“Fertility cycles, age structure and housing demand”

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Abstract

Since the early 1990s a number of researchers have put forward evidence of strong demographic effects on housing demands. More recently, a number of studies have pointed to the effect of housing market conditions on family formation. This implies that housing markets are influenced by population change, but also that the housing market conditions influence population change. In this paper, a model of demographic effects on the housing market that has been estimated on regional panel data will be used to explore these interrelationships. First, it is shown that the age effects identified in sub-national data are present also in cross-national data. Second, it is shown that high demographic pressure on house prices is associated with low fertility. The findings are discussed in relation to the Easterlin's hypothesis about the effects of cohort crowding on fertility. In Easterlin's model, cohort effects on earnings drive fertility shifts. The analysis presented here indicates that cohort effects in the housing market can be equally important. Finally, the estimated models are used to outline possible future trends in house prices and fertility. The results indicate that house price increases can slow down and that there can be some recovery from very low fertility rates.

1. Introduction

The prominent role of the housing market in the latest economic boom and bust has led to a renewed interest into the determinants of housing market trends. This issue is given even more gravity from the huge financial commitments young households must make in order to enter metropolitan housing markets as owners, and from the importance of housing equity for old-age financial wealth. At the same time, economists have been trying to determine in what way demographic change affects housing markets. The big question here is how housing markets will be influenced by the significant age structure shifts that result from several decades of low fertility in many high-income countries.

In the literature, the preferred way of analysing the effect of demographic change has been to use micro-level data to estimate how housing demand varies over the life cycle, see for example McFadden (1994) or Ermisch (1996). Another approach is to use OLS to regress national time series of house price change on demographic data. As noted by several authors, this is not an approach that yields good results, see Holly and Jones (1997), Lindh and Malmberg (2007) and Levin et al. (2009). A recent study (Malmberg, 2010) suggests that regional house price data offer a third alternative, as they make it possible to control for national level effects which, it is argued, helps improve the age effect estimates.

In this paper, the strength of the panel approach will be examined in a comparative, cross-country setting. If it is correct that estimates using regional panel data produce good estimates of life-cycle-related shifts in housing demand, then these estimates should perform well not only in sample but also out of sample. Thus, to examine the claim made in (Malmberg, 2010) the model estimated in that paper will be applied to OECD country data. If the model also works out of sample this will indicate that regional panel data can be used to obtain robust estimates of life-cycle effects on demand.

The evaluation of the panel-based estimates will furthermore be used to address a question that has lately received increased attention, namely to what extent housing market conditions, apart from being influenced by demographic shifts, also are shaping demographic trends, fertility in particular. Effects of house prices on fertility have been demonstrated for the USA (Simon and Tamura, 2009; Clark, 2011) and for Hong Kong (Yi and Zhang, 2010). Likewise, in a study of the Nordic

countries, Kulu et al. (2009) demonstrated that fertility is higher in suburbs than in city centres. Further individual-level evidence has been provided by Mulder (2006), Strom (2010) and Ost (2011). The available evidence thus suggests that tight housing markets can have a negative effect on fertility.

If demographic conditions influence the housing markets and housing market conditions influence fertility, this implies that boom-and-bust cycles in fertility can result from age structure shifts. Fertility will tend to go down when large cohorts enter into ages when life-cycle demand for housing is high. But this negative fertility trend can be reversed when smaller cohorts enter into the same age groups because of reduced demographic pressures on the housing market.

By applying panel-based estimates of life-cycle effects on housing demand to OECD data it will be possible to test the first part of this hypothesis for boom-and-bust fertility. This is the hypothesis that housing market conditions are systematically influenced by changes in the age structure. To test the second part of the hypothesis age-predicted increases will be analysed to see if housing demand has a negative effect on fertility and vice versa. The rationale for using age-predicted increases in housing demand is that data on house prices in the OECD can be of varying quality and that house price shifts do not necessarily reflect changes in availability.

The rest of the paper is organised as follows: In the second section evidence is presented of age effects on housing demand in the OECD. The third section analyses whether demographic pressure on the housing market has affected fertility trends in the OECD. The fourth section discusses how the estimated models can be used to forecast future trends in house prices and fertility. The fifth section concludes the paper.

2. Estimation of age effects on house prices

Interest in the housing market effects of changes in age structure arose relatively early, see (Campbell, 1963), (Easterlin, 1965), (Blanchet and Bonvalet, 1985) and (Ermisch, 1988), but it was the Mankiw and Weil (1989) paper that stimulated the most intense discussion, as it predicted that house prices in the USA would fall in the 1990s because of the ageing of the American ‘baby boomers’. The authors were criticized for their use of cross-sectional micro-level data to estimate age-specific housing demand, the problem being that in a cross section, housing consumption in older age groups can be influenced by low lifetime income (Green and Hendershott, 1996). Demand

values based on such data may thus lead to false conclusions with respect to how much current working-age adults will consume when they retire, see (Myers, 1999). When housing demand across age groups are properly estimated, either by controlling for different income levels in cross-section data or by using a cohort approach, the age profile becomes less dramatic, especially at higher ages. But even when the estimation is done in a correct way there is clear evidence of a life-cycle pattern in housing consumption (Ermisch, 1996, Myers and Ryu, 2008).

The empirical analysis in Malmberg (2010) is based on a stylised model of how aggregate housing demand is related to age structure because of an underlying age profile in housing demand. The innovation of the paper is the use of regional panel data to estimate this model. Every year, Statistics Sweden publishes municipal level data on the prices paid for non-rental, single- and two-family dwellings sold during the year. They also publish yearly data on municipal level age structure based on a comprehensive population register maintained by the tax authority. With this rich data set, house price variations in Sweden can be analysed in great detail.

Of course, much of the variation in house prices is linked to macro-level changes. Since 1980, major tax reforms have taken place in Sweden that have affected the extent to which interest payments made by households can generate tax reductions. Other fluctuations affecting housing demand include large shifts in the interest rate and the major economic crisis that hit Sweden in the early 1990s. In the paper it is argued that these macro-economic events influencing house prices will make it more difficult to estimate the age effects on house prices related to shifts in housing demand over the life cycle. The estimation problem will become even worse when taking into consideration the fact that macro-variables such as savings, income growth rates, labour productivity and even inflation are influenced by age structure shifts (Fair and Dominguez, 1991, Lindh and Malmberg, 2007, Lindh and Malmberg, 1998, Malmberg et al., 2005). The approach recommended is therefore to estimate the model on regional panel data and to use fixed time effects to reduce the influence of national level macro-economic shocks. Using fixed time effects is equivalent to removing the annual national mean from both the dependent and the independent variables. The estimates are then based on the variation in prices and age variables across regions. The statistical evidence suggests that this approach works well and results in a robust estimation of age effect on housing demand. The estimated age profile varies to some extent depending on the exact specification, but the variation is small.

In Figure 1, the results from the preferred estimation in Malmberg (2010) are presented. The relevance of this estimation is that it shows age effects on housing demand when the influence of

macro-economic shocks have been eliminated by using regional panel data and fixed time effects. In this specific model, using the entire 1982-2006 sample, observations from municipalities with a large number of sales are given larger weight and observations from municipalities with an age structure that deviates strongly from the average are given lower weight. The motivation for this procedure is the presence of heteroskedasticity in the residuals of an unweighted model.

Figure 1: Age effects on house prices in Sweden, parameter estimates.

Source: Malmberg (2010)

In Malmberg (2010) it is claimed that the use of panel data and period fixed effects will yield age effect estimates that reflect life-cycle-related changes in housing demand. If this is correct, the panel-based estimates presented in Malmberg (2010) would also be able to predict demographic influences on housing markets in other countries that have comparable age-earning, timing of family formation and child birth, and mortality risks by age. Empirically, the idea of a similar profile is supported by the age effects on residential investment that can be estimated using OECD data (Lindh and Malmberg, 2008). Here, the out-of-sample performance of the panel-based

estimates will be tested on annual data regarding real house prices in the OECD available from the Bank of International Settlements (BIS) for the 1970-2009 period (Takáts, 2010).

The robustness of the panel estimates will be tested first by comparing them with estimates obtained by applying the same model as in Malmberg (2010):

$$\log \frac{p_t}{p_{t-1}} = \sum_i \beta_i \frac{n_i}{N} * \frac{1}{p_t} + \sum_j \gamma_j x_j + \varepsilon$$

Here, $i = (0-14, 15-29, 30-49, 50-64, 65+)$, $t=(1971, 1972, \dots, 2006)$, n is the number of individuals in an age group, N is total population, p is real house price and x is a set of time and country dummies. The inverse of the real house price is a normalizing factor that should be included according to the theoretical model presented in Malmberg (2010). The results are shown in Table 1, together with the estimates obtained using Swedish panel data.

Clearly, the absolute size of the OECD estimates is larger than the Swedish municipal estimates, and even more so are the standard errors. Thus, taken individually, the age parameters are not significantly different from zero for the OECD estimation. Multi-collinearity is a likely explanation for this lack of precision of the estimates. In the OECD sample, variance inflation factors for the age variables are between 5.2 and 8.4 whereas for the Swedish municipal data the VIFs are between 1.4 and 2.1. Despite imprecise estimates, the age profile in the OECD is similar to that found in the Swedish data. This indicates that the Swedish profile, estimated with good controls for macro economic factors that are likely to influence housing demand, may indeed reflect age effects on housing demand that are related to fundamental life-course patterns.

The second step is to get predicted values of housing market effects in the OECD by applying the estimates obtained using Swedish regional data to OECD age structure data. If the panel-based estimates are robust, these predicted housing market effects should be correlated with house price changes in the OECD. This turns out to be the case. If changes in log house prices in the OECD are regressed on age-predicted housing market effects, together with country and period fixed effects, the parameter estimate for the predicted effect is 0.747 (0.108). This estimate is significantly different from zero and relatively close to one.

The fact that age effects estimates obtained using regional data from one OECD country can be shown to be valid when applied to a completely different data set can be seen as evidence of two things. The first is that age effects on housing demand are real, and potentially relatively robust across national and temporal contexts. Second, that using regional panel data can be a valid methodology for the estimation of life-cycle effects on housing demand. It has previously been established that household level data can be used for this purpose, and there are studies using national time series that have given promising results. To this toolbox it might now be possible to add estimation using regional panel data.

Again, it should be underlined that the demonstration of significant and robust age effects on house prices does not imply that demography is the only or even the most important determinant of house price trends. Instead, these trends are strongly influenced by economic factors such as income growth, taxation and financial conditions. From a forecasting point of view however it is important to have good estimates of demographic effects on house prices simply because demographic trends are much easier to forecast than the other factors that affect the housing market.

Table 1 Age effects on house-prices, OECD 1971-2006, and Swedish municipalities 1982-2006, (standard errors in parentheses), the dependent variable is change in log house prices.

	Weights	No weights	Swedish panel data
	1971-2006	1971-2006	1982-2006
0_14	-0.13494 (0.1560)	-0.196933 (0.133)	-0.0134 (0.0316)
15_29	0.268207 (0.1558)	0.1384185 (0.166)	0.1078 (0.0282)
30_49	0.1558168 (0.1777)	0.2167929 (0.172)	0.0868 (0.0332)
50_64	-0.010777 (0.2418)	0.1475164 (0.250)	-0.0130 (0.0307)
65+	-0.404338 (0.2955)	-0.388692 (0.294)	-0.0870 (0.0149)
R-square	0.364	0.334	0.377
N	612	612	7125
Period effect (F-value)	5.52	4.66	161.79
Country effect	1.01	0.88	-

3. Housing market effects on fertility

In the above it was possible to demonstrate clear age structure effects on the housing market. Now the question is whether there is also a feedback mechanism from the housing market back to demography via effects on fertility. Fertility studies are one of the largest research fields in the social sciences but until recently this research has been dominated by analyses of the effects of increasing education and labour market shifts on fertility. The effect of housing markets has been considered from time to time, but except for the last ten years, there has been no sustained effort to explore this issue in more depth. In the more recent literature it is possible however to find a number of important contributions that clearly point to conditions on the housing market as a key determinant of fertility patterns.

Simon and Tamura have studied the link between rent levels and fertility in American cities from 1940-2000 (Simon and Tamura, 2009). They cite Alfred Marshall as a researcher who singled out housing as an important factor for fertility as early as the early 20th century. They also cite Sato, 2006 as an author who has argued that increasing city size will lower fertility because of increasing prices on living space. Acknowledging that a correlation between the price of living space and fertility can result from sorting, based on non-observables that are correlated with both these factors, the authors adopt an IV approach to deal with this possibility. They do not find any significant endogeneity problem however and thus conclude that the negative correlation between housing cost and fertility reflects a causal effect. As a motive for using city level data they point out that ‘systematic data on the price of living space across countries do not appear to be publicly available’.

Another important contribution is the study by Yi and Zhang (Yi and Zhang, 2010) of house prices and fertility in Hong Kong, in which the authors argue that the standard explanation for falling fertility during demographic transition cannot explain the fertility decline in Hong Kong and other East Asian growth economies. They observe little increase in female labour force participation during the time that fertility was falling. Instead they point at increasing house prices as the most important explanation. Theoretically, their argument is based on Becker’s standard economic theory of fertility. First, increasing house prices will lead to downward pressure on real income which will have a negative effect on fertility. Second, since children demand housing space, increasing house prices will increase the cost of children. They conclude:

Overall, both effects may cause many relatively young or poor households to be unable to afford to set up a household in a lifecycle context. Consequently, to the extent that owning house or renting house of a sufficient size may be a pre-condition for having children, many such households may be highly constrained to have any children at all. For relatively wealthy couples, rising housing prices would diminish the house size they could afford to buy or to rent and decrease the demand for children accordingly. (p. 636)

Yi and Zhang also provide a simple model that demonstrates the negative effects of increasing house prices on fertility. Their empirical approach is based on the observation that house prices and fertility rates are non-stationary time series, for which reason they estimate a cointegration model that tests the long-term relationship between these two variables. On the basis of this model they conclude that 65% of the reduction in the fertility rate in Hong Kong from 1971 to 2005 is accounted for by the increase in house prices.

The analysis provided by (Kulu et al., 2009) is based on data from Norway, Finland, Sweden and Norway. This study does not look on the effects of house prices but on fertility differences between suburban areas and inner cities. Using information about age-specific fertility rates in different municipalities during the 1975-2003 period, the authors were able to show that 'fertility levels are significantly higher in suburbs than in urban centres'. Since house prices tend to be lower in suburban communities, this finding indicates a correlation between house prices and fertility similar to that found in the USA. The authors acknowledge that selective migration towards the suburbs by adults intent on having children may account for part of this pattern, but they argue that migrants constitute only a small proportion of the fertile population, for which reason this cannot be the sole factor.

Further evidence on the connection between housing conditions and fertility is provided by (Mulder, 2006), who shows that in West Germany and the Netherlands, transition to parenthood between the ages of 30 and 35 was significantly higher among homeowners than non-homeowners. This relationship was consistent across cohorts born between the 1920s and the 1960s.

An important study using individual level data to analyse the relationship between housing and fertility is (Strom, 2010). Her report is based on a survey designed specifically to collect joint housing and fertility histories for a sample of three Swedish birth cohorts. The main finding in the study is a strong positive association between the size of the dwelling and first-birth intensities.

Strom thus provides micro-evidence for the claim made by Yi and Zhang that house price increases that steer individuals towards smaller dwellings may have a negative effect on fertility. (Ost, 2011), using the same data as Strom, demonstrates statistically that the transition to homeownership and to parenthood are correlated events. Thus, if the transition to homeownership is blocked because of high cost, this is likely to have a negative effect on fertility.

The results of these Swedish studies have a clear link to the evidence presented by Clark (forthcoming). Using American data, he shows that childbearing is delayed in metropolitan areas where housing is expensive. However he finds no effect on total fertility, that is, women in high cost areas start later but in the end have the same number of children as women in areas where housing is more affordable.

What has been lacking in the literature are studies that analyse the extent to which housing conditions have affected fertility patterns across OECD countries. Perhaps the most important reason for this is the lack of good cross-country indicators of housing market conditions. BIS house price data is an exception, but clearly these series are not perfect indicators of housing affordability. The finding presented above, that it is possible to estimate age effects on housing demand that are also robust out of sample, opens up a possibility however to circumvent this problem. The solution is to apply an estimated age effect parameter to the age structures of those countries for which an indicator of demographic housing market pressures is needed. Admittedly this indicator will not be perfect, but as there is a lack of good indicators of housing market conditions, a measure of demographic housing market pressure can help clarify whether or not there are housing market effects on fertility.

Three arguments favour the use of a demographically based indicator. First, if there are mis-measurements in the BIS house price data, using these data as right-hand side variables will induce biased estimates. In comparison, UN population data have a good accuracy for the countries included in our sample. Secondly, it can be argued that increasing real house prices will not necessarily depress fertility if there is a parallel increase in real income, or if house prices increase in response to an availability of inexpensive financing. However, to the extent that increasing real prices on housing is the result not of increasing real income but of demographic pressures on the housing market, a downward pressure in fertility is more likely. Thus there is reason to expect that demographically based measures of housing demand will have a stronger negative effect on fertility compared to real prices as measured by the BIS. Thirdly, it can be argued that the demographic indicator of housing market pressure will not only capture the tightness in the market for owned

single-family houses. If demographic pressure is high, it is likely that there will also be considerable pressure on the market for rented housing.

Below we present estimates using both BIS house prices and the demographic indicator of housing market pressure as explanatory variables. The results show that the demographic indicator generates more stable results. A negative effect of BIS house prices on fertility is present, given that TFR and house prices are entered in levels and fixed country and time effects are used in the estimations. Both house prices and TFR however are trended variables in the estimation period which means that it may be advisable to estimate a differenced model as well. In the differenced model there is no significant negative effect of BIS house prices on fertility.

For the estimates based on the demographic indicator, the results are more reassuring. Both estimates using the Swedish regional panel model and estimates based on the OECD house price model show negative effects of housing market pressure on fertility. The estimates are based on a differenced model since this is the way the house price equation was specified. The estimates are also stable when country-fixed effects are included, but not when fixed-time effects are introduced. Given that much of the age structure variation is correlated across countries this is not entirely surprising.

Table 2a House price effects on fertility in 17 OECD countries, 1970 -2005.

	Ln TFR	Ln TFR	Diff Ln TFR	Diff Ln TFR
Intercept	0.925 (0.236)	1.14 (0.27)	-0.0408 (0.0096)	-0.0380 (0.0078)
Ln House price	-0.0728 (0.0481)	-0.116 (0.056)		
Diff(5) Ln House price			0.0693 (0.0376)	0.0441 (0.0376)
N	136	136	119	119
Time effects		x		x
Country effects		x		x

R square	0.018	0.706	0.028	0.548
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Table 2b Age effects on fertility in 22 OECD countries, 1950 -2000. Swedish model

	Diff TFR	Diff TFR	Diff TFR
Intercept	0.235 (0.058)	0.255 (0.064)	-0.0632 (0.0856)
Age Muni	-10.2 (1.6)	-10.9 (1.8)	-1.44 (2.50)
	242	242	242
Time effects			x
Country effects		x	x
R square	0.183	0.211	0.543

Table 2c Age effects on fertility in 22 OECD countries, 1950 -2000. OECD model

	Diff TFR	Diff TFR	Diff TFR
Intercept	-0.0348 (0.0323)	0.0113 (0.0430)	-0.150 (0.045)
1Age			
OECD	-3.93 (1.34)	-6.27 (1.96)	1.96 (2.18)
N	242	242	242
Time effects			x
Country effects		x	x
R square	0.301	0.410	0.633

An alternative way of interpreting the demographic indicator is to regard it as an instrumental variable regression where the first step is the regression of house prices on age structure and the second step is the regression of change in TFR on demographically predicted house price changes.

4. Projections

In the above sections it has been shown that in the OECD data, shifts in the age structure will have an effect on house price trends and increasing demographic pressure on the housing market is associated with lower fertility. This implies that movements in the age structure that exert an upward pressure on the age structure will also tend to depress fertility. House price movements that result from demographic pressure and fertility will be inversely correlated. The effect that changes in the age structure have on house prices makes it possible to forecast future house price trends using population projections. Moreover, since demographic pressures on the housing market affect fertility, fertility trends can also be forecasted.

Figure 2 presents age-predicted house price changes for 22 OECD countries from 1950 to 2050 based on (1) estimates obtained using Swedish regional panel data and (2) estimates obtained using OECD data, see Table 1. Note that the scale for predicted values from the Swedish model is

different from the scale for those predicted by OECD model. This is due to the higher absolute parameter estimates of the OECD model, which generate a larger variance in the predicted variables. Three things can be observed in this graph: (1) demographically based housing market pressure was relatively low in the early 1950s, (2) most countries experienced a demographically induced housing market boom sometime between 1960 and 1980, albeit with different timing and (3) the post-2000 period is characterised by reduced demographic pressure on the housing market, a pressure that can be expected to be negative for the next 30-40 years. This negative trend is primarily due to an increase in the share of older adults and the negative parameter estimate associated with this group. Note however that to the extent a negative effect of the oldest group is linked to the higher mortality of this group, reduced old age mortality may somewhat reduce the negative effect of ageing on house prices.

How do these forecasts compare with forecasts based on analyses of household level housing demand? Such a comparison can be made for example with McFadden's forecast for housing market real prices (1994, Table 7.19) which overlaps with the forecast period used in Figure 3. McFadden's forecast shows about the same trends for house prices in the United States as for those in Sweden and the OECD model referred to above. All three models predict declining house prices in the 1950s, a house price boom from 1965 to 1980 and declining house prices after 2010. These parallel results indicate that micro-based assessment of age effects on house prices can give results that are similar to those based on aggregate panel data. It should be noted however that the demographically based forecast for the United States does not account for the post-2000 house price boom, which again underlines that demography is but one influence on housing demand. From a policy point of view however it is of interest that the coming decade in general will be characterised by weak demographic pressure on housing demand. This may become problematic given the important role of housing construction in generating employment.

Figure 3 presents age-predicted changes in TFR from 1950 to 2050 based on the relationship estimated in Table 2b, and observed five-year changes in TFR for the same set of countries. The idea behind this forecast is, first, that demographic pressures on the housing market can be estimated using the relationships discussed in Section 2 of this paper. And second, that demographic pressures on the housing market have effects on fertility in the way discussed in Section 3. This implies that, predicted changes in fertility become a mirror image of the house price predictions in Figure 2. Thus, increasing demographic pressure on housing markets in the post-1950 period implies that this period is characterised by increasing downward pressure on fertility.

However, around 1990 or later, due to declining demographic pressure on the housing market, there is a turn-around of this trend and in most countries there will be at least a short period of upward fertility pressure in the post-2010 period.

5. Discussion

The most important conclusion of this paper is an affirmative answer to the question of whether there are mutual influences between housing markets and processes of population change. It has been possible to confirm that population age structure affects house prices not only in a regional Swedish context but also across a number of OECD countries. Furthermore, the idea that tight housing markets can have negative effects on fertility has been given additional support, which could not be firmly established using available international house price data. By extracting a demographic component in these data, it could be shown that increasing demographically induced housing market pressure is indeed correlated with declining fertility.

The availability of good population forecast and the fact that these models use age data as explanatory variables make it very easy to employ them in making projections. Given that the estimated relationships remain stable in the future, these projections indicate that housing markets may stay relatively depressed for a considerable time. This is the long-term result of a long period of low fertility rates that in time have reduced the relative size of those age groups that typically have the highest demand for housing.

The upside of this projection is that low housing market pressures may result in an upward shift in the fertility rate. The mechanism here is that an easing of the housing market makes it easier for young couples to gain access to housing opportunities that are suitable for families. As long as unemployment stays high among the young this trend is likely to be weak, but if the recession subsides, increasing fertility is a possibility that would fit well with the model estimates obtained in this study.

One caveat here is that the models have been estimated on data from a period when old-age mortality was higher than it is projected to be in the future. The negative effect on house prices of old-age groups is likely the result of their high mortality rate, since deaths, when they affect single-

person households, result in housing vacancies with no need for new construction. If mortality is reduced the flow of vacancies will decline, which may mean that the easing of housing market pressures has been overstated in the projections presented above.

Finally, certain policy implications are suggested by the analysis presented in this paper. Clearly, the prospect of stagnating housing prices points to the possibility of a very slow recovery from the current economic downturn. Depending on one's point of view it is likely that not everyone would agree that the prospect of increasing fertility compensates for the consequences of sluggish growth. Moreover fertility tends to be pro-cyclical and therefore the possibilities of increased fertility may not be realised if the economy stays depressed. The policy opportunity here is that governments could consider helping to trigger a new baby boom by implementing policies targeted at young adults that would ease their entry into the housing market and provide them with other incentives for family formation, such as subsidised childcare and paid parental leave. Although increased birth rates in the short term, according to the estimates presented above, may reduce families' abilities to pay for more expensive housing, higher birth rates, with a lag, would increase the size of young adult cohorts and in that way stimulate future housing demand. Thus stimulating fertility is a means by which secular stagnation in the housing market might be counteracted.

In terms of future research an interesting extension would be to explore housing and demographic interactions on the regional level. The American studies referred to above demonstrate considerable regional disparities in fertility patterns. It is likely that similar patterns exist in Europe that might correspond to differences in housing market conditions. A complicating factor that needs to be considered here is internal migration. Net migration will increase housing demand with potential negative effects on fertility. It seems quite clear that the connection between demography and the housing market is a research field worthy of further studies.

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Figure 2 Predicted change in house price according to age model

Figure 3 Predicted change in fertility according to age model