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The Effect of House Prices on Fertility: Evidence from Canada

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Abstract: To the extent that families' fertility decisions respond to economic factors, the price of housing is an important and relatively neglected candidate for consideration in fertility decisions. In theory, the effect of changes in housing prices on family size will depend on the quantity of housing that a family already owns, and its elasticity of substitution between children and other "goods". For renters, rises in rental costs associated with higher housing prices imply only a substitution effect that should reduce their likelihood of having additional children. Home-owners are predicted to have more children in response to higher house prices if they have sufficient housing and low substitution, but fewer children otherwise. In this paper, we combine longitudinal data from the Canadian Survey of Labour Income and Dynamics (SLID) and average housing price data at real estate board (REB) level from the Canadian Real Estate Association to estimate the effect of house prices on fertility. We follow non-moving women aged 18-40 (with their associated families) over time to ask whether changes in lagged housing price affects either total number of children, or the probability of a family having an additional birth. We differ from previous studies in employing person- rather than region-fixed effects, in covering both rural and urban areas, and in exploring the effect of housing price changes on total number of children vs. the probability of having an additional child.

For home owners, we find that lagged REB housing prices are positively associated with the probability of a birth in the previous year under pooled cross section or fixed effects. Housing prices are significantly negatively associated with total fertility measures under pooled cross section, but positively associated with number of children in the home under fixed effects. For renters, we find that lagged REB housing prices are not significantly negatively associated with either total or marginal fertility measures.

JEL Classification Codes: D13, J13, J18, R21

Keywords: economic determinants of fertility, housing prices, wealth effects, home ownership

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1. Introduction

Some societies are concerned their fertility rates are far below replacement levels, while others are concerned their rates are far above. A key question in the face of such concerns is the extent to which fertility rates respond to various price signals. Many researchers in economics and demography have therefore tried to estimate the extent to which families' fertility rates respond to the effects of wages and income, or to tax and welfare policies that affect them. In this context, changes in housing prices are also a likely candidate to influence fertility, as housing typically represents one of the households' biggest stores of wealth. However, the direction of this influence is not straight forward since housing is one of the largest components of a family's 'price' of having children as well. Thus an exogenous increase in the price of housing may *reduce* family fertility by making the space needed for raising children more expensive, or by requiring both parents to work full time to service a mortgage. Yet for families who already own housing, an increase in the price of housing creates wealth effects, accessible by moving or by home equity extraction via mortgage refinancing or opening lines of credit. Such wealth effects may *increase* homeowners' fertility, particularly if their willingness to substitute between children and other "goods" is reasonably limited, and they already have sufficient housing. Increases in the price of housing could thus be expected to have potentially very different effects on the fertility of home owners and renters, and among home owners, between those who own much or little housing, and those who are flexible or inflexible about desired family size. The net effect of housing prices on fertility is thus an empirical question.

A small number of empirical studies have tried to test directly for the effect of housing price on fertility, often its effect on delaying family formation (Borsch-Supan (1986), Giannelli and Monfardini (2003), Hughes (2003), Clark (2012)). Taking formation as given, Walker (1995) attempts to explain variations in Swedish fertility as a function of its "shadow price", which includes the additional expenditures on housing that children pose for families. In descriptive analysis, Walker finds a strong negative correlation between fertility and its comprehensive "price", though the effect of housing expenditures alone is not identified. Curtis and Waldfogel (2009) use a similar conceptual framework as Walker, but use panel regression based on the U.S. Fragile Families and Child Wellbeing study to test whether unmarried mothers in cities with higher housing price indices are less likely to have additional children, and find this to be the case. Simon and Tamura (2009) use individual public

use micro data (IPUM) from successive waves of the United States census linked with the median CMSA rental rate per room. They too find a significant negative relationship between the price of living space and the number of children living in households. Simon and Tamura also distinguish between the effect of rental price on delay in fertility vs. its effect on completed fertility by also examining the number of children ever born to women aged 40 or greater. They find that a higher rental price per room both delays mother's age at first birth, and reduces completed fertility for older women. In contrast, Feyrer, Sacerdote and Dora-Stern (2008), who use the Office of Federal Housing Oversight's repeat sales index at state or MSA level, along with IPUM data from the 1980 and 2000 census, find a positive or no relationship between total fertility and housing price.

None of these four studies, however, distinguishes between home owners and renters, for whom changes in housing price could be predicted to have different effects. They also cannot follow individuals over time to control for household-specific unobserved factors such as differing intrinsic desire for children, or willingness to substitute between children and other "goods".

Two more recent papers by Lovenheim and Mumford (2013), and Detting and Schettini-Kearney (2014) recognize the distinction between home owners and renters, though not explicitly the distinction between owners of much or little housing. Lovenheim and Mumford (2013) use restricted geo-coded data from 18 years of the American Panel Study on Income Dynamics (PSID) to estimate the effect of changes house prices on the subsequent likelihood of having a child, controlling for the number of other children already in the household. For home owners house prices are derived from self-reported household values, whereas for home renters, they use the effect of changes in MSA level average housing price growth. Under certain specifications, they find a positive relationship between house price and fertility for homeowners (meaning wealth effects dominate substitution effects), but surprisingly no significant negative relationship for renters (where only substitution effects should be in operation). Lovenheim and Mumford also conduct similar analysis using aggregate state level vital statistics and a repeat-sales housing price index sourced from the Federal Housing Finance Agency Housing Price Index (HPI) and find similar results: lagged housing prices are associated with a higher number of births per 1000 women.

The study by Detting and Schettini-Kearney (2014) also recognizes that the housing prices may have different effects on family fertility depending on the degree of home ownership. These authors

estimate the effect of lagged, de-trended MSA level house price (again using the HPI, here on repeat mortgage transactions) and MSA level home-ownership rates on MSA group level fertility using vital statistics. They include year and MSA level fixed effects as well as measures of time-varying MSA conditions such as unemployment. Across numerous specifications, Detting and Schettini-Kearney find that the main effect of an increase in lagged house price on the MSA fertility rate is negative, reflecting the negative effect of high housing costs on the fertility of renters. In contrast, an interaction term of house price and home ownership rate is positive, and of a greater magnitude than the main effect of house price. Thus, an increase in the aggregate home ownership rate raises the effect of house price on fertility, so that for MSA's with even moderate levels of home ownership, higher house prices have a net positive effect on fertility.

Both Lovenheim and Mumford (2013) and Detting and Schettini-Kearney (2014) suggest that high house prices raise fertility for homeowners, and since most Americans are homeowners, suggest that higher housing prices are pro-natal overall. Both studies use a high quality measure of repeat sales housing prices that control for unobserved differences in housing quality or type. Our contribution to this literature is to provide estimates that use individual fixed effects to control for women unobserved characteristics, such as preference for family size and willingness to substitute for children.[1] We build empirically on the approach of Lovenheim and Mumford (2013), using confidential geo-coded longitudinal Canadian data for women aged 18-40 from successive waves of the Survey of Labour and Income Dynamics (SLID), matched to time-series data on average housing price at the real estate board level from the Canadian Real Estate Association's Multiple Listing Service data set (CREA MLS). We follow Detting and Schettini-Kearney in considering the interaction between lagged housing price and lagged proxy for quantity of housing owned for home owners, though with concerns over the potential endogeneity of this approach. Finally, recognizing the contrary findings of Simon and Tamura (2009) using a total fertility measure, we measure fertility both as probability of a birth occurring and as total number of children in the household, or born to a woman.

[1] Though using also panel data, Lovenheim and Mumford (2014) does not estimate person fixed effects, but rather include year and either state or MSA level fixed effects, perhaps to exploit variation between such units while still controlling for unobserved characteristics at that semi-aggregated level.

Our study is the first we know of to use person fixed effects to control for unobserved personal preferences for family size. We are also among the first to use Canadian data owing to the lack of synchronisation between that country's census units and its housing price data from real estate board boundaries. We are able to clearly distinguish between home owners and home renters when examining the effects of changes in house price on fertility, and to examine price effects across both urban and rural areas. On the other hand, our pricing data is more aggregated than that of Lovenheim and Mumford. We are also ambivalent as to whether we can identify *causal* relationships between house prices and fertility from our empirical findings. By restricting our analysis to non-movers, with house prices taken from broadly defined real estate boards, we argue there are grounds for regarding the measured changes in housing prices experienced by our households as exogenous. At the same time, we cannot control for the fact that households might choose to live in certain broad (real estate board) areas because of future plans regarding fertility and anticipation of future movement in prices. We also exclude from consideration those who care enough about fertility to change locations as housing prices or family circumstances change.

The rest of the paper proceeds as follows. In Section II, we briefly summarize theoretical predictions regarding housing price and fertility. In Section III we describe our data and empirical estimation strategy. In Section IV we present our results, and provide a final discussion and conclusions in Section V.

2. Housing Price and Fertility in Theory

Recent empirical studies of the effect of housing price on fertility such as Simon and Tamura (2009), Lovenheim and Mumford (2013) and Detting and Schettini-Kearney (2014) do not articulate formal theories, but recognize that the wealth and income effects of housing price changes could differ for renters and home owners. A recent formal treatment of the relationship between house prices and fertility is provided by Liu and Clark (2016), and briefly summarized here. Liu and Clark assume that unitary households have constant elasticity of substitution preferences over number of children, leisure, and a composite commodity. Children are produced using a Cobb Douglas household production function requiring time and housing. Households choose whether to rent or buy housing

based on the price of each, and maximise utility subject to time and budget constraints. Liu and Clark (2016) confirm the common prediction that renters will respond to an increase in the cost of housing by desiring smaller families. The results for home-owners are more nuanced. Homeowners who both have a low willingness to substitute between family size and either leisure or consumption of other goods, and who already own substantial housing, are predicted to respond to an increase in house prices by desiring more children. However homeowners who have greater willingness to substitute between family size and leisure or consumption are predicted to respond to higher housing prices by desiring fewer children, regardless of how much housing they own. Even those homeowners with less willingness to substitute will also respond to higher house prices by desiring fewer children if their initial quantity of housing owned is sufficiently small.

The analysis of Liu and Clark emphasizes the importance of a family's elasticity of substitution between children and other 'goods.' As this elasticity is not generally observable except through the proxy of demographics, it cannot be well controlled in cross section analysis, or in longitudinal studies that follow only aggregated areas over time, since families can shift between areas.

3. Data and Empirical Methodology

Our two main sources of data for this paper are the Canadian Survey of Income and Labour Dynamics (SLID) and house price data at real estate board level constructed from the Canadian Real Estate Association (CREA). We use the confidential files of the SLID to obtain panel information about Canadian households from 1994 to 2010. The SLID is a household survey that covers all individuals in Canada, excluding residents of Indian Reserves, northern territories, or of institutions. The survey is designed as a series of two overlapping panels, each panel consisting of roughly 17,000 households, and surveyed for six consecutive years. A new panel is introduced every three years, so two panels always overlap. Besides ample information on household composition or income, the SLID also provides information on a broad selection of human capital variables, labour force experience and demographic characteristics such as education and family relationships. Its richness of information and relatively large sample size make it a valuable dataset for our purposes, and its six year panel nature allows us to control for stable but unobserved household characteristics that may influence family size.

However, because the SLID does not ask home owners to estimate the value of their homes, a key challenge in this analysis was to obtain a consistent measure of housing price that was as detailed geographically as possible. There is no official source of data on house prices in Canada. The best information available for an extended period of time, for all regions of the country, comes from the Canadian Real Estate Association's Multiple Listing Service data set (CREA MLS), which we collected for the period 1991-2010. This data set provides mean house prices, (or total sales value over total number of residential units sold) for 92 urban and rural 'boundaries' in Canada, generally the geographic boundaries of 92 real estate boards. We also collected a secondary data set - called CREA MLS II – which provides median house prices for roughly 123 boundaries. Unfortunately, this secondary data set was only available for the years 2005-2010, and was limited to 14 urban centres in Canada.[2] As the reader might gather for a country the size of Canada, having only 92 house price observations per year implies that some real estate board boundaries are quite large, and will likely contain considerable variation in house prices within them. For fixed effects regressions, this should not present a problem if there are sufficient co-movements in house prices in adjacent low and high price neighbourhoods of real estate board boundaries over time. While we know of limited evidence regarding this question, research by Clapp and Ross (2004) finds this to be true between the towns of labour market areas (similar to metropolitan statistical areas) in the American state of Connecticut.

Unfortunately, neither the CREA MLS nor MLS II boundaries match official boundaries, such as census tracts or dissemination areas used by government agencies. Hence, in order to match prices to house owners or renters, we use the census subdivision of a SLID respondent - which translates roughly into the first 3 digits of their postal code - to assign respondents into the 92 urban and rural boundaries of CREA MLS, or into the 123 urban boundaries of CREA MLS II. For the matching procedure, we collected images of the real estate boundaries from the various provincial real estate board websites across Canada (Alberta Real Estate Association, 2013; British Columbia Real Estate Assocation, 2013; Nova Scotia Association of Realtors, 2013; Ontario Real Estate Association, 2013; Winnipeg Realtors, 2013). When this data was not publically available, we consulted with real estate

[2] A full list of regions contained in CREA MLS and CREA MLS II is provided in the appendix. Examples of the former include "Calgary", "Kootenay", "Northern British Columbia", or "Prince Edward Island". Examples of the latter include the four quadrants of Calgary, or 11 regions of Ottawa, but no data for non-urban areas.

board representatives in order to define the provincial real estate boundaries on hard copy maps (Saskatchewan, New Brunswick, and the Toronto Area within Ontario). We obtained digital boundary data for the Real Estate Boards (REB) by rectifying the images to their geographic location and digitizing polygon files within Esri ArcGIS 10.0 software (Esri, 2013). We used Statistics Canada's census subdivision (CSD) as the aggregate geographic level of the census data. The CSD level of Canadian census data corresponds to "a municipality or an area that is deemed to be equivalent to a municipality for statistical reporting purposes" (StatsCan, 2001). Because this area corresponds generally to the size of the real estate areas, this level of aggregation seemed appropriate. The sales data for a particular Real Estate Board Area was linked to a unique CSD when the geographic centre of the CSD area fell within that particular Real Estate Boundary.

Alberta, British Columbia, Saskatchewan, Manitoba, Ontario, Nova Scotia and New Brunswick were all spatially linked as described above.[3] In some cases, the available real estate board maps did not provide complete coverage of a province, and in those cases we created an 'other' category to represent the rest of the province (in Saskatchewan, Manitoba, and New Brunswick). According to experts these were mostly scarcely populated rural areas that have not seen great variation in prices. Within the Province of Quebec, the Quebec Federation of Real Estate Boards provided sales data by Census Metropolitan Area (CMA), which unlike in the rest of Canada could be linked directly to the CSDs within the six CMAs. Unfortunately, this was not available for the final three years of the sample. Those parts of Quebec outside these CMA's were classified into a single 'other' category. The real estate data for the two provinces of Prince Edward Island and Newfoundland/Labrador were each a single value, and thus all unique CSD identifiers within each province were linked to a single province-wide price. Real estate data for northern territories was collected, but not used because the SLID does not cover these areas.

Our empirical analysis is based on that of Lovenheim and Mumford (2009). For homeowners and renters separately, we estimate the likelihood that family *i* (containing a female head or spouse

[3] A complication arose regarding Canada's largest city Toronto in Ontario – whose real estate board sets intra-city boundaries that diverge from those for the Toronto area set by the Ontario association of real estate boards. We opted to use the price/boundaries provided by the provincial association, which necessitated imputing a house price for the combined area of Toronto and Brampton using provincially-sourced data.

aged 18-45) will have an additional child in year t (F_{ict}) as a function of the one year lagged mean housing price (HP_{ct-1}) as reported by the real estate board for i's city or rural region c in t-1, or in robustness checks, in t-2.

$$F_{ict} = \beta_0 HP_{ct-1} + \beta_1 Bd_{ict-1} + \beta_2 X_{ict-1} + UR + t + c \quad (6)$$

We include a set of standard controls (X_{ict-1}) in fertility regressions, such as the woman's wages, family income, age, education, and other factors in t-1 (or t-2). We also include the provincial unemployment rates to control for the state of the economy, and dummies for year and province to capture time trends and differences in provincial policies that affect fertility such as child tax credits or child care support policies. Standard errors are clustered to the REB level. In some specifications for homeowners we also proxy for the physical quantity of housing owned using information on number of bedrooms (Bd_{ict-1}), along with its interaction with house price. Though Liu and Clark (2016) identify the potential importance of quantity of housing owned for the effect of housing price on fertility, we believe that in practice any such quantity measure may suffer from endogeneity, because high house prices could drive people to choose smaller homes in an area they otherwise wish to live in, and then to have fewer children. We find evidence consistent with such endogeneity (to be explained shortly), so that our preferred specifications exclude this quantity proxy and interaction term. Without the proxy, all influences of house price on fertility, including those operating indirectly via quantity of housing purchased, will be picked up by the house price variable.

Initially, we pool all observations from all SLID panels to estimate the coefficients. This pooled cross section approach exploits the substantial variation in house prices between locations at any point in time, but cannot control for unobserved, invariant individual characteristics of women and their families that may influence their fertility decisions. We then move to our main fixed effects specifications that control for such characteristics, but that must rely primarily on variation in aggregated house prices within each real estate board over time.[4]

[4] Because our person fixed effects regressions must still rely on housing prices aggregated to REB level, they may be thought of as akin to pooled cross section models with real estate board level fixed effects, but with greater efficiency. Their estimated effects of housing price on fertility would converge with the latter model if there were the same number of SLID observations from each REB, and households in each REB responded to housing price changes in an identical way.

Regarding fertility measures, in addition to examining the effect of house prices on the likelihood of an additional birth in the past year, we also consider the effect of house prices on total fertility at the time of the survey, using either the number of children living in the household or the number of children born to the woman. We use both "additional birth" and "total fertility" measures because we believe that they highlight different aspects of broadly defined fertility that may be affected by house prices. An additional birth is more likely to reflect a reaction to recent house price changes, whereas by considering total fertility we allow longer persistence in the effect of house price changes. We consider two measures of "total fertility". One is the standard measure of total number of children born to a woman. This measure does not consider, however, that relative changes in housing prices may affect the wealth of parents living apart, and thus their decisions about their children's living arrangements. Changes in relative housing prices may also affect individuals' decisions about whether or not to move in with a new spouse/partner that has children, or the decision of young adult children (and their parents) to move back home. To account for the increased fluidity of family structure, we also measure total fertility using the total number of children living in the woman's household. We expect the potential house price effects on this variable to be stronger, since the number of children currently in the household can be more easily adjusted to respond to changes in wealth associated with changes in prices than the number of children born.

We select a sample of women aged 18 to 45, who are married or live common law in the first year of the panel. This selection aims to capture relevant fertile years of women who have already selected a spouse/partner. We include a dummy variable for married/common law status vs. separated/single, though given our selection criteria this dummy can vary only in the second or higher year of each panel. We also restrict our sample to those women who did not move over the 6 years of her panel. This allows us to focus on the effects of exogenous changes in house prices on fertility, rather than the effects of possibly endogenous changes in wealth that families experience by choosing to relocate. At least in the rural/urban migration context, Glaser and Mare (2001) find that the characteristics of 'movers' and 'stayers' differ using PSID data and individual fixed effects, which we avoid by focussing on non-movers. Finally, we divide our sample between women who lived in homes owned by one or more members of the household ("owners") vs. women living in non-owner occupied households ("renters").

3.1 Descriptive Statistics

We begin in Figure 1 by illustrating the behaviour over time of real (2002 = 100) average housing prices for real estate boards (REB's) in Canada, divided into regions, for the 18 years of combined panel data (1993 – 2010). Note that the vertical scale differs between regions, reflecting strong variation in housing prices between regions in Canada. Higher REB prices occur in British Columbia and Alberta in Western Canada, and Ontario in central Canada. Note too that there is strong intra-regional variation between large urban, suburban, and rural areas. Prices are higher for urban centres: Vancouver, Victoria, Calgary, Saskatoon, the regions of Toronto, Montreal, and Halifax. Finally, particularly within regions, there is strong though not universal co-movement in prices between REB's, with price growth generally strongest in major urban centres.

We next illustrate how the total number of children born per household varies according to lagged real housing prices in Figure 2, for owners and renters pooled. We show the relationship for "movers" and "non-movers" combined in Fig. 2(a), and for non-movers alone in Fig. 2(b). For both graphs, the blue line shows this relationship for households who had no birth over the previous year, while the red line shows it for households with a birth over the previous year. The blue line is arguably more likely to reflect either younger households with no children, or older households with completed fertility. The red line is more likely to reflect a house price-fertility effect if such a relationship exists. For non-movers and movers pooled, Figure 2(a) shows an unequivocal negative correlation between house prices and total children born for households with no prior year birth (blue line), but an equally unequivocal positive correlation for households where a birth occurred (red line). This difference in the fertility/housing price correlation may reflect endogenous changes in wealth portfolios as a result of households choosing to move. For example, while higher housing

Figure 1. Real average housing price by Real Estate Board, 1993-2010, by Region

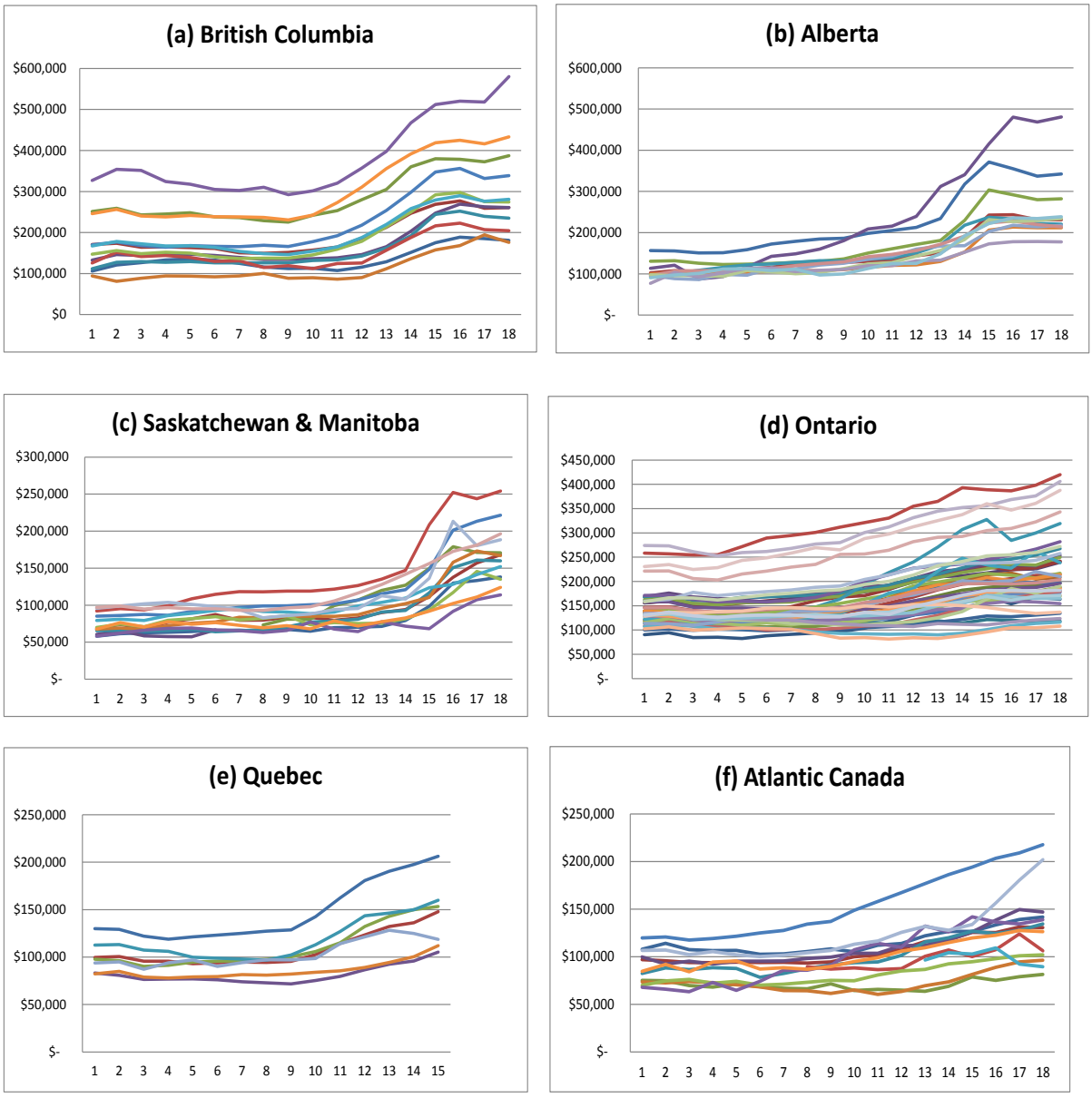
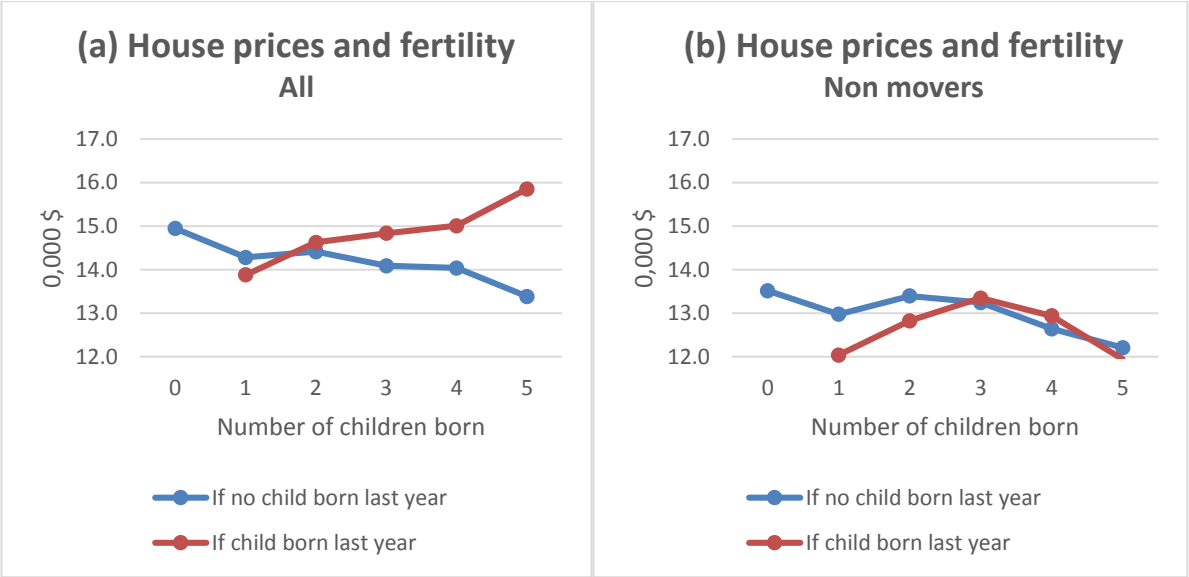


Figure 2. Average housing price by number of children born



prices are positively associated with family size for families with recent births, after some time the rising demand of large families for space and services may force them to capitalize on that wealth and move to cheaper housing areas.

By excluding movers in Figure 2(b), we control somewhat for endogenous changes in wealth secured by moving. For non-movers who are homeowners in particular, we can interpret high house prices as creating high levels of wealth not coming from an endogenous choice of portfolio (though changes in other forms of wealth are not controlled). In general, Figure 2(b) shows a positive correlation between house price and total children born for the first three children, and a negative correlation thereafter. For households where no birth was reported last year (blue line), those with no children or two children live in the highest priced REBs (around$135,000). Those with one child or three children live in lower priced REBs ($130,000) and those with more than 2 children live in progressively lower priced REBs. The red line shows the same relationship for households where a birth occurred during the previous year and provides a more pronounced inverted 'U' pattern. That is, non-movers who had their first child over the last year live in the lowest priced REB, and those with a second or third child born last year lived on average in areas with higher house prices. But households who had their fourth or fifth child were again associated with lower house price areas.

Of course, the above correlations do not take into account individual characteristics, such as the influence of the life cycle on saving and investment, or characteristics of the house such as location or neighbourhood amenities. Fortunately, the SLID collects a broad range of information that we can use to control for the main economic determinants of income, savings and fertility. Table 1 shows the sample statistics for the main variables used in our analysis for those (non-movers) who are owners or renters in the first year of their relevant panel. In general, renters are younger, less likely to be parents or have children at home, yet more likely to have had a child over the past year. They are also more likely to be immigrants and to be full time students. They have overall fewer children and tend to have lower income and live in higher priced REB's. Renting families are also more likely to receive social assistance (SA) or unemployment insurance (UI) and to be below Low Income Cut Off levels (LICO). Regarding employment, women in renter households are less likely to work or hold full time jobs or permanent jobs, and generally receive lower wages. These women are, in addition, more likely to be the major earner in the household.

4. Regression Results

Focussing first on homeowners, Table 2 shows results for pooled cross section models of marginal and total fertility. Marginal fertility is measured by an indicator variable for whether the household had a child born during the last year using a linear regression model.[5] The sample is restricted to non-movers for the duration of each woman's six year panel in order to abstract, to the extent possible, from endogenous housing choices. This gives us our best chance of isolating changes in wealth that come from changes in house values. We include common determinants of fertility such as family income, marital status, number of previous children, full or part time work status, age and education. We also include a measure for unemployment rates in the family's province of residence to control for macroeconomic conditions. Errors are clustered at the REB level. Note that housing prices are in real tens of thousands of dollars ($ 0,000), and real family income in thousands of dollars ($ 000).

[5] Regressions using a non-linear model produce similar qualitative results. For ease of exposition, we show only the linear regression models here. Estimates from other models are available upon request.

The first model indicates that one year lagged house prices are positively correlated with the probability of a child being born in the 12 months leading up to the survey date for homeowners, but the size of the effect is small. A $10,000 increase in housing prices raises the probability of having a child by 0.03%, compared to a sample mean for homeowners of 4%. The results from the other fertility controls show that marriage/living common law and education are positively associated with the probability of having a child over the previous year, whereas age and the previous number of children are negatively correlated. Employment seems to be negatively correlated and family income positively correlated, but neither is significant. The model in column (2) includes the number of bedrooms and its interaction with price as a control for quantity of housing owned, but neither are significant.[6] Results for other variables are similar to those in model 1.[7]

In the remaining models of Table 2, we measure total rather than marginal fertility, defined either as the number of children resident in the household – models 3 and 4 - or the number of children ever born to the woman – models 5 and 6. Models 3 and 5 show results for the simpler case without number of bedrooms and its interaction with price, while models 4 and 6 include them. Fertility controls change slightly as we move from marginal to total fertility measures: the previous number of children is dropped, and instead we include "age at first birth" to control for the timing of initial fertility decisions. Using the simpler models, lagged prices appear to have a significant *negative* association with total fertility - a $10,000 increase lowers the number of children in the house by 0.009 in model 3, and the number of children born to the woman by 0.013 in model 5. For context, the mean children in house and children born for homeowners are 1.91 and 2.00, respectively. Using the fuller but potentially endogenous models 4 and 6, number of bedrooms is now positively associated with total fertility. However, contrary to Liu and Clark's prediction, the effect of house price on fertility is not augmented for homeowners with more bedrooms – the interaction term is *negatively* signed and not

[6] While quantity of housing owned may influence the effect of house price on fertility in theory, we find suggestive evidence that our bedroom proxy suffers from endogeneity. In particular, when we regress number of bedrooms on lagged house price using poisson or linear regression, we find that lagged house price has large significant effects in explaining variation in number of bedrooms. This holds across sparse or full specifications, and is consistent with housing in more sought after areas containing fewer bedrooms.

[7] In additional regressions, not shown here, we have included REB fixed effects in order to isolate the effect of housing price from other unobserved characteristics of the REB that might affect fertility. Results are similar, except that the effect of lagged house price becomes larger (a $10,000 increase now raises the probability of having a child by 0.1%), although the result is not significant (p-value = 0.17).

significant. Emphasizing the simpler models (3 and 5), other controls in the total fertility regressions show standard correlations usually seen in fertility models; number of children is negatively correlated with education and employment (particularly full time employment), and positively correlated with age (for children born). It is also positively correlated with age at first birth. Total fertility is also positively correlated with lagged family income. To summarize, pooled cross section analysis shows that higher house prices have a modest positive effect on our measure of the marginal fertility of homeowners, but a negative effect on our two measures of their total fertility.

In Table 3 we show analogous pooled cross section results for renters. Unlike for homeowners, theory unambiguously predicts that if higher housing prices translate into higher rental costs, they will be negatively associated with number of children. The first item of note is that by restricting the sample to renters who do not move over the course of a six year panel, we have greatly reduced our number of observations, and consequently our results are more volatile than for home owners. Given that quantity of housing owned is not relevant in theory for renters, and our proxy measure of number of bedrooms may be endogeneous, we exclude it from all renter specifications. Surprisingly, our results for marginal fertility show a significant *positive* correlation with house prices, just as we observed for homeowners. A $10,000 increase in lagged REB house prices (with presumed knock-on effects for local rents) is associated with a .2% increase in the probability of having a child in the past year compared to a sample mean for renters of 5%. Total fertility of either children in house or children ever born shows a more expected negative correlation with lagged prices, but neither is statistically significant (The p value for price in the 'children born' model comes close at 0.147). While the lack of significant negative correlation between housing price and fertility for renters is contrary to theoretical prediction, we note it is similar to what was found by Lovenheim and Mumford (2013) using PSID data and MSA fixed effects in the United States.

In terms of other controls for renters, their marginal and total fertility is again significantly negatively correlated with the woman's full time employment, and positively correlated with family income (though this misses statistical significance in the children born total fertility model at p = 0.123). Total fertility in particular is also significantly positively associated with being married/common law, and negatively associated with even the woman's part time work. In sum, pooled cross section analysis shows that higher house prices have a modest positive effect on the

marginal fertility of renters, and no significant effect on their total fertility. We are less sure of the validity of our results for renters, as we do not know if lack of significance or expected sign of some standard variables reflects reality, or our severely reduced sample size.

We move next in Table 4 to using person fixed effects to examine the effect of housing prices on fertility, again beginning with home owners. Fixed effects will enable us to control for unobserved individual or household preferences regarding fertility, but cannot exploit the substantial variation between families and house prices at each point in time. Beginning with marginal fertility, fixed effects finds a larger but less precisely estimated pro-natal effect of house prices than did pooled cross section. From model 1 in Table 4, a $10,000 increase in REB house price raises the probability of an additional birth by 0.1% over a sample mean for homeowners of 4%. This is larger than the 0.03% effect from pooled cross section, but significant at only the .062% level rather than the 0.023% level.[8]

Interestingly, fixed effects estimation also reverses the anti-natal effects that pooled cross section found for house prices on total fertility measures. Recall that pooled cross section found such a price increase would decrease the two measures of total fertility by 0.009 and 0.013, respectively. Model 3, on the other hand indicates that for homeowners, a $10,000 increase in lagged housing price increases total number of children in the house by 0.008 over a sample mean of 1.91. Increases in lagged house prices also appears to have a positive association with total number of children born, but this is not statistically significant. This suggests that increases in house prices also affect decisions about childrens' living arrangements, either as a result of relationship changes or children moving back home – more strongly than their effect on the narrower measure of total fertility. The strength of the effect of house price on children in the home is likely associated with the direct income effect of an increase in the value of the individual's house, but also through an indirect effect through wealth realization/cost savings implied for the new members of the household.

[8] While it might be thought that models with number of bedrooms (2, 4 and 6) make no sense in fixed effects given our focus on non-movers, there is variation in this variable, presumably from renovations or additions to existing properties. Nonetheless, we emphasize results from models 1, 3 and 5.

In summary, when we better control for non-moving homeowners' unobserved characteristics, we find higher house prices tend to have a more pro-natal effect on marginal and total measures of their fertility.

We move finally to the fixed effects estimates for renters in Table 5. Here we find that the move to fixed effects eliminates the surprising pro-natal effect of higher house prices on renters' marginal fertility, and confirms the negative but not significant effect of higher house prices on renters' total fertility. In more detail, model 1 shows that a $10,000 increase in REB house prices (with presumed knock on effect in rental costs) is associated with a 0.7% drop in the probability of birth in the previous year, but this is not statistically significant (p-value 0.133). Similarly, models 2 and 3 find a suggestively negative but insignificant effect of housing price on total children in the house or total children ever born. Thus, fixed effects differs from pooled cross section in finding no positive effect of house price on renters' marginal fertility, but agrees with it in finding a suggestively negative but insignificant effect on total fertility. These results are not inconsistent with theory, but nor do they provide evidence that higher housing (and rental) costs have a strong negative effect on the fertility of renters.

4.1. Robustness Checks Regarding Time Lags

One possible objection to our approach is that a one-year time lag between measures of average annual REB house price and SLID measures of a woman's fertility may not allow sufficient time for families' fertility to respond to housing price changes. Increasing the house price time lag beyond one year allows more time for fertility responses to take place, but at the cost of losing a second or more years' observations from each six year SLID panel.[9] For fixed effects analysis in particular, this compression further reduces potential within-family variation in house prices and fertility. We have thus repeated the analysis above with average house prices lagged two years for homeowners (where the sample size is larger), and reported the results in Appendix Tables 2 and 3, analogous to Tables 2

[9] While we have the REB average housing price in the years preceding the start of each new SLID panel, we cannot know if each relevant woman and her family lived at the same address and REB in those pre-survey years.

and 4. We briefly summarize the results here.[10] In general, our pooled cross section results remain remarkably stable as the house price lag time is increased to two years, whereas house prices lose significance of effect under fixed effects. In particular, as shown in Appendix Table 2, increasing the time lag to two years leaves the magnitudes of the effects of house price on marginal and total fertility of homeowners virtually unchanged in pooled cross section analysis. A $10,000 increase in house prices two years previously is associated with a 0.04%-point increase in marginal fertility (vs. 0.03% one year), a 0.009 decrease in the number of children in the house (identical), and a 0.014 decrease in total children born to the woman (0.013 one year). In contrast, Appendix Table 3 shows that increasing the time lag to two years reduces the point estimate effect of a $10,000 house price rise on marginal fertility from 0.1% to 0.04% and is statistically insignificant. Raising the time lag similarly lowers the point estimate effect of such a price rise on total children in the house from 0.008 to 0.004 and is insignificant, while having no significant effect on the number of children born as before.

It is hard to know for certain why pooled cross section results are stable to the increase in lag, while fixed effects results lose significance. It seems most likely to us that the variation in fertility within families over our (relatively) brief panels is limited in comparison to the variation between families, so that even modest reductions in usable length of panel hampers identification more in fixed effects than pooled cross section.

5. Discussion and Conclusions

In this paper, we have used individual level data from the Canadian Survey of Labour Income and Dynamics (SLID) and average housing price data at real estate board level from the Canadian Real Estate Association (CREA) to investigate the effects of housing price on measures of marginal and total fertility for residentially stable homeowners and renters. For each woman and her associated family, we measure marginal fertility as a birth having occurred in the year prior to a survey date, and total fertility as either the total number of children living in the house, or the total number of children ever born to the woman as of the survey date. Following the predictions of Liu and Clark (2016), higher

[10] With greater concerns over sample size, we do not systematically repeat all renter specifications with longer lags. For those we have tried, in fixed effects, we find no change in lack of significant price effects on total fertility of renters, though the coefficients remaining negative.

housing prices that translate into higher rental costs should depress fertility among renters. Higher prices could be pro-natal among home owners if their elasticity of substitution between children and other goods is low and they already own sufficient housing. Higher prices would be anti-natal otherwise.

Empirically, we find that the effect of housing price on fertility does vary by home-owner status, and by whether we used pooled cross section or fixed effects analysis. Because our person fixed effects analysis uses house prices only at aggregated real estate board (REB) level, it can under some assumptions be thought of as roughly equivalent to pooled cross section with REB fixed effects.[11] For homeowners, we find that lagged REB housing prices are positively associated with our marginal fertility measure -- the probability of having an additional birth. This result held both with pooled cross section and person fixed effects. In contrast, lagged housing prices are negatively associated with our two total fertility measures in pooled cross section estimates, but positively associated in fixed effects. For renters, our sample size is extremely reduced when limiting ourselves to non-movers. Persevering, we find that lagged REB housing prices are positively associated with marginal fertility for renters under pooled cross section, contrary to theory, but negatively (though not quite significantly) associated under fixed effects. Lagged housing prices are not significantly associated with either measure of total fertility for renters in either pooled cross section or fixed effects analysis, though the coefficients are consistently negative.

Between the pooled cross section vs. fixed effects approaches, we find the latter more credible in principle because it better controls for individual unobserved preferences over fertility. Our fixed effects estimates of the magnitude of effect of housing price on the marginal fertility of homeowners is modest; a $10,000 increase in lagged REB house price raises the probability of an additional birth by 0.1%. This small size of effect is perhaps not surprising given that we are restricting ourselves to a sample of non-movers. If rising house prices cause homeowners to perceive greater wealth, and this in turn influences their fertility, this is likely because of an expectation of realizing that wealth, possibly by moving. To focus on exogenous changes in wealth caused by movements in house price, we are

[11] The two methods would find similar results if the number of SLID woman observed from each REB were identical, and families' fertility responded to house price changes similarly across all urban and rural REB's in Canada.

dismissing here those whose elasticity of substitution between children and other "goods" is low enough that they relocate to less expensive areas to purchase sufficient housing for a larger family.

Our fixed effects results for homeowners also indicate that the effect of rising house price is greater on the number of children in the household than on either marginal fertility or on the number of children ever born to the woman. This too is not surprising, since number of children currently in the household can be more easily adjusted to respond to changes in wealth associated with changes in prices. Parents living apart can change their children's living arrangements as housing price increases are generally associated with improvement of neighbourhood amenities, such as better schooling or peer effects. In contrast, the relationship of house prices to the number of children ever born to a woman is likely to be less responsive to these changes.

One drawback of fixed effects in practice is that within individual families there may be limited variation in either fertility or REB house prices over the overlapping series of six year panels we use (or actually five year panels once house prices are lagged one year). This may hinder identification of house price effects on fertility that would in fact be captured over longer panels. We find evidence of this problem in our robustness check of increasing the lag in house price from one year to two: pooled cross section results are virtually unchanged, while in fixed effects house price loses its positive significant effect on marginal fertility or total number of children in the house.

In sum, our findings do not provide evidence that areas experiencing rapid growth in housing prices will see significantly depressed fertility among those families who rent there, though our exclusion of renters who move during their 6 year panel may make our sample unrepresentative. Our finding that one year lagged higher house prices raise total fertility for homeowners under fixed effects (or at least do not lower fertility with a two year lag) might also suggest that if the number of school-aged children is falling in high price growth urban locations such as Vancouver, it is not because extant home owners there are deciding to have fewer children. (If anything, they may have slightly more children.) Declines observed might instead be caused by movement into and out of high growth urban centres by people with differing preferences regarding family size.

6. References

Alberta Real Estate Association. (2013). AREA Real Estate Boards, Retrieved February 15, 2013, from http://www.areahub.ca/About-AREA/AREA-Real-Estate-Boards.aspx

Borsch-Supan, A. (1986) "Household formation, housing prices, and public policy impacts" *Journal of Public Economics*, 30, 145-164.

British Columbia Real Estate Assocation. (2013). BCREA Member Boards, Retrieved February 15, 2013, from http://www.bcrea.bc.ca/about/member-boards

Clark, A.V. (2012) "Do women delay family formation in expensive housing markets?" *Demographic Research*, 27, 1, 1-24.

Clapp, J.M. and Ross, S.L. (2004) "Schools and housing markets: an examination of school segregation and performance in Connecticut" *The Economic Journal*, 114 (November), F425–F440.

Curtis, A. and Waldfogel J. (2009) "Fertility timing of unmarried and married mothers: Evidence on variation across U.S. cities from the Fragile Families and Child Wellbeing Study" *Population Research and Policy Review*, 28, 569-588.

Dettling, L., and M. Schettini- Kearney (2014) "House prices and birth rates: the impact of the real estate market on the decision to have a baby" *Journal of Public Economics,* 110, pp. 82-100.

Esri. (2013). Esri - GIS and mapping leader, Retrieved April 15, 2013, from http://www.esri.com/

Feyrer, J., Sacerdote, B., and Dora Stern, A. (2008) "Will the stork return to Europe and Japan? Understanding fertility within developed nations." *Journal of Economic Perspectives*, 22, 3, 3-24.

Giannelli, G. and Monfardini, C. (2003) "Joint decisions on household membership and human capital accumulation among youths: the role of expected earnings and labour markets" *Journal of Population Economics*, 16, 265-285.

Glaeser, E.L. and Mare, D.C. (2001) "Cities and skills" *Journal of Labor Economics,* 19, 2, 316-342.

Hughes, M. (2003) "Home economics: Metropolitan labour and housing markets and domestic arrangements in young adulthood" *Social Forces*, 81, 4, 1399-1429.

Liu, M. and Clark J. (2016) "The effect of the price of housing on family size: Theory and empirical analysis from New Zealand" *New Zealand Economic Papers*, http://www.tandfonline.com/doi/full/10.1080/00779954.2016.1199591

Lovenheim, M. and Mumford, K. (2013) "Do family wealth shocks affect fertility choices? Evidence from the housing market" *The Review of Economics and Statistics,* May, 95, 2, pp. 464-475.

Nova Scotia Association of Realtors. (2013). Nova Scotia Association of Realtors, Retrieved February 15, 2013, from http://nshomeguide.ca/about/

Ontario Real Estate Association. (2013). Ontario Real Estate Association, Retrieved February 15, 2013, from http://www.orea.com/

Simon, C. and Tamura, R. (2009) "Do higher rents discourage fertility? Evidence from U.S. cities, 1940-2000" *Regional Science and Urban Economics*, 39, 33-42.

StatsCan. (2001). Statistics Canada: Geographic areas - Census Subdivision Retrieved April 15, 2013 from http://www12.statcan.ca/english/census01/Products/Reference/dict/geo012.htm

Walker, J. (1995) "The effect of public policies on recent Swedish fertility behaviour" *Population Economics*, 8, 223-251.

Winnipeg Realtors. (2013). Winnipeg Realtors, Retrieved February 15, 2013, from http://www.winnipegrealestatenews.com/

Table 1. Summary statistics by home ownership (Non-Movers)

	All		Renters		House owners	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Demographics						
Age	36.74	4.73	35.31	5.28	37.02	4.55
% of mothers	0.89	0.31	0.80	0.40	0.90	0.30
% with child in household	0.85	0.36	0.79	0.41	0.88	0.32
Age@ 1st birth	23.05	9.21	19.70	10.67	23.53	8.91
Child born last year	0.04	0.20	0.05	0.22	0.04	0.20
# children in household	1.88	1.04	1.72	1.26	1.91	1.00
# children born	2.00	1.14	1.81	1.32	2.00	1.08
Immigrant	0.17	0.38	0.27	0.45	0.15	0.36
FT student	0.02	0.15	0.05	0.22	0.02	0.14
Housing						
Amount of rent	709	362	709	362		
House-owner	0.84					
Number of bedrooms	3.30	0.86	2.50	0.88	3.38	0.81
House price ($0,000)	18.54	11.47			18.54	11.47
Economic family						
real income ($000)	67.43	46.61	40.78	21.62	69.47	47.25
Size	3.99	1.11	3.73	1.28	4.00	1.07
% below LICO	0.06	0.24	0.24	0.42	0.04	0.19
% with SA	0.04	0.20	0.22	0.42	0.02	0.15
% with UI	0.27	0.44	0.30	0.46	0.26	0.44
Job characteristics						
FT job	0.53	0.50	0.42	0.49	0.55	0.50
PT job	0.22	0.41	0.17	0.37	0.23	0.42
Work hours	1,272	888	914	910	1301	877
Real hourly wage	17.53	9.45	12.98	5.69	17.93	9.63
% with permanent job	0.88	0.33	0.80	0.40	0.88	0.32
% Major earners	0.23	0.42	0.35	0.48	0.21	0.41
Observations	34,674		1,680		29,107	

Table 2. Effect of house prices on fertility of owners. (Movers excluded, standard errrors in parentheses)

	Marginal Fertility [1]		Total fertility [2]			
			Children house		Children born	
	(1)	(2)	(3)	(4)	(5)	(6)
1-yr lag house price ($0000)	0.0003**	0.0002	-0.009***	0.004	-0.013***	0.001
	(0.0001)	(0.0009)	(0.003)	(0.011)	(0.004)	(0.012)
# of bedrooms	--	0.005	--	0.478***	--	0.489***
		(0.005)		(0.059)		(0.062)
# of bedrooms x lag price	--	0.00002	--	-0.004	--	-0.004
		(0.0002)		(0.004)		(0.004)
1-yr lag FT job	-0.004	-0.009	-0.376***	-0.254***	-0.369***	-0.251***
	(0.004)	(0.005)	(0.040)	(0.036)	(0.042)	(0.047)
1-yr lag PT job	-0.004	-0.005	-0.106**	-0.058	-0.113**	-0.076
	(0. 005)	(0.006)	(0.047)	(0.065)	(0.050)	(0.070)
1-yr lag real family income	0.000067	0.000010	0.001934***	0.000117	0.001288***	-0.000662
(x $000)	(0.000053)	(0.000056)	(0.000592)	(0.000539)	(0.000395)	(0.000509)
Age at 1st birth	--	--	0.046***	0.045***	0.046***	0.045***
			(0.002)	(0.002)	(0.002)	(0.002)
Married /common law	0.018***	0.021***	0.363***	0.284***	0.430***	0.336***
	(0.006)	(0.007)	(0.036)	(0.066)	(0.044)	(0.065)
Previous # of children	-0.026***	-0.027***	--	--	--	--
	(0.002)	(0.003)				
Age	-0.010***	-0.010***	0.006	-0.000	0.020***	0.014***
	(0.000)	(0.000)	(0.004)	(0.005)	(0.005)	(0.005)
University education	0.021***	0.014***	-0.164***	-0.157***	-0.252***	-0.242***
	(0.003)	(0.004)	(0.044)	(0.042)	(0.047)	(0.050)
Provincial Unemployment	-0.001***	-0.001*	-0.009	0.001	-0.008	0.002
	(0.000)	(0.001)	(0.006)	(0.009)	(0.007)	(0.007)
Year effects	YES	YES	YES	YES	YES	YES
Observations	24,775	16,550	21,460	13,280	21,450	13,280

(1) Linear regression on an indicator for "child born last year". A logit model provides similar qualitative results
(2) Linear regression on the number of children. A poisson model provides similar qualitative results
Standard errors are clustered at REB level

Table 3. Effect of house prices on fertility of renters. [1] **(Movers excluded, standard errors in parentheses)**

	Marginal Fertility	Total fertility	
		Children in household	Children born
	(1)	(2)	(3)
1-yr lag house price($0000)	0.002**	-0.016	-0.025
	(0.001)	(0.017)	(0.017)
1-yr lag FT job	-0.029*	-0.812***	-0.817***
	(0.015)	(0.232)	(0.230)
1-yr lag PT job	0.002	-0.435**	-0.403*
	(0.020)	(0.194)	(0.215)
1-yr lag real family income	0.000893**	0.010292**	0.009321
(x $000)	(0.000356)	(0.004060)	(0.005966)
Married/common law	0.036	0.615***	0.647***
	(0.023)	(0.158)	(0.183)
Age at 1st birth	--	0.050***	0.049***
		(0.008)	(0.006)
Previous # of children	-0.007	--	--
	(0.013)		
Age	-0.007***	-0.013	0.002
	(0.001)	(0.011)	(0.012)
University education	-0.026	-0.649***	-0.662**
	(0.052)	(0.223)	(0.251)
Provincial Unemployment	0.005	-0.058	-0.054
	(0.004)	(0.048)	(0.051)
Year effects	YES	YES	YES
Observations	1,430	1,255	1,255

(1) Linear regression on an indicator for "child born last year". A logit model provides similar qualitative results
Linear regression on number of children. A poisson model povides similar qualitative results

Standard errors are clustered at REB level.

Table 4. Individual fixed effects regressions of house prices on fertility of owners

(Movers excluded, standard errors in parentheses)

	Marginal fertility [1]		Total Fertility [1]			
			Children in house		Children born	
	(1)	(2)	(3)	(4)	(5)	(6)
1-yr lag house price ($0,000)	0.001*	0.002	0.008**	0.021***	0.002	0.003
	(0.001)	(0.002)	(0.003)	(0.007)	(0.002)	(0.005)
# of bedrooms	--	-0.006	--	0.118	--	0.045
		(0.014)		(0.086)		(0.030)
# of bedrooms x lag price	--	-0.0002	--	-0.004*	--	-0.0002
		(0.0004)		(0.002)		(0.0014)
1-yr lag FT job	-0.008*	-0.010*	-0.035**	-0.018	-0.030***	-0.017
	(0.005)	(0.005)	(0.015)	(0.019)	(0.009)	(0.011)
1-yr lag PT job	-0.005	-0.009	-0.015	-0.030*	-0.020*	-0.021*
	(0.005)	(0.006)	(0.015)	(0.016)	(0.011)	(0.012)
1-yr lag real Fam. Income (x $000)	-0.000020	-0.000007	-0.000069	-0.000031	-0.000271**	-0.000238*
	(0.000069)	(0.000070)	(0.000175)	(0.000175)	(0.000133)	(0.000131)
Age at 1st Birth	--	--	0.032***	0.029***	0.032***	0.031***
			(0.001)	(.002)	(0.001)	(0.001)
Married/common law	0.092***	0.127***	0.098	0.149	0.060	0.099
	(0.020)	(0.025)	(0.063)	(0.096)	(0.050)	(0.083)
Previous # of children	-0.518***	-0.551***	--	--	--	--
	(0.005)	(0.006)				
Age	0.012***	0.010***	0.010*	-0.000	0.034***	0.026***
	(0.001)	(0.002)	(0.005)	(0.006)	(0.004)	(0.004)
University Education	0.083***	0.072**	0.080	0.125	0.102	0.095
	(0.028)	(0.030)	(0.134)	(.109)	(0.125)	(0.108)
Provincial Unemployment	0.002	-0.001	0.009	0.015	0.007	0.002
	(0.003)	(0.004)	(0.010)	(0.014)	(0.006)	(0.009)
Year effects	YES	YES	YES	YES	YES	YES
Observations	24,730	16,550	21,415	13,280	21,405	13,277
F-Test	408.66	389.18	39.25	19.84	72.74	58.88

(1) Linear regression with fixed effects. The dependent variable is an indicator for "child born last year" – columns 1 and 2 – or the number of children in the household or ever born to the woman (columns 3 -6).

Table 5. Individual fixed effects regressions of house prices on fertility of renters

(Movers excluded, standard errors in parentheses)

	Marginal fertility [(1)]	Total Fertility [(1)]	
		Children in house	Children born
	(1)	(2)	(3)
1-yr lag house price ($0,000)	-0.007	-0.012	-0.009
	(0.004)	(0.019)	(0.008)
1-yr lag FT job	-0.008	-0.024	-0.006
	(0.021)	(0.053)	(0.026)
1-yr lag PT job	0.049**	0.035	0.056
	(0.022)	(0.067)	(0.044)
1-yr lag real Fam. Income (x $000)	0.001047*	0.003486**	0.000927
	(0.000596)	(0.001457)	(0.000668)
Age at 1st Birth	--	0.033***	0.032***
		(0.002)	(0.002)
Married/common law	0.013	0.037	0.026
	(0.065)	(0.061)	(0.052)
Previous # of children	-0.425***	--	--
	(0.024)		
Age	0.035***	0.023	0.044**
	(0.008)	(0.027)	(0.018)
University Education	-0.051	-0.033	-0.101*
	(0.088)	(0.124)	(0.058)
Provincial Unemployment	0.073***	0.060*	0.023
	(0.014)	(0.034)	(0.030)
Year effects	YES	YES	YES
Observations	1,430	1,255	1,255
F-Test	16.87	35.76	28.00

(1) Linear regression with fixed effects. The dependent variable is an indicator for "child born last year" – column 1 – or the number of children in the household (columns 2-3).

Appendix Table 1. Average house price and fertility

Total # children born	Average house price (0,000 $)					
	By child		If no child born last year		If child born last year	
	All	Non Movers	All	Non Movers	All	Non Movers
0	14.95	13.52	14.95	13.52		
1	14.24	12.92	14.28	12.98	13.88	12.04
2	14.43	13.37	14.42	13.40	14.63	12.83
3	14.14	13.25	14.09	13.25	14.84	13.35
4	14.11	12.66	14.04	12.64	15.01	12.94
5	13.63	12.19	13.39	12.21	15.86	11.94

Numbers for Figure 1.

Appendix Table 2. Effect of house prices on fertility of owners with lag of 2 years. (Movers excluded, standard errors in parentheses)

	Marginal Fertility [1]		Total fertility [2]			
			Children house		Children born	
	(1)	(2)	(3)	(4)	(5)	(6)
2-yr lag house price ($0000)	0.0004**	0.0008	-0.009***	0.006	-0.014***	0.003
	(0.0002)	(0.0010)	(0.003)	(0.012)	(0.004)	(0.014)
# of bedrooms	--	0.008	--	0.488***	--	0.507***
		(0.005)		(0.062)		(0.067)
# of bedrooms x lag price	--	-0.0001	--	-0.005	--	-0.005
		(0.0002)		(0.004)		(0.005)
1-yr lag FT job	-0.009*	-0.014**	-0.371***	-0.255***	-0.368***	-0.252***
	(0.005)	(0.006)	(0.042)	(0.037)	(0.044)	(0.046)
1-yr lag PT job	-0.010*	-0.013*	-0.112**	-0.061*	-0.119**	-0.080
	(0. 006)	(0.007)	(0.050)	(0.065)	(0.053)	(0.070)
1-yr lag real family income	0.000036	0.000003	0.002085***	0.000155	0.001478***	-0.000571
(x $000)	(0.000063)	(0.000062)	(0.000574)	(0.000502)	(0.000372)	(0.000484)
Age at 1st birth	--	--	0.047***	0.045***	0.046***	0.045***
			(0.002)	(.002)	(0.002)	(0.002)
Married /common law	0.010	0.015**	0.364***	0.282***	0.435***	0.336***
	(0.006)	(0.007)	(0.039)	(0.068)	(0.051)	(0.069)
Previous # of children	-0.022***	-0.022***	--	--	--	--
	(0.003)	(0.003)				
Age	-0.009***	-0.009***	0.000	-0.004	0.016***	0.011**
	(0.000)	(0.001)	(0.004)	(0.005)	(0.005)	(0.005)
University education	0.026***	0.018***	-0.149***	-0.140***	-0.241***	-0.236***
	(0.004)	(0.005)	(0.044)	(.044)	(0.048)	(0.053)
Provincial Unemployment	-0.002***	-0.002**	-0.011*	0.001	-0.009	0.003
	(0.000)	(0.001)	(0.006)	(0.009)	(0.007)	(0.007)
Year effects	YES	YES	YES	YES	Yes	YES
Observations	19,605	13,645	16,905	10,975	16,890	10,975

(1) Linear regression on an indicator for "child born last year". A logit model provides similar qualitative results
(2) Linear regression on the number of children. A poisson model provides similar qualitative results
Prices are measured in $0,000, standard errors are clustered at REB level

Appendix Table 3. Individual fixed effects regressions of house prices on fertility of owners with lag of 2 years (Movers excluded, standard errors in parentheses)

	Marginal fertility [1]		Total Fertility [1]			
			Children in house		Children born	
	(1)	(2)	(3)	(4)	(5)	(6)
2-yr lag house price ($0,000)	0.0004	0.004**	0.004	0.020**	-0.001	-0.003
	(0.0009)	(0.002)	(0.004)	(0.009)	(0.002)	(0.005)
# of bedrooms	--	-0.009	--	0.075	--	-0.008
		(0.016)		(0.096)		(0.026)
# of bedrooms x lag price	--	-0.001**	--	-0.004*	--	-0.0006
		(0.0005)		(0.002)		(0.0016)
1-yr lag FT job	-0.017***	-0.021***	-0.023*	-0.014	-0.021***	-0.013
	(0.005)	(0.006)	(0.013)	(0.016)	(0.008)	(0.009)
1-yr lag PT job	-0.007	-0.007	-0.013	-0.016	-0.013	-0.008
	(0.005)	(0.006)	(0.014)	(0.017)	(0.010)	(0.012)
1-yr lag real Fam. Income (x $000)	-0.000005	0.000039	-.000186	-0.000118	-0.000263**	-0.000212**
	(0.00007)	(0.000074)	(0.000159)	(0.000158)	(0.000113)	(0.000108)
Age at 1st Birth	--	--	0.030***	0.029***	0.031***	0.031***
			(0.002)	(.003)	(0.001)	(0.002)
Married/common law	0.058**	0.116***	0.119	0.216**	0.061	0.119
	(0.026)	(0.032)	(0.077)	(0.109)	(0.062)	(0.098)
Previous # of children	-0.617***	-0.648***	--	--	--	--
	(0.006)	(0.008)				
Age	0.015***	0.014***	0.008	0.003	0.031***	0.027***
	(0.002)	(0.002)	(0.005)	(0.006)	(0.003)	(0.003)
University Education	0.140***	0.126***	0.150***	0.174	0.164	0.141
	(0.032)	(0.034)	(0.184)	(.156)	(0.169)	(0.154)
Provincial Unemployment	0.004	0.003	0.003	0.017	0.007	0.007
	(0.004)	(0.004)	(0.010)	(0.013)	(0.006)	(0.007)
Year effects	YES	YES	YES	YES	YES	YES
Observations	19,575	13,645	16,871	10,975	16,859	10,975
F-Test	428.57	346.47	19.54	10.30	78.69	45.07

(1) Linear regression with fixed effects. The dependent variable is an indicator for "child born last year" – columns 1 and 2 – or the number of children in the household or born to the woman (columns 3 -6).

Appendix: Full List of 92 CREA Boundaries for MLS and 123 CREA Boundaries for MLS II

MLS I: (1993-2010)

British Columbia: Northern, Chilliwack, Fraser Valley, Kamloops, Kootenay, Northern Lights, Okanagan- Mainline, Powell River, South Okanagan, Vancouver, Vancouver Island, Victoria

Alberta: Calgary, Central Alberta, Edmonton, Fort McMurray, Grande Prairie, Lethbridge, Lloydminster(AB), Medicine Hat, North Eastern Alberta, South Central Alberta, Alberta West

Saskatchewan: Battlefords, SE Saskatchewan, Lloydminster (SK), Moose Jaw, Prince Albert, Regina, Saskatoon, Swift Current, Yorkton

Manitoba: Brandon, Portage La Prairie, Thompson, Winnipeg

Ontario: Bancroft, Barrie, Brantford, Cambridge, Chatham Kent, Northumberland Hills, Cornwall, Georgian Triangle, Grey Bruce Owen Sound, Guelph, Hamilton-Burlington, Huron Perth, Kawartha Lakes, Kingston, Kitchener-Waterloo, London and St Thomas, Muskoka& Haliburton, Niagara Falls - Fort Erie, North Bay, Oakville-Milton, Orillia, Ottawa, Parry Sound, Peterborough & the Kawarthas, Quinte, Sarnia-Lambton, Sault Ste. Marie, Simcoe, Southern Georgian Bay, St. Catharines, Sudbury, Thunder Bay, Tillsonburg, Timmins, Toronto+Brampton, Durham Region, Mississauga, Orangeville, York Region, Welland, Windsor-Essex, Woodstock-Ingersoll

New Brunswick: Fredericton, Moncton, Northern New Brunswick, Saint John

Nova Scotia: Annapolis Valley, Cape Breton, Halifax-Dartmouth, Highland, Northern Nova Scotia, South Shore, Yarmouth

Prince Edward Island

Newfoundland & Labrador

Yellowknife

Yukon

MLS II: (2005-2010)

Victoria: Victoria, Oak Bay, Esquimalt, View Royal, Saanich East, Saanich West, Sooke, Longford, Metchosin, Colwood, Highlands, North Saanich, Sidney, Central Saanich, Gulf Islands

Vancouver: Burnaby, Coquitlam, Delta, Maple Ridge, North Van, New Westminster, Port Moody/Belcarra, Port Coquitlam, Richmond, Van East, Van West, West Van/Howe Sound

Fraser Valley: North Delta, North Surrey, Surrey, Cloverdale, White Rock+District, Langley, Abbotsford, Mission, Chilliwack

Calgary: North West, North East, South West, South East

Edmonton: Northwest, North central, Northeast, Central, West, Southwest, Southeast, St. Albert, Sherwood Park

Regina: Area 1, Area 2, Area 3, Area 4, Area 5, Area 6

Saskatoon: Area 1, Area 2, Area 3, Area 4, Area 5, Area 6, Area 7, Area 8, Area 9, Area 20

London/St.Thomas: London East, London North, London South, Middlesex County, Elgin County, St. Thomas, Strathroy

Hamilton: Hamilton West, Hamilton Centre, Hamilton East, Hamilton Mountain, Burlington, Dundas, Ancaster, Stoney Creek, Grimsby

Toronto: Central, East, North, West

Ottawa: Area A&B, Area C&D, Area E&F, Area G&H, Area I, Area J, Area K, Area L, Area M, Area N, Area O

Saint John: Grand Bay Westfield, West & Musquash, North Saint John, East Saint John, Rothesay & Quispamsis, Hampton and Sussex, Kingston Peninsula, Other Areas, City Centre and South, Charlotte County

Halifax: Areas 1/2/3/4, Areas 5/6, Areas 7/8/9/40, Areas 10/11, Areas 12/13, Areas 14/30, Areas 15/16/17, Areas 20/21, Area 25/26, Area 31/35

St. John's: Conception Bay North, Conception Bay South, East Extern, Mount Pearl, St. John's, Southern Shore, All Other Areas