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Cost of living and the impact on nursing labour outcomes in NHS acute trusts

Economic and Social Research Council

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Preface

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The views expressed are those of the authors and not necessarily those of the NIHR, the Department of Health and Social Care, or the ESRC.

The authors thank the Department of Health and Social Care for access to data from the NHS Electronic Staff Record (ESR). Figures published using the ESR may be different from the official workforce statistics published by NHS Digital.

Contents

Executive summary

Retention of nursing staff within the NHS is a key policy issue. Pay policy – and the ability that trusts and nurses have to react to local working conditions and the cost of living – is likely to be a key lever in reducing attrition among current staff. Understanding the restrictions that the current system places on trusts in the face of local cost-of-living changes, and the responses of staff to the decisions made by these trusts, is therefore important in improving staff retention.

Pay for the majority of nurses is determined by national guidelines on basic salary. This ensures that basic pay is the same across different trusts, and reduces wage competition between hospitals who could potentially compete for the same members of staff. Additional pay is available through geographical allowances in order to compensate nurses who live in areas with higher costs of living. Trusts also have some discretion in the use of other additional allowances depending on their local labour market conditions and their own finances. However, even with these additional payments, pay for similar roles across areas varies substantially less than the cost of living in these areas. As a result, the *relative* value of pay for nurses in lower-cost areas remains considerably higher than for those living in more expensive areas.

This report examines the effect that variation in the cost of living has on the labour supply of existing nurses in NHS acute trusts. We focus on Band 5 and 6 nurses. These accounted for 23% of the workforce in NHS acute trusts in 2018. We use administrative payroll data from the Electronic Staff Record (ESR) to examine how trusts and nurses react to changes in the local cost of living, and the impact these changes have on the amount of labour supplied by existing nurses.

Our analysis uses local house prices, measured at the travel-to-work-area level, as a proxy for the local cost of living. This is due to the unavailability of consistent data on price series, such as the Consumer Prices Index (CPI), at a local level. Housing costs represent a large share of living costs for nurses, and as such provide a good measure for their wider cost of living. The baseline results use the price for a terraced house, but are robust to using other local house price series.

We first describe how the earnings, hours and composition of nurses vary across the country. These labour market outcomes may vary as a result of differences in the cost of living. But they will also be driven by a number of factors that are related to, but not caused by, differences in the cost of living across areas, such as the amenity of the area and the opportunities offered in different types of hospitals. Our main analysis therefore examines how changes in the cost of living, as measured by changes in house prices in the local area, are related to changes in nurses' labour supply. These in turn will lead to long-run differences in labour recruitment and retention across different areas.

Key findings

- **Despite pay regulation, annual earnings for nurses in the same role vary across the country.** Basic earnings of nurses are governed by national pay scales, determined under Agenda for Change, which do not vary across the country. In recognition of potential staff shortages, trusts have some additional flexibility in using supplements to basic pay. The use of these supplements varies considerably across trusts.

- **This variation in pay is dwarfed by much larger differences in the cost of living.** Average house prices range from 2.5 to 14 times the average nurse earnings in the local area. This indicates that the relative value of nurse earnings varies considerably across the country.

- **Trusts respond to these cost-of-living differences through several channels.** These include offering extra hours of work to those who are not already full time, offering bank work and faster promotion if vacancies exist. Nurses can then choose to work additional hours, accept promotions or leave the trust (either to move to another trust or to leave the NHS acute sector entirely).

- **Increases in the cost of living lead to an increase in the earnings of nurses in the local area as a result of these trust and nurse responses.** Much of this increase in pay is explained by an increased rate of promotion to higher bands (which in part may be required to fill any vacancies created by more senior nurses leaving as a result of the growth in cost of living), and therefore to a higher salary. Trusts also increase the amount paid in supplementary allowances, although these account for a relatively small share of average earnings (15% in 2018).

- **However, nurses work fewer hours for NHS acute trusts in response to an increase in the cost of living.** The number of non-bank hours falls in response to an increase in house prices. The likelihood of working any bank hours and, conditional on doing so, the earnings from bank work are also reduced.

- **Responses vary across pay bands.** Band 5 nurses work more in response to an increase in the cost of living, while Band 6 nurses work less.

- **A higher cost of living leads to an increased exit rate from the NHS acute trust sector and an increased rate of job changes between trusts.** The median three-year increase in house prices of 13.9% between 2011 and 2017 resulted in a 1.8 percentage point increase in nurses leaving the NHS acute trust sector and a 2.4 percentage point increase in nurses switching between NHS acute trusts. These increases are equivalent to 11% and 22% of the mean exit and switching rates respectively.

- **Nurses in permanently high-cost areas also experience larger increases in earnings and in the probability of promotion than nurses in lower-cost areas.**

- **There are differences in the reaction of nurses across different groups.** Younger nurses are more responsive to cost-of-living increases than their older peers. Part-time nurses respond to shocks by working more, while full-time nurses work less.

- **There is little difference in the reactions of nurses of different nationalities.** British and non-British nurses are both more likely to leave or switch trusts, and more likely to be promoted, as a result of an increase in the cost of living.

- **In sum, our report provides evidence that the existing national pay system does not provide trusts with sufficient flexibility to retain staff in the face of cost-of-living increases.** Trusts located in areas that have a long-run high cost of living face particular difficulties.

1. Introduction

Pay for most members of staff, including nurses, is determined through a set of national pay scales as part of Agenda for Change. This is intended to promote fairness and reduce competition for staff between trusts located in the same geographical areas. However, it also limits the ability of trusts to respond to local conditions. In particular, this raises the concern that trusts may have insufficient flexibility to accurately compensate staff for increases in the cost of living in the local area. As a result, such a pay structure may limit the ability of NHS acute trusts to retain staff in the face of local price shocks.

In this report, we seek to answer the question of what role the cost of living plays in determining nurse pay, patterns of working and retention rates in the acute trust sector. Our analysis is in two parts.

We first document the extent to which trusts and nurses attempt to mitigate the impacts of these changes in cost of living. Trusts can use various allowances to supplement basic earnings, offer nurses more contracted hours and bank hours, and decide upon the rate at which staff are promoted. Nurses will respond to these attempts. This leads to differences across trusts in the use of various allowances to supplement basic earnings, the number of hours and bank shifts worked, and the rate at which staff are promoted. These outcomes are the combination of the decisions of both trusts and nurses, and cannot be separated in the data on nurse pay that we use for our analysis. We document how these responses vary across the local labour markets in which nurses live.

We then examine how *changes* in the cost of living, as measured by house prices in the local areas in which nurses live, affect *changes* in the basic hours worked by nurses, the amount of bank work they do (as measured by bank pay), whether they are promoted, whether they move trusts (both within their local area and to another trust outside their local area) and whether they leave the NHS acute trust sector entirely.

In this report, we limit our focus to all nurses working in NHS acute trusts in Bands 5 and 6 between January 2012 and December 2018. Band 5 and 6 nurses accounted for 23% of all staff in NHS acute trusts in December 2018 and 64% of all nursing staff (not including Nurse Learners) in these hospitals in 2018.

The relative generosity of earnings can be measured in a number of ways, including local measures of house prices or rent, and average wages. We use house prices in different travel-to-work areas as a measure of the local cost of living.[1] We focus on the cost of living rather than the possible wages a nurse could earn if they worked outside the nursing sector, as for many nurses this is not an option in the short term and our focus is on responses to short-run changes.

We use the travel-to-work area (TTWA) of the home location of the nurse as our measure of local area. TTWAs are statistically constructed to approximate local labour markets. The aim is to divide the country into non-overlapping areas, such that most people (usually

[1] As our measure of house prices, we focus on the median price for terraced houses in each travel-to-work area. Our results are robust to the use of mean prices across all types of houses. Results are available upon request.

three-quarters of the workforce) live and work in the same area.[2] A TTWA must have an economically active population of at least 3,500. There are 149 TTWAs in England and an additional six that span areas in both England and Scotland or Wales.[3]

The pay and hours data used in this report are from the Electronic Staff Record (ESR). The ESR contains the universe of monthly payroll data from NHS acute trusts. This includes detailed information on the pay, role, qualifications and location (trust of work and TTWA of residence) for all Band 5 and 6 nurses employed by NHS acute trusts between January 2012 and December 2018. However, the data on the hours of bank work are only partially complete, so we limit our analysis of bank work to earnings only. In addition, the data do not contain any information on work that nurses carry out either through agencies or in a non-acute trust setting (for example, at a GP practice or private hospital). As a result, we cannot observe responses along these margins even though they are likely to be important responses to cost-of-living changes.

The rest of the report is organised as follows. In Chapter 2, we describe the variation in earnings across nurses and pay components. In Chapter 3, we document how earnings and hours worked vary across different parts of the country, describing the different decisions taken by nurses and the trusts that employ them. In Chapter 4, we examine how changes in the local cost of living lead to changes in the labour outcomes of nurses in the local area. In Chapter 5, we examine how these impacts vary across different groups of nurses and trusts. Chapter 6 concludes.

[2] It is therefore possible for some nurses to work in a different TTWA from the one in which they live if they have an unusual commute. Nurses who work and live in different TTWAs are recorded in their home TTWA throughout the analysis.

[3] For detailed information on the construction of travel-to-work areas, see Office for National Statistics (2016).

2. Variation in nurse earnings

In this chapter, we show the variation in nurse earnings that arises from different choices made by trusts in how they design their remuneration packages for nurses within the constraints of meeting the national Agenda for Change structure, national wage regulations and the limited financial resources available to them. We begin by describing total earnings in 2018 before setting out the separate components of these earnings.

2.1 Total earnings

Table 2.1 shows the different components of average nurse earnings in 2018. Mean annual earnings were £28,158 and median earnings were £29,116.

Earnings are composed of three main parts: basic earnings, supplementary allowances and premiums, and bank earnings. Basic earnings are determined by the number of hours that nurses work, with national pay scales setting hourly basic wages for nurses of a given experience and job role. Basic earnings make up the largest share of total earnings. In 2018, mean basic earnings were £21,872, accounting for 78% of mean total earnings. Median basic earnings were £23,281, or 80% of median total earnings.

Table 2.1. Components of total earnings, 2018

	Mean	Median	% positive	Mean as a % of mean total pay
Total pay	£28,158	£29,116	100	100
Basic pay	£21,872	£23,281	99	77.7
Allowances and premiums	£4,160	£3,653	99	14.8
Shift pay	£2,542	£2,059	84	9.0
Geographical allowance	£729	£0	22	2.6
Local payment	£83	£0	8	0.3
Occupational absence pay	£349	£0	6	1.2
Other payments	£341	£0	29	1.2
Bank earnings	£1,997	£0	48	7.1

Note: 'Total pay' is the sum of basic pay, supplementary allowances and premiums, and bank earnings. Mean and median figures include nurses with zero earnings in the category. '% positive' gives observations that recorded a positive value for this type of pay, as a percentage of all observations with positive non-bank total pay.

Source: Authors' calculations for Band 5 and 6 nurses using the Electronic Staff Record. All tables and figures use these data unless otherwise stated. Full details of the sample used are given in the appendix.

2.2 Allowances and premiums

Basic earnings are augmented by a set of supplementary allowances and premiums to address particular aspects of the role, the geographical location of the trust, or particular retention and recruitment needs. Trusts must follow national guidelines in when to make these payments, but do appear to have some discretion in how these rules are interpreted and in the resources available to make these payments. Mean (median) allowances and premiums were £4,160 or 15% (£3,653, 13%) of mean (of median) pay in 2018. The main payments include:

Shift pay: The most common payment on top of basic earnings is to compensate nurses for working anti-social hours. In 2018, 84% of nurses received shift pay for non-bank work, with a mean payment of £2,542 (£3,048 among those with any shift pay). 28% of nurses received shift pay for bank shifts in addition to any non-bank hours they received these payments for.

Geographical allowance: This is paid to nurses working in certain areas in order to compensate them for unavoidable regional differences in the cost of living. In 2018, 22% of nurses received geographical allowances for non-bank earnings. Mean payments totalled £729 (or £3,385 among those receiving any geographical allowance) but payments are highly concentrated in particular areas. We discuss the geographical distribution of these payments in detail in Section 3.3.

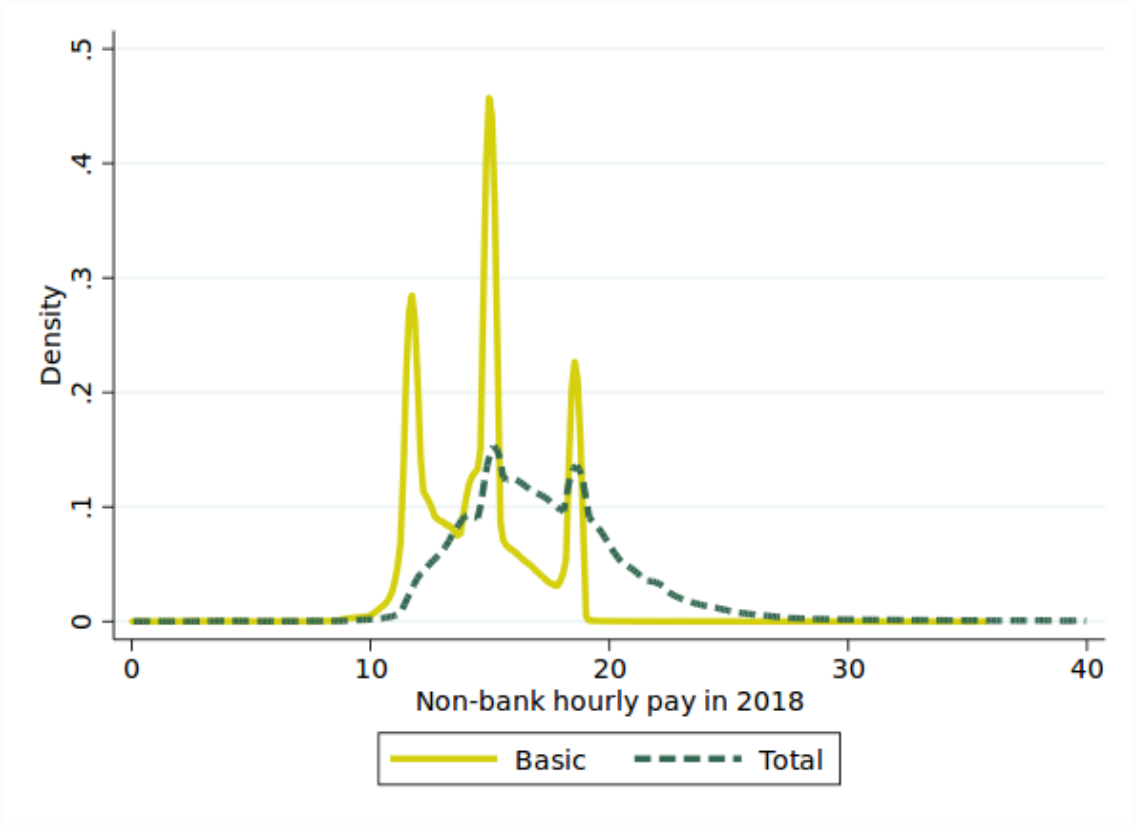
Local payments: Local payments were made to 8.4% of nurses in 2018. The mean local payment was £83 (but £999 among nurses receiving any local payments, accounting for 3.5% of mean total pay). However, this masks substantial variation across nurses, with some nurses receiving very high local payments: the 99th percentile of the distribution of the share of pay accounted for by local payments is 43%.

Occupational absence pay: This covers maternity, paternity and adoption pay. In 2018, 6% of nurses in Bands 5 and 6 received such a payment. The mean payment was therefore small, at £349 or 1.2% of mean total pay, but the mean (median) payment among those who received one was £5,851 (£5,678), or 21% (20%) of total pay in the same year.

Other payments: These together account for only a small proportion (1.2%) of total earnings. They include a recruitment and retention (R&R) premium. This was received by only 0.95% of staff in 2018 and has become less common over time, falling from receipt by 6.3% of staff in 2012.

The effect of these supplementary allowances and premiums on the distribution of earnings is most easily shown by looking at the distribution of hourly (rather than total) pay. Figure 2.1 shows the distribution of basic and total non-bank hourly wages across all Band 5 and 6 nurses in 2018. Basic hourly pay was £14.53 (£14.84) at the mean (median), and is clustered around three main points. These are roughly at £11.50 (corresponding to Band 5, Spine Points 16 and 17, the entry-level point for a Band 5 nurse), £12.10 (Band 5, Spine Point 23, the top of the Band 5 pay scale) and £18.31 per hour (Band 6, Spine Point 29, the top of the Band 6 pay scale). Some nurses are located at salary points between these spikes based on experience and field of work.

Figure 2.1. Distribution of hourly basic and total pay, 2018



Note: Excludes observations in the top percentile of total hourly non-bank pay, observations with zero basic earnings, and those with fewer than 10 hours worked in the year (so includes 98.9% of all hourly total pay observations for Band 5 and 6 nurses). We do not include bank earnings due to incomplete data on bank hours worked (43% of nurses in Bands 5 and 6 with positive bank earnings had no bank hours information in 2018).

After accounting for additional allowances, the distribution of total pay is shifted to the right, with higher mean and median hourly pay of £18.34 and £16.92 respectively. This distribution is also more dispersed. The first mass point in the distribution disappears entirely, while the other two are less pronounced than before. This suggests that conditional on the number of hours worked, the use of these allowances and premiums creates more variation in nurse earnings. This also indicates that there is some, but limited, flexibility in the pay system which allows different nurses to receive different levels of pay for similar jobs. We return to this in Chapter 3.

2.3 Bank earnings

The final component of nurses' earnings from their work for NHS acute trusts is pay earned from working bank shifts. Bank work allows them to work additional shifts on a more flexible basis. Mean bank pay is a relatively large proportion of total trust earnings, being £1,997 or 7% of mean total pay in 2018. However, only just under half of nurses received any bank pay in 2018, with a mean payment of £4,147 (15% of mean total earnings) among those with positive bank payments.

3. Geographical variation in earnings, hours and retention

Our ultimate aim is to explore the causal links between changes to the local cost of living and the nursing labour outcomes that we observe in travel-to-work areas. To this end, in this chapter, we establish the extent to which there is geographical variation in pay and the separate components – including hours, additional payments and nursing experience – that explain this variation.

We first examine how total earnings vary across the country and show that despite higher average absolute earnings in more expensive areas, these differences are dwarfed by differences in local house prices. This suggests that the actions taken by trusts and nurses to address differences in costs of living are relatively limited in the face of local price pressures. We then set out geographical variation in the labour outcomes for nurses across the country. These include hours of work, bank work, and decisions about whether to leave the NHS acute trust sector.

The outcomes that we study are the result of combined decisions taken by both nurses and the trusts that employ them, and we cannot separate out the contribution of these actors to each outcome using the ESR data. Trusts make decisions about the number of shifts to offer staff, whether to promote them, and which allowances can be used to supplement basic incomes. Nurses in turn will decide how many hours they are willing to work, whether to work additional shifts in a bank role, and whether to leave a particular NHS trust (either to switch to another trust or to leave the acute trust sector in England entirely).

3.1 Variation in total earnings and the cost of living

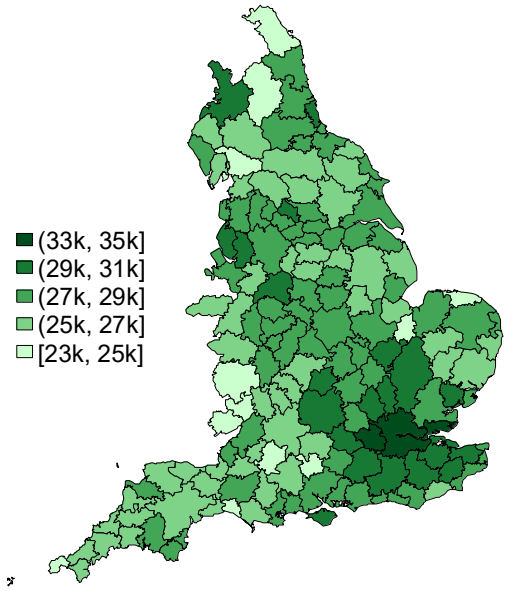
Figure 3.1 shows the geographical variation in total earnings for Band 5 and 6 nurses in England in 2018. Panel A shows annual median earnings for nurses in each TTWA. It shows considerable variation in average earnings across the country, with median earnings ranging from £23,620 to £34,126. Earnings are clearly highest in London and the surrounding areas. Earnings are also, in general, higher in urban areas and lower in rural areas.[4]

These earnings differences are determined by a range of factors. These include differences in the number of hours worked, additional payments made by trusts through allowances and premiums, the experience and composition of nurses, and the amount of bank work undertaken in different parts of the country. All of these decisions may be influenced by the local cost of living. For example, nurses may work a greater number of hours in areas with a higher cost of living in order to boost their income.

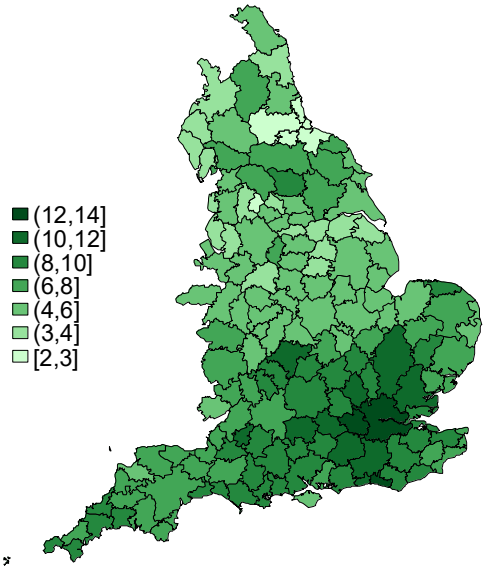
[4] There are some exceptions, with high earnings observed in some more rural areas, such as Cumbria.

Figure 3.1. Geographical variation in the earnings of Band 5 and 6 nurses, 2018

A. Median annual earnings



B. Median house prices as a multiple of median annual earnings



Note: Panel A shows the median annual earnings of Band 5 and 6 nurses in each TTWA in 2018. There were no areas with median earnings between £31,000 and £33,000. Panel B shows the median price of a terraced house as a multiple of the annual median earnings in each TTWA. Nurses in the ESR without valid postcode data are excluded.

Source: Authors' calculations using the ESR and Office for National Statistics (ONS) house price data. Full information is available in the appendix.

Crucially, however, this variation in earnings is not enough to fully compensate for differences in the cost of living across areas. Panel B shows median house prices (for a terraced house) as a multiple of median annual earnings. This shows huge variation in the pay of workers relative to property prices across the country, with high house prices relative to earnings in London and the South East, and much lower house prices relative to earnings in the Midlands and much of the North.[5]

This suggests that even after taking into account the reactions of nurses and trusts, substantial variation remains across the country in the level of compensation that nurses receive relative to their costs of living. Such variation may play a key role in explaining the labour market decisions taken by nurses. Below, we describe how these outcomes vary across different areas, before examining the direct causal link between house prices and these outcomes in Chapter 4.

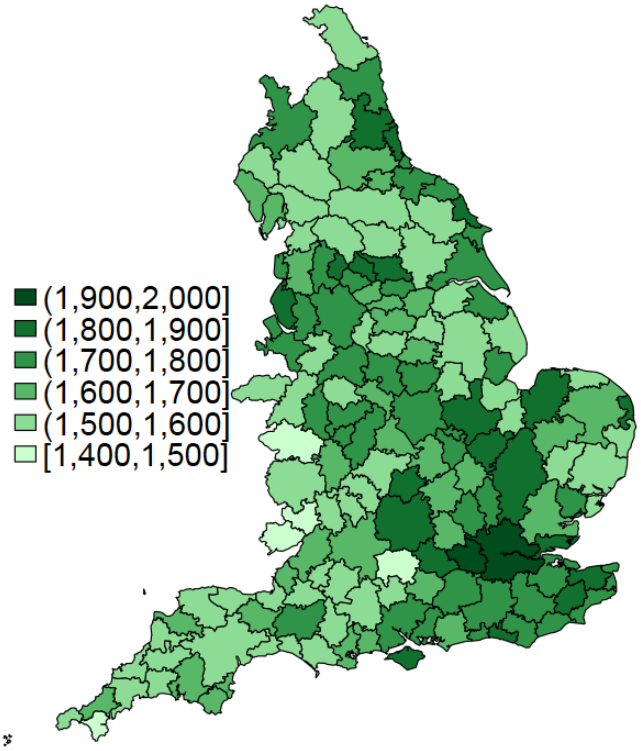
[5] The highest house prices relative to earnings are in Brighton (14 times) and London and Slough & Heathrow (13 times). The lowest are in Burnley (2.5 times).

3.2 Hours and bank earnings

An obvious way in which nurses could respond to higher living costs is to work more hours. This could be achieved by taking on a larger number of contracted, non-bank hours or by working (additional) bank shifts. We consider both margins below but are constrained by incomplete data for bank hours. As a result, while we can analyse non-bank hours directly, we examine bank earnings.[6]

In both cases, the ability to work more hours will also depend on the demand for nurses from local trusts. These trusts will vary in their demand for nurses, and also in their willingness and ability to hire bank and temporary staff. The outcomes that we observe are therefore a combination of these decisions.

Figure 3.2. Median annual non-bank hours worked by nurses in Bands 5 and 6, 2018



Note: Median annual non-bank hours worked by all Band 5 and 6 nurses with valid postcode data in the ESR in 2018. Bank hours are not included due to a high percentage of missing hours for those with positive bank earnings.

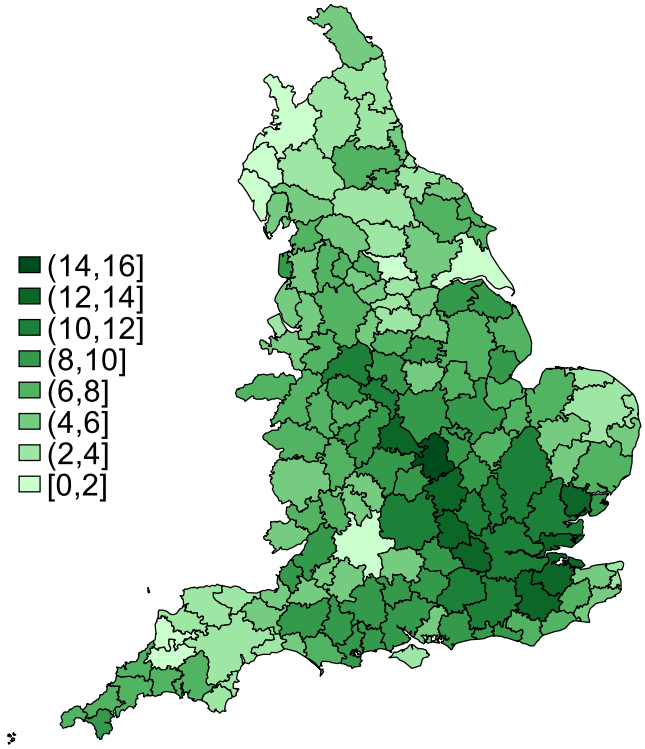
Figure 3.2 shows the median annual non-bank hours worked by nurses in 2018 in each TTWA in England. Mean (median) non-bank hours across nurses in Bands 5 and 6 in 2018 were 1,522 (1,785), or 29 (34) hours on average per week. These hours vary substantially across areas, ranging from 1,423 to 1,949 median annual hours. As expected, many of the areas with the greatest number of hours are areas where pay is low relative to their living costs. In particular, median hours are typically highest in London and other urban areas, and much lower in rural areas in the South West and the North. While these additional

[6] An alternative response from nurses to increase total earnings is to supplement their normal hours with agency work. In this way, they can work additional hours in a potentially more flexible way. Such activity is not recorded in the Electronic Staff Record and therefore cannot be explored in detail.

hours may not be caused solely by higher costs of living in these areas, it does appear that nurses work on average more hours in areas with high house prices.

There is also variation in average bank earnings across different areas. Figure 3.3 shows the mean share of total nursing earnings accounted for by bank earnings in each area in 2018. Mean bank earnings were £1,997, and accounted for 7.1% of mean total earnings. Again, bank earnings are higher (and consequently make up a higher share of total earnings) in more urban areas, with the areas in and around London having high shares. This suggests that there is a greater number of bank shifts worked in areas with already higher labour supply, accentuating differences in the overall numbers of hours worked by nurses across areas.

Figure 3.3. Mean share of bank earnings as a percentage of total annual earnings, 2018



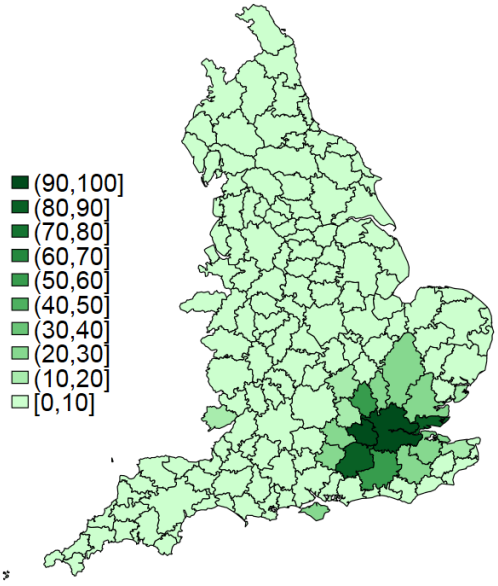
Note: Figure includes all nurses with valid postcode information in the ESR in 2018.

3.3 Allowances and premiums

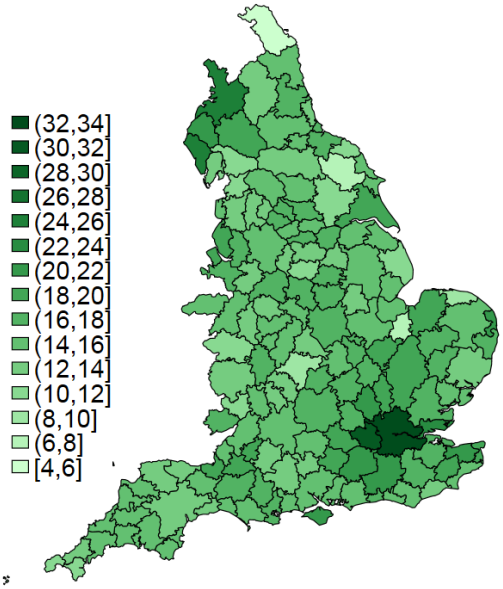
One way that trusts can increase pay for staff is through greater use of the various allowances and premiums described in Chapter 2 (shift pay, geographical allowances, local pay, recruitment and retention premiums, and others). Trusts will vary in both their willingness and their ability to use these allowances, based on their location and finances.

Figure 3.4. Allowances and premiums, 2018

A. Percentage receiving a geographical allowance



B. Difference between total and basic pay as a percentage of basic pay



Note: Panel A shows the percentage of nurses with valid postcode data who received any geographical allowance in 2018. Panel B shows the mean difference in each TTWA between total and basic pay as a percentage of basic pay.

Figure 3.4 shows how the use of these payments varies across the country. Panel A shows the percentage of nurses living in each TTWA who received a geographical allowance[7] in 2018. These payments are centred on London and the surrounding area. In London, 92% of nurses received a geographical payment. This pattern is unsurprising given restrictions over the use of geographical payments: for example, trusts are only allowed to give High Cost Area Supplements (HACS) in the London area.[8] However, this is not the only area where the cost of living is high. Nurses in other high-cost and urban areas are therefore unable to benefit from geographical allowances. The TTWAs with a prevalence of geographical allowances below 1% include Manchester, Nottingham, Birmingham, Leeds, Harrogate and York, all of which have higher-than-average house prices. Overall, the share receiving geographical allowances was below 1% in two-fifths of TTWAs.

While we would expect geographical payments to vary across the country due to regulation, it is less clear why we would expect the use of other allowances and premiums to vary by region. However, the data clearly show that this does happen. For example, the chance of receiving shift pay for individuals in the same role varies geographically.[9] The difference in the use of each of these allowances across different regions means that the share of earnings accounted for by such payments is highly variable. Panel B of Figure 3.4 shows the difference between total and basic (non-bank) earnings as a percentage of

[7] These include London weighting, Cost of Living Supplements (COLS) and AfC High Cost Area Supplements (HCAS).

[8] The NHS Terms and Conditions of Service Handbook provides guidance for where these payments can be applied: https://www.nhsemployers.org/tchandbook/annex-4-to-10/annex-9-high-cost-area-supplements.

[9] Role is defined here as primary and secondary area of work, band and tenure.

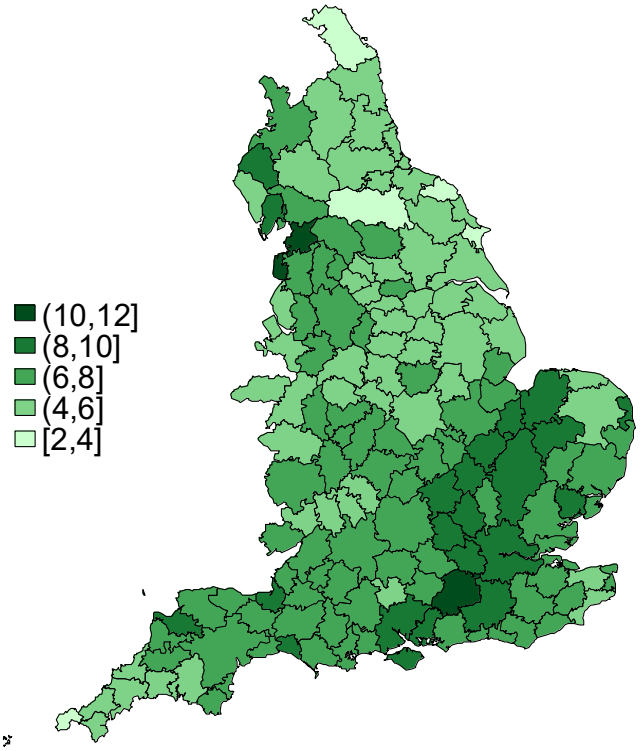
basic pay in each TTWA in 2018. The difference is greatest in London, where the difference is equivalent to 34% of basic pay.[10]

Taken together, this suggests that while the national set of pay scales and guidelines for pay limit the ability of acute trusts to pay staff very different amounts, trusts nevertheless do exercise some discretion in the payments they make to nurses.

3.4 Promotion rates

An alternative way in which trusts could attempt to increase pay for nurses is through promoting nurses to higher bands, if vacancies exist. Promoting staff more quickly would allow them to earn higher wages, and differential rates of promotion may explain some of the variation in earnings seen across the country. Promotion may also be more common in areas with a regular turnover of more senior nurses, with less experienced nurses promoted to fill these staffing gaps.

Figure 3.5. Mean annual promotion rate, 2012 to 2018



Note: A promotion is defined as a movement to a higher band between years, or becoming a district nurse, nurse consultant, manager, or community or modern matron.

[10] It is also high in a few other areas where geographical payments to reflect the cost of living are rarely made, such as in the North West.

Figure 3.5 shows the mean annual promotion rate for all nurses in Bands 5 and 6 across the country between 2012 and 2018. Over this period, 9% of nurses in Band 5 were promoted to Band 6 and 6% of Band 6 nurses were promoted to Band 7 (the figures for promotions between 2017 and 2018 are 10% and 7% respectively). However, average promotion rates varied between 3% and 10% across regions. In general, the promotion rate is higher in areas with high house prices relative to pay, with higher rates in London and the South East. However, there are some exceptions to this, with very high promotion rates in certain areas in the North West.

3.5 Retention and churn

Areas with high costs of living may also find it harder to retain staff, particularly if trusts are limited in their ability to meet these costs through higher wages. This means that in addition to adjusting the number of hours they work, nurses may also change where they work.

Nurses may choose to leave the sector for an alternative job, either in a different part of the NHS (for example, GP surgeries) or outside of the NHS. Similarly, nurses may change the location of their work, moving to a different trust which may offer them the chance of promotion or more flexible work, or which may simply be located in a less expensive area. Both are costly to the NHS. While switching trusts does not decrease the total number of nurses working in the NHS acute trust sector, this is still costly for individual trusts that must recruit and train new staff to replace them. Personnel changes may also have other impacts on the functioning of the hospital and for patient outcomes if staff turnover disrupts the quality of care given to patients.

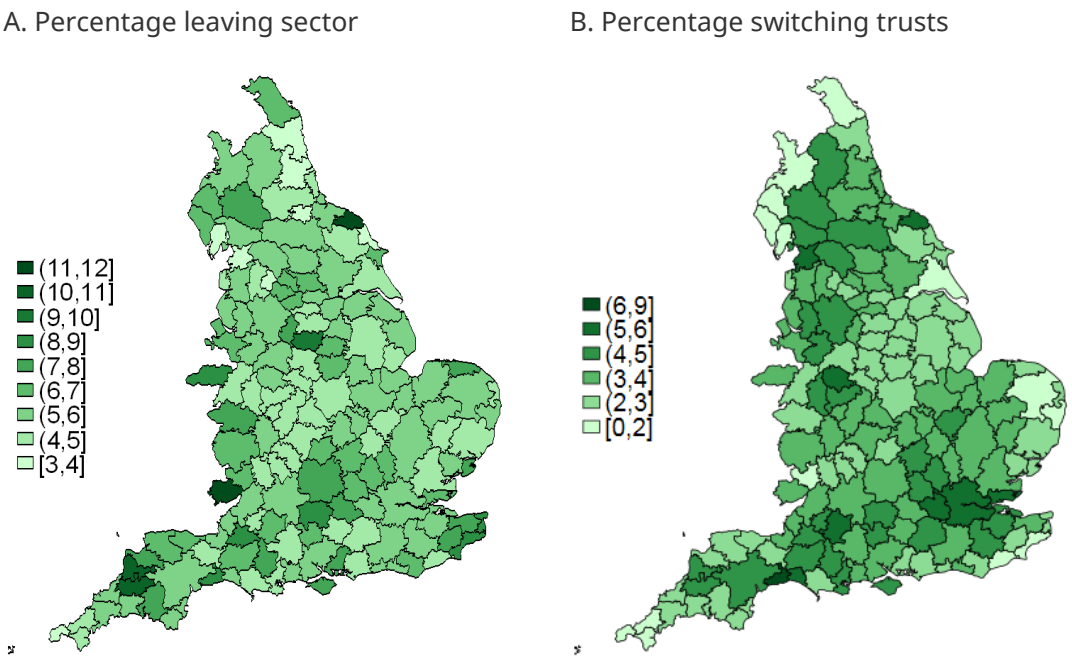
Figure 3.6 presents the distribution of leaving and switching rates across England. Panel A shows the mean annual exit rate for nurses living in each TTWA in England between 2012 and 2018, while Panel B shows the mean switching rate. Over this period, the mean annual exit rate was 5.6%. However, the rate varied considerably across regions, ranging from 3.6% to 12%, but with little obvious systematic variation. The mean switching rate was 3.7%, and again the rate varied across regions, ranging from 0.8% to 8.5%. Switching rates are higher in London than in much of the country but are also high in other urban areas, probably reflecting the larger number of trusts that can be accessed in urban areas[11] as well as more general demographic and economic factors.[12]

These differential rates of leaving and switching, together with the different likelihoods of promotion in each area, result in a different composition of nurses across the country. Figure 3.7 shows the different composition of nurses in different TTWAs. Panel A shows the percentage of the Band 5 and 6 workforce that is Band 6 nurses. Panel B shows the median tenure (years in employment at the same trust) in each area. The two panels show starkly contrasting patterns – a much higher share of nurses in London and the South work in Band 6, but these areas have much lower average tenure than areas in the rest of the country. This is consistent with much larger rates of turnover among nurses in these areas, in addition to more opportunities for promotion.

[11] This number is highest in London, where there were 22 trusts in 2018.

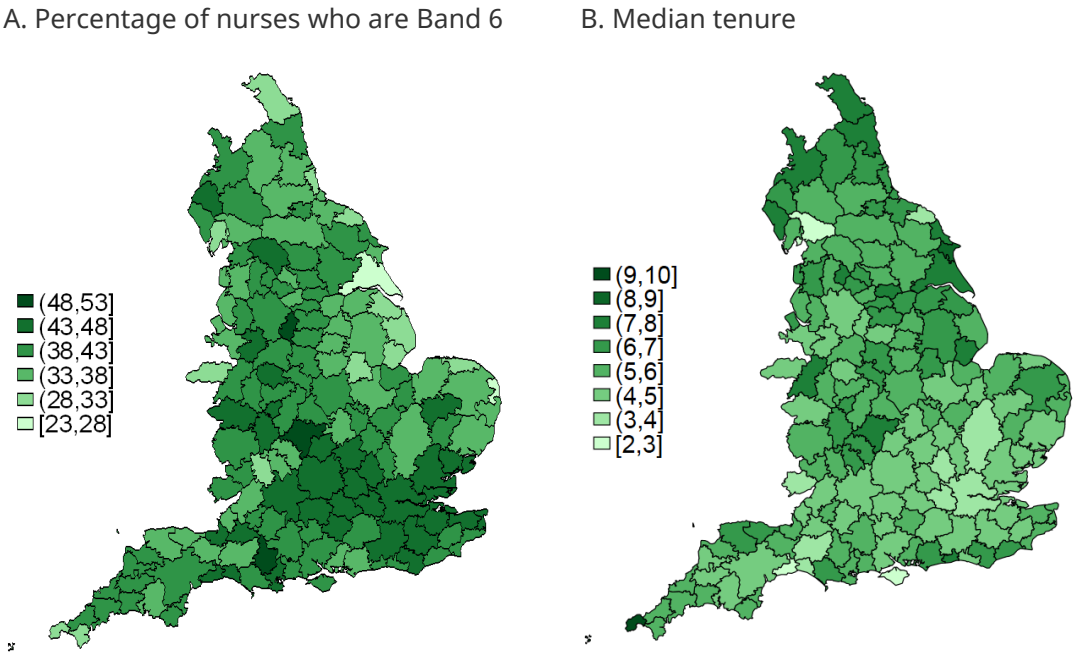
[12] This, in part, reflects a broader pattern of greater job mobility in urban rather than rural areas that is not limited to the NHS.

Figure 3.6. Percentage of nurses leaving acute trusts each year (mean for 2012 to 2018)



Note: Panel A shows the percentage of nurses with valid postcodes who were employed by any NHS acute trust in year *t* who were no longer employed by any trust in year *t*+1. The few nurses living in the Isle of Wight have been included in the average for the Portsmouth TTWA. Panel B shows the percentage of nurses with valid postcodes who changed main employer between year *t* and year *t*+1.

Figure 3.7. Composition of Band 5 and 6 nursing workforce, 2018



Note: Panel A shows the percentage of nurses with valid postcodes who were employed as a Band 6 nurse in 2018. Panel B shows median tenure of the nurses living in each TTWA. Tenure records the number of years they have been continuously employed by the same trust.

The descriptive evidence presented in this chapter indicates that there is substantial variation in pay relative to living costs across the country. In addition, there are meaningful geographical differences in the amount of non-bank and bank work that nurses undertake, the use of allowances, promotion rates, and the experience of nurses. In many cases, areas with higher costs of living are also those with higher turnover of staff. Taken together, this suggests that trusts do try to address these differences in the cost of living, but are unable to fully compensate for them. We now turn to examining whether these relationships are causal, and the extent to which changes in the local cost of living can cause changes in the labour outcomes of nurses in the area.

4. How do trusts and nurses react to increases in cost of living?

We now attempt to estimate the causal impact of changes in cost of living on the labour outcomes described above. Full details of the methodology are contained in Appendix A.

As previously shown, there is significant variation in the earnings, hours and characteristics of nurses across the country. This variation could be explained by a number of factors aside from cost of living. For example, nurses may be more willing to work in expensive areas if these areas also have good schools. Or nurses may choose to work in hospitals in London because many of them are teaching hospitals where they can see a different range of patients or learn new skills. As a result, simply correlating nurse exit rates with cost of living would likely underestimate the true impact of the cost of living on nurse attrition. To address this concern, we instead examine how *changes* in the outcomes of interest relate to *changes* in a measure of the cost of living in the local area. In this way, our results will not be affected by differences that are always present (for example, the availability of good schools or teaching hospitals) across areas.

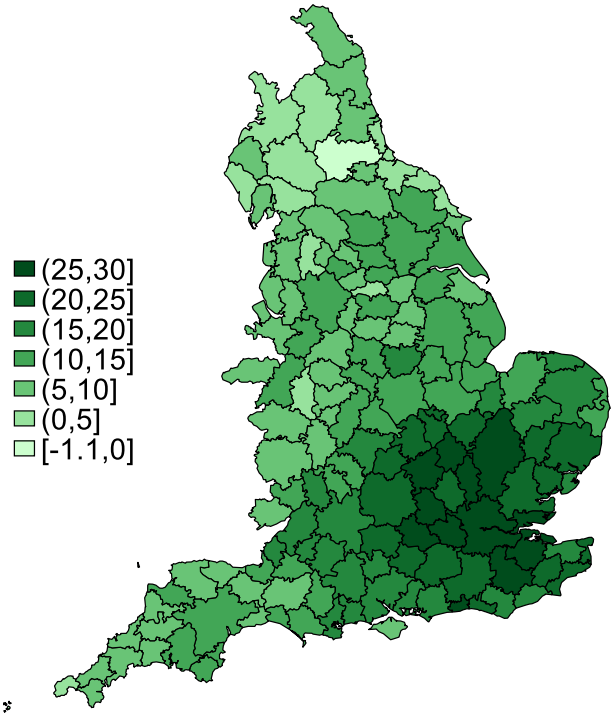
Specifically, we examine how changes in earnings, promotion rates and leaving decisions over a three-year period relate to changes in house prices in the local area over the same period. We examine changes over a three-year period in order to reduce measurement error from year-on-year fluctuations in house prices, instead using more reliable measures of longer-run trends in the changes in prices.

Ideally, we would use an inflation index (similar to the national Consumer Prices Index) at the local-area level in order to measure overall changes in the cost of living. However, such indices are not available on a consistent basis over time for small areas. As a result, we use median prices of a terraced house as a proxy measure of wider living costs. As a check for robustness to the choice of this measure, we also test our outcomes using alternative house price series and find similar results.

Figure 4.1 shows average (mean) three-year changes in house prices over the period of interest for each travel-to-work area in England. The mean three-year increase in house prices that sample nurses experienced was 15.9%, or £34,586. The median increase was 13.9%, or £17,500. There is also large variation in price changes over time and across regions. House price growth was strongest in London and the surrounding areas. Growth was much lower in the South West and the North, and in fact falling in some areas. House price growth was also much higher between 2014 and 2016 than it was in other years.

Our analysis takes place in two stages. First, we examine decisions made by nurses and trusts on the intensity of work, and pay and promotion decisions, in response to changes in house prices. Second, we examine how these changes in prices affect nurse exit and switching rates in the local area.

Figure 4.1. Mean three-year house price increases (%), 2011–18



Note: Mean three-year increase in the price of terraced houses in each TTWA. Averages are taken over all possible three-year periods in the sample (2011–14, 2012–15 and so on).

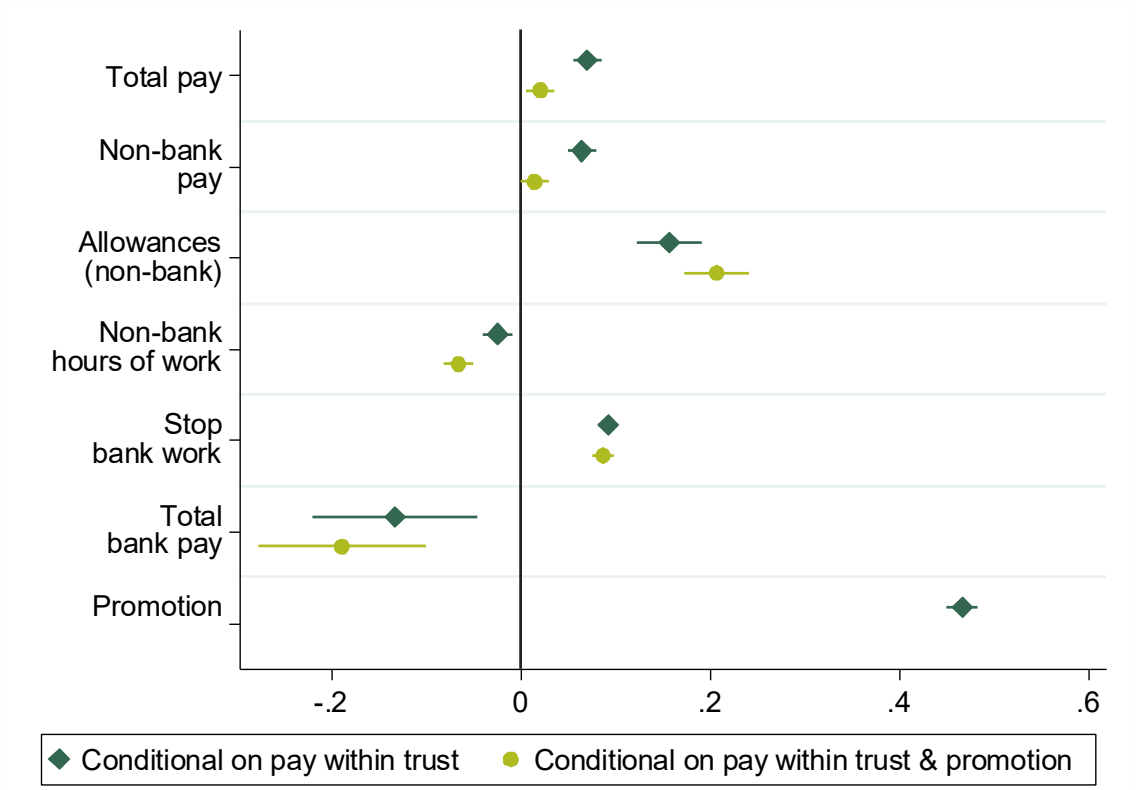
4.1 Effects on earnings, hours and promotions

Figure 4.2 shows the estimated effects of increases in house prices on earnings and hours of work. The dark green diamonds show the estimated effects after allowing for any responses to pay that the trust makes (measured at the trust level).[13] The light green circles show the estimated effects when additionally taking into account whether a nurse was promoted over the three-year period. By comparing the two sets of estimates, we can see the extent to which promotion decisions explain wider changes in nurse labour outcomes.

The estimates indicate that total earnings for nurses increase as a result of an increase in house prices in the local area. Before controlling for promotion decisions, a 1% increase in house prices is associated with a 0.07% increase in total earnings. This means that an increase in house prices over a three-year period of 13.9% (the median increase over the period) would increase nurse earnings by 0.97%. For someone with mean earnings in 2018, this would be equivalent to an increase of £274. The vast majority of these pay increases arise from an increased probability of promotion: when conditioning on whether the nurse was promoted over the period (the light green circles), the increase in earnings is much smaller. After taking into account promotion decisions, total earnings otherwise only increase by 0.02% in response to a 1% increase in house prices.

[13] To avoid endogeneity, this is measured as a change in the trust-wide median pay for all other nurses in the sample.

Figure 4.2. Effects of a 1% increase in house prices on earnings, hours of work and promotion rate (% change)



Note: Full results are shown in Tables A.4 and A.5 in the appendix. The diamonds show results from a specification controlling for three-year changes in the trust median pay for nurses. The circles show results when also controlling for whether a nurse is promoted during a three-year period. The lines represent 95% confidence intervals. Stopping bank work is conditional on maintaining some non-bank work (i.e. those who leave have a missing outcome for stopping bank work). Bank pay is conditional on having positive bank earnings in the final year of the three-year period.

The overall change in earnings is determined by changes in hours, changes in basic pay, changes in the amount of bank work carried out by nurses, and changes in the rate of promotion. Figure 4.2 shows the impact of house price changes on these outcomes. The pattern for non-bank earnings is the same as that for total earnings: increases in house prices lead to increases in earnings, with most of this effect explained by an increase in the number of promotions. The amount of allowances and premiums received by nurses also increases with house prices. A 1% increase in house prices is associated with a 0.16% rise in the amount of allowances received. This is equivalent to £7 for someone with mean allowance earnings (£4,160) in 2018.

The overall increase in earnings also comes in spite of, rather than being driven by, a change in non-bank hours of work. A 1% growth in house prices is associated with a 0.02% decrease in the number of hours. This effect is larger when also conditioning on promotion. This suggests that nurses who are promoted as a result of the house price shock work fewer hours than those who would have been promoted in the absence of this shock.

One explanation for why non-bank hours may fall is that nurses undertake an increased amount of bank work. This would give them increased flexibility over how many hours, and when, to work. However, when we examine the impact of house price changes, we see that bank earnings are actually reduced in response. A 1% increase in house prices is associated with a 0.1% reduction in bank earnings and a 0.1 percentage point reduction in the probability of undertaking any bank work.

As noted above, the differences between the results with and without taking account of changes in promotion rates indicate that promotions increase as a result of house price increases. This is shown explicitly when looking at the probability of promotion as an outcome. An increase of 1% in house prices is associated with a 0.5 percentage point increase in the probability of promotion. This would imply that the median three-year house price increase of 13.9% increased the probability of promotion by 6.5%, and is equivalent to 27% of the mean promotion rate over the period.

Taken together, these results suggest that trusts do react to the cost-of-living increases by paying staff more. While they do increase payments from allowances and premiums, these make up a relatively small part of nurses' pay package. Instead, the majority of the increase in total earnings is explained by increases in the number of promotions. This indicates that promotions are an important channel by which trusts can increase pay for nurses, and are being actively used for such a purpose.

4.2 Retention and churn

Figure 4.3 shows the estimated effects of house price changes on the probability of leaving the acute trust sector and on switching between different acute trusts. The results show that house price increases are associated with an increased exit rate from NHS acute trusts. A 1% increase in house prices is associated with a 0.13 percentage point increase in the probability that a nurse leaves the NHS acute trust sector. Taking the three-year median price increase of 13.9%, this implies a 1.8 percentage point increase in the exit rate. This is equivalent to more than 4,000 nurses leaving the acute trust sector as a result of cost-of-living increases. As a benchmark, this accounts for around 11% of the nurses who leave on average over a three-year period.

The estimates also show that house price increases lead to a greater switching rate between trusts. We define nurses switching when they move between two NHS acute trusts over a three-year period (i.e. they leave an acute trust, but still appear in the data with a different acute trust no more than a year later).[14] A 1% increase in house prices is estimated to increase the switching rate by 0.17 percentage points. Evaluated at the median increase in house prices (13.9%), this implies that the switching rate increased by 2.4 percentage points over a three-year period, equivalent to 22% of the mean switching rate between 2012 and 2018. Just over a third of the effect was due to nurses switching trusts while also moving to a different TTWA, with the larger part involving nurses switching trusts while continuing to live in the same TTWA as before. In the final specification, we also control for the number of trusts in the TTWA. The estimated effect of a house price increase on the switching rate is slightly smaller when taking into account

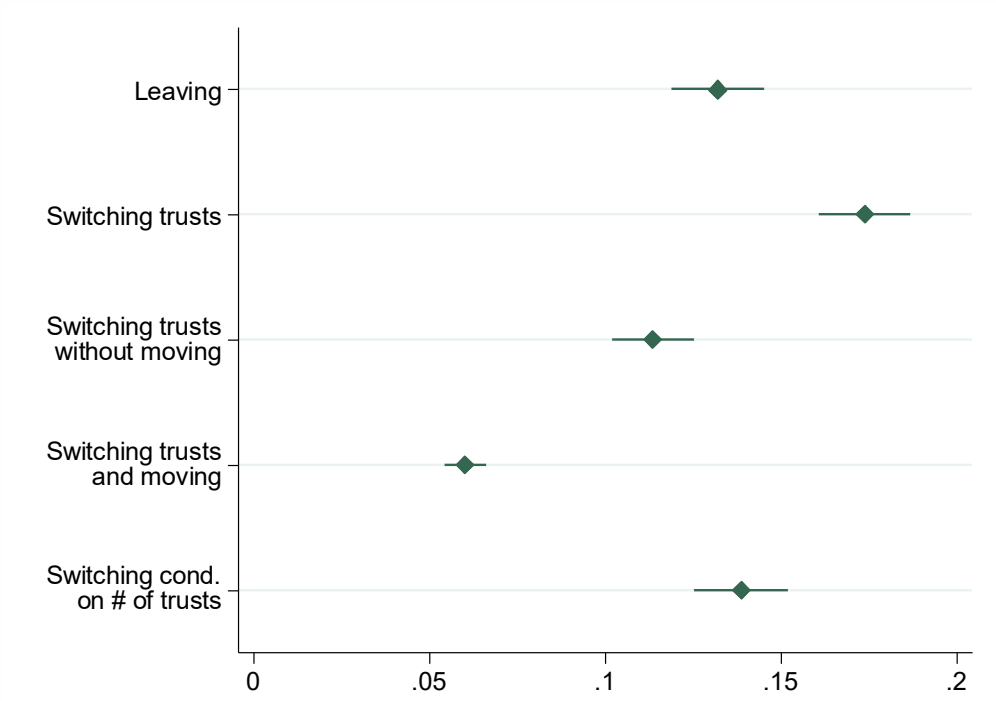
[14] Nurses who interrupt their employment in an NHS acute trust for more than 12 months are not considered as trust switchers, but as leavers. Additional assignments of a short duration (less than 6 months) are disregarded, as are bank assignments, i.e. if a nurse still works bank shifts at their old trust but only has a permanent assignment at their new trust, they are recorded as having switched trusts.

the number of trusts – a measure of the number of alternative employers – located nearby. However, the vast majority of the effect remains, suggesting that this effect is not driven simply by the number of trusts nearby.

These estimates indicate that house price increases lead to nurses leaving the NHS acute sector. It is important to note that we do not observe why nurses leave or where they exit to: many of these nurses may leave to work in another role within the NHS, such as in the community or for a GP practice. However, regardless of whether they are retained within the NHS, this will still prove costly for trusts that have to find and train new staff. These outcomes are despite efforts by trusts – through promotions – to increase pay, and suggest that the current pay system does not offer them enough flexibility to change pay in response to cost-of-living increases.

Given that acute trusts face similar constraints in setting pay, it is less immediately clear why nurses may switch between trusts – rather than leaving the acute trust sector entirely – in the face of price shocks. This is particularly the case when nurses do not change where they live in response to these shocks. However, it is possible that trusts are competing along other margins for staff rather than just wages, potentially offering a greater chance of promotion or the opportunity for more flexible shifts than their competitors or other non-pecuniary conditions. While these nurses do not leave the NHS acute trust sector, they still impose costs upon trusts that must now hire new staff to fill subsequent vacancies. It may also have other impacts on the functioning of the hospital and for patient outcomes if staff turnover disrupts the quality of care given to patients.

Figure 4.3. Effects of a 1% increase in house prices on exit and switching rates (percentage points)



Note: Full results are shown in Table A.3 in the appendix. All results control for three-year changes in the trust median pay for nurses. The lines represent 95% confidence intervals.

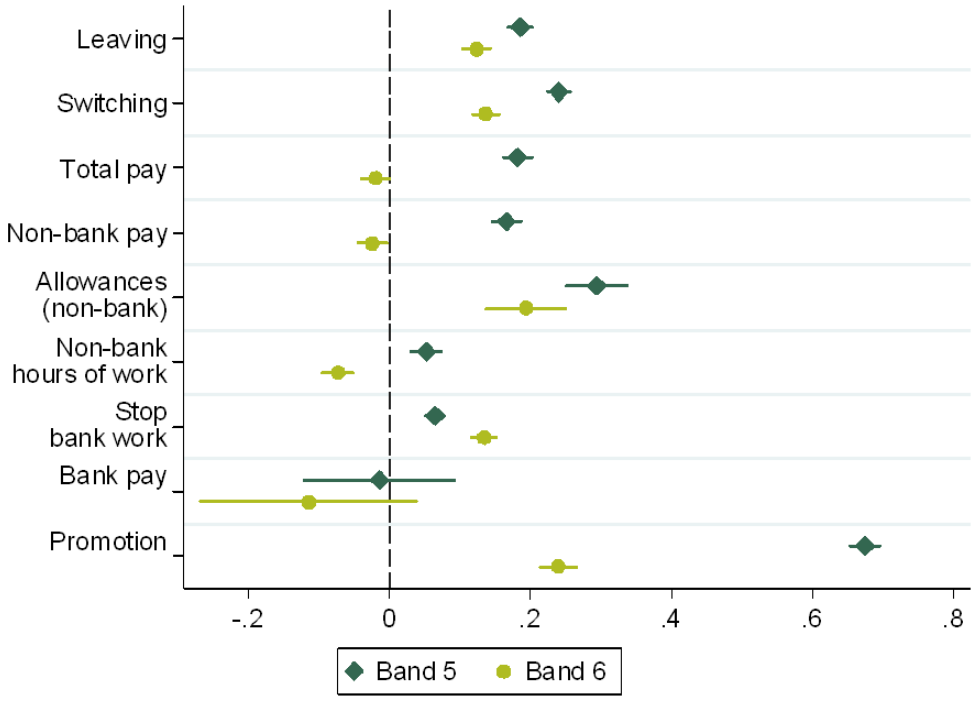
5. Differences across groups

It may be that particular groups of nurses are more affected by cost-of-living changes than others and that trusts located in areas with long-run higher costs of living are more affected. To examine this, we study separately the impacts across Bands 5 and 6, full-time/part-time work status, age groups, nationality (British and non-British nurses) and areas with permanently different levels of house prices. In all cases, we repeat the above analysis separately for each group and compare any differences across groups.

5.1 Impacts by initial band

Figure 5.1 shows the results for Bands 5 and 6 separately and reveals differences in the reactions of nurses in different bands. The dark green diamonds are for Band 5 nurses and the light green circles for Band 6 nurses.

Figure 5.1. Effects of increasing cost of living, separately for Bands 5 and 6



Note: Full results are shown in Table A.6 in the appendix. All results control for three-year changes in the trust median pay for nurses. The lines represent 95% confidence intervals. Stopping bank work is conditional on maintaining some non-bank work (i.e. those who leave have a missing outcome for stopping bank work). Bank pay is conditional on having positive bank earnings in the final year of the three-year period.

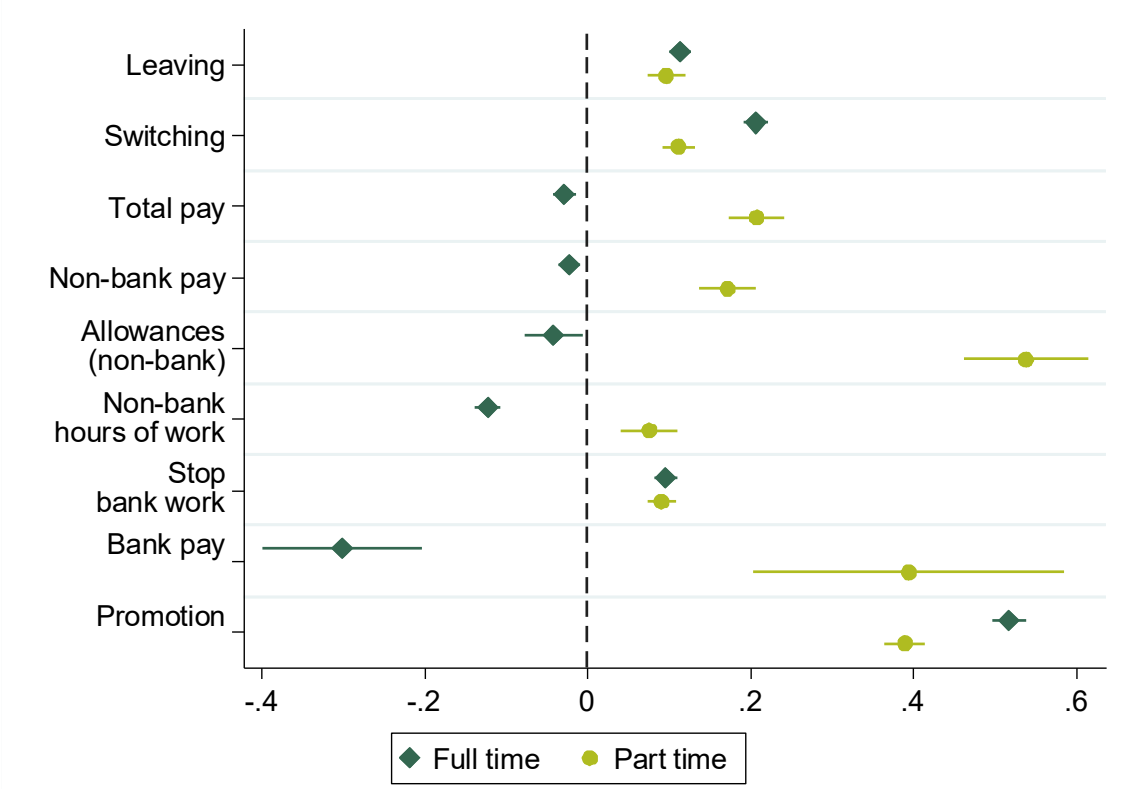
In general, nurses who were Band 5 at the beginning of the three-year period are more responsive to changes in local house prices. While house price increases are associated with increases in the exit and switching rates for both Band 5 and 6 nurses, the impact is larger for Band 5 nurses. A house price increase leads to an increase in the total pay of nurses in Band 5. This is driven by an increase in non-bank pay, and is partly explained by an increased probability of promotion. In contrast, total pay for nurses in Band 6 falls

slightly as a result of a house price increase, with a reduction in non-bank hours and a reduction in bank work. The probability of promotion also increases for both groups after a house price increase. However, this effect is much bigger for those in Band 5: a 1% house price increase is associated with an increased probability of promotion from Band 5 to Band 6 of 0.67 percentage points, as opposed to an increased probability of promotion from Band 6 to Band 7 of 0.24 percentage points.[15]

5.2 Impacts by full-time work status

Figure 5.2 shows results separately for nurses who work part time and full time at the start of the three-year period. Full-time workers are defined here as those who work at least 30 hours a week. In both cases, a house price increase is associated with an increase in the exit and switching rates, with a larger impact on switching rates for those in full-time rather than part-time work.

Figure 5.2. Effects of increasing cost of living, separately for full time and part time



Note: Full results are shown in Table A.7 in the appendix. All results control for three-year changes in the trust median pay for nurses. The lines represent 95% confidence intervals. Stopping bank work is conditional on maintaining some non-bank work (i.e. those who leave have a missing outcome for stopping bank work). Bank pay is conditional on having positive bank earnings in the final year of the three-year period. Full-time workers are defined as those working at least 30 hours per week.

[15] This may reflect a lower number of promotion opportunities for Band 6 nurses, who likely need a Band 7 vacancy to open up in order to be promoted. Within the group of Band 6 nurses, the increased churn in areas with fast growth in the cost of living may contribute to more opportunities for promotion opening up compared with other areas.

There are again differences across groups in the changes to hours and total pay. Increases in house prices are generally associated with an increase in hours and earnings among those who are part time. A 1% increase in house prices leads to a 0.21% rise in total pay for part-time nurses. Payments from allowances and premiums increase substantially among this group: a 1% increase in house prices is associated with a 0.5% increase in allowances. This is equivalent to £21 at the mean allowance earnings among the part-time in 2018 (£3,977). While the probability of doing any bank work falls among this group, those with positive bank earnings after a house price rise also tend to earn more from bank work as a result of the rise.

This is in contrast to full-time workers. Despite a large increase in the probability of promotion, an increase in house prices is associated with little change in total pay, and a reduction in both non-bank hours and bank earnings. This highlights important differences between part-time and full-time workers, with part-time workers more easily able to increase their NHS hours in reaction to a shock to their cost of living.

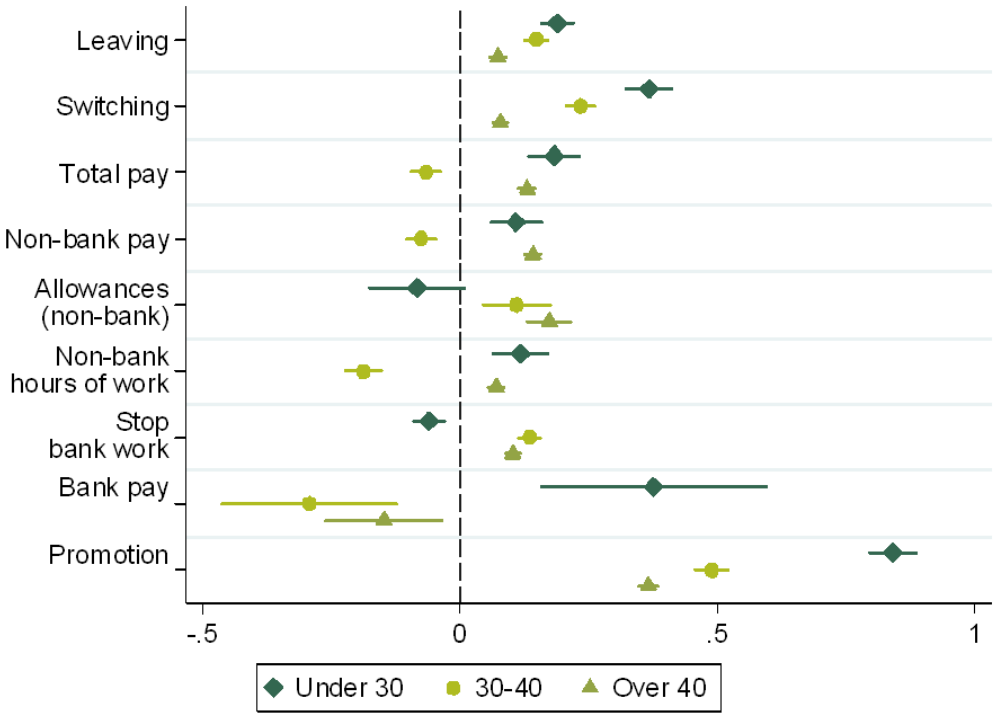
5.3 Impacts by age

The reaction of nurses may vary by age. In particular, we would expect younger nurses to be more reactive to changes in the cost of living. This is because they may be more flexible in where they can live (for example, because of family circumstances) or be more willing to change career or work setting. We therefore examine how the impact of house price changes on nurse labour supply varies across nurses in different age groups.

Figure 5.3 shows the estimated effects of house price increases on the labour outcomes of nurses in three age groups: under 30, 30–40 and over 40. The estimates show that younger nurses are indeed more likely to leave the NHS acute sector or to switch to a different trust in response to a house price shock. A 1% increase in house prices in the local area increases the proportion of nurses leaving the acute trust sector by 0.19 percentage points among those under the age of 30, compared with 0.074 percentage points for those aged 40 or older.

Looking at hours of work, both the youngest and the oldest group increase their labour supply. Combined with a positive effect on promotions which, as we would expect, is largest for the youngest nurses, this increases their non-bank earnings. However, the middle group – nurses in their 30s – reduce their non-bank hours and their bank and non-bank earnings, and are more likely to stop bank work altogether. This suggests that when the cost of living increases more rapidly, NHS acute trusts particularly struggle to retain the labour supply of nurses at a life stage when they are likely to have young children.

Figure 5.3. Effects of increasing cost of living, by age group



Note: Full results are shown in Table A.8 in the appendix. All results control for three-year changes in the trust median pay for nurses. The lines represent 95% confidence intervals. Stopping bank work is conditional on maintaining some non-bank work (i.e. those who leave have a missing outcome for stopping bank work). Bank pay is conditional on having positive bank earnings in the final year of the three-year period.

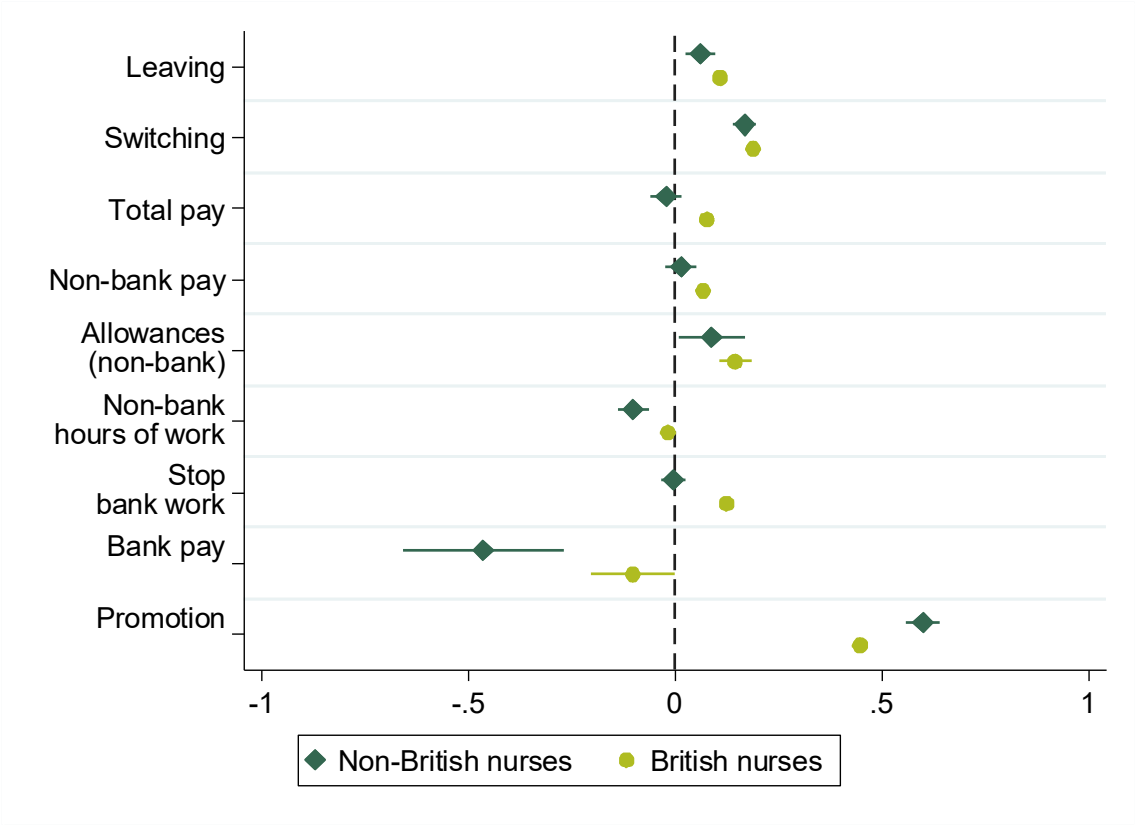
5.4 Impacts by nationality

Figure 5.4 shows the estimated impact of increased costs of living on nurse labour outcomes separately for British and non-British nurses.[16] 83% of the nurses in Bands 5 and 6 are British, with the share decreasing over the period. The geographical distribution of British and non-British nurses presents a sharp contrast: whereas 34% (42%) of British nurses in Bands 5 and 6 live in the third of areas with the highest (lowest) house prices between 2012 and 2018, the share among non-British nurses is 63% (19%).

Despite this, the two groups generally react to shocks in a very similar way. British nurses are slightly more likely to leave or to switch trust than non-British nurses. Non-British nurses decrease their non-bank hours and are more likely to be promoted. The total pay of British nurses increases while that of non-British nurses does not change. Non-British nurses' bank earnings decrease by more in response to a house price increase, but there is no effect on the probability of them giving up bank work altogether, in contrast to British nurses, who are more likely to stop bank work in the face of a house price increase.

[16] Nurses are defined as British if they are recorded as British in any year of the sample. This is to avoid improvements in the recording of nationalities over time biasing the sample. Less than ½% of nurses switch from being non-British to British year on year, but more observations are missing at the beginning of the period.

Figure 5.4. Effects of increasing cost of living, by nationality



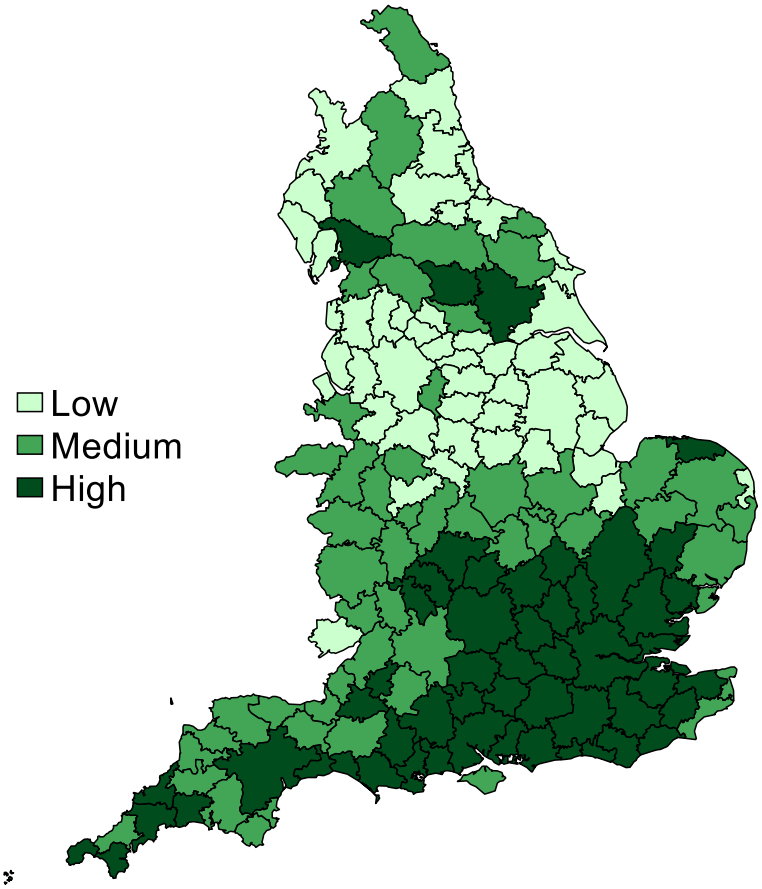
Note: British nurses include anyone who is recorded as having British nationality at any point between 2012 and 2018 (they may also record alternative nationalities at other points). Full results are shown in Table A.9 in the appendix. All results control for three-year changes in the trust median pay for nurses. The lines represent 95% confidence intervals. Stopping bank work is conditional on maintaining some non-bank work (i.e. those who leave have a missing outcome for stopping bank work). Bank pay is conditional on having positive bank earnings in the final year of the three-year period.

5.5 Impacts in high-cost areas

The impact of changes in the cost of living may be greater in areas where costs are already high. We therefore examine the outcomes for nurses in these areas separately from those with lower average prices.

Figure 5.5 splits TTWAs into three separate groups with the same number of TTWAs based on their average house prices between 2012 and 2018. While each group contains the same number of TTWAs, high-price areas are much more densely populated on average, and therefore contain many more nurses. Median house prices across areas over this period were £97,109 in low-price areas, £143,925 in medium-price areas and £211,388 in high-price areas. High-price areas are centred on London and the South, Bristol, southern Cornwall, Yorkshire (Harrogate, York and Leeds) and the Lake District. Medium prices are found in the remainder of the South West, the Midlands and East Anglia. Low prices are concentrated in the North Midlands and northern coastal areas.

Figure 5.5. Map of low-, medium- and high-price areas

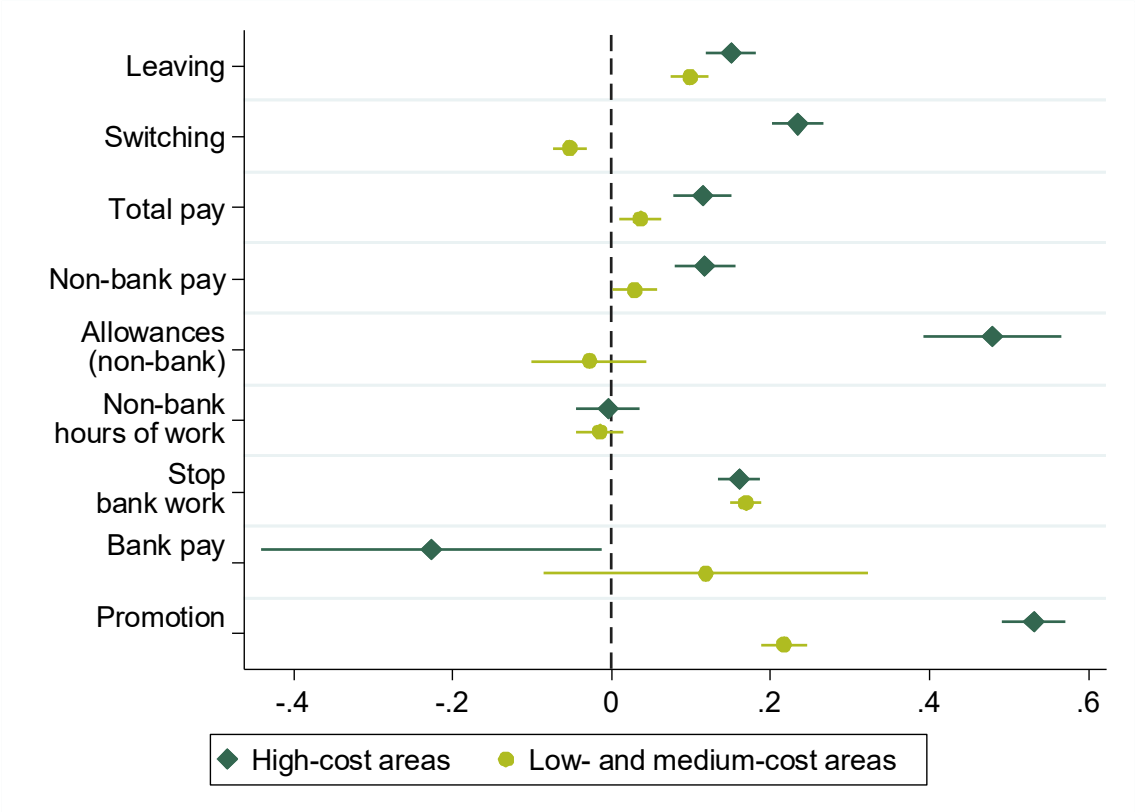


Note: Categories are defined on mean house prices throughout the sample, with an equal number of areas (but not nurses) in each group.

Figure 5.6 shows the results for high-cost areas separately from those for all other areas. As expected, nurses living in long-run high-cost areas are more reactive to house price shocks. They are 0.15 percentage points (ppt) more likely to leave the NHS acute trust sector, and 0.24ppt more likely to switch trusts, as a result of a 1% increase in house prices. This compares with estimated effects of 0.1ppt and –0.05ppt respectively for all other areas. The effect on retention is particularly pronounced in high-cost areas outside of London, whereas the impact on switching is particularly large in London.

Pay is also more responsive in high-cost areas. This is not driven by differences in the number of non-bank hours worked. Instead, nurses in high-cost areas are much more likely to receive an increase in their allowances, and in their chances of promotion, in the face of a house price increase, relative to their peers in lower-cost areas. A 1% increase in house prices is associated with a 0.48% increase in allowance payments in high-cost areas, but is not associated with any statistically significant change in these payments in other areas. A 1% increase in house prices also leads to a 0.53ppt increase in the probability of promotion in high-cost areas, more than double the 0.22ppt estimated increase in other areas. Taken together, this suggests that trusts in high-cost areas are much more responsive to these shocks, and are either willing or able to increase pay through additional allowances and promotion decisions than trusts in other areas.

Figure 5.6. Effects of increasing cost of living, separately for high-cost areas and low-/medium-cost areas



Note: Full results are shown in Table A.10 in the appendix. All results control for three-year changes in the trust median pay for nurses. The lines represent 95% confidence intervals. Stopping bank work is conditional on maintaining some non-bank work (i.e. those who leave have a missing outcome for stopping bank work). Bank pay is conditional on having positive bank earnings in the final year of the three-year period.

6. Discussion

In this report, we have examined the role played by the cost of living in determining nurses' pay, patterns of working and retention rates in the acute trust sector. We have set out the potential ways in which trusts can mitigate these shocks, and examined the reactions of nurses in response.

The results show that the national pay structure for nurses in the NHS acute sector only allows for limited flexibility in using pay to respond to changes in the local cost of living. Trusts do respond to changes in the cost of living by increasing the pay of nurses, but much of this increase is achieved by quicker rates of promotion to higher pay bands, with nurses initially in Band 5 in particular seeing a large increase in the probability of promotion. Trusts also increase the amount paid in supplementary allowances, although these remain a relatively small fraction of total pay.

Even with these changes, on average, nurses reduce the amount of labour supplied to NHS acute trusts in response to increases in the cost of living. Among those who remain employed by trusts, they work fewer hours and reduce the amount of bank work they provide. In addition to this, turnover rates within NHS acute trusts also worsen. An increase in house prices in the local area leads to an increase in the rate at which nurses switch between trusts, and an increase in the rate of nurses leaving the NHS acute trust sector entirely. This is costly to trusts, which must replace these staff with new permanent or temporary employees, and is likely to cause disruption in the provision of care to patients.

There are also some meaningful differences between the responses of trusts in different areas, and in the behaviour of nurses across bands, nationality and age. These differences are important to note when thinking about how to better tailor pay policy to reduce retention problems. In particular, younger nurses and those in Band 5 are more responsive to cost-of-living increases, with higher rates of exit and switching. This is in spite of the fact that these nurses are the most likely to receive promotions and increases in total pay. This suggests they are far less attached to the acute trust sector than their older or more experienced colleagues.

Trusts and nurses in areas with permanently high living costs are also much more responsive to changes in the cost of living. Trusts in these areas clearly react to increases in local prices with large increases in supplementary allowances, while in contrast there is no significant change in other areas, and have much larger increases in the promotion rate than other areas. Despite this, the impact on exit and switching rates remains greater in these high-cost areas. Taken together, this suggests that trusts are aware of the challenges and do, where possible, try to increase their offers to staff in the face of these local house price shocks. However, their responses are not sufficient to stop greater turnover and exit, as they are constrained both by the existing national pay guidelines and potentially by their own financial position.

One important issue that we have not explored in this work is what nurses do when they leave the acute sector. While the data used here provide a comprehensive picture of all NHS acute trusts, we cannot follow nurses into their new employment. This is important. One potential career move is to work in alternative parts of the NHS, and in particular community settings and GP practices. This means that while acute trusts must replace

staff, the NHS will still retain those staff who do not leave the NHS entirely in some capacity. And given policy goals to increase the amount of care provided in these alternative settings, increasing the numbers and skills in this sector is to be welcomed. However, it comes at the expense of the acute sector.

Alternatively, nurses may move to agency or private work (or even work outside of the nursing sphere). Importantly, we do not observe agency work even if this is provided to NHS trusts. While agency nurses may still provide labour to the NHS, heavy reliance on such staff could cause a number of potential problems around team continuity and staff quality as well as impose a high financial cost on trusts. Recent policy has tried to reduce NHS reliance on these staff, introducing caps to the amount of payroll that can be spent on temporary workers (NHS England and NHS Improvement, 2019). Better understanding the extent to which nurses are moving into these roles, and how they can be brought back into permanent NHS roles, is therefore an important next step for research.

Technical appendix

A.1 Empirical approach

Our empirical approach uses a difference-in-differences strategy to estimate the impact of house prices on nurse labour outcomes. This essentially compares the changes in labour outcomes over a three-year period across areas with differential three-year changes in the cost of living. In this way, we remove the influence of any permanent differences across areas which may be correlated with both house prices and our labour market outcomes of interest. This is a similar approach to that taken by Propper and Van Reenen (2010) to estimate the impact of outside wage changes on patient outcomes.

For all results, we estimate a variant of the following specification:

$$y_{ijm,t} - y_{ijm,t-3} = \beta\left(HP_{j,t-1} - HP_{j,t-4}\right) + \gamma\left(Trust_{m,t} - Trust_{m,t-3}\right) + \delta X_{i,t} + \left(\varepsilon_{ijmt} - \varepsilon_{ijm,t-3}\right)$$

where $y_{ijm,t}$ is the labour outcome for nurse *i* in year *t*, who four years previously (*t*–4) lived in travel-to-work area (TTWA) *j* and worked for trust *m*. Labour market outcomes include: total earnings, basic earnings, supplementary earnings, non-bank hours, whether they had any bank earnings, the amount of bank earnings, and indicators of whether in the past three years they were promoted, switched trust or left the NHS acute trust sector entirely.

An acute trust is an organisation-code-level entity in the Electronic Staff Record (ESR), with the trust type 'Acute' (including Acute Large, Medium, Small, Multi-Site, Specialist and Teaching). We define switching trusts at the monthly level originally: a nurse is defined as switching trusts in month *m* if they leave their trust – i.e. *m* is the last month that we observe a permanent assignment for them in that trust, but we still observe them in the data following that. Nurses who are observed in trust A, then trust B, then trust A again are defined as switching twice if the spell at trust B lasts for a year or longer; otherwise, the first switch is ignored.

96.6% of nurses in Bands 5 and 6 only have non-bank assignments in one trust at the same time. We ignore spells that are parallel to another spell and last for six months or less (i.e. the end of these spells is not counted as a switch). If they last for longer, then a switch is recorded whenever a nurse stops having a permanent assignment at a trust (i.e. if a nurse worked in parallel for trusts A and B, then switched to working only at trust B, this is recorded as a switch). The monthly information is then aggregated up to the yearly level (i.e. any year that contains a month with a switch is a switching year).

Nurses are defined as leaving the NHS acute trust sector if the ESR no longer records any non-bank earnings for them.

$HP_{j,t-1}$ measures median house prices in TTWA *j* in year *t*–1. We use the three-year price change lagged by one year (i.e. between years *t*–1 and *t*–4) to allow time for nurses and trusts to adjust their labour market outcomes in response to these changes in house prices. In our baseline specification, we use median prices for a terraced house. However, in robustness checks, we use mean prices for all houses and find similar results.

$Trust_{m,t}$ captures the median pay of all nurses in trust m in year t. Nurses are assigned to trusts based on the trust they worked for at the beginning of each three-year period. This means that if nurses leave or switch trusts over time, they are assigned the pay change in their original trust.

We also control for the age, sex and ethnicity of nurses, and a full set of year dummies ($X_{i,t}$). These characteristics may be correlated both with the changes in house prices faced by nurses (for example, if men live in more expensive areas) and with changes in the labour market of interest even in the absence of house price growth (for example, if male earnings increase at a quicker rate).

In an alternative specification (the circle markers in Figure 4.2), we additionally include in $X_{i,t}$ an indicator of whether nurse i was promoted during the previous three years. In this way, we control for changes in earnings or hours that are explained by promotion. Promotion is defined as moving up a pay band, or being promoted to community or modern matron, district nurse, manager or nurse consultant.

We interpret β as the impact of a change in house prices on the change in labour market outcomes over a three-year period. This interpretation would be incorrect if there remain unobserved changes in the characteristics or behaviour of nurses who live in areas with systematically different changes in house prices that also affect changes in their labour market outcomes.

A.2 Data sources

The vast majority of data comes from the Electronic Staff Record. We use data on Band 5 and 6 nurses who were employed by NHS acute trusts between January 2012 and December 2018.

There are just under a million long differences in the sample (any individual recorded as a nurse in Band 5 or 6 in an acute trust who had non-zero non-bank earnings three years before). Of these, 89% are used in the leaving equation and 71% are used in the total pay equation. Most of the observations dropped from the leaving equation (9.2% of the sample) are dropped because they could not be assigned to an English or cross-border travel-to-work area. This includes nurses with missing postcodes, invalid postcodes, and postcodes outside of England and the cross-border TTWAs. A few nurses (less than 1%) are also dropped because they record the trust type as an acute trust, but either record no OCS code or an OCS code that does not actually correspond to a real acute trust.

House prices at the TTWA level are taken from ONS's median house prices for subnational geographies, for terraced houses (data set HPSSA 24). The main results are robust to instead using mean prices for subnational geographies, for all types of houses (data set HPSSA 27).

Table A.1 shows summary statistics for the earnings and hours of nurses included in our estimation sample. Table A.2 shows summary statistics for the exit, switching and promotion rates in our estimation sample.

Table A.1. Estimation sample (Bands 5 and 6 with valid house price information): pay, allowances and hours

	Level			% change over three years		
	Mean	Std dev.	Obs.	Mean	Std dev.	Obs.
Total pay	28,665.2	10,153.9	1,243,435	7.2	47	705,394
Non-bank pay	27,122.0	9,056.1	1,243,435	6.4	48	705,394
Allowances & premiums	4,444.9	3,583.1	1,243,435	–5.2	118	628,502
Basic non-bank pay	22,677.1	7,694.9	1,243,435	7.1	53	705,394
Non-bank hours worked	1,586.8	502.7	1,243,435	–1.7	52	705,394
Bank pay	3,736.8	4,683.8	524,802	15	142	200,257

Note: Non-bank pay and hours exclude observations where basic non-bank pay or non-bank hours are missing. All earnings and hours levels are for nurses who are currently a Band 5 or 6. Three-year changes are for all nurses who were a Band 5 or 6 at the beginning of the three-year period.

Table A.2. Estimation sample (Bands 5 and 6 with valid house price information): leaving, switching and promotion rates

	In one year			In three years		
	Mean	Std dev.	Obs.	Mean	Std dev.	Obs.
Left	0.044	0.21	1,336,969	0.16	0.36	888,416
Promoted	0.090	0.29	1,253,184	0.24	0.43	715,935
Switched trust	0.043	0.20	1,229,150	0.11	0.31	705,765

Note: One-year transitions are for nurses who were a Band 5 or 6 last year and who have valid trust and TTWA information for last year, and with valid outcome measures this year. Three-year transitions are for those included in the estimation.

A.3 Regression results

Table A.3. Effect of a 1% increase in house prices on leaving and switching trusts

	Leaving	Switching	Switching, not moving	Switching and moving	Conditional on number of trusts
Change in log house prices	0.13*** (0.0067)	0.17*** (0.0067)	0.11*** (0.0060)	0.060*** (0.0030)	0.14*** (0.0068)
Change in trust median log nurse pay	0.22*** (0.021)	−0.29*** (0.020)	−0.35*** (0.018)	0.060*** (0.0095)	−0.15*** (0.021)
No trust in home TTWA					0.014*** (0.0016)
2 trusts in home TTWA					0.021*** (0.0016)
3+ trusts in home TTWA					0.040*** (0.0013)
Constant	0.0075* (0.0034)	0.34*** (0.0034)	0.24*** (0.0029)	0.091*** (0.0016)	0.32*** (0.0034)
Observations	882,957	703,539	703,539	703,539	703,539
R^2	0.021	0.045	0.028	0.020	0.048

Standard errors in parentheses, conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table A.4. Effect of a 1% increase in house prices on earnings and hours

	Total pay		Non-bank pay		Non-bank hours	
Change in log house prices	0.071*** (0.0076)	0.021** (0.0076)	0.065*** (0.0077)	0.015* (0.0077)	−0.024** (0.0082)	−0.065*** (0.0082)
Change in trust median log nurse pay	0.46*** (0.027)	0.50*** (0.027)	0.55*** (0.027)	0.59*** (0.027)	0.47*** (0.029)	0.50*** (0.029)
Promotion		0.11*** (0.0014)		0.11*** (0.0014)		0.093*** (0.0015)
Constant	0.49*** (0.0038)	0.42*** (0.0039)	0.50*** (0.0038)	0.43*** (0.0040)	0.24*** (0.0039)	0.19*** (0.0041)
Observations	701,124	695,169	702,512	696,524	702,512	696,524
R^2	0.054	0.064	0.050	0.061	0.014	0.020

Standard errors in parentheses, conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table A.5. Effect of a 1% increase in house prices on allowances, promotions and bank pay

	Allowances		Promotion	Bank pay		Stop bank work	
Change in log house prices	0.16*** (0.0174)	0.21*** (0.0176)	0.47*** (0.0085)	–0.13** (0.0444)	–0.19*** (0.0453)	0.093*** (0.0057)	0.088*** (0.0057)
Change in trust median log nurse pay	1.20*** (0.0619)	1.17*** (0.0620)	–0.34*** (0.0266)	–1.41*** (0.1504)	–1.57*** (0.1527)	0.10*** (0.0196)	0.11*** (0.0196)
Promotion		–0.088*** (0.0038)			0.033*** (0.0081)		0.0061*** (0.0011)
Constant	0.58*** (0.0087)	0.64*** (0.0089)	0.61*** (0.0041)	0.19*** (0.0208)	0.23*** (0.0220)	0.20*** (0.0028)	0.20*** (0.0029)
Observations	627,628	623,051	711,597	198,486	184,564	719,892	711,597
R^2	0.026	0.028	0.061	0.008	0.011	0.007	0.007

Standard errors in parentheses, conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table A.6. Estimated effects separately for Bands 5 and 6

A. Band 5

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.19*** (0.0086)	0.24*** (0.0083)	0.18*** (0.0106)	0.12*** (0.0107)	0.17*** (0.0107)	0.10*** (0.0108)
Change in trust median log nurse pay	0.22*** (0.0268)	–0.18*** (0.0251)	0.48*** (0.0376)	0.53*** (0.0376)	0.59*** (0.0382)	0.64*** (0.0381)
Promotion				0.095*** (0.0020)		0.097*** (0.0020)
Constant	0.026*** (0.0041)	0.30*** (0.0038)	0.57*** (0.0049)	0.51*** (0.0051)	0.58*** (0.0050)	0.53*** (0.0052)
Observations	560,979	467,531	439,287	435,071	440,279	436,038
R^2	0.022	0.046	0.064	0.071	0.060	0.067

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	0.29***	(0.0222)	0.37***	(0.0226)	0.67***	(0.0112)
Change in trust median log nurse pay	1.43***	(0.0791)	1.40***	(0.0793)	–0.48***	(0.0353)
Promotion			–0.090***	(0.0045)		
Constant	0.74***	(0.0105)	0.80***	(0.0108)	0.59***	(0.0051)
Observations	405,912		402,593		445,551	
R^2	0.036		0.038		0.071	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	0.052*** (0.0111)	0.0022 (0.0112)	0.065*** (0.0071)	0.062*** (0.0072)	–0.014 (0.0545)	–0.071 (0.0559)
Change in trust median log nurse pay	0.48*** (0.0402)	0.52*** (0.0403)	0.12*** (0.0249)	0.12*** (0.0251)	–1.64*** (0.1855)	–1.77*** (0.1885)
Promotion		0.077*** (0.0021)		0.0013 (0.0013)		0.047*** (0.0099)
Constant	0.31*** (0.0050)	0.27*** (0.0053)	0.19*** (0.0034)	0.19*** (0.0035)	0.23*** (0.0251)	0.25*** (0.0266)
Observations	440,279	436,038	451,466	445,593	130,910	121,556
R^2	0.020	0.023	0.006	0.007	0.012	0.015

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

B. Band 6

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.12*** (0.0105)	0.14*** (0.0096)	–0.019 (0.0103)	–0.047*** (0.0102)	–0.024* (0.0105)	–0.053*** (0.0104)
Change in trust median log nurse pay	0.15*** (0.0326)	–0.37*** (0.0278)	0.34*** (0.0340)	0.37*** (0.0337)	0.39*** (0.0345)	0.42*** (0.0341)
Promotion				0.12*** (0.0018)		0.13*** (0.0018)
Constant	–0.11*** (0.0060)	0.23*** (0.0051)	0.22*** (0.0055)	0.16*** (0.0056)	0.23*** (0.0056)	0.16*** (0.0057)
Observations	321,738	277,361	261,801	260,065	262,193	260,449
R^2	0.031	0.024	0.017	0.035	0.017	0.035

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	0.19***	(0.0287)	0.24***	(0.0288)	0.24***	(0.0133)
Change in trust median log nurse pay	0.45***	(0.0968)	0.40***	(0.0968)	–0.23***	(0.0398)
Promotion			–0.13***	(0.0068)		
Constant	–0.017	(0.0153)	0.058***	(0.0156)	0.54***	(0.0073)
Observations	221,725		220,471		266,046	
R^2	0.004		0.007		0.035	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	–0.072*** (0.0117)	–0.097*** (0.0117)	0.13*** (0.0092)	0.13*** (0.0092)	–0.11 (0.0784)	–0.17* (0.0799)
Change in trust median log nurse pay	0.37*** (0.039)	0.39*** (0.0388)	0.077* (0.0305)	0.082** (0.0306)	–1.11*** (0.2516)	–1.30*** (0.2553)
Promotion		0.11*** (0.0021)		0.019*** (0.0020)		–0.047** (0.0147)
Constant	0.0065 (0.0061)	–0.052*** (0.0063)	0.23*** (0.0052)	0.22*** (0.0053)	–0.064 (0.0381)	0.069 (0.0397)
Observations	262,193	260,449	268,470	266,049	67,575	63,006
R^2	0.002	0.012	0.010	0.011	0.004	0.004

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table A.7. Estimated effects separately for full-time and part-time workers

A. Full-time workers

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.11*** (0.0066)	0.21*** (0.0079)	–0.028*** (0.0070)	–0.087*** (0.0069)	–0.022** (0.0070)	–0.081*** (0.0069)
Change in trust median log nurse pay	0.14*** (0.0216)	–0.31*** (0.0243)	0.23*** (0.0236)	0.28*** (0.0234)	0.32*** (0.0237)	0.37*** (0.0234)
Promotion				0.12*** (0.0011)		0.12*** (0.0011)
Constant	0.082*** (0.0033)	0.32*** (0.0038)	0.090*** (0.0033)	0.016*** (0.0034)	0.084*** (0.0034)	0.0084* (0.0035)
Observations	547,973	468,379	472,956	469,276	473,879	470,178
R^2	0.009	0.044	0.011	0.034	0.009	0.032

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	–0.041*	(0.0181)	0.018	(0.0183)	0.52***	(0.0102)
Change in trust median log nurse pay	1.10***	(0.0642)	1.07***	(0.0642)	–0.38***	(0.0330)
Promotion			–0.10***	(0.0038)		
Constant	0.20***	(0.0089)	0.27***	(0.0091)	0.65***	(0.0048)
Observations	427,952		425,077		474,979	
R^2	0.010		0.013		0.069	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	–0.12*** (0.0078)	–0.18*** (0.0078)	0.096*** (0.0070)	0.095*** (0.0071)	–0.30*** (0.0499)	–0.36*** (0.0501)
Change in trust median log nurse pay	0.25*** (0.0263)	0.29*** (0.0262)	0.14*** (0.0247)	0.14*** (0.0248)	–1.49*** (0.1687)	–1.55*** (0.1685)
Promotion		0.11*** (0.0013)		–0.00032 (0.0013)		0.041*** (0.0089)
Constant	–0.22*** (0.0037)	–0.30*** (0.0038)	0.23*** (0.0034)	0.23*** (0.0035)	0.15*** (0.0234)	0.18*** (0.0243)
Observations	473,879	470,178	478,707	474,952	148,326	143,401
R^2	0.018	0.034	0.010	0.010	0.010	0.011

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

B. Part-time workers

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.097*** (0.0118)	0.11*** (0.0100)	0.21*** (0.0174)	0.12*** (0.0172)	0.17*** (0.0179)	0.087*** (0.0177)
Change in trust median log nurse pay	0.12** (0.0366)	–0.25*** (0.0319)	0.23*** (0.0575)	0.26*** (0.0568)	0.30*** (0.0592)	0.33*** (0.0584)
Promotion				0.22*** (0.0035)		0.23*** (0.0036)
Constant	0.023*** (0.0065)	0.39*** (0.0062)	1.46*** (0.0112)	1.35*** (0.0114)	1.51*** (0.0115)	1.39*** (0.0117)
Observations	331,421	232,516	228,168	225,893	228,633	226,346
R^2	0.047	0.052	0.176	0.196	0.168	0.189

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	0.54***	(0.0387)	0.53***	(0.0390)	0.39***	(0.0127)
Change in trust median log nurse pay	0.88***	(0.1309)	0.89***	(0.1313)	–0.12**	(0.0400)
Promotion			0.042***	(0.0088)		
Constant	1.71***	(0.0226)	1.70***	(0.0231)	0.51***	(0.0069)
Observations	199,685		197,987		235,977	
R^2	0.071		0.072		0.053	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	0.076*** (0.0178)	–0.00087 (0.0177)	0.091*** (0.0089)	0.084*** (0.0089)	0.39*** (0.0975)	0.47*** (0.1019)
Change in trust median log nurse pay	0.088 (0.0603)	0.11 (0.0598)	0.066* (0.0299)	0.069* (0.0300)	–1.52*** (0.3224)	–1.91*** (0.3369)
Promotion		0.21*** (0.0035)		0.014*** (0.0019)		0.031 (0.0193)
Constant	1.31*** (0.0110)	1.21*** (0.0112)	0.16*** (0.0052)	0.15*** (0.0054)	0.11* (0.0534)	0.29*** (0.0582)
Observations	228,633	226,346	238,475	236,048	46,655	41,072
R^2	0.130	0.145	0.004	0.004	0.013	0.021

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table A.8. Estimated effects, by age

A. Aged under 30

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.19*** (0.0167)	0.37*** (0.0230)	0.18*** (0.0255)	0.10*** (0.0260)	0.11*** (0.0261)	0.030 (0.0265)
Change in trust median log nurse pay	0.17** (0.0545)	–0.27*** (0.0748)	0.38*** (0.0966)	0.45*** (0.0970)	0.51*** (0.0985)	0.57*** (0.0988)
Promotion				0.099*** (0.0044)		0.099*** (0.0045)
Constant	–0.096*** (0.0229)	0.80*** (0.0323)	5.35*** (0.0411)	5.38*** (0.0411)	5.43*** (0.0420)	5.46*** (0.0419)
Observations	112,001	90,833	89,210	88,135	89,378	88,296
R^2	0.009	0.025	0.159	0.165	0.152	0.158

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	–0.083	(0.0475)	0.014	(0.0487)	0.84***	(0.0238)
Change in trust median log nurse pay	1.44***	(0.1775)	1.47***	(0.1777)	–0.41***	(0.0813)
Promotion			–0.10***	(0.0087)		
Constant	7.82***	(0.0792)	7.84***	(0.0792)	–0.086*	(0.0347)
Observations	85,267		84,421		91,774	
R^2	0.109		0.111		0.028	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	0.12*** (0.0278)	0.048 (0.0283)	–0.060*** (0.0152)	–0.051*** (0.0155)	0.38*** (0.1125)	0.31** (0.1147)
Change in trust median log nurse pay	0.36*** (0.1050)	0.41*** (0.1056)	0.18** (0.0554)	0.18** (0.0557)	–1.33*** (0.4016)	–1.41*** (0.4056)
Promotion		0.085*** (0.0047)		–0.012*** (0.0026)		0.068*** (0.0188)
Constant	4.91*** (0.0450)	4.94*** (0.0451)	–0.11*** (0.0236)	–0.11*** (0.0237)	1.77*** (0.1907)	1.73*** (0.1930)
Observations	89,378	88,296	93,079	91,774	27,128	25,771
R^2	0.120	0.124	0.008	0.008	0.015	0.016

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

B. Aged 30–40

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.15*** (0.0120)	0.23*** (0.0138)	–0.066*** (0.0155)	–0.13*** (0.0154)	–0.076*** (0.0156)	–0.14*** (0.0154)
Change in trust median log nurse pay	0.23*** (0.0377)	–0.45*** (0.0423)	0.42*** (0.0552)	0.49*** (0.0549)	0.49*** (0.0555)	0.57*** (0.0551)
Promotion				0.14*** (0.0025)		0.14*** (0.0025)
Constant	0.15*** (0.0119)	0.44*** (0.0133)	0.092*** (0.0157)	–0.0025 (0.0158)	0.13*** (0.0158)	0.030 (0.0159)
Observations	241,034	196,010	194,077	192,046	194,459	192,418
R^2	0.010	0.019	0.006	0.022	0.005	0.021

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	0.11***	(0.0334)	0.15***	(0.0338)	0.49***	(0.0173)
Change in trust median log nurse pay	1.21***	(0.1201)	1.19***	(0.1205)	–0.48***	(0.0550)
Promotion			–0.065***	(0.0062)		
Constant	0.76***	(0.0359)	0.80***	(0.0362)	0.68***	(0.0172)
Observations	179,247		177,696		198,224	
R^2	0.009		0.010		0.021	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	–0.19*** (0.0183)	–0.25*** (0.0184)	0.14*** (0.0111)	0.13*** (0.0112)	–0.29*** (0.0875)	–0.36*** (0.0893)
Change in trust median log nurse pay	0.38*** (0.0660)	0.44*** (0.0659)	0.023 (0.0388)	0.024 (0.0390)	–1.87*** (0.2966)	–1.83*** (0.3003)
Promotion		0.13*** (0.0029)		0.0032 (0.0019)		0.052*** (0.0144)
Constant	–0.41*** (0.0184)	–0.49*** (0.0186)	0.33*** (0.0115)	0.33*** (0.0116)	–0.32*** (0.0870)	–0.33*** (0.0894)
Observations	194,459	192,418	201,054	198,224	52,733	49,445
R^2	0.006	0.015	0.006	0.006	0.008	0.009

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

C. Aged over 40

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.074*** (0.0089)	0.079*** (0.0071)	0.13*** (0.0084)	0.092*** (0.0083)	0.14*** (0.0085)	0.10*** (0.0085)
Change in trust median log nurse pay	0.24*** (0.0273)	–0.25*** (0.0215)	0.33*** (0.0285)	0.36*** (0.0283)	0.41*** (0.0291)	0.44*** (0.0289)
Promotion				0.11*** (0.0016)		0.11*** (0.0016)
Constant	–0.28*** (0.0065)	0.23*** (0.0048)	0.66*** (0.0062)	0.58*** (0.0063)	0.65*** (0.0064)	0.58*** (0.0064)
Observations	529,922	416,696	417,873	415,029	418,709	415,849
R^2	0.042	0.013	0.057	0.069	0.052	0.064

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	0.17***	(0.0219)	0.21***	(0.0220)	0.37***	(0.0102)
Change in trust median log nurse pay	0.90***	(0.0762)	0.88***	(0.0763)	–0.23***	(0.0315)
Promotion			–0.069***	(0.0054)		
Constant	0.20***	(0.0161)	0.26***	(0.0163)	0.69***	(0.0067)
Observations	363,123		360,947		421,644	
R^2	0.007		0.008		0.041	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	0.071*** (0.0084)	0.042*** (0.0084)	0.10*** (0.0072)	0.095*** (0.0072)	–0.15* (0.0578)	–0.19** (0.0590)
Change in trust median log nurse pay	0.36*** (0.0291)	0.39*** (0.0291)	0.15*** (0.0243)	0.15*** (0.0244)	–1.30*** (0.1913)	–1.53*** (0.1950)
Promotion		0.081*** (0.0016)		0.015*** (0.0015)		0.0086 (0.0115)
Constant	0.56*** (0.0063)	0.50*** (0.0064)	0.15*** (0.0050)	0.13*** (0.0051)	0.27*** (0.0391)	0.48*** (0.0411)
Observations	418,709	415,849	425,803	421,644	118,505	109,231
R^2	0.043	0.049	0.005	0.006	0.009	0.012

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table A.9. Estimated effects, by nationality

A. British workers

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.11*** (0.0074)	0.19*** (0.0079)	0.078*** (0.0087)	0.027** (0.0087)	0.069*** (0.0089)	0.018* (0.0088)
Change in trust median log nurse pay	0.19*** (0.0233)	–0.27*** (0.0238)	0.34*** (0.0304)	0.37*** (0.0302)	0.45*** (0.0311)	0.49*** (0.0309)
Promotion				0.12*** (0.0016)		0.12*** (0.0016)
Constant	–0.0064 (0.0038)	0.34*** (0.0039)	0.49*** (0.0042)	0.42*** (0.0044)	0.50*** (0.0043)	0.43*** (0.0045)
Observations	710,755	570,787	569,674	564,453	570,741	565,489
R^2	0.019	0.041	0.050	0.062	0.048	0.060

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	0.15***	(0.0201)	0.20***	(0.0203)	0.45***	(0.0097)
Change in trust median log nurse pay	1.04***	(0.0725)	1.03***	(0.0726)	–0.28***	(0.0304)
Promotion			–0.086***	(0.0043)		
Constant	0.58***	(0.0101)	0.64***	(0.0104)	0.62***	(0.0047)
Observations	502,760		498,793		577,383	
R^2	0.023		0.025		0.059	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	–0.016 (0.0094)	–0.059*** (0.0095)	0.13*** (0.0064)	0.12*** (0.0064)	–0.10 (0.0518)	–0.18*** (0.0530)
Change in trust median log nurse pay	0.37*** (0.0335)	0.39*** (0.0335)	0.16*** (0.0224)	0.16*** (0.0225)	–1.56*** (0.1812)	–1.74*** (0.1849)
Promotion		0.100*** (0.0017)		0.0072*** (0.0012)		0.052*** (0.0095)
Constant	0.25*** (0.0043)	0.19*** (0.0046)	0.21*** (0.0032)	0.20*** (0.0033)	0.13*** (0.0248)	0.18*** (0.0264)
Observations	570,741	565,489	584,708	577,429	144,685	133,155
R^2	0.014	0.020	0.008	0.009	0.006	0.008

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

B. Non-British workers

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.062*** (0.0181)	0.17*** (0.0148)	–0.021 (0.0193)	–0.053** (0.0195)	0.015 (0.0188)	–0.022 (0.0189)
Change in trust median log nurse pay	0.16** (0.0549)	–0.038 (0.0497)	1.16*** (0.0736)	1.20*** (0.0738)	1.23*** (0.0724)	1.28*** (0.0725)
Promotion				0.055*** (0.0040)		0.064*** (0.0039)
Constant	0.25*** (0.0112)	0.38*** (0.0101)	0.53*** (0.0122)	0.49*** (0.0126)	0.50*** (0.0121)	0.46*** (0.0125)
Observations	121,971	95,387	94,324	93,755	94,595	94,024
R^2	0.030	0.111	0.074	0.076	0.064	0.068

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	0.091*	(0.0414)	0.16***	(0.0419)	0.60***	(0.0209)
Change in trust median log nurse pay	2.28***	(0.1400)	2.22***	(0.1402)	–0.57***	(0.0676)
Promotion			–0.10***	(0.0086)		
Constant	0.73***	(0.0242)	0.79***	(0.0248)	0.60***	(0.0127)
Observations	91,300		90,798		96,628	
R^2	0.049		0.051		0.076	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	–0.100*** (0.0193)	–0.13*** (0.0195)	–0.0024 (0.0151)	–0.000079 (0.0153)	–0.46*** (0.0986)	–0.48*** (0.0997)
Change in trust median log nurse pay	1.08*** (0.0753)	1.12*** (0.0755)	0.084 (0.0512)	0.076 (0.0514)	–1.24*** (0.3144)	–1.33*** (0.3161)
Promotion		0.046*** (0.0041)		–0.0056 (0.0029)		–0.025 (0.0172)
Constant	0.22*** (0.0123)	0.19*** (0.0129)	0.17*** (0.0088)	0.17*** (0.0090)	0.40*** (0.0522)	0.45*** (0.0543)
Observations	94,595	94,024	97,364	96,567	44,009	42,022
R^2	0.020	0.022	0.006	0.006	0.021	0.022

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table A.10. Estimated effects, separately for high-cost areas and low-/medium-cost areas

A. High-cost areas

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.15*** (0.0160)	0.24*** (0.0162)	0.12*** (0.0187)	0.055** (0.0186)	0.12*** (0.0192)	0.057** (0.0190)
Change in trust median log nurse pay	0.19*** (0.0321)	–0.39*** (0.0320)	0.59*** (0.0426)	0.63*** (0.0424)	0.65*** (0.0429)	0.69*** (0.0426)
Promotion				0.12*** (0.0023)		0.12*** (0.0024)
Constant	0.054*** (0.0059)	0.38*** (0.0060)	0.46*** (0.0069)	0.39*** (0.0072)	0.46*** (0.0070)	0.38*** (0.0073)
Observations	344,142	267,917	266,652	263,913	267,265	264,512
R^2	0.017	0.055	0.047	0.058	0.042	0.054

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	0.48***	(0.0439)	0.51***	(0.0442)	0.53***	(0.0200)
Change in trust median log nurse pay	1.13***	(0.0881)	1.12***	(0.0884)	–0.33***	(0.0421)
Promotion			–0.026***	(0.0050)		
Constant	0.52***	(0.0143)	0.54***	(0.0146)	0.64***	(0.0073)
Observations	252,143		249,782		271,078	
R^2	0.032		0.033		0.065	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	–0.0036 (0.0204)	–0.053** (0.0204)	0.16*** (0.0135)	0.16*** (0.0136)	–0.23* (0.1093)	–0.23* (0.1121)
Change in trust median log nurse pay	0.54*** (0.0454)	0.57*** (0.0454)	0.12*** (0.0310)	0.12*** (0.0311)	–0.48* (0.2017)	–0.50* (0.2044)
Promotion		0.093*** (0.0025)		–0.0026 (0.0017)		0.011 (0.0106)
Constant	0.21*** (0.0072)	0.14*** (0.0075)	0.18*** (0.0050)	0.18*** (0.0051)	0.27*** (0.0330)	0.33*** (0.0346)
Observations	267,265	264,512	274,975	271,078	107,898	100,307
R^2	0.011	0.017	0.006	0.006	0.007	0.008

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

B. Low- and medium-cost areas

Retention, churn and total pay

	Leaving	Switching	Total pay		Non-bank pay	
Change in log house prices	0.100*** (0.0122)	–0.052*** (0.0110)	0.037** (0.0137)	0.015 (0.0136)	0.030* (0.0141)	0.0086 (0.0140)
Change in trust median log nurse pay	0.32*** (0.0297)	–0.093*** (0.0273)	0.35*** (0.0364)	0.38*** (0.0364)	0.50*** (0.0374)	0.53*** (0.0373)
Promotion				0.11*** (0.0018)		0.11*** (0.0018)
Constant	–0.022*** (0.0044)	0.32*** (0.0042)	0.51*** (0.0048)	0.44*** (0.0049)	0.52*** (0.0049)	0.46*** (0.0051)
Observations	538,191	435,622	434,163	430,963	434,939	431,720
R^2	0.023	0.035	0.058	0.068	0.056	0.065

Allowances and promotions

	Allowances				Promotion	
Change in log house prices	–0.027	(0.0369)	0.0045	(0.0369)	0.22***	(0.0148)
Change in trust median log nurse pay	1.50***	(0.0975)	1.50***	(0.0974)	–0.22***	(0.0364)
Promotion			–0.14***	(0.0054)		
Constant	0.60***	(0.0122)	0.69***	(0.0125)	0.60***	(0.0053)
Observations	375,494		373,282		440,233	
R^2	0.023		0.026		0.052	

Non-bank hours, bank work and bank earnings

	Non-bank hours		Stop bank work		Bank pay	
Change in log house prices	–0.014 (0.0151)	–0.031* (0.0151)	0.17*** (0.0101)	0.17*** (0.0101)	0.12 (0.1041)	0.096 (0.1068)
Change in trust median log nurse pay	0.37*** (0.0407)	0.39*** (0.0407)	0.17*** (0.0271)	0.17*** (0.0272)	–2.56*** (0.2560)	–2.82*** (0.2621)
Promotion		0.093*** (0.0020)		0.013*** (0.0014)		0.060*** (0.0127)
Constant	0.26*** (0.0049)	0.21*** (0.0052)	0.20*** (0.0037)	0.19*** (0.0038)	0.12*** (0.0324)	0.14*** (0.0344)
Observations	434,939	431,720	444,961	440,564	90,385	84,070
R^2	0.017	0.022	0.010	0.010	0.012	0.015

Standard errors in parentheses conditional on nurse age, gender, ethnicity and year dummies. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

References

NHS England and NHS Improvement (2019), ‘Agency rules: June 2019’, https://improvement.nhs.uk/documents/5424/Agency_rules_-_changes_for_2019.pdf.

Office for National Statistics (2016), ‘Travel to work area analysis in Great Britain: 2016’, https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/traveltoworkareaanalysisingreatbritain/2016.

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*, vol. 118, pp. 222–73.