

# Do Nurses Respond to Wages in the NHS?

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## **Abstract**

Recent literature on the labour supply elasticity of nurses suggests their participation and hours are relatively inelastic with respect to wage. At the same time, there is great concern over the nursing shortage, a shortage which appears to be more severe in areas where the public-private wage gap is larger. While labour supply elasticity may be low, wages have a substantial impact on nurses' decisions. This paper examines the extent to which variation in vacancy rates can be explained by the difference between NHS and outside wages (opportunity cost argument), and the difference between the NHS wage and the wage needed to afford housing (cost of living argument).

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# Background

The nursing shortage in the National Health Service continues to be a major problem for many metropolitan areas, especially London. Many factors may contribute to this shortage, including workload, pay, promotion and training opportunities, staff morale and other employment options (Shields and Ward, 2001; Finlayson et al, 9/02; Audit Commission Recruitment and Retention, 2002). From a labour economics perspective, there is one obvious reason for the shortage: low pay resulting from monopsony power in the labour market for nurses. As an employer of over 300,000 registered nurses and midwives (1.2 million employees overall), the National Health Service wields enormous power over their conditions of employment. This problem is exacerbated by the presence of strong unions fighting for higher, but equal pay. Their resistance to pay differentials across the UK limits the ability of Trusts to address local shortages through wages, even when given the autonomy to do so.<sup>1</sup>

The NHS has attempted to address the low pay of nurses with an increase in pay (in cash terms) of over 15% from 1997 to 2000 (NHS Executive, 11/00) and more than 3% per year thereafter ([www.nursing-pay.com](http://www.nursing-pay.com), 3/12/03). In April 2000, an NHS Housing Coordinator was appointed, recognizing NHS wages are so low in some areas that accommodation is unaffordable in some parts of the country. The government has actively supported a starter home initiative to help public sector workers buy their first home (Merrick, 2004). They are also trying to encourage trained nurses to return to the NHS; recruit nurses from overseas; increase the number of nursing and midwifery training places; and are introducing more family-friendly, flexible working schedules (NHS Executive, 11/00). However, it is unclear how successful these policies will be if basic pay rates remain below other employers.

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<sup>1</sup>In the mid 1990s, the NHS allowed Trust-level negotiations, but the evidence suggests few Trusts took advantage of this. A 1997 survey of 137 trusts found that only 35 set their own terms and conditions of employment (not necessarily for all staff). And it was mostly ambulance trusts that used their own pay systems (Corby et al, 2003). Furthermore, a survey of school nurses in 2001 found that 91% were paid on the Whitley Scale (Lyons et al, Making the Grade, 2001). In a 2001 membership survey by the Royal College of Nursing, 80% of respondents said they were paid on the Whitley scale; almost all used the clinical grading structure (RCN, Time to Deliver, 9/01).

For a complete review of the labour supply literature on nursing, see Antonazzo et al, 2003. Below, I highlight the research most directly related to this paper. Several recent studies attempt to estimate the labour-supply elasticity of the nurse workforce in the UK. Skatun et al (2002) use a sample of 1248 qualified nurses from the 1999-2000 Quarterly Labour Force Survey (205 of whom were not in the labour force). They found that the decision to work as a nurse and responsiveness of hours to wages were both inelastic (at .62 and .48 respectively). The authors acknowledge, however, that the exclusion of trained nurses working outside the NHS and inaccurate estimation of experience could bias their estimates.

More recently, Rice (2003) uses nine waves of the British Household Panel Survey (BHPS) to estimate elasticity of hours with respect to wage for 160 qualified female nurses (who reported working as a nurse in at least one wave) between 1991-1999. Panel data helps control for unobserved heterogeneity, and two-stage least squares addresses possible endogeneity of wages. Rice finds an elasticity of 0.40, similar to Skatun et al (2000).

An earlier study by Phillips (1995) used data from the 1980 Women and Employment Survey to estimate the elasticity of participation for 312 nurses (qualified or unqualified), 144 of whom worked in nursing. While Phillips found participation was responsive to wages (elasticity of 1.4), the hours response was highly inelastic (0.15).

While earlier, albeit cross-sectional, data (from 1980) finds nurses' decision to participate in the nurse labour market might be highly responsive to wages, more recent evidence suggests they are far less so. In fact, recent work by Frijters et al (2003), found that practicing nurses were paid almost 20% more than qualified nurses working outside the NHS, yet annual turnover for NHS nurses was as high as 10 percent. Using data on qualified nurses from the 1997-2000 Quarter Labour Force Survey, they found nurses to be relatively unresponsive to wage changes primarily because of working conditions (mainly shift patterns). The higher NHS wage apparently fails to adequately compensate nurses for unfavorable working conditions.

However, current methods for estimating labour supply elasticities have limitations. Most studies estimate only a short-term labour supply elasticity without addressing the long-term disincentive low wages have on the attractiveness of the nursing profession (with long-run elasticities higher than short-term). Also, by looking mainly at nurses working in health, most studies exclude those individuals who either trained or began training as a nurse but have chosen not to work for the NHS (whose elasticities are most likely higher than those remaining in the NHS). And studies are usually limited to small samples of nurses because of data availability. To address some of these problems, I take a different approach using aggregate data on vacancy rates by Health Authority. If nurses' labour supply decisions are inelastic, then the vacancy rate (which is determined by the existing stock of nurses, including qualified nurses not working or working outside the health sector) should also not be affected by wages.

## 1 Model

Vacancy rates could be driven by supply, demand or both. For simplicity, I assume demand is exogenous (though I will revisit this assumption later). The vacancy rate is therefore determined by the availability and willingness of nurses to work for the NHS. This decision will be a function of individual characteristics, characteristics of the job, local labour market conditions and, relatedly, local area characteristics, including cost of living. Rather than study job preferences at the individual level, I will focus on the average employment decision at the Health Authority level.

$$\text{RNvac}_{i,t} = f(\text{relW}_{i,t}, \text{COLgap}_{i,t}, \text{work}_{i,t}, \text{job}_{i,t}, \text{local}_{i,t})$$

Where  $\text{RNvac}_{i,t}$  equals the number of vacancies in Health Authority  $i$  in year  $t$ ;  $\text{relW}_{i,t}$  is a measure of NHS wages relative to local labour market alternatives;  $\text{COLgap}_{i,t}$  is a measure of the gap between NHS wage and local cost-of living (related to housing costs),  $\text{work}_{i,t}$

represents workforce characteristics within the Health Authority area;  $job_{i,t}$  represents other job, Trust or Health Authority characteristics;  $local_{i,t}$  represents other local conditions.

## 1.1 Wage effect

The main hypothesis is that vacancy rates should be directly related to nurses' decisions to work. If the participation decision is inelastic with respect to wage, wages should not have much effect on vacancy rates. So the main job characteristic of interest is wage.

However, instead of using actual NHS wage as a measure of pay (which is relatively uniform across the country), wage effects are studied from two angles: opportunity cost (of job choice in terms of relative wage) and cost-of-living (whether NHS wages are adequate to afford local housing). NHS wages are centrally determined based on the Whitley scale, so there is little variation in basic salary across the country. There is, however, significant variation in the cost of living, labour market conditions and alternate job opportunities across the country. While the NHS is a virtual monopsonist in the labour market (particularly in areas with minimal private health care options), they do have to compete for workers with other employers. This competition may be strongest between health care providers (private practices and hospitals), but also exists between the health and non-health sector. There is considerable evidence for job mobility of the nursing profession. In March, 2003, there were 655,854 qualified nurses, midwives and health visitors registered with the Nursing and Midwifery Council (NMC), yet only an estimated 356,000 of them worked in the NHS at that time. Approximately 5% of registered nurses are known to live abroad, some registered nurses have retired, and of course others work in the private health sector. But there is also a large population of trained nurses who choose not to work in health.<sup>2</sup> The 1999 Quarter Labour Force Survey data included 2578 qualified nurses aged 18-65 years old, 2133 (83%) of whom worked, only 1461 as nurses. Almost 32% (672) of trained nurses worked outside nursing. Of those in nursing, 258 (18%) worked in the private health sector.<sup>3</sup>

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<sup>2</sup>Buchan & Seccombe, 9/03.

<sup>3</sup>Note: The QLFS asks for the highest qualification of the respondent. An estimated 22% of qualified

Table 1 presents a comparison of annual wages for full-time workers on the NHS Whitley pay scale (grades D0, E0 and F0) versus average basic pay for full-time workers in Great Britain from the New Earnings Survey data for the 1990-2003 period. In 2002, nonmanual full-time working women earned approximately 17% more than nurses on Grade E0 of the Whitley scale. Yet in 1990, they were roughly equivalent (nonmanual women earned only 2% more than E0 nurses).<sup>4</sup> If the local labour market offers better paying jobs than the NHS (for someone of similar skill), individuals will be less likely to seek employment in the NHS. If, however, the NHS wage is equivalent to outside options, *ceteris paribus*, they should see lower vacancy rates. In fact, in 2001, NHS wages were not only below private sector wages, but fell below other public sector jobs, such as teachers and police.<sup>5</sup> So rather than NHS wage, relative wage is included, measured either as the difference between the average annual NHS and nonmanual, full-time workers' wages in the Health Authority's area ( $W_{\text{diff}} = W_{\text{nhs}} - \bar{W}_{\text{nonmanual}}$ ), or the ratio of NHS to nonmanual wages ( $W_{\text{ratio}} = \frac{W_{\text{nhs}}}{\bar{W}_{\text{nonmanual}}}$ ).<sup>6</sup>

Another major factor affecting job market decisions is the cost of living. London and the SouthEast, which have above average living costs, have consistently higher vacancy rates than other parts of England. Assuming most individuals would like to own their own home at some stage, cost of housing would be a major consideration in assessing job and location choices. For example, in 2003 a top paid nurse in grade E would earn £21,325 plus up

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nurses report higher qualification in something other than nursing in the winter quarter, December 1996 survey (Buchan, Seccombe and Smith, 1998).

<sup>4</sup>It is harder to compare to 1980 and 1985 as the reported NHS wages were based on an entirely different nurse grading scale (See Table 1 footnote f). Still, nurse wages seem comparable to national average wages for nonmanual women in the 1980s.

<sup>5</sup>Finlayson et al, 2002 p542.

<sup>6</sup>For simplification, nonmanual is defined as SOC90 major codes 1-4 and 7, which is roughly comparable with the New Earnings Survey pre-2002 definition.

to an additional £3333 London weighting.<sup>7</sup> <sup>8</sup> The average sales value of maisonettes and flats from July to September, 2003, varied tremendously, with an average of £71,000 in Lincolnshire; £98,241 in the West Midlands; £147,000 in Dorset up to £262,560 in Inner London.<sup>9</sup> Even with weighting, London housing would be unaffordable for nurses living in single-earner households and even many in dual-earner couples. Of course, many nurses are married, hold second jobs, work extra hours and can earn more than the basic salary. But the basic pay structure is a strong signal to would-be nurses of their earnings capacity. And it stands to reason that, particularly in expensive areas, wages are a weak incentive to join the NHS payroll.

While local wages should adjust to regional variation in housing prices, they do not always adequately reflect the local cost of living, particularly in centrally determined pay systems like the NHS. To address this, a “housing underpayment” is included, measured as the difference between a grade E0 nurse salary and the salary needed to afford housing (assuming 100% mortgage with a borrowing limit at 3.5 times salary.) In other words, the cost of living gap is  $(\frac{\text{hsgP}}{3.5} - \text{NHSsalary})$  based on a nurse on grade E, point 0.

## 1.2 Workforce, job and local characteristics

A person’s willingness to work in the NHS will be a function of their qualifications, age, gender, family status, job tenure or experience within the sector and of course amenities associated with their current position. Job characteristics that may matter include management, promotion and training opportunities, staff morale, workload, fringe benefits, flexible

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<sup>7</sup>According to the RCN 2001 membership survey, the most common grades for NHS staff are hospital E (40%) , community settings G (42%), general practice F or G (89%), staff nurses E (59%) and sisters G (49%). Over half of nurses were at the top point of their pay grade (RCN Time to Deliver, 9/01). In 1999, 34% of NHS nurses were on Grade E (NHS Executive, 11/00). Furthermore, according to an analysis of the Quarterly Labour Force Survey 1997-2000 data, approximately 40% of nurses were in grades E and F and 42% were in grades D or lower (Frijters et al, 2003).

<sup>8</sup>[www.nursing-pay.com](http://www.nursing-pay.com) 12/12/03.

<sup>9</sup><http://www.proviser.com/regional/counties>, 12/12/03.

hours, and patient mix or characteristics.

Other local characteristics that could affect vacancies include the strength of the private health sector, the unemployment rate, presence of nurse training programs, and so on. Unfortunately, much of this data (particularly on working conditions and job or staff characteristics) is not available. However, several years of vacancy rate, wage and housing cost data are available from 1999-2003. This allows for either a fixed effects or first-differenced model, both of which control for fixed differences across areas over time. Only those characteristics that change annually need to be included.

The fixed effects model to be estimated is:

$$\text{RNvac}_{i,t} = \alpha_0 + \alpha_1 * \text{relW}_{i,t} + \alpha_2 * \text{Underpay}_{i,t} + \alpha_3 * \text{RNstaff}_{i,t} + \alpha_4 * \text{popn}_{i,t} + \delta_i + \tau_t + \epsilon_{i,t} \quad (1)$$

with the number of nurse vacancies regressed against the NHS-NES wage difference (or ratio), housing underpayment, staffing levels (rather than constricting the nurse staff coefficient to 1 by using vacancy rate as the dependent variable), population of the HA, and HA and year fixed effects ( $\delta_i$  and  $\tau_t$ , respectively). All regressions include clustering at the HA level to address autocorrelation (Bertrand et al, 2004) and robust standard errors (for heteroskedasticity). Alternatively, the first-differenced model is:

$$\Delta \text{RNvac}_{i,t} = \alpha_1 * \Delta \text{relW}_{i,t} + \alpha_2 * \Delta \text{Underpay}_{i,t} + \alpha_3 * \Delta \text{RNstaff}_{i,t} + \alpha_4 * \Delta \text{popn}_{i,t} + \tau_t + \epsilon_{i,t} \quad (2)$$

where period t-1 values are subtracted from period t, for all variables, and excluding the constant to address autocorrelation (Wooldridge, 2003). Eq2 would also be run with robust standard errors and clustering at the HA level.

## 2 Data

The Department of Health Vacancy Survey began in 1999 to the present, collecting data on vacancy rates by occupation code by Trust and Health Authority as of March 31 of each year.



<sup>10</sup> While this data is limited only to posts that remain vacant for at least 3 months (thereby excluding roughly half the vacancies), it still offers detailed information on the size of the nursing shortage by Trust or region.<sup>11</sup> The vacancy rate is calculated as the number of openings that have remained vacant for 3 months or more, divided by the number of staff-in-post + number of vacancies.<sup>12</sup> NHS wages are based on published information of standard NHS pay scales, combined with London weighting and other add-ons.<sup>13</sup> One advantage of using three month vacancies is that, while they may understate true vacancy rates (at a point in time), they are less affected by changes in demand. In other words, they are more likely to represent long-term difficulties in recruitment rather than short-term growth in demand.

The New Earnings Survey is an annual survey of one percent of employees in full-time employment in Great Britain. It collects information on gross weekly pay for employees on adult rates of pay whose pay was not affected by absence in the survey pay period (roughly April of each year), primarily for earners above the income tax threshold. The NES data is used to calculate average annual basic pay (excluding overtime and other payments) for nonmanual workers (SOC90 codes 1-4 and 7) by HA.<sup>14</sup>

Average house prices by 5-digit postcode produced by the Land Registry are available through the UK Data Archive from Experian Limited.<sup>15</sup> The data tracks the number of

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<sup>10</sup>Vacancy data is available by Health Authority from 1999-2001 only; for Strategic Health Authorities from 2002-2003; and for Trusts from 1999-2003, but less than half of the Trust sample reported in 1999 is consistent with the 2003 data.

<sup>11</sup>According to staff at the Norfolk, Suffolk and Cambridgeshire Workforce Development Confederation, over half of area vacancies are less than 3 months.

<sup>12</sup>see <http://www.doh.gov.uk/public/vacancysurvey.htm>, last accessed November, 2003, for more information and the NHS Workforce Electronic Vacancy Collection Guidance Document 2004 (ROCR/OR/0103/01).

<sup>13</sup>See [www.rcn.org.uk](http://www.rcn.org.uk) for further information of pay scales and adjustments.

<sup>14</sup>NES data was obtained through the Nomis website, operated by University of Durham on behalf of the Office for National Statistics. See [www.nomisweb.co.uk](http://www.nomisweb.co.uk). In order to calculate average wage by Health Authority, user-defined geographic areas were created for each HA based on all unitary authorities for which at least 30% of the UA was in the HA, according to the All Fields Postcode Directory 1999 assignments.

<sup>15</sup>see <http://www.landreg.gov.uk/propertyprice/default.asp> for further information of Land Registry data. Data available from MIMAS and the UK Data Archive is obtained from Experian Limited, but available

sales and average sales price of houses by 5-digit postcode by housing category (flat, semi-detached, terraced or detached) for England from 1995.

Data were merged using the 1999 All Fields Postcode Directory produced by ONS Geography, available from MIMAS. The AFPD maps all current and old postcodes to administrative, electoral, health and other geographic codes.<sup>16</sup> HA population data was obtained from the Health Service Financial Database produced by the Institute of Public Finance.

### 3 Results

The number of vacancies for nurses, midwives and health visitors in England increased from 7504 in 1999 to 10180 by 2001, 33% of which were in London alone, and another 21% in the South East. The Health Authority vacancy rate ranged from zero to a high of 13.2% in the Croydon HA (189 positions) or a maximum of 496 vacant positions in the East London and The City HA in 1999. The national average wage difference (between NHS pay grade E0 and basic full-time wages for nonmanual male and female workers combined) was £7,783 in 1999 (nominal value), or £9,290 by 2001. But for London, this difference was higher at £10,229 and £12,255, respectively. In fact, the difference between nurses wages and national average nonmanual salaries has been increasing over the past 20 years, as seen in Table 1. Housing costs have also increased faster than NHS wages, with national average sales (of all homes in nominal units) of £97,000, £108,000, and £120,000 in 1999, 2000 and 2001, respectively, but £154,000, £183,000 and £202,000, respectively, in the London area. Summary statistics for London and England are presented in Table 2; vacancy numbers, rates, housing costs and pay for English Health Authorities are presented in Table 3.

It stands to reason that areas with less affordable housing, or more attractive outside labour market opportunities, would have a harder time recruiting nursing staff. Regression

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only until 2002.

<sup>16</sup>for further information see: <http://www.statistics.gov.uk/geography/afpd.asp> but for a simplified conversion facility, see [convert.mimas.ac.uk](http://convert.mimas.ac.uk)

results testing this hypothesis are presented in Table 4. All regressions include clustering at the HA level and robust standard errors. Equation 1 is run in most columns, either with a Prais-Winsten estimation method to further address autocorrelation, or with HA fixed effects to eliminate fixed differences between HAs (for which the Prais estimation proved unnecessary). Another way to address autocorrelation is the first-differenced estimation of eq2, with no constant (Wooldridge, 2003). As first-differencing also eliminates fixed differences between HAs, fixed effects are unnecessary. These results are in columns 3 and 8 of Table 4.

All regressions without fixed effects or first-differencing suggest better outside wage opportunities have a positive effect on the number of nurse vacancies (as theory predicts). This effect is strong until the housing underpayment variable is included, at which point it becomes insignificant. But the sign curiously reverses with fixed effects and first-differencing, though the coefficient is always insignificant. In other words, it is sensitive to specification, with no significant effect on Health Authority vacancies (as recent literature predicts).

The strongest result from the regression analysis is the robustness of estimates of housing underpayments on the number of vacancies. Areas with large housing underpayments (i.e. the increase in salary needed for a grade E0 nurse to be able to afford a mortgage for the average home sold within their HA) have higher vacancies. An underpayment of £1,000 would lead to about 7 more vacancies, but a £50,000 underpayment (which easily applies to the London area) would result in roughly 350 more.<sup>17</sup> From eq2, we find that an increase in the housing underpayment of £10,000 (for example, due to housing price inflation in excess of NHS wage inflation), would lead to an additional 100 nurse vacancies. This suggests the current housing initiative to help public sector workers purchase their first home should help reduce vacancies. Whether it works in the long run, however, will depend on whether the housing subsidy keeps pace with housing prices (and also the rate of wage increases).

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<sup>17</sup>It is probably more applicable to use average value of flat sales for this estimate, as a better indication of what a sole earner nurse is likely to purchase. However, the results are comparable, but the number of flat sales within some HAs is too small to provide reliable average annual sale prices.

Further regressions were run with squared terms but are not presented due to insignificance. Regressions using nonmanual women’s wages as the comparator group were also run (which lowers the number of HAs with 3 years of data), but without an appreciable difference (particularly as the relative wage effect is insignificant). Of course, the results should be interpreted with caution as they assume demand is strictly exogenous and nothing else varies over time that could affect vacancies other than housing costs and wage differentials. If, for example, more recruitment results in changing numbers of the local nurse pool, these results may suffer from omitted variable bias. While first-differencing or fixed effects estimation strategies partially address omitted variable bias, they are by no means foolproof.

## 4 Conclusions

Surprisingly, the opportunity cost wage argument was not supported by the data. However, this could be because the relative wage effect is dwarfed by the impact of housing underpayments. In areas where nurse wages are £50,000 shy of affording a 100% mortgage, Health Authorities experience about 350 more vacancies than areas where a mortgage is affordable. And as house price inflation continues to exceed wage inflation, this problem may worsen. Under Agenda for Change, an E grade nurse may expect to earn somewhere in the Bands 5 and 6 range, with a grade E0 nurse probably near the middle to high end of Band 5. Assume the average E0 nurse were to see a base salary scale of Band 5, point 9, at £20,387; an increase of £2,727 (or 15%) over the current E0 salary of £17,660. This would afford an extra £9,500 on a mortgage (again, assumes borrowing limit up to 3.5 times salary). Also assume house price inflation continues at roughly 15% annually. From equation 2, we can calculate that these wage and housing price increases would lead to roughly 70 more vacancies next year than currently.<sup>18</sup> If house price inflation were as high as 20%, the

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<sup>18</sup>We see from columns 3 and 8 in Table 4 that the effect of house price inflation can be calculated as:  $\Delta RNvacancy = .010 * \Delta HousingUnderpayment$  which, for 2004 with house price inflation represented by  $r$ , would be:  $.010 * (\frac{r * hsgP_{03}}{3.5} - (W_{04} - W_{03}))$ . This calculation does not take into account any increase in the London weighting or cost of living supplements.

increase in vacancies would rise to approximately 100. This increase is in addition to the already high level of vacancies in London and the SouthEast and suggests, even with the implementation of Agenda for Change, the vacancy problem is not likely to end anytime soon.

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**Table 1: Comparison of NHS vs Great Britain average annual pay**

New Earnings Survey Estimates <sup>a</sup>					NHS Whitley Pay Scale		
Year	Women		Men&Women		Grade D0 <sup>b</sup>	Grade E0 <sup>c</sup>	Grade F0 <sup>d</sup>
	Manual	Nonmanual	Manual	Nonmanual			
2003 <sup>e</sup>	19583		22636		16525	17660	19585
2002	11674	20056	14997	25038	16005	17105	18970
2001	11424	19323	14435	24071	15445	16510	18310
2000	10816	18356	13629	22901	14890	15920	17655
1999	10135	17170	13208	21616	14400	15395	17075
1998	9485	16266	12589	20540	12633	14448	16029
1997	8944	15574	11856	19630	12230	13990	15520
1996	8824	14950	11544	18964	11895	13605	15095
1995	8424	14290	11034	18101	11660	13339	14801
1994	8076	13837	10686	17529	11320	12950	14370
1993	7826	13348	10468	17040	10980	12585	13955
1992	7498	12792	10114	16370	10820	12400	13750
1991	6552	11783	9521	15262	10230	11720	12995
1990	6516	10686	8710	14139	9165	10500	11645
1985 <sup>f</sup>	4415	6656	6006	8949	5467	5688	6478
1980 <sup>g</sup>	3021	4165	4285	6854	4021	4184	4764

<sup>a</sup>Average annual basic earnings for manual and nonmanual full-time workers (women only, and men and women combined), excluding overtime or other supplementary payments, before statutory deductions. Full-time defined as working more than 30 hours per week, excluding overtime; 25 hours for teachers and academics. Excludes those whose pay was affected by absence during the NES reference period. Reported in nominal annual sterling.

<sup>b</sup>Newly qualified nurses, Grade D, point 0.

<sup>c</sup>Experienced staff nurse or newly qualified midwife, Grade E, point 0.

<sup>d</sup>Senior nurse, Grade F, point 0.

<sup>e</sup>Manual/nonmanual breakdown not available for NES 2003 due to change in occupational coding classifications (from SOC90 to SOC00). Reported average annual earnings for all full-time employees (nonmanual and manual combined).

<sup>f</sup>The NHS changed the payscale grade structure for nurses in 1988. Prior to that, the grade/point structure was based on nurse matrons, wardens, sisters, staff nurses and nursing officers. The figures reported here for 1980 and 1985 are based on Staff Nurse (RFN) in column D0; Day Nursery Deputy Matron (a) in column E0; and Deputy Nursing Sister in column F0.

<sup>g</sup>NES did not report men's & women's earnings combined until 1984. The figures under "men&women" for 1980 represent male earnings only.



**Table 2: Statistics for London and England<sup>a</sup>**

Variable	London			<sup>b</sup>	England	
	1999	2000	2001	1999	2000	2001
RNvacancy#	2486	3693	3324	7504	11194	10180
RNvacancy%	4.71	6.78	6.04	2.23	3.21	2.86
RNstaff#(wte)	50797	51516	51767	331921	338248	345802
Basic salary:						
women <sup>c</sup>	20769	22195	23512	18189	19124	20420
men&women <sup>d</sup>	25624	27476	28765	23178	24314	25800
Housing Prices:						
Flats	127770	154462	171469	92094	106867	117812
Terraced	158462	189985	204539	74299	82382	91158
Semi-detached	174413	206289	227180	82923	92167	104074
Detached	316556	385776	405902	146396	166111	183519
Total	153898	183342	201685	96509	107978	119815

<sup>a</sup>All prices in nominal sterling.

<sup>b</sup>London statistics aggregate data for all 14 Health Authorities (and their post-codes) in the 5 London Strategic Health Authorities.

<sup>c</sup>Basic annual salary for full-time nonmanual female workers in the New Earnings Survey.

<sup>d</sup>Basic annual salary for full-time nonmanual workers for men and women combined, from the New Earnings Survey.

**Table 3: Summary Statistics**

**English Health Authorities**  
with NES earnings data for 1999-2001 <sup>a, b, c</sup>

Variable	1999		2000		2001	
vacancy# <sup>d</sup>	77	(88)	114	(131)	103	(113)
vacancy% <sup>e</sup>	.021	(.021)	.029	(.025)	.027	(.022)
RN <sub>wte</sub> <sup>f</sup>	3366	(1723)	3429	(1759)	3503	(1831)
flatP <sup>g</sup>	60787	(34485)	69779	(43079)	78868	(47061)
housingP <sup>h</sup>	90666	(45750)	103209	(57373)	114849	(62451)
pay <sub>nes</sub> <sup>i</sup>	21707	(3220)	22761	(3561)	24039	(3935)
NHSpay <sub>D0</sub> <sup>j</sup>	14400	14933	14890	15441	15445	16009
NHSpay <sub>E0</sub> <sup>k</sup>	15395	15938	15920	16473	16510	17074
Wdiff <sup>l</sup>	6312	(3220)	6841	(3561)	7529	(3835)
Wdiff% <sup>m</sup>	1.41	(.21)	1.43	(.22)	0.46	(.24)
Wratio <sup>n</sup>	1.41	(.21)	1.14	(.16)	1.46	(.24)
Sample Size	97		97		97	

<sup>a</sup>Standard deviations in parentheses where applicable.

<sup>b</sup>Excludes Health Authorities for whom New Earnings Survey wage calculations were too unreliable (sample size < 30 or standard error > 5%). Excludes Northern Ireland, Scotland and Wales.

<sup>c</sup>All prices nominal units.

<sup>d</sup>Number of 3-month nurse vacancies in the HA from the Department of Health NHS Workforce Vacancy Surveys.

$$e \frac{\text{vac\#}}{\text{vac\#} + \text{RN}_{wte}}$$

<sup>f</sup>Number of whole-time-equivalent nursing staff.

<sup>g</sup>Average price of flats sold in calendar year within each Health Authority's postcodes from the Experian extract of Land Registry housing sales data.

<sup>h</sup>Average price of all homes sold in calendar year within each Health Authority's postcodes from Experian Limited.

<sup>i</sup>Average salary in Health Authority area, excluding overtime or other payments, for nonmanual workers only (defined by SOC90 major codes 1-4 and 7) based on New Earnings Survey workplace data from Nomis.

<sup>j</sup>NHS pay rate Grade D, point 0. Basic pay is in the first column of each year; basic pay + London weighting and cost of living supplement in the second. The cost of living supplement was 5% of salary (up to a maximum £750) for inner and outer London, or 2.5% (up to a maximum £375) for fringe zones. The London weight for 1999-2001 was 2205, 2280, 2365, respectively, for inner London; 1570, 1623, 1684 respectively, for outer London; and 285, 295, 306, respectively, for fringe zones. No adjustments were made for extra-territorially managed and contiguous units as these apply mostly to individual Trust or hospital units and cannot be easily applied to aggregated Health Authority data.

<sup>k</sup>See previous footnote for details.

<sup>l</sup>Wdiff = pay<sub>nes</sub> - NHSpay<sub>E0</sub> (including London weighting calculation for relevant Health Authorities).

$$m \text{Wdiff\%} = \frac{\text{Wdiff}}{\text{pay}_{E0}}$$

$$n \text{Wratio} = \frac{\text{pay}_{nes}}{\text{pay}_{E0}}$$

**Table 4: Nurse Vacancy Regressions, 1999-2001<sup>a</sup>**

Variable	Wdiff <sup>b</sup>			%Wdiff <sup>c</sup>			Wratio <sup>d</sup>	
	1	2	ΔWdiff	4	5	6	7	ΔWratio
Wvar	.008 (.004)	-.012 (.007)	-.012* (.006)	113 (81)	-199 (117)	113 (81)	-199* (117)	-189 (100)
Hsg <sub>underpay</sub>	.002** (.001)	.007* (.003)	.010** (.003)	.003** (.001)	.006 (.003)	.003** (.001)	.006 (.003)	.010** (.003)
RNstaff	.030** (.005)	.080 (.065)	.071 (.048)	.030** (.006)	.079 (.065)	.030** (.006)	.079 (.065)	.070 (.048)
Popn(000s)	.005 (.034)	.003 (.049)	.023 (.038)	.006 (.034)	.004 (.049)	.006 (.034)	.004 (.049)	.024 (.038)
HA FE	n	y	n	n	y	n	y	n
Sample Size	291	291	194	291	291	291	291	194
Original DW <sup>e</sup>	0.87	1.93	–	0.84	1.93	0.84	1.93	–
Transformed DW	1.47	n/a	–	1.47	n/a	1.47	n/a	–
R <sup>2</sup>	.43	.73	.17	.42	.73	.42	.73	.17

<sup>a</sup>

1. Robust standard errors in parentheses. Significance at the 1% (\*\*) and 5% (\*) levels, as indicated.
2. English Health Authorities for which NES nonmanual full-time basic (i.e. excluding overtime and other supplemental payments) wages could be calculated for men and women combined (Barnsley HA was dropped).
3. All financial figures adjusted to £2001 using the all-item Retail Price Index (RPI) prior to running regressions.
4. Dependent variable, RNvac, equals the number of all nurse vacancies in a Health Authority as of 31 March of year XX, including qualified and unqualified nurses, midwives and health visitors (the majority were for qualified nurses).
5. Housing cost variable based on average cost of all homes sold in HA.
6. Regressions for all columns based on eq1 except columns 3 and 8, based on eq 2. Where NHS wage is based on nurse grade E0, adjusted for London weighting and cost of living supplements. All regressions include year fixed effects.

<sup>b</sup>Wdiff = NHSpay - NES basic pay, columns 1-2, and first-differenced (Wdiff<sub>t</sub> - Wdiff<sub>t-1</sub>) with first-differenced dependent variables as well, column 3.

<sup>c</sup>%Wdiff =  $\frac{Wdiff}{NHS\ pay}$ , columns 4-5.

<sup>d</sup>Wratio =  $\frac{NES\ pay}{NHS\ pay}$ , columns 6-7, and first-differenced (Wratio<sub>t</sub> - Wratio<sub>t-1</sub>) with first-differenced dependent variables as well, column 8.

<sup>e</sup>Durbin-Watson statistic testing autocorrelation in regular level regressions. Transformed DW reported, where applicable, for Prais-Winsten estimation to address autocorrelation.