The short run elasticity of National Health Service nurses' labour supply in Great Britain

Rowena Crawford
Richard Disney
Carl Emmerson

The short run elasticity of National Health Service nurses' labour supply in Great Britain

By

Rowena Crawford[*]   Richard Disney[†]   Carl Emmerson[‡]

Abstract

The paper investigates the short run responsiveness of National Health Service (NHS) nurses' labour supply to changes in wages of NHS nurses relative to wages in outside options available to nurses, utilising the panel data aspect of the Annual Survey of Hours and Earnings. We find the short run responsiveness of NHS nurses' labour supply to the relative wage of NHS nurses is positive and statistically significant, albeit economically small, in regions outside the London area. In contrast, in the London region, the short run elasticity is much higher. We discuss the policy implications of these findings.

Key words: NHS   Labour supply   Relative wages
JEL classification: J31 J38 J45

Acknowledgements

[*] Institute for Fiscal Studies, London.
[†] Institute for Fiscal Studies, London, and University College London. Corresponding author: Institute for Fiscal Studies, 7 Ridgmount Street, London WC1E 7AE. Tel: +44 (0) 207 291 4800 email: richard_d@ifs.org.uk
[‡] Institute for Fiscal Studies, London.

The short run elasticity of National Health Service nurses' labour supply in Great Britain

"There is nothing wrong with a few unemployed doctors and nurses. Until now we have been dealing with a monopoly provider. We need a labour market in the NHS, just like there already is in other areas of the economy". Alan Milburn, Secretary of State for Health 1999-2003, quoted by Mullin (2011) p.89.

1. Introduction

There is a substantial literature on the labour supply of nurses in Great Britain and elsewhere. That research, which is summarised in the next section of this paper, uses standard labour supply techniques, albeit with varying degrees of sophistication, to obtain a measure of the elasticity of nurses' labour supply with respect to nurses' wages and other factors. Some of this research considers 'outside options' including non-participation and, in a few papers, the possibility of nurses engaging in non-nursing occupations. However the nature of these outside options and, in particular, the implications of spatial differences in the nature of the local labour market facing nurses, has received much less attention. Outside a few studies in the United States, there have been few attempts, for example, to link the literature that estimates nurses' labour supply elasticities to the parallel literature on the degree of monopsony power in public sector labour markets (including that of nurses) and thereby to examine the implications of local market structure for nurses' wages and for the measured elasticity of labour supply of nurses.

In this paper, we investigate the short run responsiveness of NHS nurses' labour supply to changes in the wages of NHS nurses relative to wages in outside options available to nurses ('short run' because we assume that in the medium term, nurses' labour supply can be increased by more training places, immigration and so on). Because nurses live and work in different local labour markets that vary in the range and attractiveness of alternative job opportunities relative to NHS nursing, there may be temporal and spatial variations in the responsiveness of nurses' labour supply to NHS nurses' wages, rather than a single 'elasticity of supply of nurses to NHS'. In particular, as we shall describe in more detail shortly, the model we consider implies that the elasticity of supply of nurses to the NHS in response to changes in the NHS nurses' wage will be higher where the range and attractiveness of outside opportunities is greater, and *vice versa*. This aspect of the 'outside option' has not been captured in previous applications of more traditional models of labour supply which implicitly assume that the market for nurses is a competitive market.[1]

---

[1] Conversely, the few studies of nurses' labour supply that consider the possibility of monopsonistic behaviour by employers implicitly assume that *all* employers of nurses have monopsonistic power.

To examine this issue, we not only compare the wages of NHS nurses to those employed as nurses outside the NHS but also exploit the panel data aspect of the Annual Survey of Hours and Earnings (ASHE) to track the employment patterns and wages of workers who have previously been employed as nurses.[2] One attraction of this strategy is that the 'outside option' is defined by the occupational choices of nurses rather than by arbitrary comparison groups. Secondly, we can demonstrate that, where the outside options available to NHS nurses are less attractive and, hence, the NHS is the dominant employer, the elasticity of nurses' labour supply to the NHS is low – consistent with the NHS exerting a degree of monopsony power in the labour market. Conversely, where the outside options are more attractive (such as in London), we show both that a higher proportion of potential NHS nurses work outside the NHS and that the elasticity of supply of nurses to the NHS is correspondingly greater, corresponding to a more competitive market for nurses.

Our paper is structured as follows. Section 2 provides a brief literature review. Section 3 describes the NHS pay structure and provides a stylised model of NHS pay. Section 4 describes our data and presents some descriptive on pay relativities and the occupations of nurses across the regions. Section 5 details our empirical strategy and gives some provisional empirical results. Section 6 concludes.

2. Literature review

2.1 Estimates of nurses' labour supply elasticity

There is a significant academic literature on the nurses' labour market in the US, UK and elsewhere, focussing especially on the issue of labour supply. Much of it is surveyed by Shields (2004) and by Antonazzo, Scott, Skåtun and Elliott (2003), and many articles not cited here can be referenced in those two papers. Most of this literature argues that the supply of nurses is relatively inelastic, although Phillips (1995) argues that, when incorporating currently inactive women who had been nurses in the past into the data set, the elasticity of participation of nurses in the labour force is considerably more elastic. In the UK context, and elsewhere in Europe and Australia, some of the literature conflates nurses working in the NHS (or equivalent public sector institutions in other countries) and nursing employment as a whole.

It should be emphasised that the elasticity of supply to the workforce, to the occupation, and to a particular employer are not the same thing. Hence the measured supply responses in these papers may be describing one of three different potential elasticities: the wage elasticity of supply of

---

[2] A similar strategy, but using the Labour Force Survey, which has a considerably smaller sample size, is used by Elliott *et al* (2007) for a slightly different purpose. We discuss this paper in the next section. Likewise, Disney and Gosling (2008) suggest using ASHE data in similar fashion in order to examine public-private pay differentials.

workers to the labour force who are trained (or report that they are) nurses; the elasticity of supply of workers to a given occupation (nursing) relative to other occupations in which they could be employed; or the elasticity of supply of nurses within nursing to a public employer such as the NHS or even to a specific NHS Trust. Moreover, where the literature does distinguish between supply elasticities of nurses in general and of nurses to the NHS, the data typically rely on self-reported definitions of public versus private status of nurses (as in the Labour Force Survey, LFS).

In a sophisticated but traditionally-grounded labour supply model, Di Tommaso, Strøm and Saether (2009) match a sub-set of registered nurses in Norway to their public sector employer to estimate the elasticity of nurses' labour supply to various 'packages' of hours, shifts and hospital types. The employment of nurses in occupations other than nursing is not considered in that paper. However, Hanel, Kalb and Scott (2014) have recently adopted a somewhat similar approach using the Australian HILDA household panel, in which one of the choice options is working in an occupation other than nursing, although sample sizes, particularly of transitions between nursing and other occupations, are rather small. The authors estimate a generic predicted wage in a non-nursing occupation for each observed individual as an argument in the choice model. They show that the elasticity of supply of nurses' hours to nurses wages conditional on working as a nurse is significantly lower than the unconditional elasticity once transitions between nursing and other occupations is considered (*ibid*, p.105). However, they do not discuss at any great length *what* nurses do if they are not nurses, or the nature of the local labour market.

In the paper closest in spirit to the present paper, Elliott *et al* (2007) consider the spatial differentiation of the market for nurses in Britain. They argue, as in the present paper, that nurses have an 'outside option' of working in alternative occupations which vary in attractiveness – primarily in expected wages – across localities. Using the LFS, they are able to identify occupations which employ individuals with nursing qualifications. They then estimate a predicted wage for nursing in each locality (presumably using self-reported 'public sector status' at some point in the analysis to identify a nurse employed by the NHS relative to a nurse employed as a nurse outside the NHS) and construct an unweighted predicted wage for all occupations in which individuals with nursing qualifications are employed.[3] These predicted wages are termed 'standardised spatial wage differentials' (SSWDs) for nurses relative to 'outside options'. They argue that the relative attractiveness of nursing in any locality rests on the difference between these two predicted wages.

---

[3] It would seem more natural to weight these occupations by the proportion of erstwhile nurses observed in them in predicting the 'outside' wage; however in some specifications the authors exclude occupations with very small proportions of nurses working in them. Note that numbers in the 'outside' sample are boosted by estimating the wage equation over *all* individuals in the occupations and not just those with nursing qualifications.

They then regress the three-month vacancy rate for NHS nurses on the predicted differences and show that the vacancy rate for nurses is higher (lower) when the predicted outside SSWD is higher (lower) than the predicted nurses' SSWD. This result accords with the view that it is harder to recruit nurses when the outside occupation is more attractive.

One could quibble with some of these findings,[4] (and in any event it is no longer possible to obtain vacancy data for NHS nurses). Nevertheless, this study represents the point of departure for our analysis, insofar as it is the nature of the NHS market for nurses relative to the local labour market that is central to our hypothesis. Our own methodology allows us to make an inference that is not established by Elliott *et al* (2007): where the attractiveness of the 'outside option' is relatively weaker, the dominance of the NHS as the employer becomes more pronounced, and where the 'outside option' is comparatively stronger, that power is weakened. This has the implication that there is no single supply elasticity of nurses to the NHS, but potentially different supply elasticities for each local market depending on the outside opportunities available and hence the effective degree of dominance of the NHS as an employer of nurses. Our analysis is compatible with, for example, a search model where, in some spatial markets, one dominant employer has a degree of market power in setting wages across that market (Burdett, 2012).

2.2 Local labour markets and market power

There is other evidence that a monopsony model, where the employer has power in setting wages subject to an exogenous supply curve of labour to the enterprise, is a plausible model of the nurses' labour market. Hence, in this context we have to measure the elasticity of supply to a given employer (or averaged across several employers) rather than an elasticity of supply to an occupation or to the workforce. Sullivan (1980) examines alternative models of wage determination using US hospital data, where nurses' case loads ('demand') are assumed to be exogenous across observations. The central estimate of the elasticity of nurses' labour supply to the hospital in the short run is 1.3, and closer to 4 in the long run. This leads Sullivan to infer that, at least in the short run, hospitals exert monopsony power towards nurses. Although the computed elasticities are relatively high by the standards of monopsony models, they are well below the magnitudes that might be expected in a fully-competitive labour market (Manning, 2005). Sullivan also provides a useful summary of earlier studies of monopsony power in the supply of nurses.

Hirsch and Schumacher (1995) criticise the findings of Sullivan (and, implicitly, earlier studies), arguing that a monopsony model would predict different degrees of employer power across varying

---

[4] In addition to the weighting issue discussed in the previous footnote, the self-reporting of public sector status, the relative lack of variation in the predicted SSWD ratios across many localities, and the imprecision of the vacancy rate data (noted by successive NHS Pay Review Bodies) might all warrant further attention.

degrees of geographically concentrated labour markets. Based on US panel data, they find no such evidence. This critique is itself, however, open to question where there is evidence of employer collusion even in markets where there are several employers of nurses (e.g. metropolitan areas with several large hospitals). Both Sullivan, and Fogel and Lewin (1974), give qualitative evidence that such collusion exists in the market for nurses. However, the argument by Hirsch and Schumacher that market power (if any) is likely to vary across localities is convincing and central to the argument of the present paper.

In Staiger, Spetz and Phibbs (1999, published in 2010) a monopsonistic setting is again assumed in the market for nurses. The analysis focuses on the decision of Veterans' Hospital (VA) administrators in the United States to depart from the collectively-agreed national wage structure for nurses by engaging in independent wage-setting based on local labour force conditions. The exogenous change in wages for VA relative to non-VA nurses could then be interpreted as shifting the budget constraint for a sub-set of nurses with the supply elasticity then identified off both the response of nurses' labour supply to the higher wage in VA hospitals, and, of course, the impact on nurses in non-VA hospitals. Staiger, Spetz and Phibbs concluded that this elasticity, as estimated from this 'treatment', lay between 0 and 0.2. This is at the lower end of the various estimates in the meta-analysis of labour supply elasticities of nurses in Shields (2004) but it should be borne in mind that this elasticity has a very different interpretation from the traditional approach to labour supply in the literature on nurses. There are several other 'tests' of monopsony for other public sector occupations in the 2010 special issue of the *Journal of Labor Economics* in which the Staiger *et al* paper is published, most of which find considerably higher elasticities of labour supply than their estimate, but well below the elasticities that might be expected to apply in competitive markets.

3. Pay of NHS nurses

3.1 Institutional features

The disparity in public-private pay relativities for nurses across England and Wales demonstrated shortly arises because pay in the NHS is broadly set at a national level via a national review process administered by the NHS Pay Review Body. Since 2004–05, national pay rates for nurses and many other professional groups in the NHS have been determined by the Agenda for Change (AfC) pay structure. Agenda for Change is essentially a national job-evaluated pay structure that awards a national 'rate for the job' for each occupational category in the NHS. The nominally independent NHS Pay Review Body is then tasked with making recommendations as to changes in these national scale rates over time in response to macroeconomic conditions and in the light of representations from employers, employees and the government of the day. In contrast private sector pay in

comparable occupations and even some parts of the public sector (such as local public administration) exhibit greater local pay variation.

One implication of the rigidity of the NHS national pay structure has been noted by Propper and van Reenen (2010), who argue that differences in local 'outside options' for NHS nurses affect the quality of nurses that can be recruited and hence the quality of nursing in particular localities. There is, however, some scope for adjustment of nurses' pay in the NHS in response to local conditions. First, where local living costs are high (such as housing costs) and demonstrably cause difficulties in the retention and recruitment of NHS staff, the Agenda for Change pay structure allows for workers covered by the AfC agreement in these locations to receive nationally-approved High Cost Area Supplements (HCAS) to their pay. Although these supplements are designed in principle to reflect differences in local area living costs, assuming that competitively-determined pay is likely to reflect these area costs explicitly, they will also reflect local pay differences. A second form of flexibility is that NHS Trusts are permitted to pay local Recruitment and Retention Premia (RRP) for hard-to-fill occupations, although this facility does not appear to be used a great deal given that such premia have to be paid to all employees in that occupation within the NHS Trust and not simply applied to specific hard-to-fill vacancies.

Third, budgetary allocations to NHS Trusts from central government contain an explicit Market Forces Factor (MFF) adjustment which is designed, in part, to reflect local variations in pay of non-AfC staff. These budgetary adjustments are quite separate from AfC-based High Cost Area Supplements and are supposedly independent of AfC pay. However there is some evidence (NHS PRB, 2012, Table F5) that AfC staff receive higher base pay in areas where MFF payments are higher independently of receipt of HCAS payments.[5] This may be for two reasons: first, 'grade drift' whereby employees tend to be assigned to higher grades by the local AfC job evaluation process in areas with more attractive outside options, and secondly 'incremental drift', by which, within given grades, employees may be distributed on higher points of the grade scale where recruitment and retention pressures are more keenly felt. The implication of this 'pay drift' is that High Cost Area supplements alone do not fully reflect outside pay differences. Finally, NHS Trusts that have achieved Foundation status and that have thereby been given greater local autonomy also have the flexibility to vary pay scales from the national AfC structure. So far, with one exception, 'Foundation Trusts' have conspicuously not done so, at least in relation to nurses.[6]

---

[5] For further discussion of MFF, see Elliott *et al* (2010) and NHS PRB (2012)

[6] The Foundation Trust that departed from AfC actually reverted to the pay scale rates that existed prior to AfC. A proposal from a consortium of NHS trusts in south west England (where outside pay rates are considerable less) attempted without success to negotiate lower pay scales. The main departure of NHS

Notwithstanding this scope for local pay variation in the NHS, we shall demonstrate that these variations are not sufficient to compensate for the variation in 'outside' wages. Whether local pay variation in the NHS should be enhanced is discussed at some length in a comprehensive analysis of the issue of local 'market-facing pay' by the Department of Health (2012) and, subsequent to this analysis, by the NHS Pay Review Body itself which issued a report considering at some length the case for and against greater local pay variation for NHS employees (NHS PRB, 2012).

Summing up these points, at present, despite greater management autonomy given to NHS Foundation Trusts, It is not unreasonable to characterise large parts of the NHS nurses' labour market as a market in which the Department of Health (as ultimate paymaster) acts as a 'discriminating monopsonist', using labour market power as a means of standardising pay across the nursing profession as a whole in the face of differential local pay pressures. Indeed the NHS Employers' federation, which represents the management of the various individual NHS institutions, has publicly expressed its opposition to the use of local pay variation such as RRPs within AfC as a means of dealing with recruitment and retention problems because it 'destabilises the internal NHS market and possibly leads to pay spirals' (evidence cited in NHS PRB, 2009, p.28). This is the classic statement of the employer's case for control of wages, since of course 'instability' of inside pay in response to variations in outside wage pressures is characteristic of a competitive labour market. Of course, the constraint on such a strategy is that holding down pay in the face of competitive pressures in local labour markets is only feasible by reducing employment along the supply curve, and this consequent reduction in employment in turn depends on the elasticity of labour supply.

All this has some bearing on the notion of 'shortages of nurses' that is extensively discussed in the existing labour supply literature. In particular, as we shall demonstrate, the competitive nature of the London labour market for nurses suggests that reducing the pay of NHS nurses could potentially induce a sharp reduction in the effective supply of NHS nurses in that area. In other regions of the country, however, the short term reduction in the supply of nurses to the NHS from such a policy would be muted.

3.2 A stylised model of NHS pay-setting for nurses

A particular public sector employer of nurses – such as a NHS Trust or indeed the NHS as a whole, faces a set of constraints. The first is an overall budget constraint set by the relevant public authority – here, the Department of Health. Within this budget constraint it is broadly free to choose its mix of inputs. Second, it faces a set of local outside employment opportunities and wage rates in

---

Foundation Trusts from national pay scale rates has occurred at the senior management level, where rates are not covered by the AfC agreement.

alternative occupations for potential nurses which are not under its control.[7] Third, it faces a supply curve which reflects the willingness of qualified nurses to work in the public institution given these outside opportunities.

The nature of this supply curve is at the heart of this paper. For our stylised illustration, we assume that there is a common supply curve of nurses across all localities (it is straightforward to think of this function shifting in relation to differential local amenities or to a different skill mix in the available supply of nurses). However, we do not assume that this supply curve is of constant elasticity, because the elasticity depends on the nature of the local labour market and the dominance or otherwise of the public sector employer as a potential employer of nurses.

Consider therefore two spatial labour markets, which we term 'the North East' and 'London'. In the 'North East', the ratio of the nationally set wage to the local outside option is relatively high. Most potential NHS nurses choose to work in the NHS and, the employers have *de facto* monopsony power. Labour supply is highly inelastic in the short run, since almost the whole available stock of nurses is employed in the NHS. The NHS could indeed exert downward pressure on wages with only a slight resultant fall in employment; conversely an outward expansion of spending on the NHS would induce only a slight increase in nurses' employment in the short run, unless there was substantial migration between labour markets. In contrast, consider the market labelled 'London'. The relative wage is much lower and a much smaller fraction of potential NHS nurses choose to work in the NHS. This implies that the elasticity of supply of nurses in response to changes in the NHS wage rate is much greater and the monopsony power of the NHS wholly limited. Cutting budgets and pay simply induces nurses to exit (and to exit in significant numbers), however an additional supply of nurses *would* be forthcoming were pay to be raised by the use of recruitment premia, 'London weighting' or other financial incentives to attract potential NHS nurses into the NHS.[8]

Define the nationally-set wage of nurses in the NHS as w^n, and the 'outside option' , which is the wage available to nurses if they choose an occupation outside the NHS, either as a private sector nurse or in some other occupation, as w^*. Making the assumption that the supply curve is identical across regions and ranking regions by the ratio (w^n/w^*), the sub-markets can be illustrated as in Figure 1.

---

[7] We abstract from any 'spillover' effect on local pay rates in outside employment of pay rates in the NHS for nurses. It is likely that such spillovers will occur for local nurses' pay in non-NHS employment. However, as we shall demonstrate (see also Elliott *et al,* 2007), NHS nurses choose a wider range of occupations when not in the NHS than simply nursing.

[8] The evidence in Department of Health (2012) Table 2.3 suggests that such recruitment premia and 'high cost area supplements' account for around 16% of current pay costs for qualified nurses in London and almost zero elsewhere.

In Elliott *et al* (2007), the inflexibility of the NHS wage relative to outside options is reflected in the unfilled vacancy rate, and therefore in the possibility of local 'shortages' of nurses. In our stylised model, there is a presumption that the NHS employer has some flexibility such as to optimise its employment given the effect elasticity of supply in the local sub-market. The first is to vary the mix of workers, using fewer nurses where they are harder to attract, relative to other inputs such as nursing auxiliaries, doctors and non-medical staff. The second is to vary the NHS wage to some extent by whatever discretion is available (RPPS, 'grade drift' etc). Note however that this strategy is only effective where the supply elasticity is relatively large, as in 'London' because in the markets where the NHS employer dominates the market for nurses, a large increase in pay would be necessary to induce any increase in supply – hence it is better in such markets to operate with fewer nurses, a greater number of unfilled positions, and so on.

Figure 1
Potential labour supply and relative wages
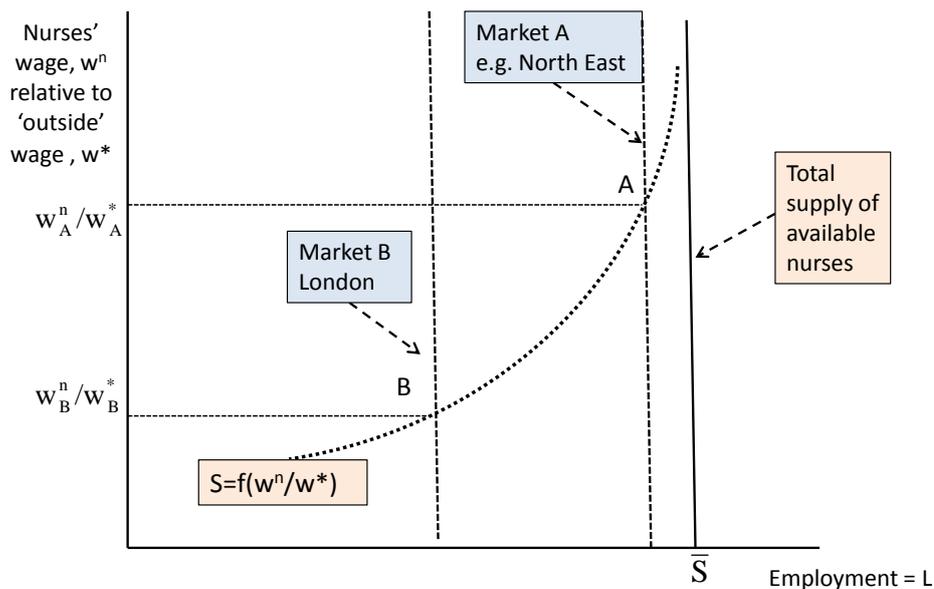
4. Data and initial descriptives

4.1. Data

To examine these issues – first descriptively and then with a more formal statistical analysis – we use the restricted individual-level data from ASHE – an annual panel survey of 1% of the employed population of Great Britain. The advantages of this survey are three fold: first, the sample size is large, meaning that there are a reasonable number of observations of both current NHS

nurses and comparators at a local level of disaggregation within each wave of data; second, being panel data we can identify as comparators both individuals who are currently working as nurses outside of the NHS, and individuals who have worked as nurses in the past but now work in an alternative occupation; finally, ASHE is completed by employers (rather than the individuals themselves) and therefore contains accurate information on the hours and earnings of the individuals and their sector of employment.[9]

Fifteen years of ASHE data are employed, 1997–98 to 2011–12. An individual can have multiple jobs (either sequential or simultaneous) reported in the ASHE data. For the purposes of this work, an individual's employment for the year is assumed to be that job that is reported as the job associated with the highest hourly earnings. Taking advantage of the panel nature of the survey, a dataset is constructed of 'potential NHS nurses' – that is individuals who are either observed working as a nurse (either in the NHS or in the private sector) or who have been observed working as a nurse in the past (again either in the NHS or in the private sector). The sample is then restricted to individuals aged between 20 and 59 (inclusive) who have positive hourly wages.[10] The data are subsequently treated as a repeated cross section of observations of potential NHS nurses (although in the regression analysis in the results section of this paper the standard errors allow for clustering at the individual level). There are 64,458 observations of potential NHS nurses, comprised of 44,059 observations of NHS nurses and 20,399 observations of individuals not currently working in the NHS spread across the 15 years of data (arising from the repeated observation of 9,683 individuals).

4.2. Descriptives

The key variables of interest for estimating the short run labour supply elasticity of NHS nurses are employment of nurses in the NHS, the wages of NHS nurses and the current wages of potential NHS nurses in their alternative occupation (and thus, the relative wage of NHS nurses). While the number of the ASHE sample members employed as nurses in the NHS is clearly observed, the implications of this for the absolute numbers in such employment in Great Britain is dependent on the sampling size and response rate of ASHE, which varies over time.[11] To take this into account,

---

[9] A somewhat similar methodology would be to use a cohort of individuals who trained as nurses, and then follow their occupational choices as wages varied between NHS nursing and other employment. We do not have these data; moreover the comparators may then contain trained nurses who chose *never* to be nurses or who left the labour market completely; i.e. whose commitment to nursing is potentially relatively limited. An individual has to have been a nurse at some point in their career in order to enter our sample.

[10] Individuals may be reported as having zero earnings if, for example, they are absent from work due to maternity leave and are not entitled to a wage from their employer during that period.

[11] In particular, due to cost saving measures, the sample size of ASHE was reduced by 20% in 2007–08 and 2008–09.

instead of focusing on absolute numbers in employment, we focus on variations in the proportion of potential NHS nurses that are actually employed as such.[12]

We consider two different levels of disaggregation at which the employment of nurses and the relative wage is measured: the 'regional' level, where Great Britain is divided up into Scotland, Wales, and the standard nine Government Office Regions of England; and the 'travel to work area' (TTWA) level, where England, Scotland and Wales is divided up into 234 areas based on patterns of commuting for employment.[13] The advantage of a less disaggregated level is that it less restrictive in terms of the scope of the labour market across which potential NHS nurses are defined. The advantage of the more disaggregated model (in addition to boosting sample sizes and therefore the accuracy of the measured coefficients) is that it perhaps better captures local labour market conditions, and it allows the supply function of NHS nurses to contain regional fixed effects without then solely relying on the interaction of time and region for the identification of the labour supply response.

Figure 2 shows that the proportion of potential NHS nurses observed currently working as NHS nurses, currently working as a nurse outside the NHS, or currently working in some other occupation varies by region of Great Britain and over time. At any one time on average just under 70% of potential NHS nurses work as NHS nurses, with just over 10% working as nurses outside the NHS. The remainder are found working in other occupations. The proportion of potential NHS nurses actually working as NHS nurses at a given point in time is significantly higher, the further the region is from London. The highest proportions are in Scotland, the North East of England and in Wales, where there are fewer trained nurses working in occupations other than nursing, and a particularly small proportion of potentials working as nurses in the private sector. The proportions of potential NHS nurses working as NHS nurses in these regions is about 7 or 8 percentage points higher than in London, the South East, the East and the East Midlands. However it should be noted that London is not the region with the lowest share of NHS nurses suggesting that there are other factors at work, such as the availability of alternative jobs in nursing (for example in private residential care) and in

---

[12] An alternative approach would be to use absolute numbers employed as NHS nurses, and weight the individuals in the sample in order to account for the sampling design and to calibrate the sample to the UK population. However, the ASHE documentation explicitly advises against attempting to gross up the employment figures reported in ASHE.

[13] The ONS website contains maps of UK regions (http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/maps/regions--former-government-office-regions--as-at-january-2012.pdf) and UK TTWAs (http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/maps/travel-to-work-areas-2001.pdf). The travel to work areas are constructed by the ONS using census data for commuting, based on the different locations of individual's home and work addresses. The fundamental criterion of a TTWA is that of the resident economically active population, at least 75% actually work in the area, and also, that of everyone working in the area, at least 75% actually live in the area.

other occupations. We will capture these variations in employment composition using local fixed effects.

Figure 3 describes the occupations of those classed as potential NHS nurses who are not currently working in the NHS in the most recent year of ASHE data (2011–12). Nearly half (42%) are working as "Health and social welfare associate professionals" (see panel A of Figure 3). This category includes nurses in the private sector, which alone accounts for 32% of potential NHS nurses not currently working in the NHS. Restricting the pool of potential NHS nurses to those who are not currently working in the public sector, 59% of these individuals are employed as nurses (61% are working as "Health and social welfare associate professionals" more generally), as shown in panel B of Figure 3.[14]

Figure 2:
Proportion of 'potential NHS nurses' currently working as NHS nurses, other nurses or in another occupation, by region

---
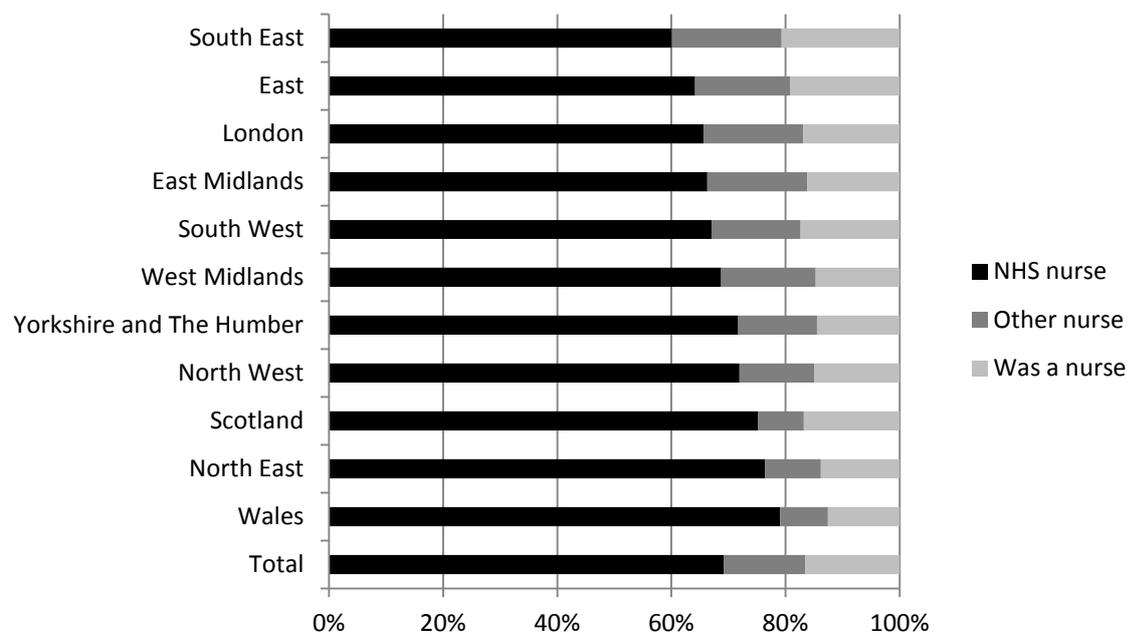
[14] We have also investigated whether the occupations of potential NHS nurses who are not currently working as NHS nurses are different in London compared to the rest of Great Britain. Pooling ASHE data from 2002 to 2011, we find that the only real difference is that London has a slightly larger proportion of potential NHS nurses employed as 'health and social welfare associate professionals' (55.5% as opposed to 45.2%, with 43.6% employed as private sector nurses compared to 36.3%) and a slightly smaller proportion are employed in 'caring and personal service occupations' (15% as opposed to 24%). There is little difference between London and the rest of Great Britain in terms of the proportions of potential NHS nurses employed in the other main occupations separated out in Figure 3.

Figure 3:
What are 'potential NHS nurses' who are not NHS nurses doing?

Panel A – All potentials

Legend:
- Health and social welfare associate professionals
- Caring personal service occupations
- Corporate managers
- Administrative occupations
- Teaching and research professionals
- Business and public service associate professionals
- Health professionals
- Other

Values: 9%, 2%, 3%, 3%, 4%, 12%, 25%, 42%
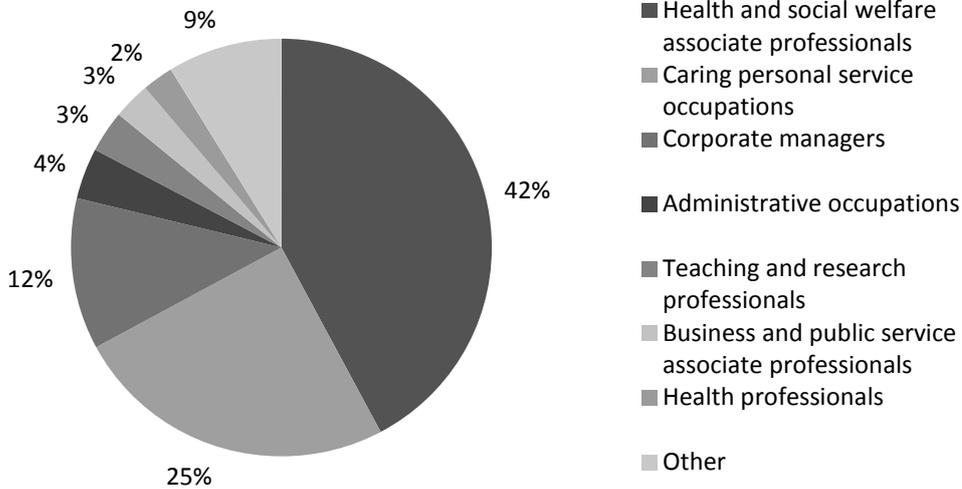
Panel B – Private sector potentials

Legend:
- Health and social welfare associate professionals
- Caring personal service occupations
- Corporate managers
- Administrative occupations
- Teaching and research professionals
- Business and public service associate professionals
- Health professionals
- Other

Values: 9%, 1%, 2%, 3%, 3%, 9%, 12%, 61%
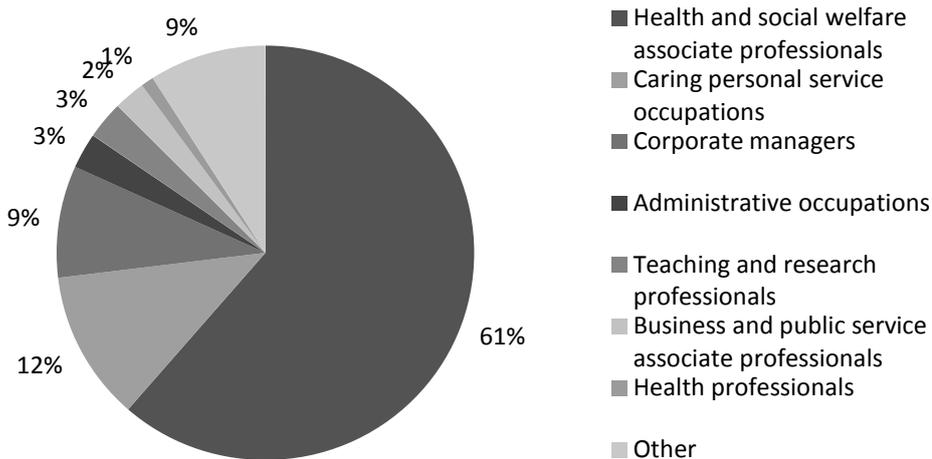
Note: ASHE data 2011–12. Sample is 2,288 for all potential NHS nurses not currently working in the NHS and 1,225 for potential NHS nurses currently working in the private sector.

As a final descriptive that lends support to our spatial identification strategy, Figure 4 describes the ratio of mean hourly pay of NHS nurses by region to the mean hourly pay of NHS nurses and other potential NHS nurses across Great Britain. Also shown is the ratio of mean hourly pay of potential NHS nurses not currently working in the NHS by region to the mean hourly pay of potential NHS nurses across Great Britain. The pay of potential NHS nurses not currently working in the NHS is on average slightly below the pay of those nurses who are working in the NHS. But this difference varies considerably across the country. Average pay of nurses in the NHS varies little across the country – as would be expected given the national pay strategy – with the exception of

London, where pay is subject to a London weighting. By contrast, the average hourly pay of potential NHS nurses who are not working in the NHS varies much more across the country (as does the average hourly pay of potential NHS nurses who currently work in the private sector). Across all regions of Great Britain aside from London average hourly pay of potential NHS nurses is below that of current NHS nurses, whereas in the capital it is higher.
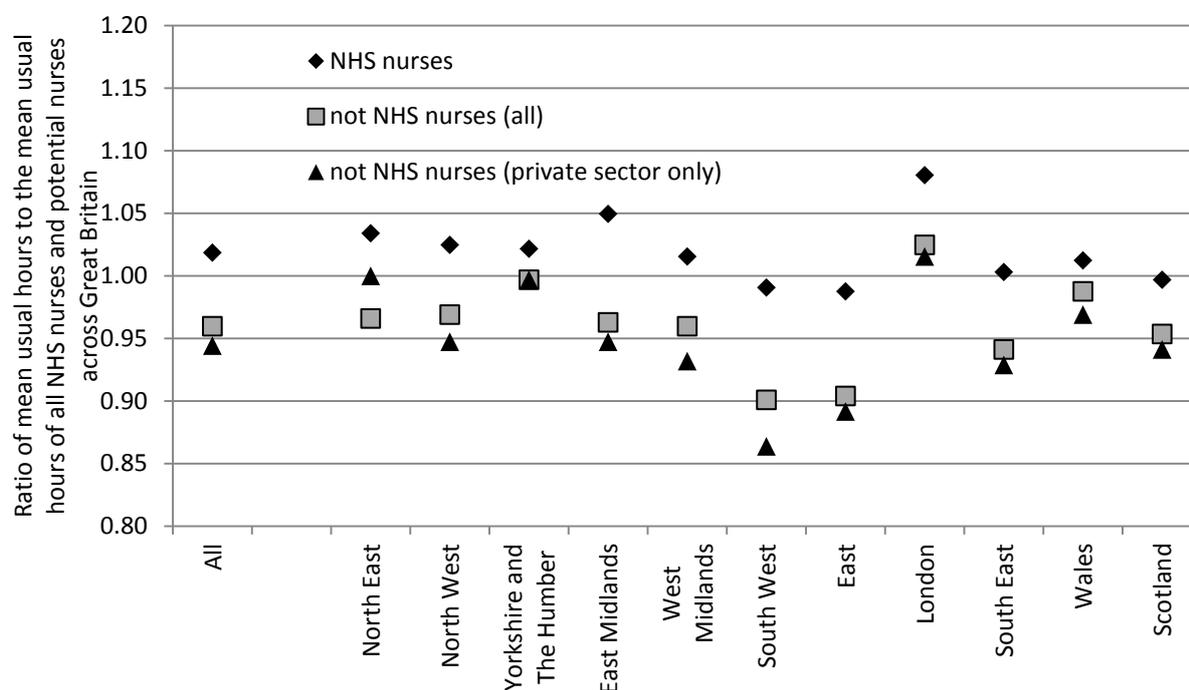
Figure 4:
Mean pay of NHS nurses and other potential NHS nurses, by region
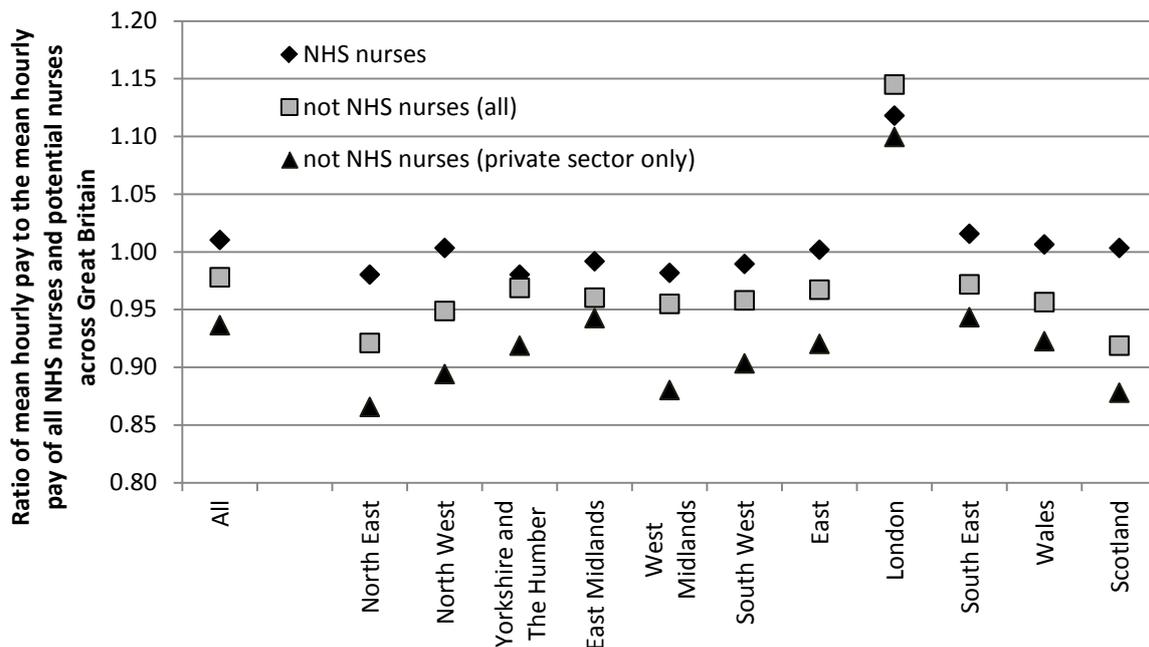
Note: Pooled ASHE data 1997–98 to 2011–12 (inclusive). Sample sizes range from 397 (potential NHS nurses currently employed in the private sector in the North East) to 7,106 (NHS nurses employed in Scotland). The mean hourly pay of all NHS nurses and potential nurses across Great Britain is £13.00.

That the average hourly wage of potential NHS nurses not working in the NHS is lower than that of nurses who are working in the NHS is potentially surprising, as it begs the question why so many trained nurses would take lower paying jobs, particularly in the private sector. One potential explanation for this is suggested by Figure 5, which shows an equivalent picture to that of Figure 4 but for usual hours worked. Across all regions of Great Britain (including London) the average hours worked by potential NHS nurses not working in the NHS is lower than the average hours worked by NHS nurses, suggesting that on average those who leave nursing (or NHS nursing in particular) might do so for a more part-time position, which are often associated with lower hourly earnings. This finding is compatible work such as Di Tommaso, Strøm and Saether (2007), who suggest that nurses and potential nurses choose among alternative pay-hours-amenities packages.

Figure 5:
Mean usual hours of NHS nurses and other potential NHS nurses, by region

Note: Pooled ASHE data 1997–98 to 2011–12 (inclusive). Sample sizes range from 397 (potential NHS nurses currently employed in the private sector in the North East) to 7,106 (NHS nurses employed in Scotland). The mean usual weekly hours of all NHS nurses and potential nurses across Great Britain is 32.3.

5. Statistical analysis of nurses' labour supply

5.1. Estimation method

We estimate the elasticity of NHS nurses' labour supply by exploiting temporal and spatial wage differentials. For the purposes of identification, we assume that nurses in all regions (or TTWAs) are on an identical supply curve. This *does not* require the assumption of a constant elasticity across regions – as illustrated in Figure 1 and described in the adjoining text, we would hypothesise that, in general, the short run supply elasticity of nurses to the NHS is lower (higher) the greater (smaller) the ratio of NHS nurses' wages to the average outside option. For this identification assumption not to be valid, it would have to be the case that the supply response to wage differences differed across localities – we have no reason for believing this to be the case.[15]

We assume that outside wages are exogenously determined. This implies, in particular, that the wage set for nurses does not 'spill over' – whether positively or negatively – to pay in the rest of

---

[15] In fact our assumption is slightly less restrictive, insofar as we include regional fixed effects, which would allow the supply curve to shift between regions. Of course our method allows for supply responses that vary according to the relative wage – this is how we derive our elasticities.

the local labour market. In a monopsonistic setting of the labour market for NHS nurses, where the NHS nurses' wage is set nationally, the wage relativity in any sub-market then determines the feasible level of employment along the supply curve and the budget constraint must be set accordingly. Alternatively, where the NHS employer has some discretion to set the NHS nurses' wage locally (e.g. through a recruitment premium), the NHS budget constraint will thereby determine both the wage relativity and the level of employment. Either way, we effectively identify the supply curve off the exogenous component of the wage ratio of local NHS nurses' wages to the outside or potential wage offer. Contrast this with a competitive market where the NHS employer has limited scope to set the nurses' wage exogenously, and where the supply of nurses will be highly responsive to outside forces.

Given these assumptions our approach can be parameterised by the general equation:

[1]
$$\left(\frac{\text{\# NHS nurses}}{\text{\# potentials}}\right)_{t,R} = \alpha + \beta ln\left(\frac{W^N_{t-1,R}}{W^O_{t-1,R}}\right) + X_{t,R} + \varepsilon$$

Where w^N is the average wage of NHS nurses in locality R, w^0 is the average wage of individuals who have worked as NHS nurses but are currently working in alternative employment so ('potential' NHS nurses), $X_{t,R}$ is a vector of controls, which includes some combination of year dummies, regional dummies, and average age and sex of potential NHS nurses in the local area, depending on the exact specification of the statistical model.[16] Given that there is likely some delay between changes in wages and individuals' labour market response we use the relative wage lagged by one year rather than the contemporaneous relative wage. (This also has the attraction of reducing concerns about endogeneity, which could arise if the wage of NHS nurses is set with the intention of achieving a certain level of employment.) Linear regression methods are used, with the observations weighted to account for the size of the local area (in terms of the number of actual and potential NHS nurses).[17]

The interpretation of the coefficient β in equation [1] is that a 1% increase in the lagged relative wage of NHS nurses in a locality results in a β/100 unit increase in the ratio of NHS nurses to potential NHS nurses. The advantage of formulating the equation in this way, rather than having the dependent variable expressed in logarithms and the coefficient β interpreted directly as an elasticity,

---

[16] Note that our normalisation of nurses' wage on outside wages rules out any differences in local amenity values as an explanation of nurses' pay (an issue raised in some of the literature) because it can be assumed that local amenity values apply to both the numerator and denominator of the wage ratio.

[17] This is particularly important in the TTWA level approach, since the size of TTWAs can vary markedly – the whole of the London region for example is one TTWA, with 682 potential NHS nurses in the ASHE sample, while some TTWAs have no potential NHS nurses in one or more years of the ASHE sample. (TTWAs are only included in the analysis when they have at least 1 current NHS nurse and at least 1 other potential NHS nurse in a given year (since otherwise we cannot generate a relative wage for that TTWA in that year). Because of this restriction our sample consists of repeat observations of 208 (out of 234) TTWAs).

is that it imposes a structure whereby the change in the lagged relative wage has a constant percentage point effect on the labour supply ratio across regions and time rather than a constant elasticity. A constant elasticity would have the somewhat counterintuitive implication that a 1% increase in the lagged relative wage of NHS nurses would result in a larger increase in the proportion of potential NHS nurses employed in the NHS in a region that already had a high proportion employed than in a region where there was a large supply of potential NHS nurses not currently working in the NHS.

5.2. Relationship between labour supply and relative wages

Table 1 reports our baseline estimates of the effect of a change in the relative wage on the proportion of potential NHS nurses actually employed as NHS nurses, estimated according to the regression in equation 1. The models (A), (B) and (C) relate to regressions with increasing numbers of controls included, as indicated by the bottom section of Table 1. When the model is estimated at the regional level, there is no significant effect (either statistically or economically) of relative wages on labour supply once regional dummies have been included (model C). This implies that there is not enough variation over time *and* across regions to be able to identify any effect in model (C), and that much of the effect apparently identified in models (A) and (B) is actually arising from fixed differences across regions. A significant advantage of the TTWA model is therefore that spatial fixed effects (at the regional level) can be controlled for, while preserving sufficient variation across area (both within and between regions) *and* time to be able to identify a significant effect of relative wages on NHS nurse employment.

Estimation at the TTWA level, but without regional controls, results in much smaller estimates of the effect of changes in the relative wage on the employment of NHS nurses than the central estimates from the equivalent models (A and B) estimated at the regional level. Our preferred specification is at the TTWA and includes regional dummies (model C). The coefficient in this case (column 4, row 3) is 0.039, indicating that a 10% increase in the relative wage of NHS nurses results in a 0.39 percentage point increase in the proportion of potential NHS nurses actually employed as such.

The right hand panel of Table 1 displays the estimation results when the sample of potential NHS nurses who are not currently employed as NHS nurses comprises only individuals who currently work in the private sector. In many circumstances this could be considered the comparator group of choice, since increasing the supply of NHS nurses by reducing the supply of other NHS workers (or other public sector workers in general) could be argued to be simply shifting rather than solving the labour supply problems of the NHS (or perhaps the wider public sector). Restricting the set of

available potential NHS workers in this way is not found to affect materially the size of the estimated effect of relative wages on labour supply to the NHS.

Table 1:
Main regression results: Fraction of nurses employed in NHS as a function of relative

| | Coefficient on lagged relative wage (β) | | | | | |
| | All potential NHS nurses | | | Potential NHS nurses from private sector | | |
	(A)	(B)	(C)	(A_p)	(B_p)	(C_p)
Regional level						
Weighted	0.327*	0.209*	-0.041	0.348	0.221	-0.024
	(0.139)	(0.092)	(0.039)	(0.2)	(0.122)	(0.028)
Weighted (excl London)	0.302	0.214	-0.050	0.303	0.209	-0.038
	(0.156)	(0.102)	(0.033)	(0.198)	(0.134)	(0.018)
TTWA level						
Weighted	0.087***	0.088***	0.039*	0.087***	0.089***	0.049***
	(0.022)	(0.022)	(0.016)	(0.022)	(0.022)	(0.014)
Weighted (excl London)	0.074***	0.075***	0.039*	0.075***	0.077***	0.047**
	(0.019)	(0.019)	(0.016)	(0.020)	(0.020)	(0.014)
Controls included:						
Year dummies	✓	✓	✓	✓	✓	✓
Average age and sex	✗	✓	✓	✗	✓	✓
Regional dummies	✗	✗	✓	✗	✗	✓

Notes: Standard errors in parenthesis are clustered at the regional level or the travel to work area level. ***, ** and * indicate statistical significance at the 1%, 5% and 10% respectively. For "All potential NHS nurses" sample sizes N=154 (140) for the regional level regressions (excluding London) and N=2,102 (2,088) for the TTWA level regressions (excluding London). For "potential NHS nurses from private sector" sample sizes N=154 (140) for the regional level regressions and N=1,955 (1,941) for the TTWA level regressions.

We therefore focus on the specification C_p, in which the elasticity is estimated at the TTWA level, with controls for region, and where the pool of potential NHS nurses comprises only individuals currently working in the private sector. In this instance the estimated effect of a 10% increase in the relative wage of NHS nurses is a 0.49 percentage point increase in the percentage of potential NHS nurses currently employed as NHS nurses. Given that on average across Great Britain 72.2% of such potential NHS nurses are employed as NHS nurses, this would equate to an average elasticity of 0.07 (since 0.049 / 0.722 = 0.07) – in other words, a 10% increase in the relative wage of NHS nurses would result in a 0.7% increase in the proportion of potentials employed as NHS nurses.

The exclusion of London from the regressions does not made a significant difference to the estimated coefficient, rejecting the potential assertion that the effect found is driven solely by the

London labour market. This is shown in Table 1 – the point estimate of the effect only changes from 0.049 to 0.047 when London is excluded from the analysis. However it is interesting to consider more explicitly whether the effect is different in London. To do this our preferred specification (C_p) is also estimated including an interaction of the lagged relative wage with a London dummy, and including an interaction of the lagged relative wage with both a London dummy and an 'outer London' dummy. Two definitions of 'outer London' are explored: one which includes the TTWAs that border London, and one which includes the South West, South East and East regions. The results are shown in Table 2: the interaction with London was statistically significant in all cases, but the interaction with either definition of 'outer London' was not. This suggests that while the labour supply elasticity in London is different to that of the rest of Great Britain, the elasticity in either the TTWAs or regions that border London is not.

Table 2:
Supplementary regression results: Different regional effects?

	Coefficient on lagged relative wage (β)			
	(C_p)	(C_p_1)	(C_p_2)	(C_p_3)
Lagged relative wage	0.049***	0.048***	0.044**	0.053**
	(0.014)	(0.014)	(0.015)	(0.016)
London*lagged relative wage		0.442***	0.445***	0.436***
		(0.061)	(0.061)	(0.059)
"Outer London 1" * lagged relative wage			-0.051	
			(0.028)	
"Outer London 2" * lagged relative wage				-0.199
				(0.230)

Notes: Results from a weighted OLS regression, with year dummies, regional dummies and controls for average age and sex included, and where potential NHS nurses are drawn only from the private sector. Standard errors in parenthesis are clustered at the regional level or the travel to work area level. ***, ** and * indicate statistical significance at the 1%, 5% and 10% respectively. "Outer London 1" comprises TTWAs that border London (Southend & Brentwood, Harlow & Bishop's Stortford, Stevenage, Luton & Watford, Wycombe and Slough, Guildford & Aldershot, Crawley, Tunbridge Wells and Maidstone & North Kent). "Outer London 2" comprises the regions of the South West, South East and East. N = 1,955.

The estimated coefficients and implied elasticities for Scotland, Wales and the regions of England (from model C_p_1) are summarised in Table 3. The effect on employment of an increase in the relative wage of NHS nurses is estimated to be much greater in London than across the rest of Great Britain: a 10% increase in relative wages would, according to our estimates, lead to a 5.0 percentage point increase in the percentage of potential NHS nurses currently employed as NHS nurses in London which is nearly ten times larger than the estimated response elsewhere in Great Britain of just 0.48 percentage points. The implied short run labour supply elasticity in London is therefore 0.68, compared to just 0.06 to 0.07 across the rest of the country.

Table 3:
Implied elasticities of short run NHS nurses' labour supply to relative wages of NHS nurses

		TTWA level, model (C)	
	B	Mean employment %	Implied elasticity
North East	0.048***	76.7	0.06
North West	0. 048***	77.0	0.06
Yorkshire and The Humber	0. 048***	73.8	0.06
East Midlands	0. 048***	70.5	0.07
West Midlands	0. 048***	69.2	0.07
South West	0. 048***	67.7	0.07
East	0. 048***	70.0	0.07
London	0. 500***	72.5	0.68
South East	0. 048***	64.6	0.07
Wales	0. 048***	80.2	0.06
Scotland	0. 048***	80.0	0.06
All	0.049***	72.2	0.07

Notes: Regression results from weighted OLS of model C_p_1 at the TTWA level. Sample size N=1,955.

6. Conclusions and Policy Implications

Recent research suggests that, given demographic change and the trends in the prevalence of different diseases, demands on the NHS are set to increase considerably in the near future (see for example, Roberts, Marshall and Charlesworth (2012)). This increase in demand for NHS services is likely to result in a significant increase in demand for nurses in the NHS, which increases the importance that the Government gives serious consideration to how it might encourage the employment and retention of quality nurses in the NHS at the lowest cost to the taxpayer. At the same time, the Government is anxious to ensure that the NHS workforce is used productively and efficiently, and that the labour market for NHS nurses more fully reflects local conditions and variations in outside opportunities for nurses. Arguably this becomes even more important given that the tight envelope for NHS funding is likely to continue for the foreseeable future (Crawford and Emmerson, 2012).

Boosting the number of NHS nurses by increasing nationally negotiated NHS nurses' pay rates should increase the short run numbers seeking employment as NHS nurses, unless labour supply is completely inelastic, and indeed the labour supply elasticities estimated here do indeed imply that higher NHS wages would attract more potential NHS nurses to work in the NHS. But across most of Great Britain this effect, at least in the short run, would be extremely small. Our central estimate is that across most areas of Great Britain the labour supply elasticity of NHS nurses

is just 0.06 to 0.07. This means that a 10% boost to the relative pay of NHS nurses would most likely increase the numbers employed as an NHS nurse in the short run by less than 1%.

A different picture exists for London. We find that, even in the short run, the number of NHS nurses in London is quite responsive to pay levels (in sharp contrast to the rest of Great Britain): we estimate that the short-run labour supply elasticity for NHS nurses in London is around 0.7 – implying that, for example, a 7% increase in nurse numbers could be expected to be achieved in year through a boost to the relative pay of NHS nurses of about 10%. While a nationwide increase in wages of this magnitude would achieve this increase in employment in London it would seem more sensible to target the pay increases solely towards those working in the capital, which could be done through enhancing the existing high cost area supplements or local recruitment and retention premia. Of course whether this is the most cost-effective way of boosting the number of NHS nurses in the capital is another matter, as there may be other potentially more cost effective ways of boosting employment than increasing pay, such as greater flexibility over hours of work, measures to reduce the difficulty and stress of the job, and improvements to the way individuals are managed – for example with regards to their potential career progression.

A natural extension of our model is to attempt to incorporate currently inactive ex-NHS nurses into the estimation procedure. It should however be noted that the object of the present paper is *not* to produce an estimate of the potential supply of NHS nurses in the short run, but to show how differential labour market conditions across localities impact on the elasticity of supply of NHS nurses. The decision of a potential nurse *not* to work is likely to be related to life choices such as withdrawal from the labour market to bring up children rather than wage relativities *per se*. Hence we would not expect the inclusion of inactive NHS nurses, in terms of the labour market, to affect our key parameter values.

Finally, it should also be reiterated that a long run perspective on nurses' labour supply might be different. While the estimates in this paper suggest that the short run elasticity of nurses' labour supply is extremely small across most of Great Britain, it is quite possible that a sustained increase in the relative wage would increase supply in the long run, either by attracting more potential NHS nurses to the NHS, increasing the retention of NHS workers (i.e. reducing the number of NHS nurses who leave in the first place), increasing the number or quality of individuals who want to train to become nurses or boosting the numbers who come to the UK to work as a nurse in the NHS. But in circumstances where the government controls the number of training places in nursing, the government has weapons in its armoury both to increase the stock of nurses overall as well as the fraction of those that wish to work in the NHS.

References

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

Burdett, K. (2012) 'Towards a Theory of Labor Market Equilibrium with a Public Sector, *Labour Economics*, 19, 1,68-75.

Crawford, R. and Emmerson, C. (2012) *NHS and social care funding: the outlook to 2021/22*, London: Nuffield Trust.

Department of Health (2012) *NHS Pay Review Body – Market-facing Pay: Written Evidence from the Health Department for England, April 2012,* Department of Health: London.

Di Tommaso, M., Strom, S. Saether, E. (2009) 'Nurses wanted: is the the job too harsh or is the wage too low?' *Journal of Health Economics,* 28, 748-757.

Disney, R. and Gosling, A. (2008) 'Changing public sector age differentials in the UK', Institute for Fiscal Studies *Working Paper*, 08/02, London.

Elliott, R., Ma, A, Scott, A., Bell, D, and Roberts E. (2007) 'Geographically differentiated pay in the labour market for nurses' *Journal of Health Economics,* 26, pp.190-212.

Elliott, R., Sutton, M., Ma, A., McConnachie, A., Morris, S., Rice, N., and Skåtun, D. (2010) 'The role of the staff market forces factor in distributing NHS funding: taking account of differences in local labour market conditions'. *Health Economics*. 19(5); 532–548.

Fogel, W. and Lewin, D. (1974) 'Wage determination in the public sector', *Industrial and Labor Relations Review*, 27, April, 410-431.

Hanel, B., Kalb, G. and Scott, A. (2014) 'Nurses' labour supply elasticities: The importance of accounting for extensive margins', *Journal of Health Economics,* 33, 94-112.

Hirsch, B. and Schumacher, E. (1995) 'Monopsony power and relative wages in the labor market for nurses', *Journal of Health Economics*, 14, 443-476.

Journal of Labor Economics (2010) 28, April, Special issue: 'Modern models of monopsony in labour markets: tests and estimates'.

Manning, A. (2005) *Monopsony in Motion*, Princeton: Princeton University Press.

Mullin, C. (2011) *Decline and Fall: Diaries 2005-2010*, Profile Books: London.

NHS PRB (2012) 'Market facing pay: How Agenda for Change pay can be made more appropriate to local labour markets', Cm 8501, The Stationery Office.

Office for National Statistics (2012), *Annual Survey of Hours and Earnings, 1997-2011: Secure Data Service Access [computer file], 3rd Edition*. Colchester, Essex: UK Data Archive [distributor], June 2012. SN: 6689, http://dx.doi.org/10.5255/UKDA-SN-6689-2.

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

Propper, C. and Van Reenen, J. (2010) 'Can pay regulation kill? Panel data evidence on the effect of labor markets on hospital performance', *Journal of Political Economy,* 118, 2, pp. 222-273.

Roberts, A., Marshall, L., and Charlesworth, C., (2012) *A Decade of Austerity*', Nuffield Trust Research Report, London

Shields, M. (2004) 'Addressing nurse shortages: what can policy makers learn from the econometric evidence on nurse labour supply?', *Economic Journal*, 114, pp. F464-F498.

Staiger, D., Spetz, J. and Phibbs, C. (1999). 'Is there monopsony in the labor market? Evidence from a natural experiment', National Bureau of Economic Research *Working Paper* Series No. 7258, Cambridge: Mass; published in 2010, *Journal of Labor Economics*, 28, April, 211-236.

Sullivan, D. (1989) 'Monopsony power in the market for nurses', *Journal of Law and Economics*, 32, October, S135-S178.