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journal homepage: www.elsevier.com/locate/econbaseNurses' labour supply elasticities: The importance of accounting for extensive margins[☆]Barbara Hanel^{a,*}, Guyonne Kalb^{a,b}, Anthony Scott^a^a Melbourne Institute of Applied Economic and Social Research, The University of Melbourne, Australia^b Institute for the Study of Labor (IZA), Germany

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ABSTRACT

We estimate a multi-sector model of nursing qualification holders' labour supply in different occupations. A structural approach allows us to model the labour force participation decision, the occupational and shift-type choice, and the decision about hours worked as a joint outcome following from maximising a utility function. Disutility from work is allowed to vary by occupation and also by shift type in the utility function. Our results suggest that average wage elasticities might be higher than previous research has found. This is mainly due to the effect of wages on the decision to enter or exit the profession, which was not included in the previous literature, rather than from its effect on increased working hours for those who already work in the profession.

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1. Introduction

Maintaining an adequate supply of nurses is a key ongoing policy issue in many countries. The World Health Organisation (2006) estimated global shortages of health workers of 4.3 million. Shortages are important in the light of evidence, largely from the US, of the impact of the level of nurse staffing on patients' health

outcomes (Lankshear et al., 2005; Kane et al., 2007; Cook et al., 2010). It is clear that shortages are common across many low and high income countries, which means that research on the determinants of nursing labour supply remains a priority. Even where overall shortages are less of an issue, shortages in specific sectors, disease areas, and geographic areas highlight the role of maldistribution. Although the budgetary pressures from the global financial crisis may have reduced demand for nurses employed in the public sector in some countries, the 'need' for health care, and therefore for nurses, continues to grow as the population ages and as developing countries continue to struggle to provide basic health services. Shortages are a long-term issue since labour markets, especially for nurses who work in the public sector, are often slow to adjust to changes in demand and supply conditions partly due to centralised wage bargaining. At the same time, the nursing workforce is also ageing and a high number of 'baby boomer' nurses are leaving the profession as they retire. This trend is aggravated by relatively low numbers of young graduates who enter the profession.

The stock of trained nurses who could in principle work in the profession but are currently not doing so is relatively high. For example in Australia, around 17% of registered or enrolled nurses were not working as nurses in 2005 (Australian Institute of Health and Welfare (AIHW), 2008). Raising wages in order to attract them back to the profession may be one possible option to tackle the

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problem, but increasing wage offers will be an optimal strategy for the demand side of the market (i.e. public and private health care providers) only if the response of the supply side is strong enough. Otherwise, the cost of inducing any substantial change in labour supply will be too high and have an even greater dampening impact on demand. Most previous research suggests that the labour supply elasticity with respect to wage is fairly low among nurses at around 0.3 (see Antonazzo et al., 2003; Shields, 2004 for a review). However, a major drawback of these studies is that they do not model the decision to exit or enter the nursing profession versus other occupations. The elasticity of labour supply in nursing at the extensive margin might differ considerably from that at the intensive margin. This is of particular importance as the nursing workforce primarily consists of women. Not only is their general labour force attachment lower than that of men, but their career paths, moving out of and back into the labour force around child-birth, also lower the opportunity costs of changes in occupation and thus make career changes more likely. In order to obtain reliable estimates of the total labour supply elasticity in nursing, it is thus important to model not only individuals' labour force participation decisions – which has been done in previous research using a broad range of methods – but also their occupational choices.

This paper seeks to investigate the viability of wage policies to increase nurses' labour supply through a multi-sector labour supply model. We extend the literature by considering a sample of *nursing qualification holders*, rather than those who work as registered nurses only. This means that our sample contains potentially available nurses regardless of their labour force participation and regardless of the occupation they are currently working in. Thus our sample enables us to model the extensive margin not only in terms of workforce participation (Creedy and Duncan, 2002), but also in terms of choice of non-nursing occupations. This allows us to address the following questions: (1) how responsive is the decision to enter the nursing profession to wages in nursing?, (2) how responsive is the decision to exit the profession to wages in non-nursing occupations?, and (3) is the estimated total elasticity of labour supply in nursing higher than suggested by previous research, once transitions between nursing and other occupations are allowed for in the model? The answers to these questions will indicate whether increasing wages in nursing could be a more promising policy to tackle the problem of nurse staffing shortages than previously thought.

Additionally, we examine the choice for shift type (distinguishing regular day shifts, regular night shifts and irregular shifts) as part of nurses' labour supply. In our structural approach employment in different shift types enters the utility function as separate arguments. This leads to our fourth research question: (4) does the responsiveness of labour supply to wage changes differ by shift type? A further novelty of our research is that we investigate the importance of family circumstances for nurses' labour supply, as these are expected to affect the utility derived from income and the disutility derived from working hours in nursing jobs with different shift types or a non-nursing occupation. This leads to our final research question: (5) to what extent does the responsiveness to wage changes depend on a nurse's family circumstances?

To give a preview of our findings, 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. This higher elasticity is due to changes in the entry into and exit from the nursing profession in response to wage changes. Earlier research has ignored the possibility of entry from or exit to other occupations. Work in night shifts turns out to be associated with a 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, 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. For the labour supply elasticity with respect to nursing wages, it is found that lower qualified, childless, and older nursing qualification holders respond more strongly to a given wage increase than their counterparts.

The paper continues as follows. Section 2 briefly discusses previous literature, and Section 3 the proposed estimation strategy. This is followed in Section 4 by a description of the data, including some summary statistics. The results are presented in Section 5. Section 6 concludes.

2. Literature review

Antonazzo et al. (2003) and Shields (2004) provide extensive reviews of the literature on the labour supply of nurses. 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 labour force 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 systems of equations using a 2SLS- or 3SLS-framework 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, 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. estimated the number of supplied hours together with a participation equation, accounting for unobserved heterogeneity through correlated error terms. Regardless of the applied estimation methods, with few exceptions (e.g. Sloan and Richupan, 1975; Link and Settle, 1985), previous studies 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 relatively 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 professions 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

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