

PRELIMINARY DRAFT: PLEASE DO NOT CITE

House prices and fertility in England and Wales

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Abstract

Traditionally the relationship between the cost of housing and fertility has been assumed to be negative: high relative house prices deter the moves into home ownership or into larger dwellings deemed necessary by many for raising children. However, recent research from the US challenges this view by emphasizing the wealth effects of increasing home values among owners. This paper examines the relationship between short-run fluctuations in local area house prices and fertility in England and Wales between 1995 and 2008, using individual-level data from a household panel merged to area-level data on house prices. Innovations relative to previous work are a focus on the precise timing of the relationship between housing market conditions and fertility responses and a systematic analysis of the differential effects of house price levels and changes. The results suggest house price effects vary considerably for different groups and point to the importance of the national contexts.

1. Introduction

A diverse body of work in demography and economics has explored the idea that high housing costs have a negative influence on fertility. Higher housing prices reduce disposable income so that children become less affordable and, to the extent that additional children require larger dwellings, high housing costs increase the relative “price” of a child. In addition to this standard economic argument there is much evidence of social norms around the types of dwelling that are considered appropriate for raising a family, owner-occupation being a key example. In times of high prices individuals in the early stages of the life course may find it difficult to access this type of accommodation and so postpone or forego childbearing. The structure of the housing market has been put forth as one potential explanation for the very low levels of fertility that have emerged recently in some southern and eastern European and countries, an issue of great policy concern (Mulder and Billari 2010). Evidence of a negative relationship between house prices and fertility also raises the question of whether we can expect a “baby boom” following the dramatic falls in property values in the US, Britain and elsewhere following the 2008 financial crisis.

Britain provides an interesting case study for this topic because of the house price boom that began in the mid-1990s and lasted for over a decade. As shown in Figure 1 the real price of properties sold in England and Wales (that is the price relative to the cost of other goods and services) almost tripled between 1995 and 2007, the peak of the boom. Yet as Figure 1 also shows, we see little evidence in the aggregate that this was accompanied by a decrease in fertility, with the total fertility rate rising slightly over much of the period, ending up in 2007 11% higher than its 1995 level.

On the face of it the British experience appears to provide little support for the idea that expensive housing deters fertility. However, a closer reading of the literature suggests that the impact of house prices on childbearing is likely to vary across sub-groups of the population and will be dependent on a number of contextual factors. In particular recent work from the US has focused on the investment, rather than the consumption, aspect of home ownership (Lovenheim and Mumford 2011, Dettling and Schettini Kearney 2011). These papers emphasise the positive effect of house price inflation on the equity of home owners, arguing that the increase in liquid wealth for this group during the boom years led to increased demand for children and higher fertility rates. Those in the rental sector in the US, however, did not benefit in this way and instead exhibited constant or falling levels of fertility. Other theoretical work suggests that the deterrent effect of high prices on non-owners will be dependent on the accessibility and affordability of appropriate family housing in the rental sector and on the ease of access to

mortgage borrowing. Finally, Britain is unusual in that it has a large social housing sector to which access is determined administratively rather than by market forces. The existence of a sizable fraction of the market that is relatively insulated from the effects of changing prices may also be expected to dampen fertility responses.

This study examines the relationship between short-run fluctuations in local area house prices and fertility in England and Wales between 1995 and 2008. We use data on conceptions among women aged 18 to 44 from the British Household Panel Survey (BHPS), merged to area-level data on house prices from the Land Registry database. A key innovation in this study relative to previous work is the use of monthly rather than annual (or sometimes quarterly) data. This issue of the timing of effects of housing costs on fertility is one that has to date received relatively little attention. Related evidence from the literature points to different hypotheses about whether we should expect instantaneous or more delayed effects. Studies relying on annual data are limited in the extent to which the timing of decisions can be distinguished precisely and the averaging of price levels and conception rates over 12 month periods may obscure differences in trends within that interval.

Here conception probabilities are related to measures of the average selling price of, and rate of change in, all dwellings in the relevant local authority (county) in a baseline month. The use of individual-level panel data means we can explore whether house price effects vary by housing tenure and other demographic characteristics. Year fixed effects control for unobserved time-varying influences on fertility at the national level and area fixed effects control for, amongst other things, the sorting of individuals into low- or high-house-price areas on the basis of time-invariant fertility preferences. Identification therefore comes from within-area changes in real house prices over time. Time-varying controls for area unemployment rates are used to capture changes in economic conditions that may be confounded with real estate trends.

2. Background

2.1. Housing costs as a barrier to family formation

Theoretically and empirically the focus in the demography literature on the impact of housing conditions has been on those in the earlier stages of the life course: those yet to have children who reside in the parental home or in rented accommodation. The behaviour of singletons and childless couples is likely to be relatively more sensitive to changes in the housing market than that of those in other family types. The transactions costs of a residential move, both financially and in terms of disruption to social networks, increase with family size so that individuals in

more stable family types tend to have already settled into “higher commitment” forms of housing (Mulder 2006a). For those at a relative fluid stage of the life course, high housing costs may make it difficult for individuals in this group to establish a first independent household (Ermisch 1999, Mulder and Clark 2000, Mulder 2006b), potentially delaying union formation, or make it difficult to move to an appropriate dwelling (for example in terms of size) in which to raise a family.

Fertility of these groups will be more sensitive to housing market conditions the more restrictive are social norms about homes that are suitable for families. There has been much discussion in the literature about the extent to which home ownership is viewed as a prerequisite for childbearing (Mulder 2006a), but other factors such as living in a single-family dwelling or in a family-friendly neighbourhood have also been discussed (Kulu and Vikat 2007, Mulder and Wagner 1998). To the extent these sorts of norms exist high housing costs will prevent some people from realizing the minimum conditions they deem necessary for starting a family, leading them to postpone or forego childbearing.

Support for the idea that households often want to enter homeownership before or shortly after starting a family is widespread in the literature, for example because of the greater perceived security of owning compared to renting or because owners have more freedom to make changes to their homes (Saunders 1990). High housing costs will have a greater impact on fertility the more home ownership is the preferred tenure for family formation because of the difficulties involved in meeting down payment and borrowing constraints in order to take out a mortgage (Linneman and Wachter 1989). Those who are content to raise a family in rented accommodation are potentially less affected, particularly if high house purchase prices are not mirrored in the rental market, as has been the recent experience in Britain (Hills 2007).

The same sorts of mechanisms may also affect fertility of those who have already become owner-occupiers but are still at a relatively early stage of the life course. The increase in home ownership in more recent cohorts means that individuals may expect to move within the owner-occupied sector several times before ‘settling down’ into the sort of high commitment household situation associated with parenthood (Feijten and Mulder 2002). Such individuals may anticipate upgrading their homes in terms of size or neighbourhood characteristics such as access to good schools before expanding the family, plans that again may be hindered by high house prices. It has also been suggested that home ownership, and housing consumption more generally, could deter fertility in times of high prices by acting as a substitute rather than a complement (Courgeau and Lelièvre 1992). That is, instead of deferring fertility because of lack of appropriate housing individuals forego having children in order to meet the high costs of

home ownership. There is evidence that of high mortgage commitments lead to greater female labour market participation, hampering their ability to “afford” a child (Fortin 1995). This mechanism is likely to be of particular relevance where the culture of home ownership is strong.

Evidence that housing adjustments are often synchronized with the birth of a child (Courgeau 1985, Clark et al 1984, Deurloo et al 1994, Deurloo et al 1998, Clark and Huang 2003, Michielin and Mulder 2008, Mulder 2006a) points to strong links between these two aspects of the life course. There is also a wealth of evidence that fertility rates differ with housing characteristics. It has been shown that conception rates are higher among couples living in single family dwellings than those in apartments (Kulu and Vikat 2007, Murphy and Sullivan 1985); higher in suburban areas (Kulu, Boyle and Andersson 2009); and higher in larger dwellings (Ström 2010). Home ownership has also been shown to speed up the transition to parenthood in West Germany and the Netherlands (Mulder and Wagner 2001).

Other work has documented a direct negative association between housing costs and fertility. The cost of being a home owner negatively affects first-time childbearing in Sweden and more strongly so among more recent cohorts for whom entering the housing market has become more difficult (Ernstrom Ost 2012). Cross-sectional studies have shown a significant correlation between the price of living space in US cities and fertility (Simon and Tamura 2009, Clark 2012). Time series studies of long-term trends in fertility and house prices have documented a negative relationship for Britain (Ermisch 1988) and Hong Kong (Yi and Zhang 2010). Finally, macro-level studies have linked characteristics of the housing market in different countries to their fertility rates.

2.2. Factors mitigating the negative impact of housing costs on fertility

The evidence outlined above provides a convincing case for a negative relationship between fertility and housing costs. However, there are other considerations that suggest this negative response may be muted in certain circumstances, or even off-set by positive effects. First, house prices are only one aspect of the accessibility of home ownership. The workings of the financial market and the ease with which mortgages can be taken out are also key variables to consider (Mulder and Billari 2010). High prices may have little impact on behaviour if it is easy and cheap to borrow enough to make a purchase. Second, the extent to which home ownership is viewed as necessary for family formation will depend crucially on the degree of access to affordable family-friendly housing in the rental market (Mulder 2006a). In some countries (such as the US and Spain) there appears to be a sharp distinction between “ownership neighbourhoods” and “rental neighbourhoods”, such that the only way to access spacious single-family dwellings and amenities such as good schools and safe environments is to buy a property

(Mulder and Wagner 1998, Clark 2012). Ownership becomes less important when a wide range of dwellings in terms of type and location are available on the rental market. Of course, if house prices are closely tracked by rents then affordability, and the effects on fertility, will be the same in both sectors.

A positive relationship between house prices and fertility becomes plausible when housing is viewed as an investment, rather than a consumption, good. Rising house prices increase housing equity among owners and potentially lead to a positive wealth effect on the demand for children. Using area-level data on house prices and fertility rates for the US, Dettling and Schettini Kearney (2011) show that a 10% increase in house prices is associated with a 4% increase in births. The argument that the association truly reflects a housing wealth effect is strengthened by the finding that the increase is dependent on the proportion of home owners in an area: their estimates suggest that for renters the equivalent effect is in fact a 1% decrease in births. Lovenheim and Mumford (2011) use individual-level data on housing values and conceptions and come to very similar conclusions. Similar studies have not yet been conducted outside the US. However, Ermisch and Washbrook (2012) show that housing equity is positively associated with residential mobility among female home owners of childbearing age in the UK, which suggests that housing adjustments for increases in family size potentially become easier with greater liquid wealth.

Consideration of housing equity raises the issue of the differential effects of the level of and changes in house prices. For example, Loveneim and Mumford (2011) find no relation between the level of home values and conception risk – it is only short-term increases in the value of owners' homes that prompt fertility. Volatility in the housing market, as distinct from the level of house prices, has been put forward as a factor that may deter family formation for those at the start of the life course. Very rapid increases in housing values, such as those seen in Britain and the US in recent decades, may depress fertility because of an increase in uncertainty and concerns about housing market stability (Clark 2012).

A key issue is how short-term trends in house prices influence people's expectations about the future. If people expect prices to continue to rise they may bring forward moves into owner-occupation and residential upgrades, either because they anticipate becoming priced out of the market if they wait or because of the anticipated capital gains. Similarly, falling prices may deter moves into larger, more family-friendly housing if prices are expected to come down even further in future. Alternatively, sharply rising prices may lead some people to believe it will be impossible to buy an appropriate home during their preferred childbearing window. As a result childbearing may be brought forward if they revise their criteria for an appropriate family

dwelling and, for example, choose not to delay family formation while saving for a down payment but go straight into rental accommodation.

Collectively the existing literature gives an ambiguous picture of when we should expect the effects of housing costs on fertility to emerge. Mulder (2006a) argues that we might expect that couples prefer to secure suitable housing before they have their first child rather than having to move after the child is born. The extent to which couples are able to realize this depends on economic and housing market circumstances and the accessibility and affordability of home ownership. Timing will also depend on the amount of down payment required to obtain a mortgage loan. The higher the requirement the longer we might expect periods to be in which savings are accumulated. Work from the residential mobility has shown that moving propensities increase shortly after the birth of a child (Courgeau 1985, Clark et al 1984, Clark and Huang 2003, Boheim and Taylor 2002), particularly for moves into owner-occupation (Deurloo et al 1994, Withers 1998). This suggests that couples are content to conceive in less than ideal housing circumstances provided they anticipate they will be able to make the necessary adjustments soon afterwards. High house prices may then have instantaneous or at least relatively quick effects on the conception rate via their impact on expectations about housing opportunities. Work by Kulu (2008) showing that many couples move during pregnancy, and by Ström (2010) showing that housing characteristics become more strongly associated with fertility in the 16-month period prior to a birth, support the idea that this ordering of events is a common one.

However, there are other reasons to expect a substantial lag between housing market stimuli and conception rates. One possibility is that ease of access to home ownership positively affects union formation (Lloyd and South 1996; Mulder et al. 2006) which then in turn leads to accelerated fertility (Baizán et al. 2003, 2004). It may be some years before those who delay union formation due to high house prices reach the stage at which they would otherwise have chosen to increase family size. More generally, if people expect to progress through several stages of the housing career before starting a family then factors inhibiting the “first step on the ladder” will only show up in fertility rates after some time. Mulder and Wagner (1998) showed that couples in the Netherlands were increasingly likely to seek owner-occupied housing earlier in the life course, some time prior to the initiation of childbearing (although this was less true in West Germany). Feijten and Mulder (2002) report similar findings and suggest that the increased incomes of more recent cohorts have led to greater desires for home ownership among those who have not yet settled into stable family types.

As many authors have recognised there is a great deal of potential for selection effects in the relationship between housing costs and fertility. Individuals with low fertility preferences may tend to locate in high price areas. A clear example for which there is substantial evidence is the tendency of highly educated women who want professional careers to locate in urban centres (Clark 2012). High prices also associated with economic activity which may have an independent influence on the demand for children, although evidence is mixed on whether fertility is pro- or counter-cyclical. At an aggregate level the demand for housing will clearly be a function of the demographic composition of the population. Since children require space, trends in the age structure and in migration patterns of different groups will influence both the fertility rates and the price of housing in a given geographical area in the same direction (Malmberg 2009). The empirical specification outlined in section 3 addresses many of these potential sources of confounding.

2.3. *The United Kingdom context*

The United Kingdom has a moderately large rental sector, with a tenancy rate of around 30% in 2000, larger than countries such as Spain, Greece and Ireland but markedly smaller than countries such as Switzerland, Germany and the Netherlands (Mulder and Billari 2010). Contrary to US studies that tend to show a very high correlation between purchase prices and rents (Simon and Tamura 2009, Clark 2012) the growth of house prices in the UK was not accompanied by a similar rise in rents. As Hills (2007) reports, while the average real house price in England more than doubled between 1996 and 2005 average private sector rents rose over the same period by only 14%, roughly in line with the increase in earnings. Using per capita mortgage debt as an indicator of access to mortgages, the United Kingdom again falls somewhere in the middle of the ranking of developed countries, with an average of around 21 000 euros in 2000, well above the 10 000 euro cut-off Mulder and Billari (2010) choose to denote difficult access to mortgages.

As Mulder (2006a) argues, the extent to which home ownership is viewed as a desirable goal is likely to differ across countries and with financial and housing market circumstances. It is not clear where the UK around the turn of the 21st century fits in this regard. On one hand, the attaching of great importance to home ownership has been described as part of an “Anglo-Saxon tradition” (Kemeny 1981) and one might expect the British to share the “American dream” of home ownership more strongly than, for example, those in Germany (Börsch-Supan 1985). Two further pieces of evidence support this conjecture. One, as discussed above, is the relatively high rate of home ownership in Britain at least in terms of other Northern European countries. The second is the finding that, unlike in most countries that have been studied, home owners in

Britain have fewer children and have them later than renters (Murphy and Sullivan 1985). This pattern is consistent with a scenario in which there are strong preferences for home ownership and the costs of home ownership compete with the costs of rearing children.

On the other hand, Britain is unusual in having around a fifth of households who rent their dwellings from local authorities. Social housing (“public housing” in American terminology) is allocated administratively on the basis of need rather than by price. As one of the criteria of “reasonable preference” is overcrowding (as well as homelessness, disability and risk of hardship) in practice families with children, and particularly single parents, are one of the groups given preferential access. Social tenancy is strongly concentrated among the most disadvantaged, with 70% of tenants in the mid-2000s in the lowest two-fifths of the income distribution and only 32% in employment (Hills 2007). Social rents are set at levels well below market value, ranging from 40% of the equivalent private sector rent in London to around 60% outside the South East of England (Hills 2007).

The extent to which those who are currently or potentially social tenants in the UK are affected by house prices depends on the extent to which public- and private-sector housing are perceived as substitutes. One view sees social housing as the natural tenure choice for disadvantaged groups, given the cost differentials. If this is the case then potential social tenants may be relatively unaffected by changes in the private housing market. It is also possible, however, that rising private sector housing costs increase the demand of social housing, putting pressure on capacity. The link between family size and allocation may then create positive incentives for fertility if social housing supply becomes scarce. On the other hand, it has been argued that housing tenure is strongly associated with social status in Britain, such that many social tenants aspire to home ownership in the future (Murphy and Sullivan 1985). High private sector house prices may then impact on social tenants in a very similar way to private tenants. The fact that social tenancy tends to be a very stable form of tenure suggests that relatively few expect to make the transition to home ownership: 82% of social tenants in 2004 were in the same tenure in 1994, similar to the 90% figure for owner-occupiers but far higher than the 56% for private renters (Hills 1997).

3. Empirical model

Using C_{it} as binary indicator for whether individual i conceives in month t , we can define $p_{i(t+s)}$ as the probability that individual i conceives in month $t + s$, conditional on no conception in months t to $t + s - 1$.

$$p_{i(t+s)} = \Pr(C_{i(t+s)} = 1 | C_{it} = 0, \dots, C_{i(t+s-1)} = 0)$$

The outcome modelled is the first conception occurring since some baseline month t . Individuals who conceive in month $t + s$ are no longer in the risk set for months beyond $t + s$. We model conception in month $t + s$ as a function of variables measured at time t , the baseline month, with $s = 0, \dots, 35$. Hence the risk of conception is modelled in each month over the next three years from the date of house price measurement. Formally, we estimate 36 separate models for each lead s of the form

$$\log\left(\frac{p_{ij(t+s)}}{1 - p_{ij(t+s)}}\right) = \delta_s + \Theta_s \mathbf{X}_{ijt} + \mu_{js} \quad (1)$$

where j indexes person i 's area of residence at time t , \mathbf{X}_{ijt} is a vector of characteristics measured on individual i at time t and μ_{js} is a time-invariant fixed area effect. The s subscripts on the constant, δ , the parameter vector Θ and the area fixed effect allow for all effects to vary by the lag length between t and potential conception at $t + s$.

A more standard approach is to model the outcome at $t + s$ as a function of covariates at $t + s$ in a single regression, possibly including lagged measures of the key covariate of interest (house prices) to allow for delayed effects. The problem with such an approach is that other covariates measured at $t + s$ are potentially endogenous with respect to house prices. We want to allow, for example, that high house prices at t affect fertility by influencing the individual's choice of dwelling in the intervening period in terms of location and tenure. Controlling for characteristics of the residence at $t + s$ confuses the interpretation of the estimates in the sense that mechanisms through which house prices affect the outcome are inappropriately held constant¹.

The specification of the fixed part of the model needs to be flexible enough to allow the effect of house prices to vary by individual tenure and to allow differential effects of house price levels and changes. If we define K binary indicators for whether the tenure of individual i at time is of type $k = 1, \dots, K$, i.e. $\text{tenure}_{itk} = (I | \text{tenure}_{it} = k)$, then the specification is

$$\Theta_s \mathbf{X}_{ijt} = \sum_{k=1}^K \alpha_{sk} (\text{tenure}_{ijtk} \times \ln \text{HP}_{jt}) + \sum_{k=1}^K \beta_{sk} (\text{tenure}_{ijtk} \times \ln \text{HP}_{j(t-12)}) + \Gamma_s \mathbf{Z}_{ijt} \quad (2)$$

¹ Consider, for example, a model in which local house prices are measured with some lag while the outcome, other covariates and area fixed effect indicator are all measured at t . If the individual has moved between the timing of house price measurement and time t then there can be discrepancy between the area indicator and the area in which lag house prices were measured.

where $\ln\text{HP}_{jt}$ is the log of the average house price in area j at time t . The interaction terms with the tenure indicators allow the effect of the house price at t on fertility at $t + s$ to differ by tenure. For a particular tenure group k , α_{sk} gives the effect of a log-point increase in house prices holding constant prices one year ago ($\ln\text{HP}_{j(t-12)}$), i.e. the effect of roughly a doubling of house prices over the year prior to t . The sum ($\alpha_{sk} + \beta_{sk}$), in contrast, gives the effect of a log-point difference in house prices that has been sustained for a year, isolating the effect of the level of house prices rather than their change. Standard errors for this level effect are derived by combining the estimated variances and covariance of α_{sk} and β_{sk} .

The vector \mathbf{Z}_{ijt} (associated with the parameter vector Γ_s) contains the main effects of tenure and three-way interactions between age (the level and square of age in months), education (3 categories) and parity (0, 1 or 2 previous births), all measured at time t . Year dummies are included to control for any unobserved influences on fertility and house prices that occur at the national level (e.g. movements in interest rates and other macroeconomic variables) and calendar month dummies control for seasonal effects.

Area dummies are included to capture the fixed effects shown in equation 1. These will absorb the impact of any area characteristics that influence both house prices and fertility (such as the nature of the housing stock, local amenities and demographic composition), provided these do not vary over time. Hence identification of the effect of house prices on fertility comes from short term house price variation within geographical areas. We investigate whether women experiencing levels of, or growth rates in, house prices that were unusually high relative to the national average for that year made different fertility decisions to those experiencing unusually low house prices, while accounting for time-invariant differences in fertility rates across areas.

Of course, the estimates of house price effects are still vulnerable to confounding from unobservable factors that vary with time differently across areas. Variation in demographic composition is one possibility that is a danger in studies using aggregate data on fertility across areas. However, this can be tackled in a model estimated on individual data via the controls for age, education and parity. We also include a measure of the monthly unemployment rate in the local authority at time t and an individual measure of log real household income. Both of these should help to control for area-specific economic shocks potentially correlated with both fertility and house prices. Finally, standard errors are clustered at the individual level to allow for dependence in the residuals of the same women over time.

4. Data

Data come from the British Household Panel Survey (BHPS) a long-running panel study that began with a representative sample of about 5,500 households in 1991. The original sample members (OSMs) have been interviewed annually since 1991, with additional members joining the sample at later waves because they become co-resident with an OSM or as part of several booster samples.

Our sample consists of all women in the survey aged between 18 and 44 and resident in England or Wales during the 152-month period January 1996 to August 2008 (Waves 6 to 18). Observations on women resident in Scotland or Northern Ireland, and observations from the earlier BHPS waves prior to 1996, are excluded due to lack of local area house price data (see below).

A file containing detailed information on fertility histories was used to identify the calendar month of any conceptions occurring to women in the sample and parity in each month. Conception is defined as the month in which a live birth occurred minus nine – hence conceptions that did not lead to live births are not measured. Information on residential history was used to construct indicators of housing tenure and geographical location for each month in between the annual interviews. We distinguish four types of housing tenure. The first three apply to individuals who are either the household reference person (HRP) or partner of the HRP, where the HRP is defined as the person legally or financially responsible for accommodation. Such individuals are then classed as either owner-occupiers, private renters or social renters (in housing rented from the council or a housing association). Individuals co-resident with an HRP who is a relative (other than their partner) are classed as family renters. The vast majority, 94.2%, of person-wave observations in this group belong to children living in the parental home. Of those remaining the most common are siblings of the HRP (2.6%) and grandchildren of the HRP (2.4%). Finally, individuals living an HRP who is not a relative (such as lodgers) are classed as private renters. Information on educational attainment and annual gross household income are taken from the annual interview and assumed constant over the previous twelve months.

Area house price data are provided by the Land Registry and are available for England and Wales only from January 1995 onwards. The database contains data on all residential housing transactions, whether for cash or with a mortgage, and is the only complete record of residential property transactions in England and Wales. The large sample size means that average sales prices for 172 local authorities can be distinguished on a monthly basis, rather than a quarterly

or annual basis as in other house price series. Districts in non-metropolitan counties are aggregated into a single authority while the 33 London boroughs constitute separate areas.

The measure used is the average price of all properties sold in a local authority in a particular month, deflated by the monthly Retail Price Index excluding housing costs. Table 1 gives some information on the distribution of the monthly house price levels and annual growth rates separately for authorities in London and the South East and for the rest of England and Wales. It shows the huge differentials in price levels between the South East and the rest of the country, with the median average sales price per authority more than twice as high in the former than the latter. The data on annual changes in sales prices show that this was a period of generally rising prices, with both the mean and median monthly inflation rates well above zero. House price growth was also generally faster in the in the South East than elsewhere, mostly because of fewer occurrences of negative price changes than because of greater changes in times of high inflation. Note however, that there is substantial variation in growth rates over the period, including over 25% of area-month observations outside the South East, and over 10% within the South East, where real prices fell relative to the previous year.

Although all 172 authorities are represented in the BHPS sample, a small number contain no conceptions during our analysis period and these observations are dropped from the sample. The final analysis sample contains 308,798 person-month observations on 4,816 women in 160 local authorities (an average of 64 months per woman). Each additional lag between house price measurement and conception results in a loss of sample observations from the end of the analysis period and also the censoring of observations in which a conception has occurred prior to the month in question. Our longest lag length of 35 months can only be estimated on observations between January 1996 and September 2005, a sample prior to censoring of 230,413 person-month observations on 4,286 women in 152 local authorities and after censoring of 158,214 person-month observations on 3,167 women in 144 local authorities. Robustness of the results to restricting all regressions to outcomes measured prior to October 2005 in the 152 local authorities with at least one conception in this period will be assessed in sensitivity analyses.

Table 2 provides some descriptive statistics for the full analysis sample, broken down by tenure status. Since our focus is on women of childbearing age, a relatively large fraction of person-month observations, just under a third, are spent in non-owner-occupied housing, with a roughly even split between family, private and social rentals. The strong association between housing tenure and life cycle stage is clear. Women living in homes headed by a relative (usually a parent) tend to be young – under 24 on average – and 90% are yet to have a first birth.

Women in private rented accommodation are older on average at 29 but the majority, 60%, have also not yet initiated childbearing. The characteristics of women in the two “longer-term” tenures of social renting and owner-occupation are very different. Both groups are older on average than those in private or family rentals, with owner-occupiers the oldest of all. Over 90% of women in social rented accommodation have at least one child and two-thirds have at least two. This is unsurprising given rules on access to social housing on the basis of need, a point further emphasised by the low levels of educational attainment of women in this group, which proxy for social disadvantage. Despite the fact they are older on average than social renters, some 30% of owner-occupiers have not experienced a first childbirth. Table 2 also reveals some evidence of an association between conception risk and housing tenure. Owner-occupiers are the most likely to conceive and those living in the family home are, unsurprisingly, by far the least likely to conceive. Conception rates are equal among women living in private and social rented accommodation although of course this does not condition on their very different demographic characteristics.

Table 3 focuses in more detail on the 1,562 conceptions observed in the analysis sample. It shows that 35% of sample conceptions occur to women living in non-owner-occupied accommodation, including 20% to women in the “shorter-term” tenures of private and family rentals. We find some evidence of housing adjustment in the months before and immediately after childbirth, as documented by Kulu (2008) and Strom (2010), with the proportion of women in owner-occupation rising to 70% by the time the child is three months old. Conceptions of those becoming mothers for the first time are slightly more likely occur outside owner-occupation than those of women with existing children but housing adjustment is also more likely for new mothers. Some 30% of first children are conceived in private or family rented accommodation although only 20% are still there three months after the birth, mostly because of moves into owner-occupation. Nevertheless, it is still the case that a substantial fraction of infants are raised by women not living in a “normative” owner-occupied single-family dwelling.

5. Results

5.1. *The effects of high house price levels*

Figure 2 plots the estimated effects of a log-point difference in the area house price level at time t on the log-odds of a first conception in each of the subsequent 36 months (the quantity $(\alpha_{sk} + \beta_{sk})$ from equation 2). The estimates capture the difference in the conception risk of a woman living in an area at t with a house price level that has been roughly double that of a woman in the reference area over the previous 12 months. Estimates marked with an open

circle are significant at the 10% level, those with a closed circle indicate significance at the 5% level and estimates marked with a cross are not significantly different from zero. In general there is little evidence that high house price levels are associated with significant differences in fertility behaviour at any time in the following three years. The estimates for women living in the family home or in private rented accommodation are generally negative, while the estimates for women in the more stable tenures of social renting and owner occupation are generally positive. However, the only significant estimates are those that show that women who were living in the family home in high price areas had lower conception rates than their equivalents living in low price areas around 12 to 16 months later.

It is possible that the estimates shown in Figure 2 obscure differences in the effects of house price levels for subsets of women within each tenure group. To explore this we interacted each tenure-house price term with indicators for whether the woman had had a previous birth or not and (in separate models) whether she lived in London and the South East or in the rest of the country. We found no significant effects for women in owner-occupied housing at baseline for any of the sub-groups and, moreover, the pattern of coefficients was very similar in all cases. This was also the case for estimates of the effects of price levels for private renters so disaggregated estimates for these two tenure groups are not shown.

Figure 3 looks in more detail at the effects of high price levels among those living in the family home at the start of the period. It is clear the negative effects that emerge at 12 to 16 months are limited only to those who have not yet started childbearing, and there is also some evidence of additional negative effects on conception risk for this group just several months after the date of house price measurement. The estimates for those who already have at least one child are smaller and are all insignificant, although recall that these are a fairly unusual group – only one in ten of all those living in the parental home. The pattern of effects for those living in London and the South East is similar to that for women in the rest of the country. The negative estimates after a 12 to 16 month lag are more strongly significant for the sample outside the south east, possibly because of a larger sample size. To give an idea of the magnitude of the estimated effects, the mean hazard of conception of a childless family renter at 16 months is 3 conceptions per 1000 women. The coefficient of -0.93 implies that a 10% differences in the house price level is associated a reduction of 0.28 conceptions per 1000, or a 9.3% fall.

Figure 4 shows the disaggregated estimates for women living in social rented accommodation. As when all social renters are pooled together we find no significant effects of high house price levels for those who have already started childbearing or for the small group who are childless at the baseline. However, there is a stark difference in the effects of high price levels for social

renters living in London and the South East relative to those outside that region. For social renters living in the south east only there is evidence that women were more likely to conceive 6 to 9 months later, and even more so 20 to 27 months later, after a period when house prices were high rather than low. The coefficient of 1.2 at 20 months translates to a 12.2% increase in the hazard of conception in that month associated with a 10% difference in house prices when evaluated at the mean of that group. Women in this group made changes to their circumstances when prices were high that resulted in more conception two years later, changes that were not made when prices were low. Or, looked at another way, low prices were associated with changes that resulted in lower fertility after that time. The relatively long time lag in the effect suggests that house prices for this group affected intermediate behaviours that then had a knock-on effect of fertility. Perhaps when prices were higher demand for social housing increased, reducing the supply of available dwellings for those wishing to move within the sector. It is possible that having children became the only way to secure allocation to a higher quality social rented home. Outside the south east, where pressure of demand on social housing is less, the opportunity to improve housing within the sector may have been less constrained. Another possibility is that high price levels put moves out of social housing, and particularly into owner-occupation, out of reach for some social tenants. Whereas in times of lower prices some may defer fertility in order to work and save for a deposit, for example, this is no longer worthwhile in times of high prices. However, if this were the explanation we would expect to see effects on fertility to emerge quickly, rather than only after several years. We might also expect to see the same pattern outside the southeast, although the generally lower level of prices in the rest of the country may mean the pricing-out effect is less acute.

To sum up, we find some evidence that high house price levels deter fertility among young childless women living in the family home. Women in this group who would make choices leading to conceptions around a year down the line when house prices are lower do not make those choices when prices are higher. This is consistent with the idea that high housing costs hinder the ability of young adults to establish an independent household, at least one in a dwelling deemed suitable for a partner and children. We find no significant effects for childless women who have already left the family home and moved into either private rented or owner occupied accommodation. On the other hand, the estimates indicate that low, rather than high, prices deter fertility after a lag of several years among the particular group of women in social rented accommodation in London and the south east. This finding is puzzling and merits further attention. One possibility is that high prices affect the demand for social housing with longer term effects on the availability of dwellings within the sector for those with smaller families.

5.2. *The effects of high house price inflation*

Figure 5 plots the estimated effects of a log-point increase in house prices over the 12 months prior to baseline (α_{sk} from equation 2). The estimates capture the difference in the conception risk of a woman living in an area at baseline in which house prices have roughly doubled over the previous year relative to a woman in the reference area where prices have remained constant. Unlike the effect of high price levels, there is evidence that rapid increases in house prices are associated with lower conception risks for all four tenure groups. For those living in the family home these effects emerge around 22 to 29 months after baseline while for those in private rentals the effects occur earlier, after 15 to 17 months. Among social renters negative estimates are apparent from 17 months after baseline and become strongly significant after 27 to 33 months. Negative effects emerge latest of all for owner-occupiers, at 28 to 31 months after baseline. Among those living in the family home the estimates suggest a positive fertility response to rapid house price growth in the months immediately after baseline, raising the possibility that house price inflation brings forward conceptions among this group that would otherwise have been delayed for several years.

The disaggregated results for family renters shown in Figure 6, however, reveal that this is not the case. In fact the early positive fertility response and delayed negative fertility response belong to different groups of women. High house price inflation is strongly associated with reduced fertility between 16 and 29 months after baseline for childless women living in the family home, while the significant positive effects seen in the first year are restricted only to the (small) sub-group of women who have already had a child. Furthermore, the positive response is one much more strongly associated with inflation in the south east than in the rest of the country. Note that it is not the case that the parity and regional divisions are isolating the same group of women: 12 % of family renters in the south east had at least one child at baseline, similar to the 10% in the rest of the country.

Figure 7 looks in more detail at the effects of house price inflation on those living in private rented accommodation. While only weak evidence of negative effects was found in the pooled group of private renters in Figure 5 it is clear that for the childless group of private renters high house price inflation is strongly associated with reduced fertility, both 10 to 13 months after baseline and again after a 22 to 31 month lag. Women already living in private rented accommodation with children show little significant response to house price inflation and the point estimates become consistently weakly positive after 20 months. The region interactions reveal that the negative effects found for this group are concentrated in London and the south east. Figure 8 plots the interacted coefficients for the group of social renters. As for the private renters, the negative effects of high inflation that emerge several years after baseline are driven most strongly by those living in the south east. The consistent negative effects shown from in

Figure 5 are not apparent for the group of social renters who were childless at baseline, but recall that this is a small and untypical group. There were no notable differences in the pattern of estimates for the sub-groups of owner-occupiers so these plots are not shown.

6. (Preliminary) conclusions

Overall, the results indicate that volatility in the housing market is more consistently associated with fertility outcomes than are high house prices per se. The deterrent effects of a high price level were found only for those living in the family (parental) home, after a 12 to 18 month lag. The negative effects of a high price level may be relatively muted in England and Wales for the three reasons. First, the period we examine was one of historically relaxed conditions for mortgage lending in Britain. When it is easy to borrow very large sums of money, house prices may have less salience for fertility decisions. Second, Britain has a relatively large and diverse private rental sector in which rents were consistently below the costs of home ownership during this period. Raising a family in a rented rather than an owned dwelling was therefore relatively more attractive than in some other developed countries. Third, the existence of a sizable social rented sector in which housing is allocated on the basis of need insulates many from the impact of market forces. Given these last two factors it is perhaps unsurprising that around a quarter of the infants born during our sample period were living in rental accommodation at one year of age.

Some evidence of the anticipated negative effects of house price inflation were found. For childless tenants and those living in the family home conception rates were significantly lower around 18 to 30 months after a period of rising house prices. This was also the case for social tenants with existing children and, at the very end of the window, for owner-occupiers. These findings are consistent with the idea that expensive housing makes it difficult to establish a first home suitable for raising children.

Positive effects of house price inflation for certain groups were also found, but not where expected. We found no support for the positive association between housing equity of owners and fertility documented in several recent US studies. Instead, the results suggest that social tenants in the tight housing market of the South East of England have higher fertility rates after periods of high relative house prices. It is possible that this is a reaction to pressure of demand for social housing, such that increasing family size becomes the only mechanism to improve housing allocation within the social sector.

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Figure 1. House prices and fertility in England and Wales, 1995 to 2011

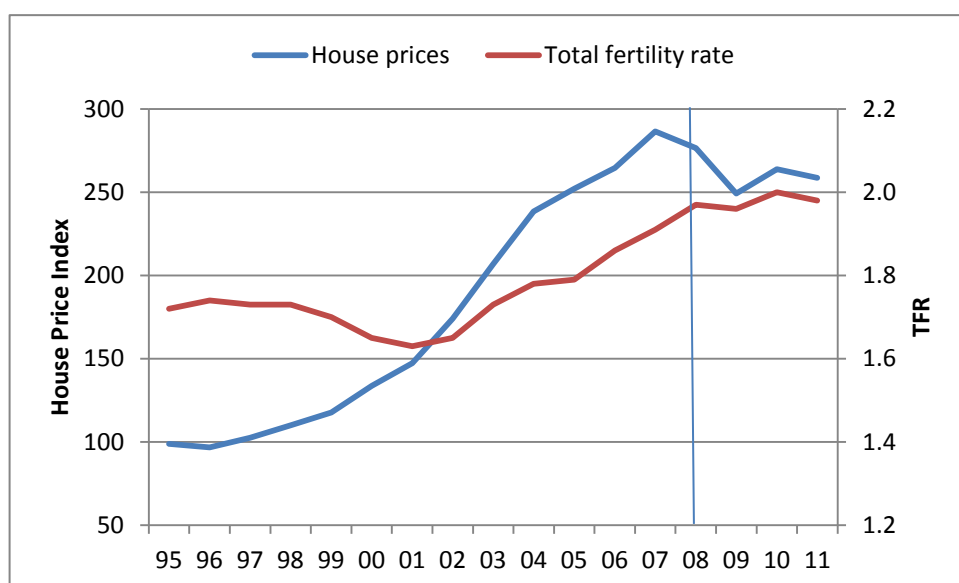


Table 2. Distribution of monthly local authority house price observations , Jan 1996-Aug 2008

	Real house price*		Annual change (%)**	
	London & SE	Rest of country	London & SE	Rest of country
Mean (SD)	151.3 (73.4)	77.0 (32.9)	8.4 (7.5)	6.2 (9.8)
5 th percentile	59.9	40.1	-2.9	-7.0
10 th percentile	70.9	42.7	-1.1	-4.8
25 th percentile	95.4	49.1	3.2	-0.4
50 th percentile	139.2	67.9	7.8	4.0
75 th percentile	193.7	99.0	13.1	11.8
90 th percentile	235.2	126.2	18.4	21.7
95 th percentile	276.8	141.7	21.8	25.1

*In thousands of Jan 1995 pounds. **Percentage change on 12 months previously. Samples are 152 months per authority, with 58 authorities in London and the South East (N=8816) and 114 authorities in the rest of the country (N=17,328).

Table 3. Sample composition by tenure status, women age 18-44

	N (% total)	Mean age (SD)	Previous births			Highest education			Concept- ion rate
			None	One	Two or more	High	Med- ium	Low	
Family renters	48,197 (15.6%)	23.5 (5.6)	0.89	0.07	0.04	0.09	0.53	0.38	2.9
Private renters	33,841 (11.0%)	28.8 (7.0)	0.59	0.16	0.26	0.21	0.50	0.29	5.1
Social renters	45,840 (14.8%)	32.3 (6.8)	0.09	0.24	0.67	0.03	0.27	0.70	5.1
Owners	180,920 (58.6%)	35.0 (6.0)	0.29	0.21	0.50	0.19	0.46	0.36	5.6
All	308,798 (100%)	32.1 (7.5)	0.39	0.19	0.42	0.15	0.44	0.41	5.1

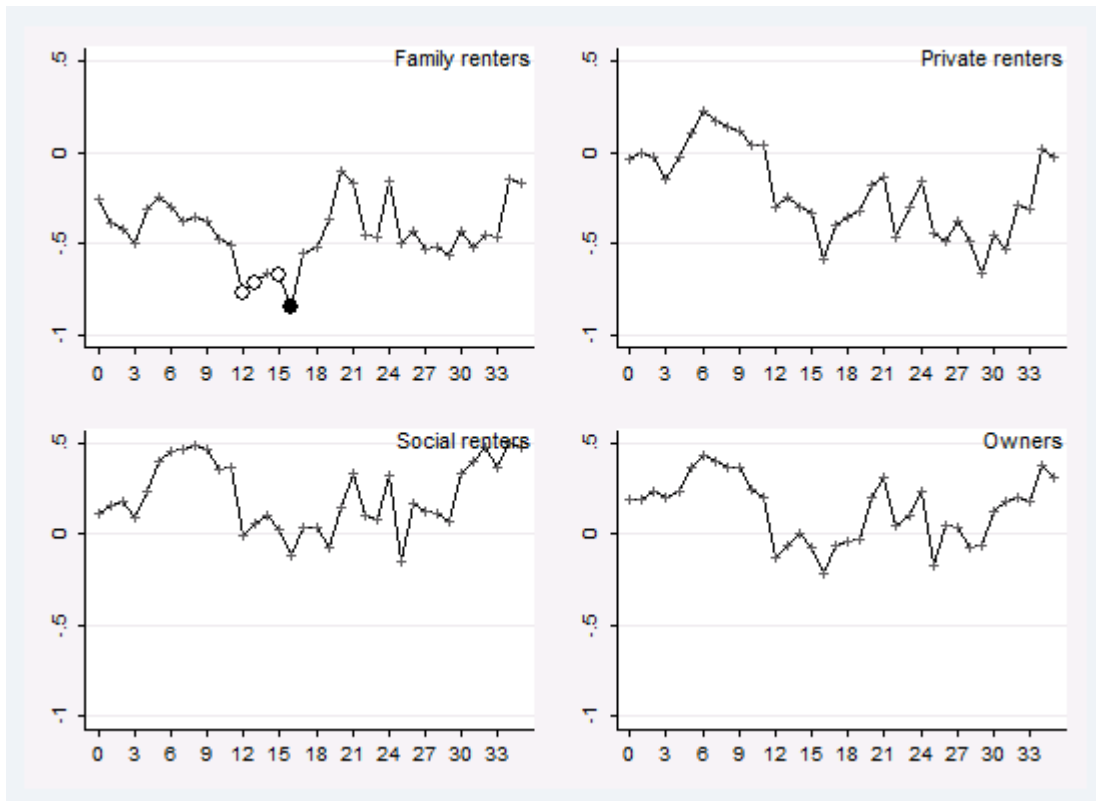
High education is a degree or more; low education is O-level or less. The conception rate is the monthly conception rate per 1000 women.

Table 4. Tenure distribution of women around the time of conception, by number of previous births

	All		No previous births		Had previous birth	
	Month of conception	12 months after conception	Month of conception	12 months after conception	Month of conception	12 months after conception
Family renters	8.9	5.5	17.7	10.3	2.8	2.1
Private renters	11.1	9.3	12.4	10.3	10.3	8.7
Social renters	15.1	15.1	5.7	6.4	21.6	21.1
Owners	64.9	70.2	64.2	73.1	65.3	68.1
Total	100%	100%	100%	100%	100%	100%

Numbers relate to the 1562 conceptions observed during the sample period.

Figure 2. Effects of a log-point increase in the area house price level on the log-odds of conception in subsequent months



Figures plot the coefficients on house prices from discrete-time hazard models of the probability of conception is each month since baseline. The horizontal axis measures elapsed time between the month of house price measurement and month of conception. Open circles indicate estimates significant at the 10% level; closed circles estimates significant at the 5% level.

Figure 3. Effects of a log-point increase in the area house price level on the log-odds of conception of family renters in subsequent months

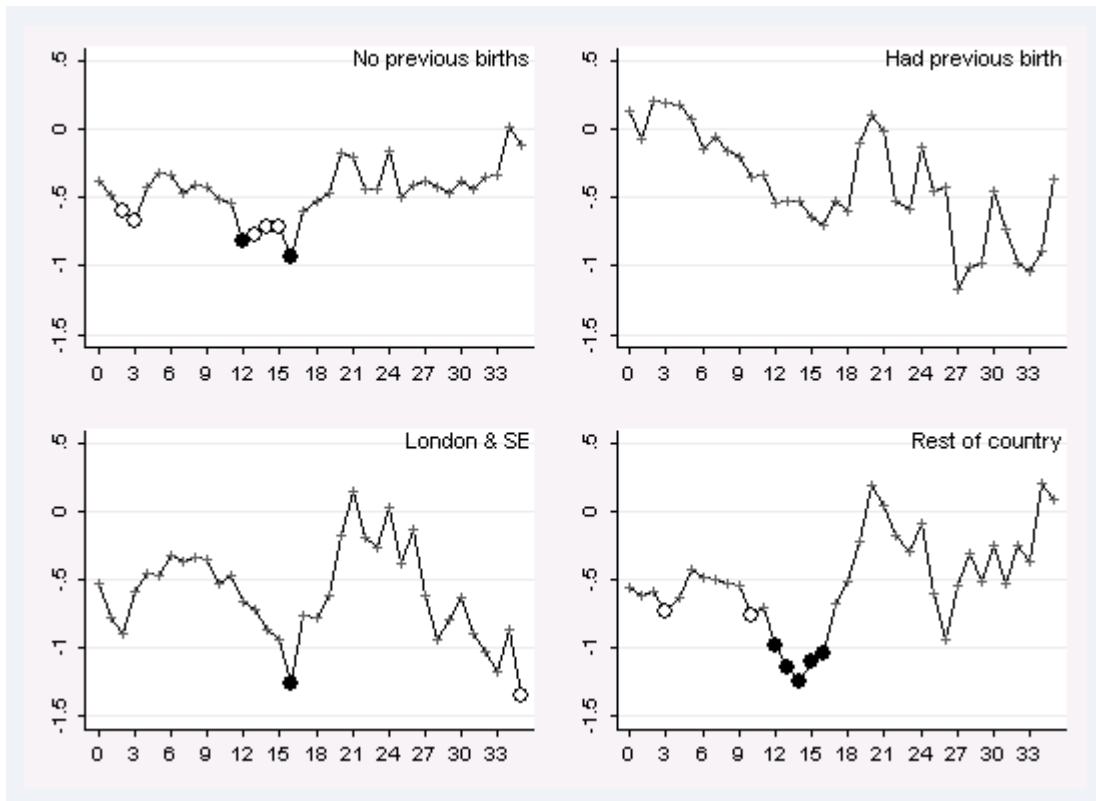


Figure 4. Effects of a log-point increase in the area house price level on the log-odds of conception of social renters in subsequent months

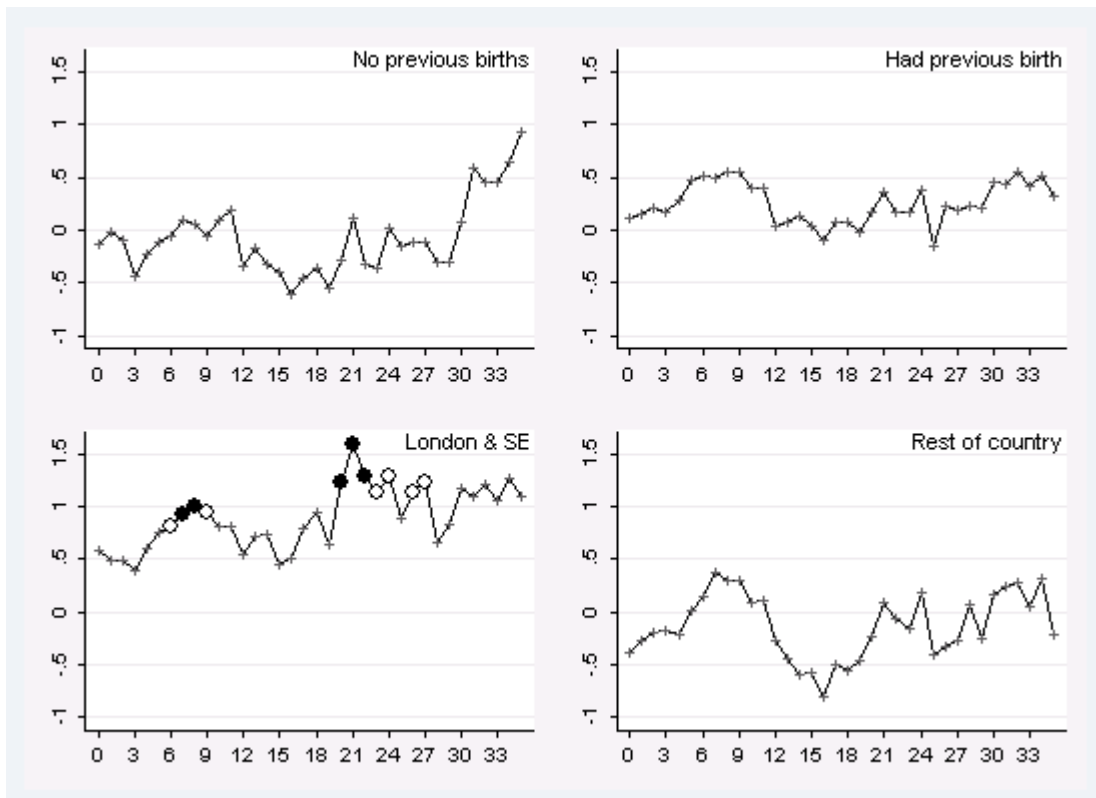


Figure 5. Effects of a log-point rate of annual area house price inflation on the log-odds of conception in subsequent months

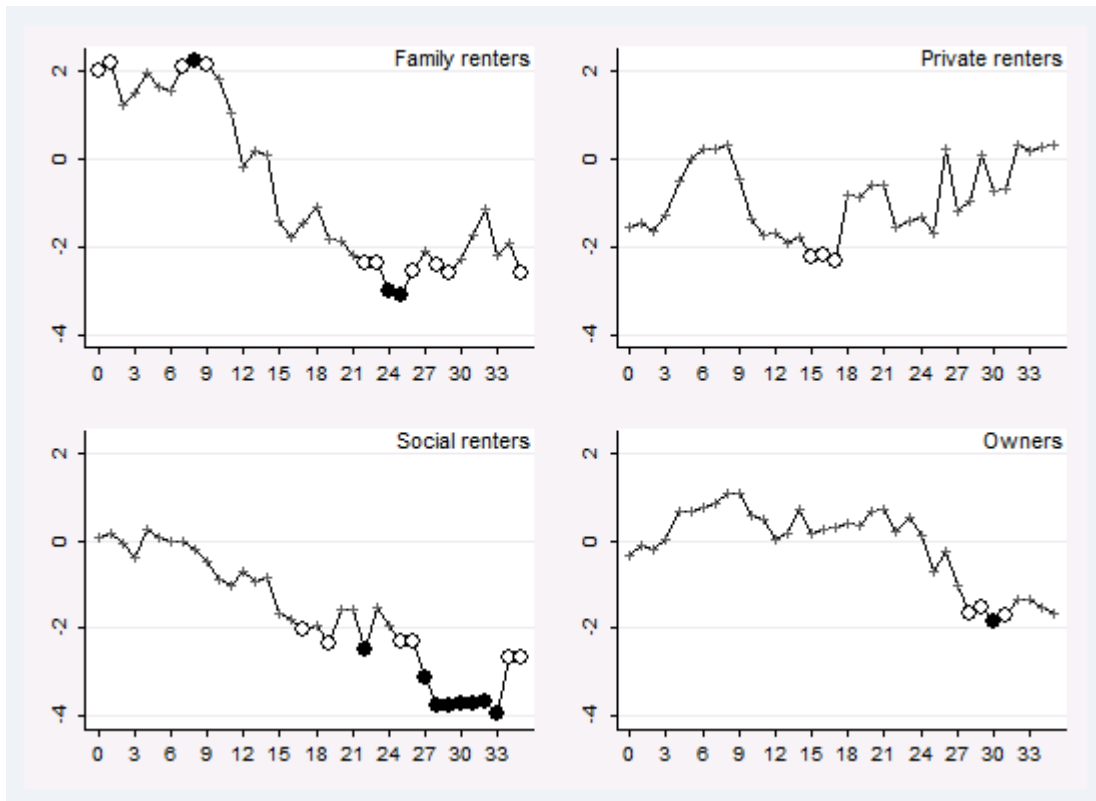


Figure 6. Effects of a log-point rate of annual area house price inflation on the log-odds of conception of family renters in subsequent months

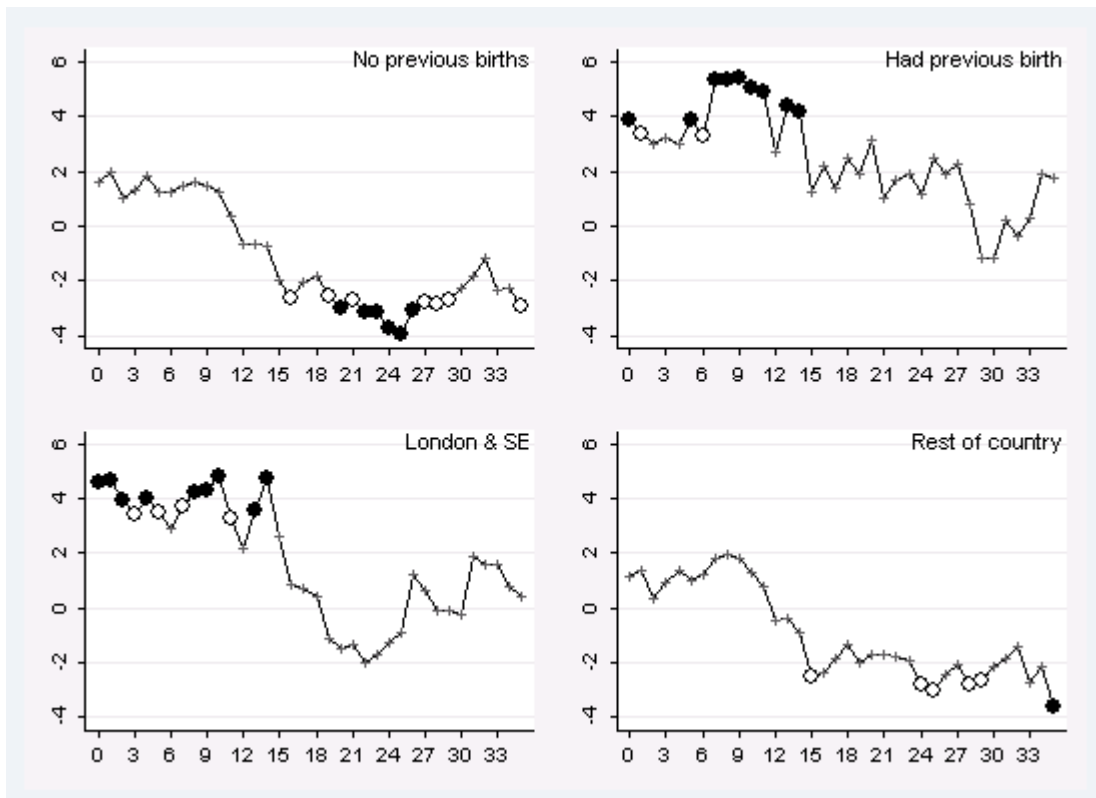


Figure 7. Effects of a log-point rate of annual area house price inflation on the log-odds of conception of private renters in subsequent months

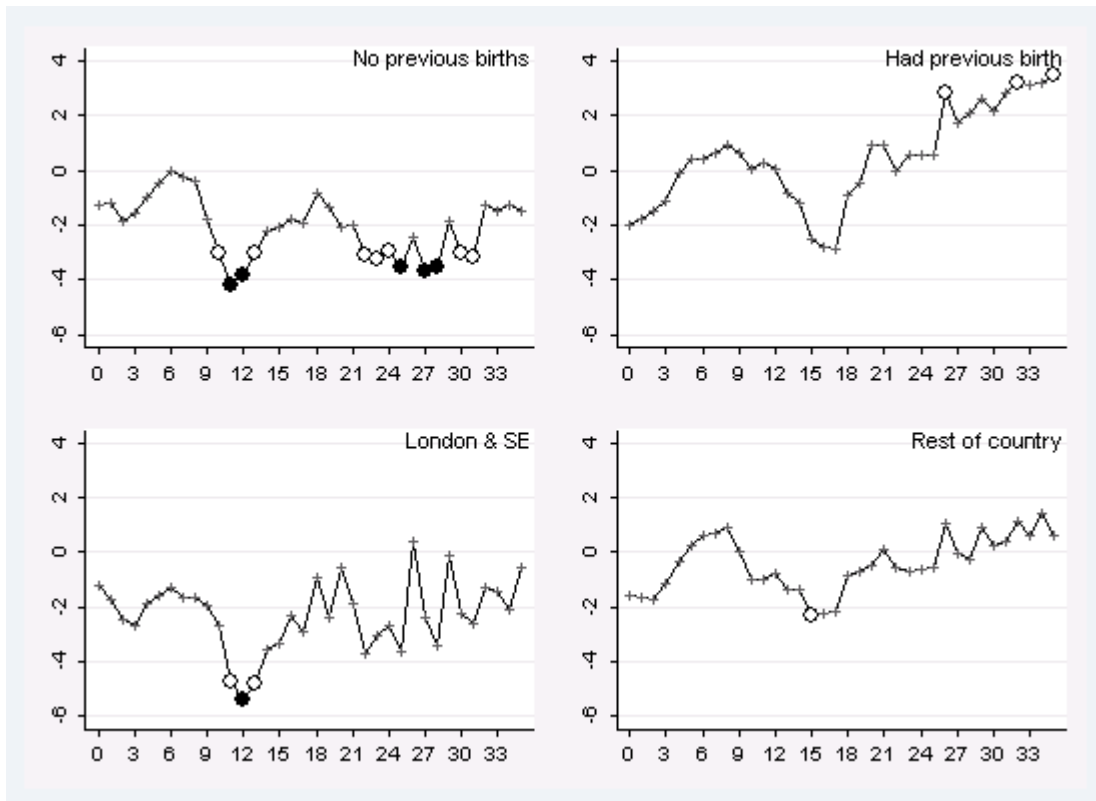


Figure 8. Effects of a log-point rate of annual area house price inflation on the log-odds of conception of social renters in subsequent months

