupation)	1.557	0.203	**	1.623	0.215	**	0.960	0.175	**	1.496	0.208	**
Δ E(hours)	0.095	0.014	**	0.098	0.014	**	0.071	0.014	**	0.099	0.018	**
Elasticity of Working hours	0.407	0.066	**	0.441	0.071	**	0.270	0.056	**	0.443	0.092	**
	Children			Bachelor			Age			Openness to New Experiences		
	Yes			Yes			Upper 50%-Quantile			Upper 50%-Quantile		
	Coeff.	Std. Err.		Coeff.	Std. Err.		Coeff.	Std. Err.		Coeff.	Std. Err.	
Δ Prob (No Employment) (in %-points)	-0.196	0.071	**	-0.124	0.052	*	-0.318	0.044	**	-0.224	0.031	**
Δ Prob (Day Shift) (in %-points)	0.135	0.046	**	0.152	0.045	**	0.294	0.073	**	0.202	0.034	**
Δ Prob (Night Shift) (in %-points)	0.056	0.027	*	0.042	0.019	*	0.129	0.030	**	0.096	0.020	**
Δ Prob (Irregular Shift) (in %-points)	0.149	0.071	*	0.312	0.094	**	0.407	0.065	**	0.345	0.049	**
Δ Prob (Other Occupation) (in %-points)	-0.144	0.060	*	-0.381	0.098	**	-0.512	0.091	**	-0.421	0.050	**
Δ E(Hours in Nursing Occupation)	0.126	0.048	**	0.216	0.057	**	0.304	0.046	**	0.247	0.028	**
Elasticity (Hours in Nursing Occupation)	0.821	0.349	*	0.880	0.277	**	2.305	0.396	**	1.566	0.210	**
Δ E(hours)	0.080	0.030	**	0.077	0.029	**	0.130	0.020	**	0.100	0.015	**
Elasticity of Working hours	0.374	0.156	*	0.245	0.113	*	0.616	0.114	**	0.426	0.076	**

*Notes: **, * and ° indicate statistical significance at the 1, 5 and 10 percent level. The standard errors were bootstrapped with 100 draws from the original sample. Elasticities by Children, Bachelor Degree and Age are estimated based on Model (2) and the full sample (3,974 observations). Elasticties by openness to new experiences are estimated based on Model (3) and the sub-sample with non-missing values in the personality variables (3,331 observations).*

Figure 1 Predicted Probability of Employment Type by Presence of Children, Partner and Partner's Annual Net Income (in AUD)

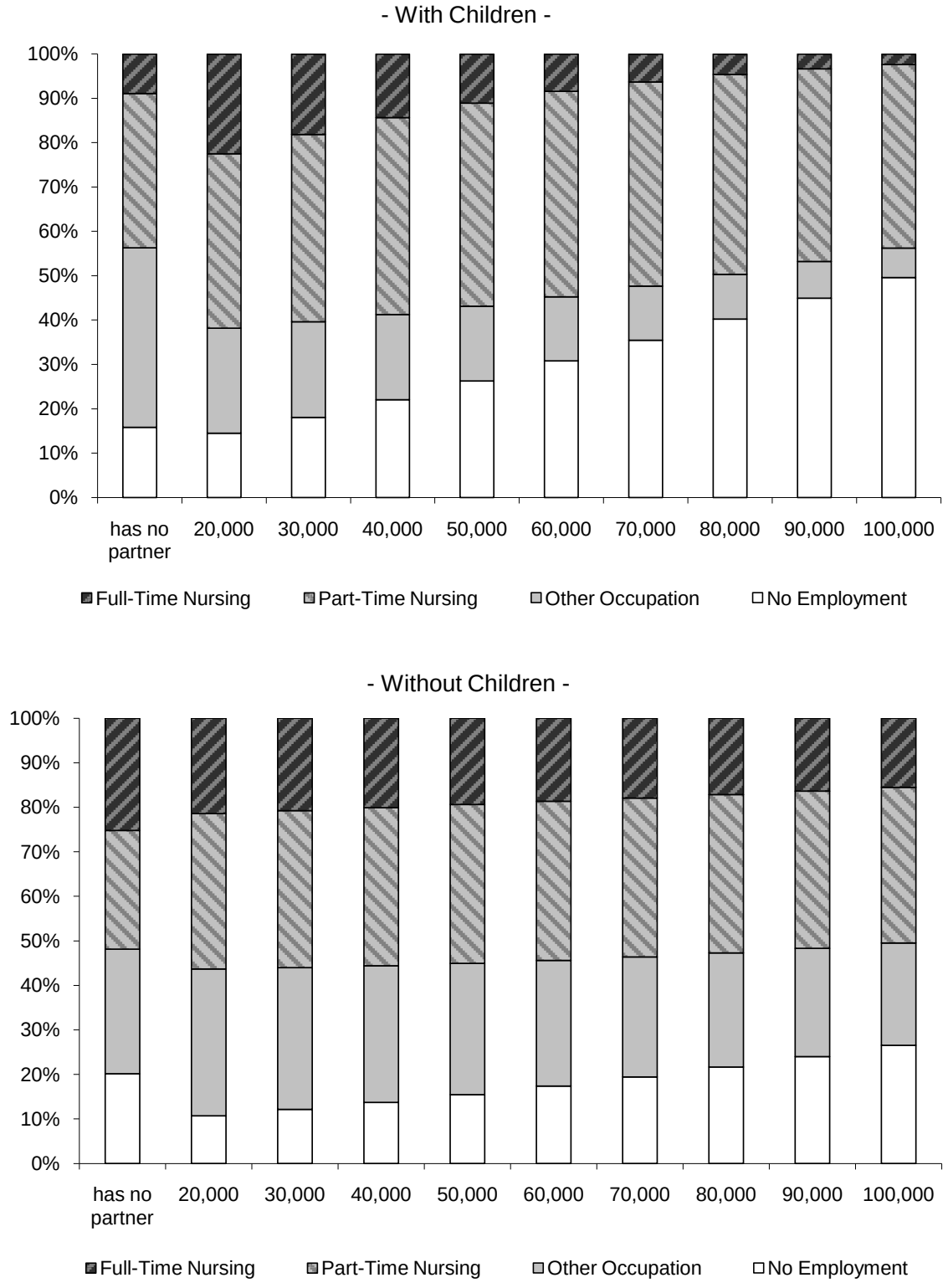

Figure 2 Predicted Probability of Shift type by Presence of Children, Partner and Partner's Annual Net Income (in AUD)

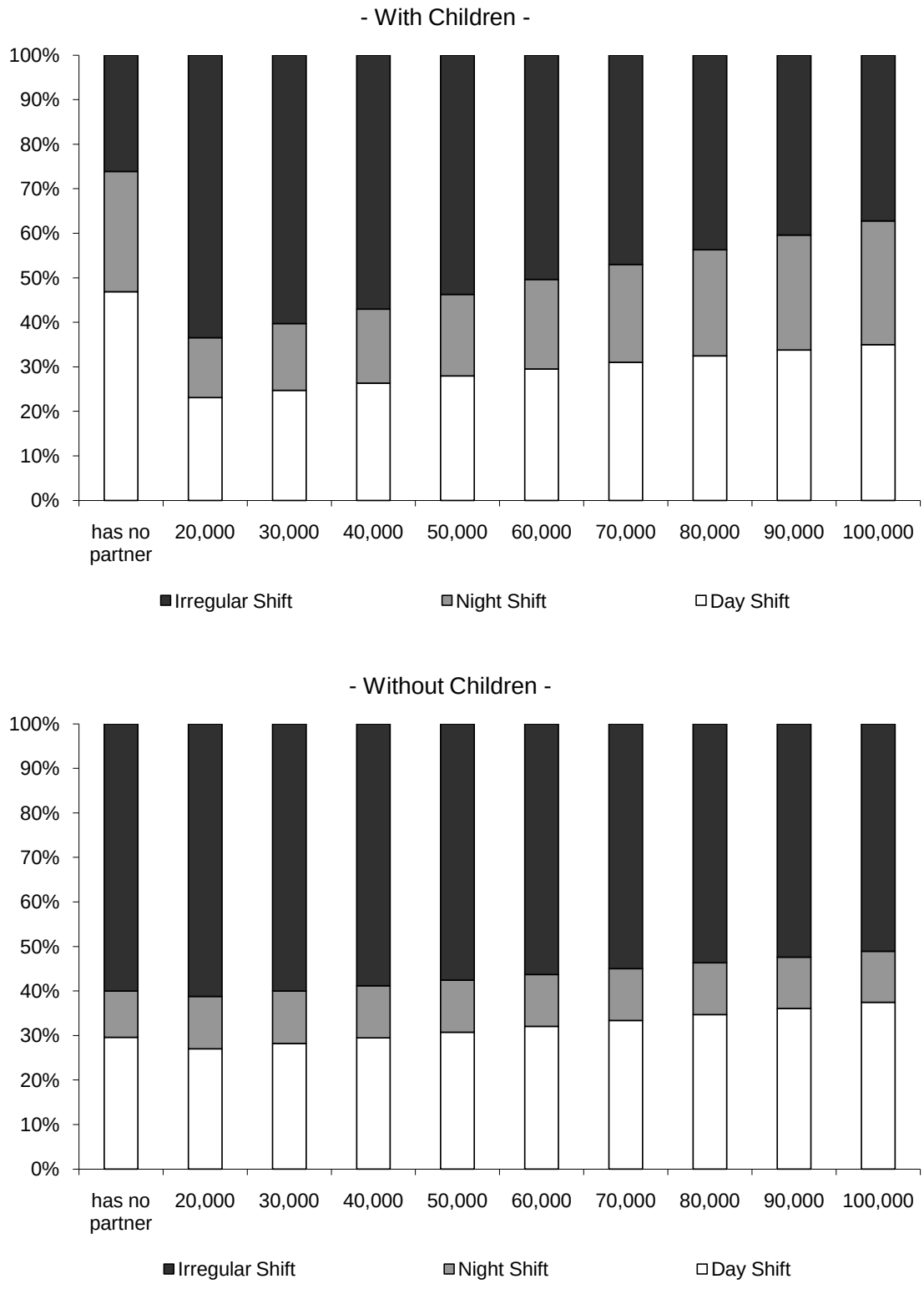

Figure 3 Distribution of Elasticities

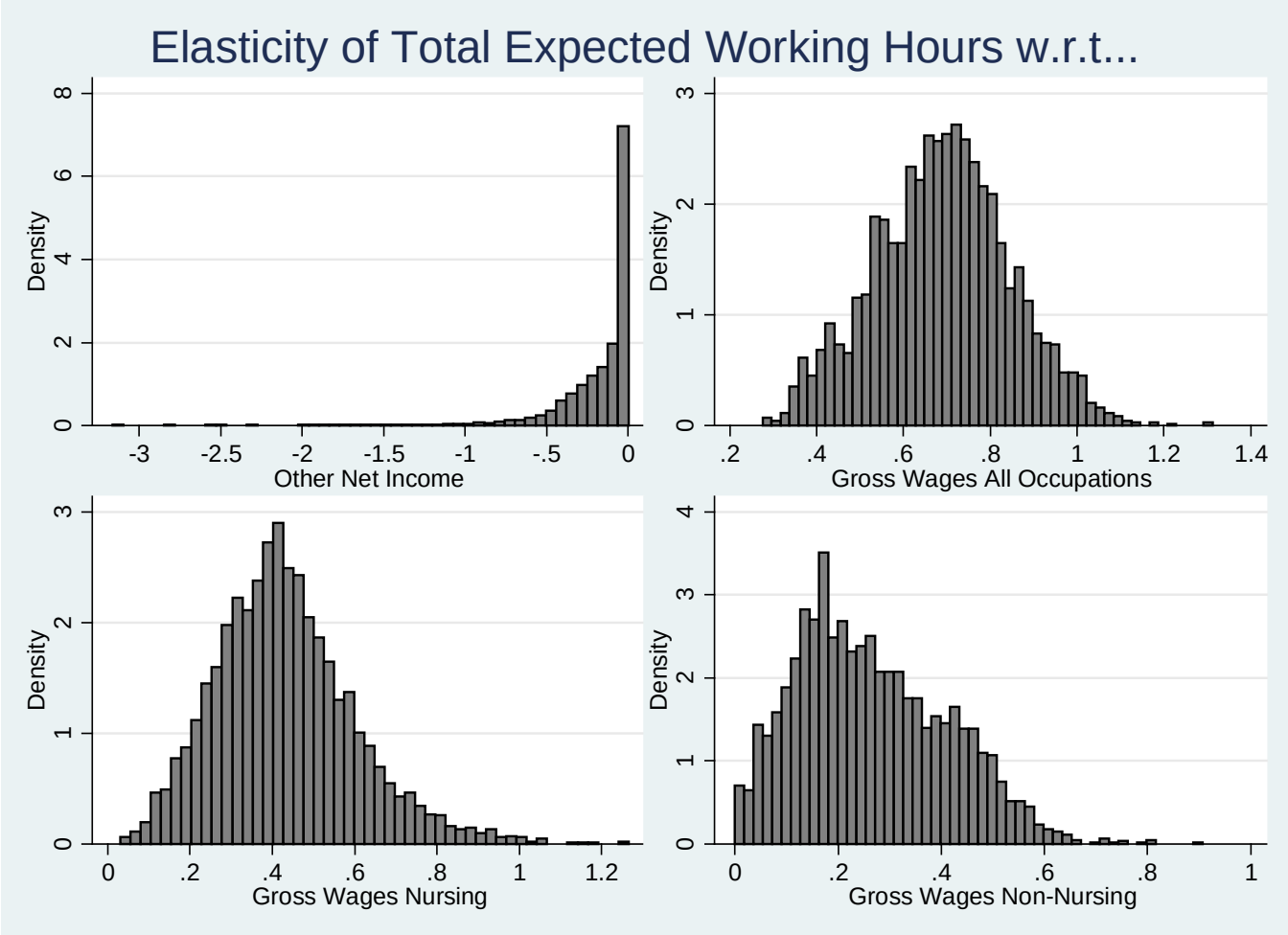

Figure 3 continued