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Do Changes in Housing Prices and Rents Affect Fertility Decisions?

A panel data study on women aged 20-45 in Switzerland.

Eric Hermansson (25346) & *Kristóf Surányi* (25538)

ABSTRACT: The following paper was carried out to investigate the effect of changes in housing prices and rents on fertility decisions. More specifically, by observing owners and renters of housing in Switzerland during 1999-2019. Previous studies have examined this relationship in various countries, but such a study had not yet been carried out in a Swiss setting. The source of data is an unbalanced panel dataset extracted from the *Swiss Household Panel*, a longitudinal large-scale household survey with thousands of annual respondents, complemented with price indexes describing regional aggregate price levels. Using a linear probability model extended with controls and fixed effects we estimate the relationship between the change in regional aggregate prices and rents on the probability of conception as a measure of fertility. In conjunction with past literature, we examine the impact of the wealth and cost effect that arises due to changes in housing prices and rents. Unaligned with results from previous research, our findings suggest a negative relationship between changes in housing prices and fertility with respect to owners, but no evidence of a relationship is found for renters. In conclusion, housing prices play an overall role in family planning in Switzerland which has considerable implications in a developed country with record low fertility rates.

Keywords: Fertility Decisions, Housing prices, Switzerland, Wealth effect, Cost effect

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1. Introduction

1.1 Background

"In the long run, low rates of fertility are associated with diminished economic growth", warns an article by the National Bureau of Economic Research (Belsie, 2009) examining the effects of low fertility rates in Europe. Although various continents are struggling with low natural replacement, the European continent has the lowest overall fertility rate (United Nations, 2015). Low fertility is an established problem as fertility is crucial at the macro-level, due to its role in determining population development along with mortality and immigration (OECD, n.d.). This declining continental tendency is simultaneous with increasing housing prices, which have shown an almost entirely undisturbed growth between the period of 2010 and 2022 (Eurostat, 2023), meaning that housing has become relatively less affordable for the next generation. Recognizing this phenomenon, the necessity to observe causal relationships arose. In addition, the rise of contraceptives and medical assistance has greatly increased the decision-making to have children which has drawn attention to the influence of environmental and economic factors regarding fertility decisions (Becker, 1960).

Equipped with these tools to minimize unwanted pregnancy, both households and governments are now more actively engaged in strategic family planning. In this context, we look at children as any other part of a household that is associated with costs and benefits. To estimate the probability of having children we should take the financial and non-financial costs and benefits that come with them. Whilst the non-financial costs and benefits are hard to outline, we have historical proof of the financial costs that come with having a child. According to a report by the United States Department of Agriculture, the distribution of these costs for a child from birth to the age of seventeen are the following: 6% clothing, 7% miscellaneous, 9% health care, 15% transportation, 16% childcare & education, 18% food, and 29% housing (Lino et al. 2015). Whilst some studies report different distributions of costs, the findings suggest that housing cost remains an important cost to consider when having children[1].

One of the above-highlighted factors that has increased significantly in many developed economies since the turn of the 20th century is the price of housing (Knoll et al. 2017). Giving birth to another child requires the households to provide enough space for them, which possibly demands the family to move to a place with more room either in size or number of rooms or undertake additional renovations and extensions of the current living space. Increased rents, therefore, come with difficulties for families who wish to increase their family size. On the other hand, owning housing is not only a mere cost, but also an investment, and, with that, welfare changes come whenever the asset is appreciated or depreciated. These welfare effects could be more substantial than the ones arising from the stock market (Case et al. 2005). The appreciation or depreciation of owning a home has a direct effect on housing wealth, which is also the greatest source of household wealth (Helfer et al. 2023). In addition, housing costs account for the greatest household expenditure and thus have a large impact on the decision-making of a household's resource allocation (Helfer et al. 2023).

Extensive past research has shown and examined that responses to changes in housing prices can occur in two ways: as a (i) wealth effect or (ii) cost effect and these in turn affect fertility (Dettling & Kearney, 2014). Wealth effects signify a change in the perceived or liquified wealth of a property because of a change in prices. For this to happen certain conditions need to be met, such as efficient credit markets that make it possible to realize the positive changes of wealth in liquid assets (Case et al. 2005). On the

[1] See also for example, (Menon & Perali, 2019), on household accounts in Italy.

other hand, the cost effect suggests that changes to prices in housing affect the costs of a household and thus also influence the resource allocation of other products. The supported hypotheses of this field of research summarized are the following: as children come with costs, both the wealth and cost effects have an impact on the demand for them, similarly to other household products.

By building on the previous research conducted in developed and developing countries and the theoretical framework provided by scholars, this paper will examine the effects of housing and rental prices on the likelihood of giving birth using a longitudinal household panel from Switzerland.

The panel is called the Swiss Household Panel (SHP) and is carried out by the Swiss Expertise in Social Sciences (FORS), which is part of the Cross-National Equivalent Files (CNEF), an international organization unifying national panel studies around the world. The SHP includes household and individual data from 1999 and onward, and has previously mainly been used for sociological research, but in this paper, we aim to widen its usage towards economic analysis. The SHP includes information about areas such as accommodation, family composition, education, employment, income, and health. To represent housing values, annual regional real estate price indexes published by the Swiss National Bank (SNB) have been used. By connecting cantons and regions of residence reported at the household and individual level data files from the SHP with reported real estate indexes, we investigate how price changes affect the probability of having a child. More specifically, the studied sample is restricted to examining the probability of having a child using women ages 20-45.

By inheriting models from similar studies performed on panel data in the United States (Lovenheim & Mumford, 2013) and China (Liu et al. 2023) we apply a linear probability model with an endogenous conception variable, resembling the probability of having a child, regressed on changes to housing prices. We perform the regression separately for homeowners and renters in several steps, adjusting the housing indexes for inflation and controlling for the effect of price changes earlier in time. We also control for other household and individual characteristics and include regional fixed effects and time-fixed effects.

Our findings show a statistically significant relationship for homeowners regressing the conception on changes in the housing index with a negative coefficient, suggesting that price changes negatively affect the likelihood of conception given an increase in housing prices. For renters, the effect was also negative, but no statistical significance was found undermining the presence of a real effect.

The findings of no statistical significance for renters are aligned with the literature based in developed countries such as the United States by Lovenheim & Mumford (2013) and Canada by Clark & Ferrer (2019), whereas the findings for owners resemble the results that were found in China (Liu et al. 2023). Compared to studies in developed countries, the results presented by (Liu et al. 2023) indicated a negative relationship between housing prices and fertility. The reasons behind the results differing in China compared to developed countries included limited labor and housing mobility as well as inefficient credit markets. In Switzerland, one potential explanation could be the inconvenience of realizing housing wealth and moving patterns. The findings could also suggest that the negative cost effect and substitution effect of additional children due to increasing housing prices outweigh the positive wealth effect.

The following passages describe fertility in general and Switzerland in particular. Thereafter we present a literature background of fertility in economics, its connection to housing prices, and findings from previous studies. The literature background is followed by the purpose and contribution, research question formulation, and corresponding hypothesis. In the next section, we present a description of the

methodology and data. We then advance to create the empirical framework and present our results after which we discuss the findings. Lastly, conclusions and suggestions for future research are presented.

1.2 Fertility and the Swiss Setting

In 2022, Switzerland reported a fertility rate of 1,39 (FSO, 2023a), which is the lowest it has been in 20 years (Ryser & Délétroz, 2023). This fertility rate is slightly below the European average at 1,48. Although the Swiss fertility rate is the lowest it has been in two decades, it has been relatively stable at around 1,5 since the 1980s (O'Neill, 2022). The low birth rates, in which most Swiss cantons had more deaths than births in 2022, were offset by net migration mainly from the neighboring countries Germany, Italy, and France resulting in a 0.8% increase in population during 2021. Despite an increase in population, the low birth rate and aging population in Switzerland is a growing concern in the political landscape (Keystone-SDA, 2023), which was also reflected in the fall's (2023) parliamentary elections. The high and rising health premium insurance was the number one concern for the Swiss, ahead of immigration, which was also reflected by the second largest party, the Social Democrats, where coping with inflation levels and reconfiguring the health insurance system was the highest priority (Swiss Info, n.d.).

Historically, the global population has increased steadily since the start of the Industrial Revolution, which correspondingly has led to high economic growth. However, similarly to Switzerland, falling fertility rates have been reported in the rest of the world (Economist, 2023), reflecting a decreasing population, particularly in developed countries (Yew, 2012). Since the year 2000, the global fertility rate has dropped from 2.7 births per woman to 2.3. A fertility rate of 2.1, known as the "replacement rate" keeps the population stable. Today, the 15 largest countries in the world by GDP all have fertility rates below the replacement rate (Economist, 2023).

The low fertility rates combined with greater life expectancies result in aging populations, posing economic risks such as rising healthcare costs and a smaller global workforce (WEF, 2022). A smaller workforce obstructs the ability to support the elderly in the form of public pensions, which are funded by a working-age population through tax systems that are controlled by state governments and serve as important income sources for the elderly (Economist, 2023). To avoid risks of economic slowdown, countries must alter their economic policies in accordance with the forecasted future population measures (WEF, 2022).

On the contrary, a decreasing population would ease pressure on our finite resources and generate a greater capital accumulation, in which more resources would be spent on fewer children. A decreasing population would also create greater automation to make up for a smaller workforce and, hence, increase productivity. However, the idea generation would also stagnate with an ageing population which could offset this effect (Doepke et al. 2022).

Many factors could explain the falling fertility rates, but it usually stems from three general factors: the increasing acceptance of women in higher education and the workforce, lower child mortality due to greater health care, and increasing costs of raising children (WEF, 2022).

In Switzerland, the greatest monetary cost of raising children is housing, ahead of food, clothing, and entertainment (Gerfin et al. 2009). Furthermore, housing prices have steadily increased during the last 20 years which can be attributed to a low supply, higher immigration rates, a rise in mortgage loans, and increased institutional real estate investment (Lepcha, 2022). Today, housing in Switzerland is approximately twice as expensive as the European average (Hirschi, 2021), and real estate prices have

on average doubled since the year 2000. Despite Swiss wages also being comparatively high, the average salary has only increased by around 25 percent during the same period (Jaberg, 2022).

Similar trends with falling fertility rates and rising house prices have also been observed in other countries. In England, Aksoy (2016) states that housing is overvalued, and prices are amongst the highest in the world. The Chinese housing market has experienced large price appreciation of housing nationwide and has one of the lowest fertility rates in the world despite relaxed birth control policies during the last decades (Liu et al. 2023).

Compared to the European Union average where nearly 70 percent of the population own their home (Jaberg, 2022) and Chinese ownership as high as 90 percent (Liu et al. 2023), Swiss ownership is only estimated to be around 40 percent (FSO, 2023b). The ownership rates are greater in the countryside whereas the metropolitan areas have lower ownership (FSO, 2023b)[2]. Other than housing prices being relatively high compared to incomes, the low ownership rate can be attributed to land constraints. Switzerland's geography with a mountainous terrain and restrictions on developing agricultural land or urban areas contributes to the high prices (Bourassa & Hoesli, 2010). In addition, homeowners are relatively highly taxed compared to other countries and must have a minimum 20 percent cash deposit when buying a home, which considering already expensive prices, makes homeownership difficult. Furthermore, rental legislation is relatively attractive given protection from eviction and rent increases (Bourassa & Hoesli, 2010).

[2] See appendix A for ownership distribution in Switzerland.

2. Related Literature

Fertility as a determinant of economic development can be traced back to early economic population growth models by Thomas Robert Malthus, who first anonymously published his paper *An Essay on the Principle of Population* (1798) theorizing about the consequences of high fertility and population growth. Clearly and correctly summarizing the determinants of growth up until the end of the 1700s, he concluded that population growth is unsustainable and can come with negative economic growth effects (Malthus, 1817). Since then, this statement has become largely dismissed with the facts falsifying it: food production techniques have become more efficient than anticipated (Buchholz, 2021). In contemporary economics, population size and population growth, although not sufficient on their own, are positive components of economic growth (Romer, 1989). Having the importance of fertility established, economists look at households to understand factors that affect family planning decisions. Fertility as a part of neoclassical economic literature can be attributed to the rise of Home Economics in the 1920s by Hazel Kirk and Margaret Reid, which was complemented by the wave of New Household Economics in the 1960s by Jacob Mincer and Gary Becker at Columbia University, in which theoretical and econometric analysis used to study firms was applied to understand a household's allocation of resources (Grossbard-Shechtman, 2001). As a matter of fact, household economics is one of the oldest disciplines within economics, and the origin of the word *economic* itself can be traced back to the Greek word *oikonomia*, directly translating to *household management* (Leshem, 2016).

A foundation for fertility in economic research was laid out by Becker (1960), in which fertility was to be viewed as a choice. Control over the number of births had historically been achieved through abortion or abstinence at the turn of the 19th century, in which marriage was delayed or coition restricted during marriage, undermining that fertility was a choice even by those circumstances (Becker, 1960). The growth of contraceptives and knowledge have widened the scope further for the decision-making of when to have a child, enabling environmental factors to play a role which has paved way for economic research on the topic.

Becker (1960) also established the idea that parents choose the number of children that maximizes their lifetime utility with regard to the budget constraints they face, similar to how people are expected to choose between different goods. Because of the psychic income children bring, children can be perceived as a consumption good. Furthermore, given the lack of substitutes, they can be assumed to be normal goods in this regard (Becker, 1960). By neoclassical economic theory, this would imply that fertility would respond positively to increases in household income or wealth (Lovenheim & Mumford, 2013). However, this has been disproven by a broad range of empirical evidence suggesting that higher income is often associated with lower fertility[3].

Becker (1960) also observes this relationship himself using several surveys such as the Indianapolis survey and Census data for 1910, 1940, and 1950, and therefore expands his theory to introduce the distinction between quantity and quality of children, referring to the amount spent on them. For example, the quality in terms of separate bedrooms for each child in the family's household, music lessons, or education tuition. Becker (1960) stipulates that the quantity and quality trade-off that parents face when choosing the number of children is dependent on the income elasticity of demand, in the sense that if the income elasticity for quality of children is greater than that of quantity, parents will substitute additional children for higher spending on their existing children. This means that rich parents tend to

[3] See for example, (Jones & Tertilt, 2006) and (Jones et al. 2008).

spend more money on each child rather than having more children because the investment in quality children is costly, there is thus a negative relationship between fertility and income (Doepke et al. 2022).

Another factor in the income and fertility research is the c*ost of time hypothesis* (Mincer, 1963) and (Becker, 1965), in which the price of children is mainly the time required to spend on (with) them. It implies that for higher-wage parents, the opportunity costs of raising additional children are higher. As income rises, so does the cost of parental time in relation to the wage. When income increases, parental time becomes more costly (Dettling & Kearney, 2014). This is known as the price effect or substitution effect (Bagozzi et al. 1978). On the other hand, the rise in opportunity cost for the wife due to an increase in wage could positively influence fertility because the family can afford having more children, which is referred to as the income effect (Bagozzi et al. 1978).

Although Becker (1960) states that most data tend to show a negative relationship between income and fertility, he is careful to point out that there could be opposing effects due to knowledge accumulation of contraceptives among different social classes, with the upper-class using contraceptives earlier in their marriage. When testing for his whole sample, the negative relationship between income and fertility is retained as mentioned above in which higher income is associated with lower fertility, but when using a sample of households that had planned their number of children, the richest families had on average twice as many children as the poorer families. (Becker, 1960, p.219, table 1). With regard to the income effect carried out by (Mincer 1962, 1963) explained in (Bagozzi et al. 1978, p. 202) and the results of fertility in rich families in (Becker, 1960) does not disregard that having more children can be demanded when wealth effects arise.

In more recent times, studies on fertility and housing prices have been conducted in various countries. Dettling & Kearney (2014) examine the relationship between fertility and housing prices in the United States at the Metropolitan Statistical Area (MSA)-level. They focus on mothers in two age groups *20-29* and *30-44* and three ethnic groups, *Non-Hispanic White, Non-Hispanic Black, and Hispanic*. By using aggregate data on birth from the Vital Statistics Natality Files, housing prices from the Federal Housing Finance Agency and population counts from the National Center for Health Statistics, the researchers construct a regression model with year fixed effects and group fixed effects. To account for the risk of reverse causality or unobserved bias they implemented an instrumental variable looking at how supply elasticities differ depending on geographical and regulatory circumstances. The authors find that a $10,000 increase in prices is associated with a 0.8 increase in births. The effect also differs across their defined groups where a $10,000 increase at MSA-level housing prices leads to a 0.7 percent increase in births for whites, a 0.2 percent increase among blacks, and a 0.2 decrease among white Hispanics.

Aksoy (2016) employs a similar model to Dettling & Kearney (2014) in England. Similarly, in England, a statistically significant positive relationship is presented for homeowners and a statistically significant negative effect for renters.

Other than deriving the effects of housing prices on fertility through aggregate cross-sectional and time series data like Dettling & Kearney (2014) and Aksoy (2016), there are also studies that have made use of panel data from the Cross-National Equivalent Files (CNEF), that the Swiss Household Panel is also a part of to examine the effects of housing prices on fertility.

Lovenheim & Mumford (2013) use the *Panel Study of Income Dynamics* from the United States to examine how changes to self-reported housing values influence fertility intentions. Compared to the logarithmic multiple regression models performed by Dettling & Kearney (2014) and Aksoy (2016), Lovenheim & Mumford (2013) uses a linear probability model with the dependent variable *birth*,

denoting whether birth took place in a given period or not. Furthermore, instead of examining how housing prices directly impact birth, the main independent variable of interest is price changes, and how these changes affect the likelihood of having a child. With microdata from the Panel Study of Income Dynamics (PSID) and the state-level Federal Housing Finance Agency Housing Price Index (HPI), the sample is limited to women aged 25-44. The authors conclude that a $100,000 increase in housing wealth among homeowners results in a 16-18 percent increase in the probability of having a child. For renters, the price changes have a negative effect on the likelihood of having a child, but no statistically significant relationships are found.

Atalay et al. (2021) and Clark & Ferrer (2019) similarly explore how changes in housing values affect fertility using Australian and Canadian CNEF panel counterparts respectively. Aligned with Lovenheim & Mumford (2013), both Atalay et al. (2021) and Clark & Ferrer (2019) find support for a positive effect of increasing housing prices for owners and a negative effect for renters. Unlike Lovenheim & Mumford (2013) and Atalay et al. (2021), Clark & Ferrer (2019) do not have data on self-reported housing values at an individual level. Instead, the panel is combined with geographical averages based on 92 Census Metropolitan Areas (CMAs) in Canada and additionally makes use of a logit model rather than a linear probability model.

Aligned with Lovenheim & Mumford (2013), Liu, et al. (2023) utilize panel data and a linear probability model to investigate how home value changes in China impact fertility decisions. In this paper, only married homeowning women are included in the study. Compared to most studies on housing and fertility in developed countries, the results show that a 100,000 Chinese yuan change in home values results in a 14% decrease in the probability of giving birth or 1.28 percentage points. According to the authors, an explanation for the negative effect for homeowners in China compared to the positive effects found in developed countries could be due to undeveloped credit markets, making it more difficult to liquefy increases to home equity. Another explanation stated was the restricted labor mobility in China, making it more difficult for people to move. Similarly, to previous papers, the authors employ an instrumental variable strategy using land constraints in terms of water availability as well as regional government revenue due to the land-owning rules in China. Below is a graphical summary of findings from previous studies.

Table 1

Summary of findings from previous research on the effect of housing and renting prices on fertility.

Article	**Country**	**Effect of housing prices on owner fertility**	**Effect of housing price changes on renter fertility**
Dettling & Kearney (2014)	United States	*Positive*	*Negative*
Lovenheim & Mumford (2013)	United States	*Positive*	*Negative*
Aksoy et al. (2016)	England	*Positive*	*Negative*
Atalay et al. (2021)	Australia	*Positive*	*Negative*
Liu et al. (2023)	China	*Negative*	-

Note: Includes main recent papers presented in *(2) Related Literature*, papers mapped according to the main findings. No distinction is made based on statistical significance in the findings, solely the magnitude of the effects for the respective ownership groups. Illustration: Author's own.

3. Purpose, Research Questions and Hypotheses

3.1 Purpose and Contribution

The purpose of this paper is to investigate how changes in housing prices and rents influence the probability of having a child in Switzerland during 1999-2019 for women aged 20-45. Housing prices and rents will be represented by yearly regional price indexes from the Swiss National Bank and individual characteristics of the women will be derived from annual personal files and household files from the Swiss Household Panel.

As described in (Dettling & Kearney, 2014), changes to real estate prices result in two opposing effects: wealth effects and cost effects. To examine the influence of both effects, a distinction between the women is made at the ownership level, where our modulation will be run separately for owners and renters[4]. Since homeowners possess home equity in their house, their home equity changes when prices change which creates changes in wealth or perceived wealth (Dettling & Kearney, 2014). Renters do not have any home equity and are therefore only affected by the cost effect. In addition to the categorization based on ownership, we also limit the study to investigate how housing and renting prices affect woman of childbearing age, more specifically the age of 20-45. Control variables deemed to have an impact on fertility decisions will be included.

The contribution of the research paper can be divided into two main parts, societal economic relevance, and a new setting. Today, decreasing fertility is a global concern in most developed countries with figures below the replacement rate (Economist, 2023). This means that the net of immigration, populations are decreasing. There are many associated consequences with a decreasing population, which could decrease economic growth. For example, a smaller workforce could make public pension financing more difficult (Economist, 2023) and decrease overall idea generation (Doepke et al. 2022). The widespread trend of decreasing fertility rates around the world which is largely driven by developed countries creates future challenges for population development and will therefore have a large effect on the macroeconomy.

Compared to fertility rates, which have sought to decrease over time, housing prices in most countries have been increasing, causing a growing concern for young adults to enter the real estate market. The cost of housing today is the greatest household cost for most households (Helfer et al. 2023) and therefore has a significant effect on household spending and resource allocation. Considering that having children incurs additional costs, it could be possible that changes to housing prices impact the likelihood of having a child. Today, fertility planning is also more accessible compared to earlier in history (Becker, 1960) due to access to contraceptives and medical abortion care. This has shifted the landscape of fertility determinants of birth to economic and environmental factors.

Referring to the literature review, previous studies on housing prices and their effect on fertility have been conducted based on data in developed and developing countries, where findings in developed countries tend to show empirical evidence for a positive relationship between rising housing prices and fertility. Among previous studies, several are based on panel data studies as part of the CNEF. For example, Lovenheim & Mumford (2013) in the United States, Atalay et al. (2016) in Australia, and

[4] Distinction is made based on the ownership type of household and not the individual. There is no data in the SHP on ownership proportions within household members.

Clark & Ferrer (2019) in Canada. In this study, we make use of the Swiss counterpart of the CNEF, the Swiss Household Panel to examine this relationship.

Similar trends of rising real estate prices and decreasing fertility rates can be observed in Switzerland as with previously researched countries. The Swiss fertility rate is now at its lowest reported rate in two decades (Ryser & Délétroz, 2023) and despite high real estate prices being observed elsewhere, Swiss housing is comparably higher in relation to other developed countries (Hirschi, 2021). What makes Switzerland stand out further is the ownership landscape, having the lowest ownership rates of housing in Europe (Statista, 2023). All these characteristics make the Swiss setting unique and relevant.

3.2 Research Questions

From the above-formulated purpose, the following two research questions have been formulated:

> *(1) What is the effect of changes in housing prices on the likelihood of having a child for homeowning women aged 20-45 in Switzerland during 1999-2019?*

> *(2) What is the effect of changes in renting prices on the likelihood of having a child for women renters aged 20-45 in Switzerland during 1999-2019?*

3.3 Hypotheses Formulation

With the assumption of children as a normal good by Becker (1960) and that housing is a significant cost associated with having children, an increase in housing prices would have a negative substitution effect on the demand for children in the current period, ceteris paribus (Dettling & Kearney, 2014). Liu et al. (2023) also refer to a negative cost effect, implying that increasing housing prices would result in a higher cost of attaining additional living space to make room for an additional child, affecting both homeowners and renters. The effect captures how increasing housing prices would lead to increasing costs, and therefore a shift away from having children in the period. Similarly, to the United States, housing is the greatest cost of raising children in Switzerland (Schell, 2023), meaning this reasoning can be said to hold.

Compared to renters, homeowners also possess home equity in their house or apartment, enabling them to capture wealth effects when housing prices change. If housing prices in an area increase, so does the home equity for homeowners in that area. This positive wealth effect could play out through a traditional wealth effect or equity extraction effect (Dettling & Kearney, 2014).

The traditional wealth effect implies that if housing appreciation on an owner's house is assumed to be permanent, and housing is perceived as a store of wealth, this increases the perceived wealth for owners (Dettling & Kearney, 2014). This increase in perceived wealth would suggest an increased demand for normal goods, and since children are part of this cohort, the number of children would be expected to increase when perceived wealth increases.

The equity extraction effect stems from the increase in home equity as a result of increases in housing prices. If a homeowner does not sell their house to liquefy the increase in home equity there is no change in actual wealth (Dettling & Kearney, 2014). Furthermore, housing prices could return to initial levels

after an increase. If homeowners otherwise could liquify increases in home equity, through for instance an equity loan, there is an increase in current period accessible income which could increase birth rates.

We formulate our two main hypotheses distinguishing between ownership, with the basis of the idea of wealth and cost effects, where we expect similar relationships to be observed in Switzerland as with studies performed in the United States by Lovenheim & Mumford (2013) and Dettling & Kearney (2014) as well as the United Kingdom by Aksoy (2016).

For owners, we expect the positive wealth effect to be greater than the negative cost effect. Since renters are not exposed to changes in household wealth, the negative cost effect is expected to have a decreasing likelihood of having a child. The two hypotheses can be formulated as follows:

H1: Rising rent prices for women renters have a negative effect on the likelihood of having a child.

H2: Rising housing prices for homeowning women have a positive effect on the likelihood of having a child.

3.4 Definitions

In this paper, housing prices and homeowners are defined as individuals who have some type of ownership in their home. It includes but is not limited to people who fully own their house. Most households have outstanding mortgages to pay off, but if an individual has some ownership in their accommodation, they are classified as owners. Furthermore, homeowners refer to owners of both houses and apartments.

Housing prices refer to prices of houses and apartments and are associated with owners. Renting prices include rental properties that are houses and apartments that are associated with renters. If the term "real estate prices" is used, it refers to houses and apartment prices for both groups.

3.5 Limitations of the Study

The thesis is limited to investigating how housing and renting prices affect fertility in Switzerland. The effects of housing and renting prices on fertility rates in other countries will not be examined. Our findings will reflect the composition of the Swiss Household Panel, which follows a random sample of households and individuals living in the respective households every year (Voorpostel et al. 2021). Emphasis should be placed on the fact that we are limited to this sample and will not investigate the whole population of Switzerland directly.

Compared to previous studies in other countries and panel data studies in particular such as Lovenheim & Mumford (2013) in the United States, Atalay et al. (2016) in Australia, and Liu et al. (2023) in China, the SHP did not contain yearly information of housing values. On the one hand, respondents were asked to estimate their total wealth during 2012, 2016, and 2020, but no reporting was done in consecutive years (Voorpostel et al. 2021). Due to these limitations, we merged the SHP with yearly regional real estate indexes from the Swiss National Bank. Although the potential measurement errors that could arise from self-reported housing valuation are mitigated, the study will not be able to fully capture changes in housing wealth at an individual level compared to these studies. However, the SHP did contain figures of annual rents for renters, which will be used to assess the effect of changes in rents on fertility.

However, in the base model, rental indexes from the Swiss National Bank like those for owners will be used.

The absence of annual self-reported housing values was also the case for (Clark & Ferrer, 2019), in which case they inherited housing price levels from an additional source and connected them to each specific year and location of the household, similar to the methodology of the data creation for this study.

4. Data

In this section we discuss the attributes, building components, and construction of the panel dataset for the study. First, we clarify the specifications of our final data. Second, we explain the three main components in detail. Finally, we provide explanations of the construction of the data that was undertaken by the authors of this thesis.

4.1 Specifications of the Panel

We built a panel dataset of women aged 20-45, using three different sources. These include the Swiss Household Panel (SHP), price indexes from the Swiss National Bank created by Wüest Partner, a reputable Swiss real-estate firm, and the consumer price index (CPI) sourced from the Swiss Federal Statistical Office, which we included to account for inflation. The SHP looks at the individuals over time and concentrates on their characteristics, but also captures some of the household and partner or spouse characteristics whenever applicable. As we attempted to measure the effect of housing price changes and fertility rates, we looked at the intent of having children, thus we constructed our main dependent variable as a dummy: conception. To avoid problems that can arise from this method, we removed the years 2020 and 2021 from our final data frames on which we ran the regressions. We did this to account for the lower likelihood of deriving the conception date from the birth of a child[5].

4.2. Data Sources

4.2.1 The Swiss Household Panel

The core of our data is The Swiss Household Panel (SHP Group, 2022), a longitudinal large-scale household survey carried out by the Swiss Centre of Expertise in the Social Sciences (FORS) primarily funded by the Swiss National Science Foundation. FORS aims to implement large surveys nationally and internationally to offer data and information to research and academic institutions (FORS, n.d.). As stated by Tillmann et al. (2022), the SHP has been used in various research projects, such as investigating the consequences of unemployment for social networks (Rözer et al. 2020), and lone one mothers employment forecasts (Struffolino et al. 2020). It has also been used in cross-national comparative studies, such as the relationship between unemployment and well-being in Switzerland and Germany (Oesch and Lipps 2012). The SHP was introduced as part of the Swiss Priority Program (SPP) "Switzerland Towards the Future" during 1998-2003, which was the largest social scientific program in

[5] Conception variable in 2021 only equals 1 if the child was born by the end of 2021 and the survey was filled out by the very end of that year. In numerous cases the conception variable could not be created in 2020 either as the child has not been born by the time of 2021 survey response. This is supported by our analysis where irregularly low number of conceptions was found for 2020.

the country at the time (Tillmann et al. 2022). The SHP aims to be a relevant dataset for research about social changes, changes in living conditions, and social representations in Switzerland (Voorpostel et al. 2021).

The SHP is an extensive questionnaire with hundreds of different variables[6] sent out to the same people and households each year. It follows a random sample of household residents in Switzerland since 1999 and since its initial sample (SHP_I) that started in 1999, three additional samples have been created. SHP_II (added in 2004), SHP_III (added in 2013), and SHP_IV (added in 2020). The samples are drawn by the Swiss Federal Statistical Office and the sample is limited to people living in private households in Switzerland, excluding people living in elderly homes, collective households, and prisons.

The SHP contains annual data files from 1999 to 2021 for households and individuals respectively. The housing data contains information about the household in general and is divided into five categories, *composition of the household*, *accommodation*, *standard of living*, *financial situation*, and *household and family organization* (Voorpostel et al. 2021). More specifically, variables include, among others, location (region), type of residence, year moved to the accommodation, and number of people in the household. The individual files include information on *household and family*, *life events*, *health and quality of life*, *social origin*, *education*, *employment*, *income*, *participation*, *integration and networks*, *leisure and media*, and *psychological dimensions* (Voorpostel et al. 2021). More specifically, variables include for instance age, sex, civil status, and education.

The sample frame for SHP_I was the Swiss telephone directory (Stichprobenregister für Haushalterhebungen – SRH) with a coverage rate of approximately 95 percent with the sampling frame being at the household level. The second sample, SHP_II, was based on the successor register of SRH, named Cadre de Sondage pour le Tirage d'Enchantillons de Ménages (CASTEM), which is owned by the Swiss Federal Statistical Office. The SRH and CASTEM samples were subject to under coverage, meaning that households with unlisted numbers were not listed in the sample. Similarly, on rare occasions, duplicates were created. SHP_III and SHP_IV were drawn from SRPH, cantonal, and commune registers owned by the Swiss Federal Statistical Office. Compared to the two former samples, observations were not based on phone directories, but registers issued by municipality and canton. Under and over-coverage could still be present but is accordingly insignificant (Voorpostel et al. 2021). The initial response rates in the first wave for the four respective household samples were 64 percent for SHP_I, 65 percent for SHP_II, 60 percent for SHP_III, and 52 percent for SHP_IV. On the individual samples participation rates were 85, 76, 81, and 73 percent respectively. Since initiation, participating households in the survey have been approximately 5,400 households and 8,700 individuals, with latter years consisting of more participants due to the addition of more waves over the years[7] (Voorpostel et al. 2021).

First, we were to limit our sample to women of childbearing age, which according to (World Health Organization, n.d.) spans ages 15-49. However, we decided to include only women aged 20-45. One reason for this decision is the considerably low rate of young motherhood. Another reason is to isolate the women more precisely for whom the housing prices matter in their fertility intent. While it is rare to move from home before as a minor, by the age of 20, 32.3 percent of women have moved from home (BFS, 2023), which is a considerable amount for us to have 20 as the threshold year for our group of interest. Our analysis of our panel supports the earlier assumption of a low rate of young motherhood,

[6] See the Vorpostel et al. (2023) *SHP User Guide* and SHP *Questionnaires* (QuestionML-P-W1), (QuestionML-X-W1) and (QuestionML-H-W1) for a full list of the variables. Sources can be found in the reference list.

[7] See appendix B for a graphical illustration of participation for each respective year and sample.

as the number of conceptions and percentage of conceptions for both ownership groups are very low at the age of 20 (*see Figures 1 and 2*).

Figure 1

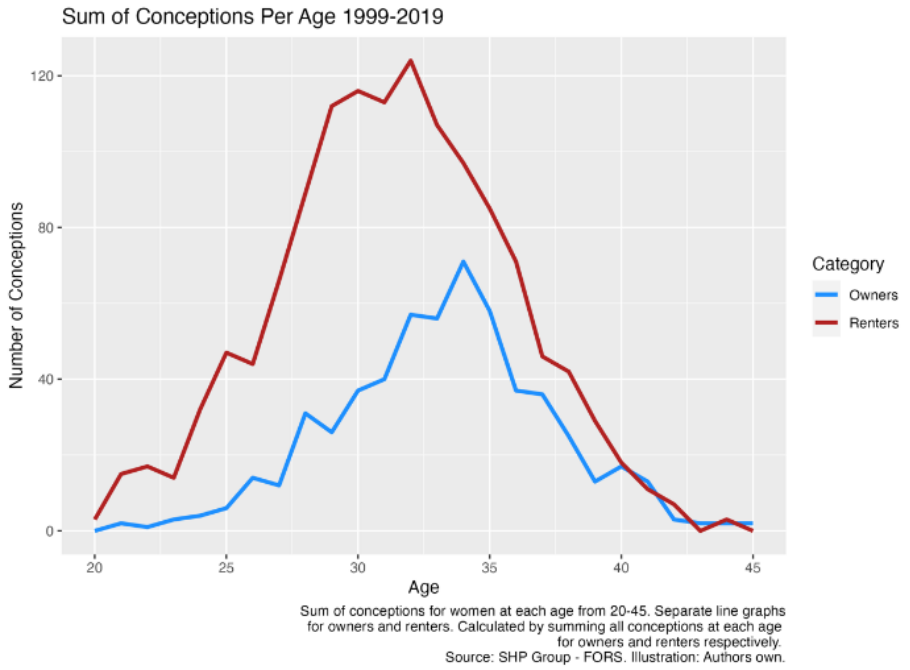
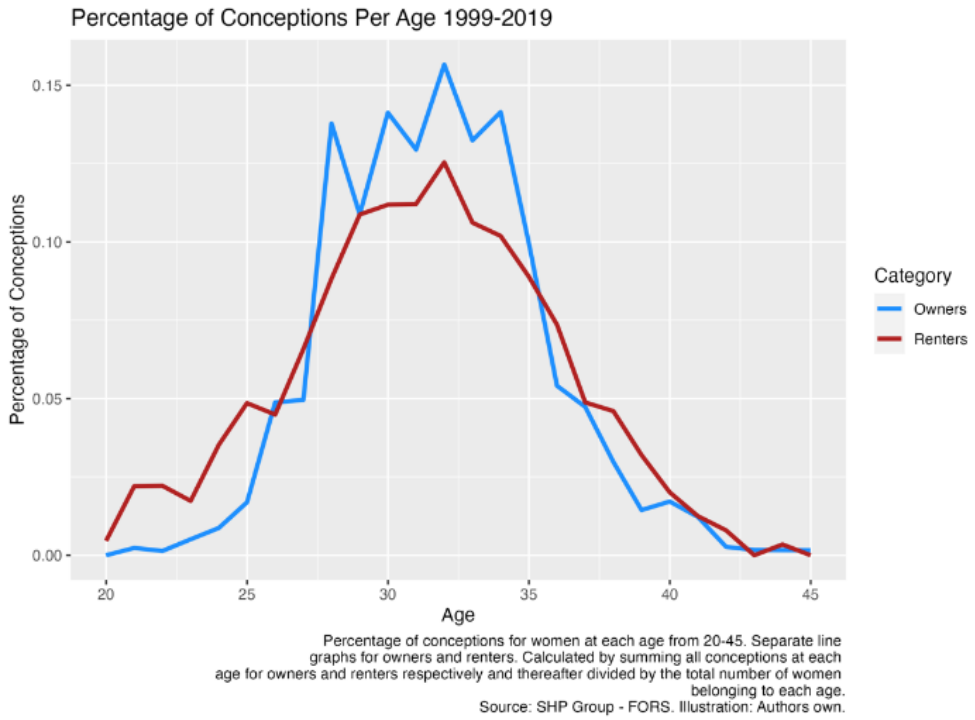


Figure 2



As can be seen in *Figures 1 and 2* most conceptions for owners and renters take place between the ages 20-45. Below and above these age groups, conception is unlikely and correspondingly of very small frequency and proportion meaning that those age groups are not faced with the same decisions of when to have a child.

4.2.2 Housing and Renting Price Indexes

The SHP includes hundreds of variables for households and individuals of the households, but there are no variables observed annually indicating housing value consistently throughout the years. During 2012, 2016, and 2020, respondents were asked about their wealth and property wealth but not before that nor in subsequent years (Voorpostel et al. 2021).

To account for this, housing price and rental price data have been accessed from the Swiss National Bank (SNB), a dataset named *Real Estate Price Indices – by market area – Year* (Wüest Partner, n.d.-b). These indexes were created by the Swiss independent service company in the real estate industry, Wüest Partner. The firm was founded in 1985 with its main offices and facilities in Switzerland but also regional offices in France, Portugal, and Germany (Wüest, n.d.).

The index dates to 1970 and has been recorded yearly and quarterly to date. In this study, we made use of the yearly indexes, since the SHP data is recorded at an annual level. The base year for the indexes is the year 2000 and it is made up of five respective indexes depending on the type of real estate, *privately owned apartments*, *single-family houses*, *rental housing units*, *office space,* and *industrial and commercial space* (Wüest, n.d.). Given the purpose of our study, the latter of the two groups are not included. For privately owned apartments and single-family houses, a distinction is also made between an asking price index and a transaction price index. Rental housing units only have an asking price index.

The asking price indexes are constructed based on real estate offers in Switzerland. For the years 1970 to 1995, 100,000 real estate offers were collected per year by a differentiated sample plan. Other than the price, most of the offers in the data also included size information (number of rooms), the macro location (community), and the condition of the building (new or old). The data was then combined into groups to be as homogenous as possible based on the information available. To create the overall index, the average prices in each group were weighted to create a general index. The averaging was done using median values rather than mean values because of its sensitivity to extreme values. From 1995 and onwards, the sample was enlarged to 500,000 real estate offers annually[8] (Wüest Partner, n.d.-a).

The transaction price index was available for the years 1985-2022. It is based on Wüest Partner's hedonic valuation function, which is used to value residential properties – properties not generating periodic income. A hedonic price valuation states that the market value of a property is determined by individual willingness to pay for the features of a property. Such features include macro location (tax level, region, and reachability) and location of community (access to public transport and noise emissions), and object (condition of the house, living space, and year of construction). The transaction index is based on approximately 22,000 transactions each year (Wüest Partner, n.d.-a).

For owners, we used the transaction index and matched the prices depending on the accommodation type stated in the SHP. If it was an apartment, the index for privately owned apartments was used, and if it was a house, the index for single-family houses was used. Although the deviation between the transaction price index and the asking price index was often subtle, the transaction index was preferred because it reflects the actual prices of the houses and apartments and the transactions that took place. For renters, there was no transaction index. Therefore, the asking price index was used.

[8] For further information regarding the calculation of the index, see https://www.wuest.io/online_services_classic/angebotspreisindex/information/pdf/Methodenbeschrieb.pdf

To join this dataset together with the SHP variables, we merged by the respective year, housing type, and region. Note that the two datasets used different regional distinctions. Compared to the SHP, which included locational variables at the canton (regional) level in Switzerland (NUTS[9]), the real estate price index was based on eight monitoring (market) regions which altogether consisted of 106 Mobilité Spatiale regions (MS regions) in Switzerland which have been divided by spatial mobility[10]. Using a reference key provided by Wüest Partner (n.d) we linked the market regional level indexes to the canton level and assigned the indexes to the respective ownership type and period in the SHP. Although the assignment instructions were provided, we can only assume an accuracy of 95% which is caused by slightly differing borders around Lake Geneva based on the two distinctive regional categorization systems (MS and NUTS).

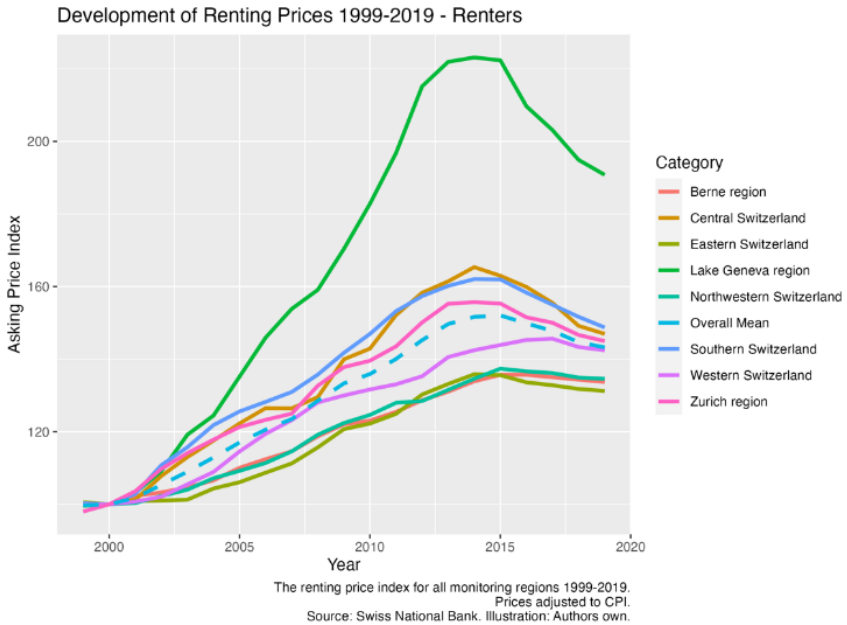
4.2.3 Consumer Price Index (CPI)

The asking price index and transaction price index were expressed in nominal terms (Wüest, n.d.). To express the index in real terms, we adjusted the index levels using the Consumer Price Index for Switzerland. (FSO, n.d.). This was achieved by rebasing the CPI index to have the same base year as the housing index and then proceeded with the following:

$$New\ Price = Price \div (CPI \cdot 100)$$

In the below figures, the housing price and renting index adjusted for inflation are plotted for the respective monitoring regions during 1999-2019.

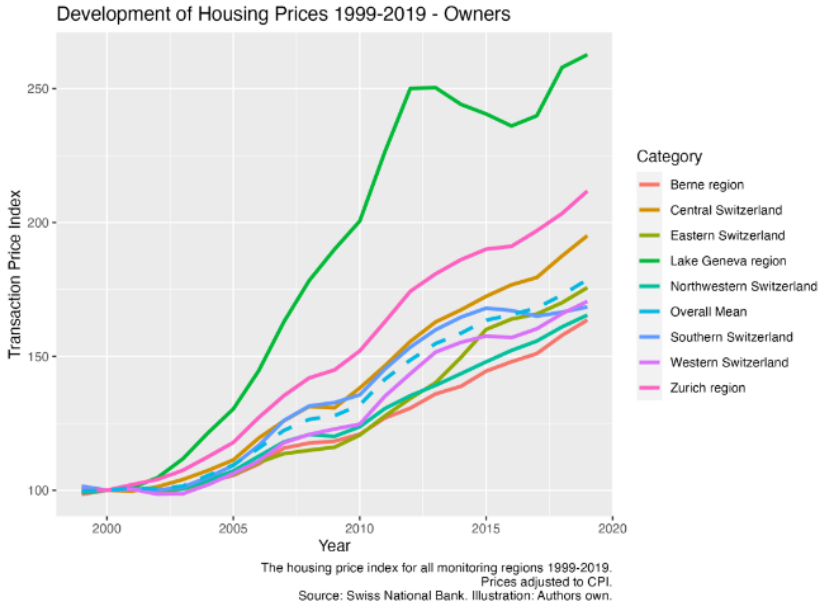
Figure 3



Note: Development of rents per region, based on analysis of our panel dataset, constructed from SHP, Swiss National Bank (Wüest Partner) data, and CPI.

[9] The NUTS classification (Nomenclature of Territorial Units for Statistics) is a hierarchical system for dividing up the economic territory of the EU and the UK (Copernicus, n.d).
[10] A map of these geographical areas can be found in Appendix C.

Figure 4



Note: Development of prices per region, based on analysis of our panel dataset, constructed from SHP, Swiss National Bank (Wüest Partner) data, and CPI.

As can be seen by both figures, housing prices and renting prices have increased during the period. The overall mean of housing prices has increased stable throughout time. The renting prices have increased over the years but have decreased since 2015. We also observe greater price levels for the big metropolitan cities of Zurich and especially the Lake Geneva region in both figures.

4.3 Construction of the Panel

The SHP data is divided into annual files that contain the housing and personal datasets separately. First, we renamed the variables, that were year-specific[11], then we compiled the data into a longitudinal form. Finally, the two main datasets were merged based on "IDHOUS", the unique household identifier.

To understand fertility, we needed to construct a variable that captures it. Our main interest was fertility intent, so the most practical solution was to have conception as our dependent variable. To make deductions about conception we needed the date of birth. Fortunately, in addition to the household and personal files, there are two master files included in the SHP for households and individuals respectively, containing all variables that were not year-specific. We used the personal master file to create a children matrix that assigns children to their mothers[12] with all their birth date specifications. We later used these columns to create the conception variable. The general logic was to subtract 9 months from the date of birth (year and month).

Here we did not make a distinction between twins, or the birth of a single child as was a rare occurrence and not within the control of the parent. In addition, the binary conception variable made it unable to capture the possibility of a woman conceiving twice in one year.

[11] Such as P$$N04 to PN04 where $$ defines the year '99-'21 in every file.

[12] IDPERS = IDMOTH unique personal identifier matched with mother identifier.

A large portion of the observed women were in a relationship. Some variables indicated the characteristics of these relationships. Based on these, we defined four, non-overlapping dummy variables: *non-marital relationship with cohabitation*, *non-marital relationship without cohabitation*, *marriage with cohabitation*, and *marriage without cohabitation*. In addition to these variables, we captured the quality of the relationship by adding up two variables that rate emotional and practical support received from the partner separately on a scale of 0-10. To enable ourselves to use these variables in an econometrically sound way[13], the relationship dummy variables were interacted with quality in the following way:

$$Dummy\ relationship\ variable \cdot \frac{Quality}{20}$$

This way, these four variables were converted to numerical and received a value equal to or between 0 and 1.

Including the income and worked hours of the partner of the women in our data was also important to capture the full financial and time resources that could be provided to the child in case of birth from the potential other parent. This inclusion was made by joining the partner income and work hour variables based on a unique partner identifier.

We constructed the income variables that were made of income of personal income and other income (yields of bonds, dividends, etc.). In some cases, when there were no or insensible responses to the income variable, but usual weekly work hours were indicated. The income variable equals WORKH*20*52 CHF, since wherever the minimum wage is set in Switzerland, it is at least 19.5 francs (www.ch.ch, n.d.).

Finally, we constructed variables based on the housing panel files that would help our analysis further. As mentioned earlier, the SHP data contains rents as a variable. From that variable we constructed a delta rent – the change in rent between t and $t-1$. However, including the delta rent per individual in our regressions would lead to an endogeneity issue due to reverse causality, for example, some people might move to a bigger housing to make space for children and thus pay higher rent. To prepare a variable that accounts for this, we create a region median delta variable similar to Atalay et al. (2021). Constructing the region delta by using a bottom-up method, we were able to utilize other variables to create smaller regions. Thus, we assigned households to artificial regions by taking their canton location and their community typology[14].

These are the steps through which we built our panel data[15] that is suitable for our regression models which are explained in the following sections.

[13] Avoiding multicollinearity due to relationship dummies and quality variables as quality of relationship is dependent on the existence of relationship.

[14] See appendix G for the types of community typologies.

[15] For more information on variables, see appendix K.

5. Methodology

In this section, we start by describing our model in detail followed by a closer look at the variables of our dataset. By the end of this section, we include a meticulous report on the factors that played an important role in our decision on specifying our model.

5.1 Model Specification

To examine the effect of housing prices and rents on the likelihood of having a child, we employ a linear probability model inspired by the empirical strategy conducted by Lovenheim & Mumford (2013) in the United States and Liu et al. (2023) from China that both also make use of a panel data sets. Our model can be estimated as follows:

$$\textbf{(1)}\ Conception_{irt} = \beta_0 + \beta_1 \Delta HI_{rt-(t-1)} + \beta_2 \Delta HI_{r(t-2)-(t-5)} + \beta_3 \boldsymbol{X}_{irt} + a_r + \tau_t + \varepsilon_{irt}$$

Where the subscript i indicates individual, r is the monitoring region, and t the period – year. The model is regressed separately for owners and renters respectively.

The dependent variable $Conception_{irt}$, is a binary variable taking the value 1 if conception took place and 0 otherwise.

β_0 is the intercept, which for this linear probability model can be defined as the probability of conceiving if all other variables were zero(Pradhan, 2020). The main coefficient of interest, β_1 is defined as the probability of conceiving, conditional on changes in the regional housing or rental index between periods. One index unit increase would be associated with an additional β_1 probability of conception, holding the other variables constant. The variable HI_{rt} represents housing or rental price indexes depending on the two respective ownership groups: owners and renters. More specifically, ΔHI_{rt} is the difference in index between two periods, either t and $t-1$ or $t-2$ and $t-5$.

The β_2 coefficient is the probability of conception conditional on changes in housing and rental prices between the periods $t-2$ and $t-5$ to examine the possible effect of price changes earlier in time on the probability of conception.

The variable $\boldsymbol{X}_{irt}$ is a vector of control variables that could affect fertility rates. These variables are described further below and presented in *Table 2* and *Table 3*. The variable a_r and $represent$sents monitoring region fixed effects and year fixed effects respectively.

The control variables of $\boldsymbol{X}_{irt}$ will be added in several steps. In the first model (M1), $Conception_{irt}$ will be regressed solely on $\Delta HI_{rt-(t-1)}$, changes in housing (renting) price, excluding fixed effects. The second model (M2) will include region[16] and time fixed effects, which will be included in all the subsequent models. In the third model (M3) the change in prices between $t-2$ and $t-5$ will be added.

In the fourth model (M4) $Years\ of\ Education_{irt}$, defined as the years of education will be added, which is based on the International Standard of Education (ISCED) classification (Lipps & Kuhn, 2023). Thereafter in (M5), income controls will be included. These are $Income_{irt}$ and $Income\ of\ Partner_{irt}$. A variable for governmental family support denoted $Family\ Government\ Support_{irt}$[17] will also be

[16] Region fixed effects are on the lowest level possible, which is in our case the eight monitoring regions.
[17] Numeric variable measure describing the state family subsidy received in the respective year.

added in this phase. All three variables are reported as annual levels in Swiss Francs (CHF) and have been rescaled by dividing them by 10,000 to observe unit changes in tens of thousands of francs.

In the sixth (M6) model, four control variables related to the relationship will be added. These variables are $Non-marital\ partnership_{irt}$, which is a dummy variable for women in the panel that are not married, signifying a 1 if the woman has a partner 0 otherwise. $Non-marital\ cohabitation_{irt}$ is a dummy variable with 1 if the woman has a partner and live together and 0 otherwise. $Married_{irt}$ is a dummy variable defined as 1 if the woman is married and 0 otherwise. $Marital\ cohabitation_{irt}$ is a dummy variable labeled as 1 if the woman is married and lives with her partner and 0 otherwise. All of the relationship dummy variables are mutually exclusive, meaning that for a given year, a woman can not belong to more than one of the four groups. If the woman does not have a partner at all, no relationship variable will be labeled as a 1 to her.

These relationship variables will be interacted on $Quality_{irt}$ defined as the quality of the relationship. The quality of the relationship is calculated by the sum of the variables $Practical\ support_{irt}$ and $Emotional\ support_{irt}$, which are rated on scales 0-10 divided by the total possible support, 20. Practical support refers to support from a partner for example when the woman is sick, taking them to the doctor or providing them with advice when problems arise. Emotional support is defined as the extent to which a partner shows availability and understanding, for example, by talking (SHP Group, 1999). Quality is defined as follows:

$$Quality_{irt} = \frac{Practical\ support_{irt} + Emotional\ support_{irt}}{20}$$

At last, the seventh model (M7) includes remaining variables that determine fertility such as Age_{irt}, $Number\ of\ children\ born_{irt}$, defined as the existing children a woman has, $Number\ of\ children\ wanted_{irt}$, which is a variable describing the overall intention of an individual to have children. Furthermore, $Usual\ weekly\ hours\ worked_{irt}$, which is the amount of hours the individual works per week (Lipps & Kuhn, 2023), $Usual\ weekly\ hours\ worked\ partner_{irt}$, and $Wanting\ to\ move_{irt}$, denoted on a scale 0-10 with how willing the individual is to move out of her current accommodation will be included.

In more detail, the model can be summarized as follows:

(2) $$Conception_{irt} = \beta_0 + \beta_1 \Delta HI_{rt-(t-1)} + \beta_2 \Delta HI_{r(t-2)-(t-5)} + \beta_3(Years\ of\ Education_{irt}) + \beta_4(Family\ Government\ Support_{irt}) + \beta_5(Annual\ Income_{irt}) + \beta_6(Annual\ Income\ of\ Partner_{irt}) + \beta_7(Non-marital\ partnership_{irt} \cdot Quality_{irt}) + \beta_8(Non-marital\ cohabitation_{irt} \cdot Quality_{irt}) + \beta_9(Married_{irt} \cdot Quality_{irt}) + \beta_{10}(Marital\ cohabitation_{irt} \cdot Quality_{irt}) + \beta_{11}(Number\ of\ children\ wanted) + \beta_{12}(Age) + \beta_{13}(Usual\ weekly\ hours\ worked_{irt}) + \beta_{14}(Usual\ weekly\ hours\ worked\ partner_{irt}) + \beta_{15}(Wanting\ to\ move_{irt}) + a_r + \tau_t + \varepsilon_{irt}$$

To understand the characteristics and distribution of the different variables in our dataset, we include a set of summary statistics. These include measures of location, mean and median values as well as measures of spread, minimum values, maximum values, and standard deviation.

Table 2 – Owners

SUMMARY STATISTICS OWNERS

Variable	Min	Mean	Median	Max	SD	Observations
Conception	0.00	0.033	0.00	1.00	0.178	17411
Price	96.24	126.640	119.76	267.07	27.260	17411
ΔPrice	-10.23	3.240	3.09	26.66	3.410	17411
ΔPrice t-2 - t-5	-13.70	18.710	18.47	91.18	12.210	17411
Education	0.00	12.770	12.00	21.00	3.720	17411
Income	0.00	2.970	1.62	149.70	4.180	17411
Income of Partner	0.00	6.460	1.90	413.26	10.570	17411
Family State Support	0.00	0.040	0.00	2.52	0.160	17411
Usual Weekly Hours Worked	0.00	17.670	17.00	100.00	16.420	17411
Wanting to move 1-10	0.00	0.950	0.00	10.00	2.500	17411
Quality	0.00	0.540	0.75	1.00	0.420	17411
Non-marital Partnerhsip*Quality	0.00	0.080	0.00	1.00	0.240	17411
Non-marital Cohabitation*Quality	0.00	0.050	0.00	1.00	0.210	17411
Married*Quality	0.00	0.000	0.00	1.00	0.020	17411
Marital Cohabitation*Quality	0.00	0.430	0.50	1.00	0.430	17411
Usual Weekly Hours Worked Partner	0.00	8.780	0.00	100.00	13.900	17411
Number of Existing Children	0.00	1.030	1.00	7.00	1.180	17411
Age	20.00	34.760	37.00	45.00	8.330	17411

[a] Observations include all homeowning women aged 20-45 that were reported in at least one year during the period 1999-2019.
Price, ΔPrice and ΔPrice t-2 - t-5 are adjusted for inflation using the Swiss CPI.
Education in years of education. Relationship variables are reported with quality interacted on them.
Income and Family Support variables are annual in 10 000 CHF. Wanting to move scaled on a 0-10 scale, 10 indicating high willingness to move.
Source: SHP Group - FORS & Swiss National Bank. Interacted relationship variables, derived by the authors.
Table: Authors own.

Table 3 – Renters

SUMMARY STATISTICS RENTERS

Variable	Min	Mean	Median	Max	SD	Observations
Conception	0.00	0.055	0.00	1.00	0.228	23731
Price	99.67	122.620	120.87	209.14	19.870	23731
ΔPrice	-11.05	1.500	1.66	18.33	3.140	23731
ΔPrice t-2 - t-5	-30.50	11.350	11.54	59.11	10.850	23731
Education	0.00	12.950	12.00	21.00	4.060	23731
Income	0.00	3.970	3.69	240.00	4.260	23731
Income of Partner	0.00	4.210	0.00	868.48	8.700	23731
Family State Support	0.00	0.030	0.00	5.00	0.140	23731
Usual Weekly Hours Worked	0.00	23.260	28.18	97.00	17.930	23731
Wanting to move 1-10	0.00	2.080	0.00	10.00	3.410	23731
Quality	0.00	0.490	0.70	1.00	0.440	23731
Non-marital Partnership*Quality	0.00	0.100	0.00	1.00	0.270	23731
Non-marital Cohabitation*Quality	0.00	0.160	0.00	1.00	0.340	23731
Married*Quality	0.00	0.000	0.00	1.00	0.030	23731
Marital Cohabitation*Quality	0.00	0.260	0.00	1.00	0.400	23731
Usual Weekly Hours Worked Partner	0.00	9.530	0.00	90.00	15.820	23731
Number of Existing Children	0.00	0.610	0.00	6.00	0.960	23731
Age	20.00	32.670	33.00	45.00	7.180	23731

[a] Observations include all women renters aged 20-45 that were reported in at least one year during the period 1999-2019.
Price, ΔPrice and ΔPrice t-2 - t-5 are adjusted for inflation using the Swiss CPI.
Education in years of education. Relationship variables are reported with quality interacted on them.
Income and Family Support variables are annual in 10 000 CHF. Wanting to move scaled on a 0-10 scale, 10 indicating high willingness to move.
Source: SHP Group - FORS & Swiss National Bank. Interacted relationship variables, derived by the authors.
Table: Authors own.

As can be seen by the two tables, the conception rate – mean conception, varies between owners and renters. For owners, the annual conception rate is 3,3 percent, and for renters 5,5 percent. One possible explanation for this could be the slightly higher mean and median for age in the owner dataset, suggesting that the owner dataset contains slightly older women, and with age, it is possible that conception decreases. Referring to *Figure 1* and *Figure 2*, most conceptions take place between the ages 27-36. The conception rates are similar to those reported by (Lovenheim & Mumford, 2013) where the conception rates for owners and renters are approximately 5 percent. In (Liu et al. 2023), the conception rate is slightly larger at 9,2 percent.

The variation in the price is substantial for both ownership groups during the studied period 1999-2019, which would suggest that prices have changed a lot during the period. This can additionally be seen graphically by observing *Figures 3 and 4* in section *4.2.3 Consumer Price Index (CPI)* above.

The price change variables for periods t and $t-1$ as well as $t-2$ and $t-5$ are to be expected. No greater deviation can be found between the mean and median values suggesting that outlier values are not driving the measures of location.

Variation is clear by observing the income variables, where higher incomes drive up the mean values, which can be observed by the great differences between the mean and median values of the income variables for both ownership groups.

Furthermore, the median years of education is 12 years, converting to a primary and high school education. The median renter in the data has an annual income[18] of 36,900 CHF and for owners 16,200 CHF (all years taken into account even when respondents do not earn any money at all). The variation in income is also greater for homeowners, suggesting that income across homeowners varies more than for renters. We also observe that the income of the partner, whenever it is applicable is larger in an ordinary case comparing median to median between the two groups. This indicated to include that variable as a control, so that we have a better understanding of the household income.

The quality of the relationships appears to be similarly high for both groups. In this case, the median is a more suitable measure than the mean, since the mean includes values of quality that are 0 which in that case include women that are not part of a relationship at all. The quality of the relationships suggests that relationships in Switzerland are on average very good, or that people tend to have the opportunity emotionally, practically, and financially to exit one whenever it takes out more than gives.

5.2 Discussion of Methodology

5.2.1 Variables Included and Hierarchical Linear Regression

We included variables that are, first, aligned with our research question and, second, relevant to our dependent variable: fertility, and conception. Socioeconomic factors, personal characteristics, and relationship variables are associated with fertility (Adhikari, 2010), thus the inclusion of income, family, partnership, and personal variables, is explained in depth above.

In our presentation of results, we display various models with an increasing number of included variables, based on a comparison method, called hierarchical linear regression (B. Kim, 2016). We do

[18] Our income variables have no net/gross considerations.

this to observe and present the robustness of results, through the potential changes to coefficients and statistical significance. Although some suggest quantitative methods to evaluate variable dominance and the order of variable introduction (Budescu, 1993), we decided to base our order on theoretical relevance to our research question.

As our theory relies on cost and wealth effects, we include the variables that determine the financial situation first. Current education level was introduced first as it highlights the potential wage in future years[19], in the time, when costs would be associated with the child to be born. Second, we introduce the variables that directly describe the available resources earned in the respective year, similarly relevant to our research question. After these steps, we include variables that are in descending relevancy to fertility intent. Relationship, which is to a certain extent necessary for conceptions, given its biological requirements, and then finally personal and other characteristics associated with fertility intent.

5.2.2 Fixed vs Random Effects

The SHP is a longitudinal data source observing individuals and households over time, combining cross-sectional and time-series data, enabling it to deal with unobserved heterogeneity (Stock & Watson, 2020). Controlling for unobserved variables could be achieved through random effects or fixed effects. The latter can include both group-fixed effects – variables that do not change over time but across groups, and time-fixed effects – variables that change over time but not across groups (Torres-Reyna, 2007). Whilst fixed effects imply that the variation across groups depends on characteristics within the groups, the random effects model assumes that the variation is random (Torres-Reyna, 2007). Group fixed effects can be defined in various ways and at different levels, such as entity level or geographical regional level.

To determine the usage of fixed effects or random effects mathematically, a Hausman test was conducted (Princeton University Library, n.d.) suggesting the usage of fixed effects[20]. In this case, we make use of regional fixed effects since the price levels of housing and rents are at the monitoring region level.

5.2.3 The Linear Probability Model

Examining the likelihood of conception each period can only have two outcomes; to have a child or not to have a child. There are three main models used for estimating a regression with a binary dependent variable, the linear probability model, logit, and probit model (Stock & Watson, 2020). The linear probability model has been supported in previous panel studies on housing and fertility, used by Lovenheim & Mumford (2013), Liu et al. (2023), and Atalay et al. (2021).
Clark & Ferrer (2019) preferred the logit model because the proportion of giving birth was small. When the probability of the endogenous variable of interest is between 0.2 and 0.8, the linear probability model produces similar results to a logit model, but if the probability is not within these values, the logit model could be more robust (*Logistic Regression vs the Linear Probability Model*, 2018). The linear probability model could also be prone to results outside the scope, $y < 0$ and $y > 1$ (Dustan, 2010). However, the

[19] Theory strongly suggests that education yields "education premium" resulting in higher wages (Karasiotou, 2012).
[20] See Results of Hausman test in the appendix D.

coefficients of the logit model are more difficult to interpret because they represent log-odds and not direct probabilities.

As the linear probability model is the main theoretical framework used in previous papers on the subject, the model can be perceived to be legitimately accepted despite some of the shortcomings described above. In addition, the choice of the linear probability model would enable a greater effective comparison across studies and thus across countries. Furthermore, an advantage of the model is the interpretability of its results, where the coefficients of the model represent the probability of the dependent variable being equal to 1 (Stock & Watson, 2020).

5.2.4 Heteroscedasticity and Autocorrelation

The assumption of homoscedasticity is violated in linear probability models (Dustan, 2010), due to the binary endogenous variable. This violation was additionally confirmed by the results of the Breusch-Pagan test[21], suggesting the presence of heteroscedasticity in the model which means that homoscedasticity-only standard errors are inappropriate (Stock & Watson, 2020). To address heteroscedasticity, we employ heteroscedastic robust standard errors (Dustan, 2010) when computing our model output.

More specifically, we employ clustered standard errors, a type of robust standard errors accounting for heteroscedasticity across clusters of observations, commonly used in panel data analysis. The clustering aims to account for the variation of the errors between the defined groups, in our case where our observed individuals are residing. In our model, we cluster the errors at the pricing level and locality level. The housing price for homeowners is obtained through the housing index at the monitoring region level, in which all homeowning women each year and region are assigned with the same housing price index. The SHP additionally reports two variables on the locality of residence for each individual, called community typology 1 and 2. The difference is that typology 1 is divided into 21 groups and typology 2 is divided into 9 groups. We choose to cluster based on "artificial clusters" generated by the help of community typology 2[22]. For the models, where the price and rent changes were observed in monitoring region, we created 72 clusters for owners from 8 regions with 9 respective community typologies.

For the models where price changes were aggregated based on the SHP data, we cluster on the level of treatment, which is based on community typology 2, but, here instead of the 8 monitoring regions, we cluster at a lower geographical level, cantonal level. As there are 26 cantons in Switzerland, this would create 234 clusters for renters. To clarify, our methodology in this case was to calculate the median price change per artificial region that were created based on the canton and the community typology. As rent changes are on this level, we accordingly cluster on this level.

This method of clustering for both groups is supported by the assumption that individuals' conception probabilities are more correlated with each other within a geographic group than across geographic locations. The assumption can be explained by factors that can differ across regions, such as infrastructure development, quality of education, different family support policies, level of safety, distance from employment opportunities, language – and with that – culture et cetera. We find support for this assumption through (Cameron & Miller, 2015, p. 17), where if it is believed that the errors or

[21] See Results of the Breusch-Pagan test in appendix E.

[22] Types of community typologies (Community typology 2) can be found in the appendix G.

regressors are likely to be correlated within a potential group, it could be useful to cluster within that group. Additionally, according to (Cameron & Miller, 2015, p. 25), there is no clear definition as to how many clusters are too few. In general terms, the minimum can be said to vary between 20-50 clusters. The two main problems related to too few clusters are the risk of overfitting and over-rejection (Cameron & Miller, 2015).

Considering potential issues related to the presence of autocorrelation, we performed which was detected Woolridge/Breusch-Godfrey test on the model with all control variables used. In an early model, a variable called *Children wanted in the next two years*. However, since this variable was driving autocorrelation in the model, this variable was left out to avoid issues related to autocorrelation[23].

5.2.5 Variables Description and Multicollinearity

Instead of defining the time of birth as the endogenous variable as in Lovenheim & Mumford (2013) and Liu et al. (2023), we derived the time of conception as the response variable. Using the time of conception rather than birth date enables for the possibility to observe the control variables at the time of conception rather than observing lagged control variables at the time of birth. Observing the control variables at the time of conception allows us to investigate the circumstances of the decision of when to have a child. If the value of control variables were those during the time of birth, they are likely to have changed since the conception, due to the approximate nine months pregnancy period between conception and birth.

The conception was estimated by deducting nine months from the reported birth of the child. In the SHP, the birth of each child was reported by the year and month, but not on the exact day of birth. Nine months was used as an approximation, being the average pregnancy period from conception to birth (Why Is 40 Weeks so Important? n.d.). Since the conception was derived from the reported birth year and month, factors influencing whether a child was born or not during the pregnancy period could be ruled out. Such factors could have been stillbirths or abortions. A potential issue, however, could be adoptions. In such a case, the decision to have a child could not be traced to the approximate time of conception. However, if the adoption takes place when the children are infants or toddlers, the decision to adopt and the birth date of the adopted child is considerably close. On the other hand, children could be adopted at various ages. But all in all, considering the whole of Switzerland, adoption can be perceived as a rare phenomenon in relation to births. In Switzerland, adoptions yearly are approximately 500 each year (BFS, n.d.), whereas annual births are approximately 80,000 each year (FSO, 2023a). Regarding the random sampling of households part of the SHP, the effect of potential adoptions on the outcome can therefore be assumed to be insignificantly influential.

Another issue that could arise with a binary dependent variable for conception could be occasions upon which conception occurs twice in one year. For example, if a woman was conceived early in the calendar year it could occur that she becomes conceived again by the end of the same calendar year after giving birth earlier that year. Given that the woman already conceived earlier that calendar year, the model is unable to capture the second conception.

The housing index is defined at the ownership and monitoring regional level for every year. As opposed to Lovenheim & Mumford (2013) and Liu et al. (2023) who exploits individual yearly self-reported housing values by the respondents from their respective datasets, we have used an annual regional

[23] Results of the Breush-Godfrey test can be found in the appendix F.

housing price index, meaning that individual changes in housing wealth cannot be captured, rather the regional levels are applied to all households in a region every year. Similarly, this was a challenge in (Clark & Ferrer, 2019) in which regional mean housing price values were applied to all households in a certain area, as a substitute for yearly self-reported housing values. On the one hand, using housing price levels at the regional level could be problematic, because housing prices could go up in one area of the region and decrease in another. However, although such fluctuations are not captured at an individual household level, the indexes are representative of the region as a whole.

The reason for using the change in the housing and rental index rather than yearly numeric values for the main model is to examine the change in a household's resources between the two periods (Liu et al. 2023). The change in the housing index represented by index units denotes the variation in regional household resource levels. We make use of several lags in housing index changes to account for the possibility that the effects of changes in housing prices do not occur directly and that small yearly changes do not alter considerations of having a child.

When evaluating which controls to include in the model, consideration was placed on potential multicollinearity issues. To address this, we performed a set of VIF tests[24], showing that our variables do not possess a high degree of multicollinearity. When the VIF test signifies a value higher than 5 to 10 multicollinearity is present (Kim, 2019), if a VIF test shows a value above 10, the multicollinearity is high and can be a problem. However, small to moderate levels of multicollinearity are usually not an issue (Siegel, n.d.). As can be concluded by the VIF tests, the variables do not possess high multicollinearity.

Despite no multicollinearity issues being detected from the results of the VIF tests, the independent variables in the model are not perfectly uncorrelated, also defined as orthogonal. Orthogonality among the independent variables is very unlikely for observational data and occurs most often for balanced designed experiments (Hastie et al. n.d.).

When determining the order to add the controls into the model, consideration was placed on including variables with lower correlation with conception early in the model. This is because the controls added earlier will affect the coefficients added to the model later. This way, we would be able to observe how much of the variation the control variables would capture in the main coefficient of interest, β_1. For example, it is presumably likely that relationship status and health of a relationship will have a greater correlation with conception compared to the years of education. Similarly, the number of children wanted will likely have a greater effect on conception than controls added earlier.

5.2.6 Unbalanced Panel

Due to attrition and additional waves added in the SHP throughout the studied period, the number of women in the defined age group 20-45 varies from year to year. Although this variation is not sufficiently large[25], the dataset can per definition be classified as an unbalanced panel (Torres-Reyna, 2007).

Before moving on to the interpretation of the results of our model, it is important to consider the drivers of the dropouts, and whether the attrition is correlated with having children. For example, if a woman

[24] Results can be found in the appendix J.
[25] The yearly participants in each year for owners and renters can be found in the appendix B.

in our defined sample aged 20-45 is surveyed in one period and does not respond to the survey in the subsequent period because she has gotten a child. This reasoning is described in (Voorpostel & Lipps, 2011) in which children arriving at a household could cause less participation in surveys in general because of time limitations and lower levels of interest. Among other drivers of attrition, (Voorpostel & Lipps, 2011) find support in the Swiss Household Panel during 1999-2004 that that the "arrival of children" in the household could have a negative effect on the response rate and increase the likelihood of dropping out.

To cope with this issue, we could have possibly subsetted the dataset and only observed women present throughout the whole period of 1999-2019, which would come at the expense of discarding a lot of observations. Other ways include reconstructing the missing observations to obtain a balanced panel (Biørn et al. 2016). Assuming that women potentially drop out of the survey due to them having children aligned with (Voorpostel & Lipps, 2011) would suggest that the conceptions in our dataset are underrepresented which could lead to underestimated results.

6. Empirical Results

6.1 Homeowners

Effect of price changes on fertility rates | owners

	Dependent variable:						
	Conception						
	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)	(M7)
Δprice t-1	.0001 (.0005)	-.0005 (.0008)	-.0015* (.0009)	-.0016* (.0009)	-.0016* (.0009)	-.0016* (.0009)	-.0016* (.0009)
Δprice t-5 to t-2			.0011*** (.0004)	.0011*** (.0004)	.0011*** (.0004)	.0010*** (.0003)	.0010*** (.0004)
Years of Education				.0023*** (.0005)	.0016*** (.0005)	.0013** (.0005)	.0012** (.0005)
Family government support					-.0186*** (.0061)	-.0270*** (.0059)	-.0048 (.0061)
Annual income					.0015*** (.0006)	.0010* (.0005)	.0019*** (.0007)
Annual income of partner					.0005*** (.0001)	.0001 (.0001)	-.0003* (.0002)
Partner (not living together)						-.0227*** (.0039)	-.0366*** (.0044)
Partner (living together)						.0349*** (.0119)	.0327*** (.0117)
Married (not living together)						-.0257*** (.0056)	-.0156 (.0138)
Married (living together)						.0276*** (.0050)	.0373*** (.0069)
Number of kids born							-.0144*** (.0020)
Number of children wanted							.0056*** (.0013)
Age							-.0027*** (.0003)
usual weekly hours worked							-.0002** (.0001)
usual weekly hours worked for partner							.0008*** (.0001)
Wanting to move (1-10)							-.0028*** (.0007)
Constant	.0324*** (.0025)	.0362*** (.0068)	.0527*** (.0079)	.0234** (.0095)	.0263*** (.0094)	.0186** (.0093)	.1062*** (.0102)
Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,462	16,462	13,414	13,414	13,414	13,414	13,414
R^2	.000001	.0019	.0035	.0056	.0077	.0136	.0360
Significance levels							*p<0.1; **p<0.05; ***p<0.01

NOTE 1: Income and subsidy variables are in 10'000 CHF | NOTE 2: Four partnership dummies have been interacted with quality

Note: Regression output for homeowners. Price change for period t-1 to t as well as t-5 to t-2. The drop in observations from M3 and onward is due to the change in price from t-5 to t-2 for the early years undefined with regards to the period 1999-2019. Standard errors clustered at "Cluster 2" which is based on monitoring region and community typology2.

In our regression output above we present and provide seven distinct models to evaluate the impact of housing prices on the likelihood of conception for homeowners. The initial model only considers the price change without any control or fixed effect variables, to establish a baseline effect. Subsequent models introduce more variables and controls in an increasing manner.

We find that changes in housing prices between the current period and the previous period ($t \; and \; t-2$) negatively affect the probability of conception for homeowners in Switzerland. According to model (M7), one unit increase in the change of housing index for time period $t-1$ to t is associated with a decrease in the likelihood of conception by 0.0016, or 0.16 percentage points. With regards to the baseline conception rate of 0.033 in the dataset for owners as presented in Table 1, the decrease of conception in percentage terms is approximately 4.8 percent (0.0016/0.033≈0.04848).

The coefficient is significant at the 10 percent level and the deviation of the coefficient magnitude across the models is small, thus suggesting that earlier models with less control specifications also support the presence of a negative relationship. More specifically, the coefficient of the $\Delta Price_{t-(t-1)}$ is statistically significant at the ten percent level in model three (M3) and onwards.

Compared to the most recent price changes, a positive relationship can be observed for the price change from $t-5$ to $t-2$. Similarly, to the coefficient for $\Delta Price_{t-(t-1)}$ the variation in magnitude of the coefficient for $\Delta Price_{t_{-2}-t_{-5}}$ is low, and it remains statistically significant at the one percent level in all

models. In model seven (M7) we observe that one unit increase in the change in housing index for the period $t-5$ to $t-2$ is associated with a 0.0010 increase in the probability of conception.

Years of education, which is measured based on the International Standard Classification of Education (ISCED) (SHP, codebook) is positive and significant in all models. In model seven (M7) an additional year of education increases the probability of conception by 0.0012 or 0.12 percentage points.

Regarding the income variables, family government support is statistically significant at the one percent level in (M5) and (M6) but is statistically insignificant in (M7) – the p-value is above ten percent. The negative coefficient would suggest that an additional 10,000 CHF in family support would decrease the probability of conception by 0.0048 or 0.48 percentage points. The annual income of the woman is positive and statistically significant at the one percent level in (M5) and (M7) whereas at the ten percent level in (M6). In (M7) a 10 000 CHF increase in annual income would increase the probability of conception by 0.0019 or 0.19 percentage points. The coefficient of the income of the partner can be interpreted similarly, but in this case, the magnitudes, direction, and statistical significance vary across the models.

The relationship variables suggest that the probability of conception is greater if the partners live together, both for women who are married and women who are not married (but in a relationship). Accordingly, if partners do not live together, the effect on the likelihood of conception is negative for both married and non-married women. All variables provide significant results in both models at the one percent level, excluding married women who do not live together, which is statistically insignificant in the last model (M7). When interpreting the relationship variables, consideration must be placed on the interaction on the relationship dummy variables and the interaction of the quality of the relationship.

The remaining controls number of kids born, referring to the number of existing children is statistically significant at the one percent level with a negative coefficient (M7). Assuming a linear relationship the probability of conception decreases by 0.0144 or 1.44 percentage points for every child that had been born before conception. Number of children wanted is also statistically significant at the one percent level, but in this case the coefficient is positive, the willingness to have one additional child is thus associated with a 0.0056 or 0.56 percentage points increase in conception.

Age and usual hours worked each week both have negative coefficients that are statistically significant at the one and five percent level respectively. A one-year increase in the age of the woman would imply a 0.0027 decrease in the probability of conception and for usual weekly hours worked, an additional hour worked would decrease the probability of conception by 0.0002. Comparably, usual weekly hours worked by the partner have a positive effect on the likelihood of conception, an additional hour of work would suggest an increase of conception by 0.0008 or 0.08 percentage points. Wanting to move has a negative coefficient and rating this intention to move one digit higher signals the decrease in probability of conception by 0.0028 (0.28 percentage points).

With regards to the standard errors of the coefficients, they are generally small but for coefficients in some models such as Family State support in M7 or the relationship variables, the standard errors are a bit larger. The output for the R-squared is low in all models, but the R-squared also functions insufficiently for linear probability models.

6.2 Renters

Effect of price changes on fertility rates | renters | Wüest partner rent index

	Dependent variable:						
	Conception						
	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)	(M7)
Δrents t-1	-.0008 (.0005)	.0002 (.0006)	.0006 (.0005)	.0005 (.0005)	.0005 (.0005)	.0003 (.0005)	.0004 (.0005)
Δrents t-5 to t-2			-.0002 (.0003)	-.0001 (.0003)	-.0001 (.0003)	-.0002 (.0003)	-.0002 (.0003)
Years of Education				.0035*** (.0005)	.0027*** (.0006)	.0020*** (.0005)	.0012** (.0005)
Family government support					-.0160* (.0089)	-.0315*** (.0083)	.0119 (.0092)
Annual income					.0010** (.0005)	.0004 (.0005)	.0021*** (.0007)
Annual income of partner					.0014** (.0007)	.0004 (.0003)	-.0001 (.0001)
Partner (not living together)						-.0210*** (.0035)	-.0318*** (.0036)
Partner (living together)						.0374*** (.0065)	.0120* (.0065)
Married (not living together)						.1728* (.1018)	.1604 (.0994)
Married (living together)						.0907*** (.0065)	.0849*** (.0073)
Number of kids born							-.0248*** (.0025)
Number of children wanted							.0073*** (.0015)
Age							-.0015*** (.0003)
usual weekly hours worked							-.0006*** (.0001)
usual weekly hours worked for partner							.0009*** (.0001)
Wanting to move (1-10)							.0020*** (.0004)
Constant	.0561*** (.0025)	.0809*** (.0085)	.0548*** (.0066)	.0101 (.0094)	.0128 (.0093)	.0007 (.0086)	.0585*** (.0139)
Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,114	22,114	17,717	17,717	17,717	17,717	17,717
R^2	.0001	.0021	.0021	.0055	.0093	.0313	.0483
Significance levels							*p<0.1; **p<0.05; ***p<0.01

NOTE 1: Income and subsidy variables are in 10'000 CHF | NOTE 2: Four partnership dummies have been interacted with quality

Note: Regression output for renters. Price change for time period t-1 to t as well as t-5 to t-2.. The drop in observations from M3 and onward is due to the change in price from t-5 to t-2 is for the early years undefined with regards to the period 1999-2019. Standard errors clustered on cluster 2 level that is based on monitoring region and community typology 2.

The table above presents the findings from the estimated model for women renters. The results show a positive relationship between changes in rents in time periods t and $t-1$ and a negative relationship is observed for changes between $t-2$ and $t-5$. According to the table, a one index unit increase in the change of rent in the most recent period would imply a 0.0004 (0.04 percentage point) increase in the probability of having a child (M7). With regards to the average conception rate in the sample for renters presented in Table 2, at 5.5 percent, one index unit increase in the change of rents decreases the likelihood of conception by (0.0004/0.055≈0.00727) 0.73 percent. We also observe that the standard deviation is also greater than the coefficient. Compared to the results for owners, the coefficients for the price variables on renters are statistically insignificant.

Years of education are positive and statistically significant at the one percent level in (M4)-(M6). In (M7) the statistical significance is at the five percent level.

The coefficients of the income variables are mainly positive, excluding the annual income of partner in (M7), which is negative. Annual income is significant at the one percent level in (M7) and the five percent level in (M5). The annual income of the partner is not statistically significant in (M7) and has a negative magnitude.

Similarly, to the results for homeowners, the coefficients of interacted relationship variables are statistically significant. For non-married women, not living with their partner has a negative effect on fertility, and living with their partner has a positive impact. For married women, both living together and not living together with their spouse have a positive effect on the likelihood of conception. The coefficient estimates are also statistically significant.

Aligned with the results for owners, the number of existing children has a negative effect on the probability of conception and the number of children wanted has a positive effect. Age is also negative and statistically significant for renters. Compared to the results for owners, wanting to move has a positive effect.

7. Discussion

In this section, we start by interpreting the results for owners complemented by an exploratory discussion of the reasons behind them with similar steps carried out regarding renters. This is followed by a thorough look at concerns on causality. Finally, we dedicated a section to place our findings within the existing research landscape.

7.1 Interpretation of Results

7.1.1 Homeowners

The price change coefficient results for homeowners are unaligned with the formulated hypothesis, where a positive relationship was to be expected between changes in housing prices and the conception probability. The results are also statistically significant at the ten percent level, indicating that the effect is unlikely to have occurred by chance and that there is a real effect (Gallo, 2016). The negative relationship differs from the findings in previous papers on developed countries and would theoretically suggest that the negative cost effect is greater than the wealth effect. On the other hand, the results of the price between t-2 and t-5 suggest that the wealth effect could be present, but in that case, delayed.

We find two distinct approaches that provide us with the framework to provide a more in-depth explanation for our results. First, we explore the characteristics of cost and wealth effects in Switzerland and second, we take a closer look at the necessity of new housing as a basis of divided analysis.

With regards to the idea of the wealth and cost effect, Lovenheim & Mumford (2013) describe an ongoing debate among economists as to the impact of housing wealth on the allocation of a household's resources. For example, whether housing wealth has any effect on savings, consumption, and education. In detail, the debate is as follows. On the one hand, housing wealth is described as an important source of household wealth in (Helfer et al. 2023) and housing costs are one of the largest parts of household and child-rearing spending. On the other hand, realizing housing wealth without selling the home and "cashing out" – an expression used by Dettling & Kearney (2014) – could be difficult as pointed out in Lovenheim & Mumford (2013). It can furthermore be stated that the process of cashing out is also difficult, or at least requires time, including finding a new suitable home, selling the home, and the process of moving. In that case, the cost of time to cash out is also a consideration part of the process.

The idea of realization of housing wealth through "cashing out", implies that people would sell their accommodation and move to a lower-priced housing market (Dettling & Kearney, 2011). One potential explanation for our regression results is that in Switzerland, people tend to stay put once they have bought a house or an apartment (Jaberg, 2022). A comparison is made to France where moving to new housing is more frequent and dependent on the location of a person's workplace, Swiss people generally prefer to stay put and commute longer to work rather than moving (Jaberg, 2022). Additionally, homeowners in Switzerland are cautious about selling because of the risk that they will not find a house of similar standard for a similar price (Jaberg, 2022). Finally, of those people who do move, only a quarter of those who do move do so to find more suitable housing (Zufferey, n.d.). In such case, cashing out could be rather uncommon in Switzerland, due to the Swiss being reluctant to move, making it difficult to realize potential wealth gains as a homeowner from increasing prices, providing a potential explanation for the negative results.

Despite our findings of a negative relationship between housing prices and the likelihood of having a child are unaligned with research in developed countries, the findings align with (Liu et al. 2023) results

in China. Liu et al. (2023) also find evidence that the negative cost effect differs between women with smaller and larger areas of housing, showing that women with smaller accommodation are more negative to increases in housing prices on the likelihood of having a child. This brings us to our second explanation of results, which is based on the housing need distinction. We investigate these possibilities and create two subsets from the original homeowner data used in the model presented in (6.1) based on how homeowners viewed their accommodation, an additional variable part of the dataset labeled as a binary variable, either the respondent viewed their accommodation space as small or not. Homeowners who viewed their accommodation as small were placed in one dataset and homeowners who viewed their accommodation space as sufficient were placed in another group[26].

In these results, we observe that the negative relationship is driven by the homeowners who view their accommodation as small compared to those who view it as sufficient. This is likely due to the perceived small accommodation making it more difficult to facilitate living space for additional people in the house, therefore having a negative effect on conception, aligned with the negative cost effect described in Liu et al. (2023). In these outputs, we observe that the effect of housing price changes between t-1 and t increase to about four times as high as in the output presented in (6.1). Important to note that the dataset on women living in housing which is perceived as small by them, contains considerably few observations, so the results here are not as robust as in our main outputs. However, ruling these individuals out of the larger dataset despite being few, our main independent variable loses its significance. Even where the significance was retained, the magnitude shrank. These findings give support to our assumption about the housing size reasoning behind our findings of owners, but further research ought to be put into this field to determine the reasons for our findings decisively.

Similarly, to how previous literature has suggested negative relationships between income and fertility and of the quality and quantity trade-off, it could be possible that if homeowners in Switzerland could realize wealth gains from increasing prices, that this additional wealth is attributed to the quality of their children rather than quantity. In our study, we have investigated conception, derived from the quantity of births and thus focusing on how housing price changes relate to the quantity of children meaning that drivers related to quality could be a suggestion for future research.

7.1.2 Renters

As with the results for owners, the results for renters are unaligned with the hypothesis, where a negative relationship between the latest price change and conception was to be expected. Instead, the coefficient for the change in rents from t-1 to t is positive in all but the first model (M1). However, the results are statistically insignificant in which it cannot be ruled out that the results occurred by chance (Gallo, 2016). Aligned with the price effect, the results for the change in rents from previous periods are statistically insignificant but negative, decreasing the probability of having a child in the current period.

With the unexpected results for renters, we attempted to make use of the self-reported annual rent variable in the SHP. A drawback of this self-reported rent was that it was not reported by all renters every year. From the individual women who had reported yearly rents, we computed the two different price change variables. In the case of no renting price reported, the median change in renting price for the period was applied to these renters. Exploiting this median annual rent enabled clustering at the canton and community typology level compared to the monitoring region level for the housing prices.

[26] Results can be found in appendix H.

The identical model was run as for the output above but on the self-reported rents and median change in rents[27].

The results of this model similarly reported insignificant results for the estimated price change coefficients. In the new model output, the recent price change in rent was negative and the rental price change between t-2 and t-5 was estimated to be positive. The inconsistency and opposing magnitudes of the respective coefficients in these outputs make it difficult to draw any conclusions as to a relationship between renting prices and fertility, which is further strengthened by the statistical insignificance of the coefficients in both models.

7.2 On Causality

When addressing causality concerns it is important to consider the risk of endogeneity in our model. A type of endogeneity is reverse causality, meaning in our case the risk that conception could explain the changes in housing and renting prices. Liu et al. (2023) alongside Atalay (2021) raise concerns of endogeneity based on the individual self-reported housing values in their data, which could cause measurement errors and thus attenuation bias.

Previous papers have dealt with these risks in different ways. To deal with potential measurement errors Atalay (2021) employs an instrument on self-reported housing values using the median housing prices at the local government area (LGA)-level. Individual households are not assumed to be able to influence the local housing market as a whole, and therefore the LGA median housing prices are viewed as independent of fertility choices. The measurement error issue and risks of endogeneity attributed to individual self-reporting of housing prices are not thought to be a major concern in our modulation since the SHP does not report such values. In our case, we did not take advantage of such an instrument due to reporting inconsistencies, but the use of indexes from monitoring regions account instead of individual data addresses this type of endogeneity. Similarly, to Atalay (2021), it is unlikely that individual home price changes have a significant marginal effect on the housing index for each monitoring region.

Other ways of coping with the risks of endogeneity include implementing a similar instrumental variable to Dettling & Kearney (2014) and (Liu et al. 2023) based on regulatory and geographical land constraints. The papers use the findings of Saiz (2010 & 2012) in the United States where cities with constrained geography were found to have lower housing supply elasticity. This would imply that geographical constraints would affect housing prices and rents, fulfilling the relevance condition of an instrument. In addition, the geographical constraints in (Dettling & Kearney, 2014) and (Liu et al. 2023) are assumed to be uncorrelated with fertility, thus fulfilling the second assumption of a valid instrument – exogeneity.

Similarly, we therefore attempted to implement an instrument in terms of land cover in Switzerland, which can be divided into four main groups, settlement and urban areas, agricultural areas, wooded areas, and unproductive areas (Schubarth et al. 2013). Settlement and urban areas are areas referred to as areas for housing and residence. Across Switzerland, 90 percent of new settlements and urban areas are from areas that have previously been agricultural areas. From wooded areas, approximately 10 percent was developed to settlement areas and only 1.5 percent of the unproductive areas in Switzerland were transformed to settlement and urban areas during the period 1985 to 2009 (Schubarth et al. 2013.). Unproductive areas could therefore be perceived as a fitting instrument in terms of geographical

[27] Results can be found in appendix I.

constraint, because a very small part of it is transformed into areas that could be used for housing. The unproductive areas are made up of five categories, bare land which refers to rocks and screes, unproductive vegetation, lakes and rivers, and glaciers and perpetual snow (Schubarth et al. 2013). The unproductive land areas reported every five years at the cantonal level were connected to the respective monitoring region. The two-stage least squares method was applied but no significance was to be found in the first stage. Even though the instrument was viewed fulfill the exogenous assumption, the relevance was violated in the first stage of our estimated two-stage least squares estimation.

8.Conclusion and Future Research

In Switzerland, fertility rates are at record low levels and housing prices, besides being initially one of the highest in Europe, show an overall increasing tendency during the observed time period. The aim of our paper has been to measure the effect of changes in the housing price and rents on fertility rates in Switzerland to better enable ourselves, scholars, and policymakers to understand the relationship between these two tendencies. We examine this, using linear probability models with many controls and both time and region fixed effects. Our data is in the form of an unbalanced panel of women between the ages 20-45 in the period 1999-2019. The data is based on the Swiss Household Panel and complementary data sources, the housing price index provided by Wüest Partner, and the consumer price index issued by the Federal Statistical Office.

The theoretical components of our paper rely on the following concepts: The economy of a household is based on costs, income, and wealth and the changes in these factors influence the consumption patterns. The fact that children come with costs and benefits to a household and in modern society people are empowered with fertility decisions implies that the changes in costs, income, and wealth of a household result in changes in the demand for children.

Motivated by theory, explained in the existing literature on the topic, we formulated our hypotheses stating that an increase in housing price would positively influence fertility of owners arising from positive wealth effects, but the increase of rents would negatively influence renters due to the negative cost effect. However, our results indicate that changes in aggregate regional housing prices negatively affect the fertility rates of owners[28]. In addition, we find no statistically significant evidence for a relationship between aggregate changes in rents on the fertility of renters.

Explaining the differing results from existing literature on developed countries for owners, we first point at the difference in moving habits in Switzerland compared to those in other countries and the difficulty to financially realize wealth effects. Second, we highlight the distinction between owners of small and adequate-sized housing. Technically elaborating on that, we created two subsets of our data of owners and found that the coefficients for people are substantially of higher magnitude, implying that the negative relation might arise from the individuals in our data who need to move in order to welcome another family member to the household.

Unlike wealth estimations of owners, monthly rents paid were reported in the SHP dataset. Using these values, but avoiding reverse causality issues[29], we measured the effect of region median rent change on fertility. Similar to the initial regression results, we did not find evidence for the effect of rent change on fertility.

The findings of our study have to be seen in the light of some limitations, due to several factors. Although it would probably result in underestimation, evidence has been found that childbirth might be a factor of attrition bias. In addition, we failed to implement an instrumental variable method as applied in some of the existing research, which implies that our results should be subject to scrutiny when it comes to causality. Another factor to consider is the fact that we use price changes on a relatively high regional level. These regions are based on the industry expertise of a renowned Swiss real estate firm and are subject to similar housing shocks, intra-regional differences might occur which we don't capture with

[28] 10% statistical significance level.

[29] In this case, when someone would change their housing according to their fertility intention, thus the higher reported rents reflect the effect of fertility on rents, not vice versa.

our data. Furthermore, examining the effect of rents on fertility, it is important to consider spillover effects. Rental agreements have fewer exit barriers than ownership of a house, so increased rent in Region “A” might result in moving to Region “B” where prices remain the same. These cases might create noise in our regressions.

These above limitations are simultaneously a call for further research to be carried out on this topic, with a methodology that can address these and enhance the robustness of our results. Finding more evidence on the examined relationships can guide policymakers to make better decisions when it comes to prioritizing solutions addressing low fertility.

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10. Appendix

Appendix A: Ownership in Switzerland

Figure: Occupancy status Switzerland

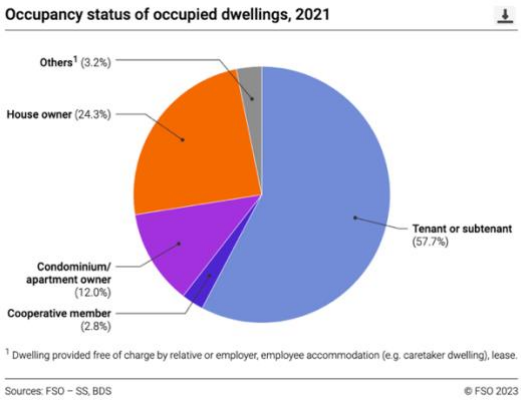
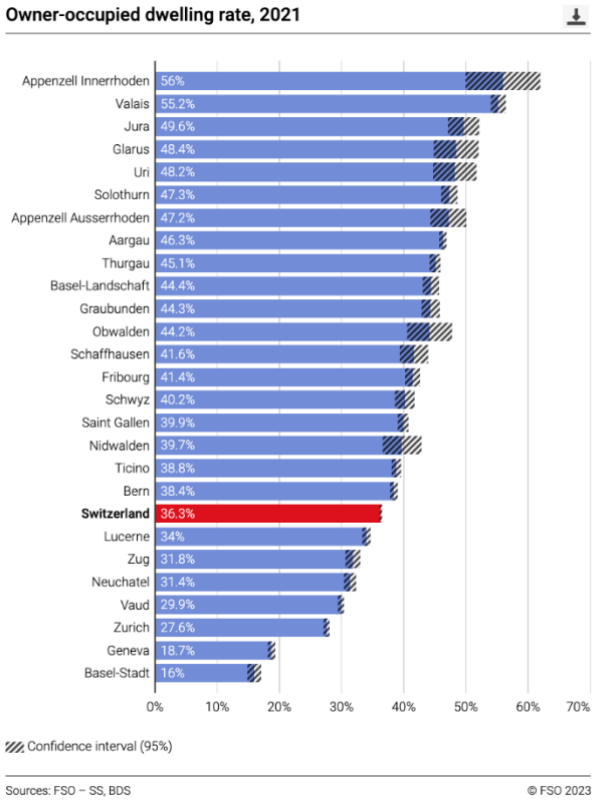


Figure: Dwelling rate per canton



Note: Dwelling rate includes others, *homeowners*, *condominium/apartment owner* and *cooperative member*. Source: FSO (2023). *Tenants/Owners*. Retrieved from: https://www.bfs.admin.ch/bfs/en/home/statistics/construction-housing/dwellings/housing-conditions/tenants-owners.html

Appendix B: Response Rates – Swiss Household Panel

Figure: Participating Households and Individuals

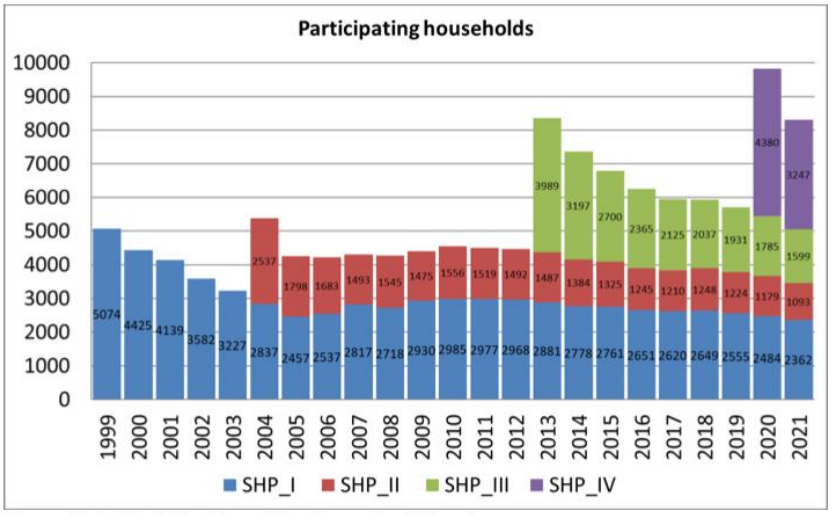


Figure 2.1: Participation at the household level

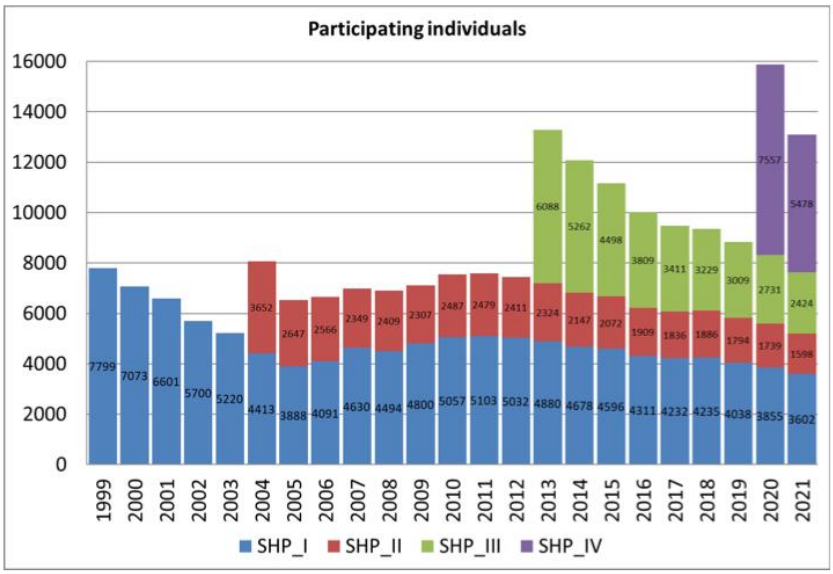


Figure 2.2: Participation at the individual level

Note: Participation rates at the household and individual levels. Includes, but is not limited to our chosen sample of women 20-45, this is the total level of all participating households and individuals.

Source: Voorpostel, M., Tillmann, R, Lebert, F., Kuhn, U., Lipps, O., Ryser, V.-A., Antal, E., Dasoki, N., & Wernli, B. (2021). *Swiss Household Panel Userguide (1999- 2020)*, Wave 22, March 2023. Lausanne: FORS.

Appendix C: Regions – Wüest Partner

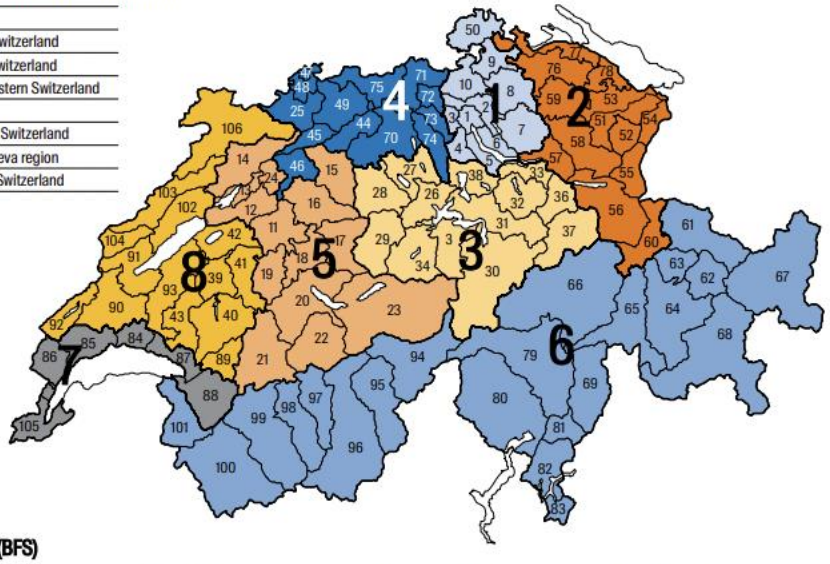
Figure: Regional categorization

Market regions

For the market report, Switzerland is divided into 106 so-called spatial mobility (MS) regions, based on the "mobilité spatiale" model (BFS, Berne 1994). These MS regions are grouped by Wüest Partner into 8 market (monitoring) regions.

Monitoring regions (Wüest Partner)

1	Zurich
2	Eastern Switzerland
3	Central Switzerland
4	North-western Switzerland
5	Bern
6	Southern Switzerland
7	Lake Geneva region
8	Western Switzerland



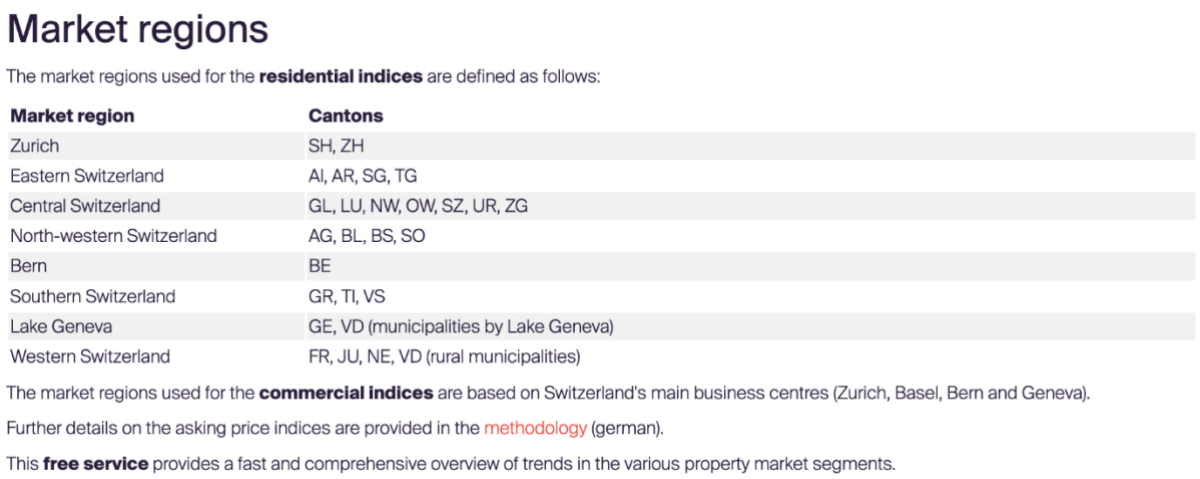
MS Regions (BFS)

1	Zürich	28	Willisau	55	Werdenberg	82	Lugano
2	Glattal/Furttal	29	Entlebuch	56	Sarganserland	83	Mendrisio
3	Limmattal	30	Uri	57	Linthgebiet	84	Lausanne
4	Knonaueramt	31	Innerschwyz	58	Toggenburg	85	Morges/Rolle
5	Zimmerberg	32	Einsiedeln	59	Wil	86	Nyon
6	Pfannenstiel	33	March	60	Bündner Rheintal	87	Vevey/Lavaux
7	Zürcher Oberland	34	Sarneraatal	61	Prättigau	88	Aigle
8	Winterthur	35	Nidwalden/Engelberg	62	Davos	89	Pays d'Enhaut
9	Weinland	36	Glarner Mittel-/Unterland	63	Schanfigg	90	Gros-de-Vaud
10	Zürcher Unterland	37	Glarner Hinterland	64	Mittelbünden	91	Yverdon
11	Bern	38	Zug	65	Domleschg/Hinterrhein	92	La Vallée
12	Erlach/Seeland	39	La Sarine	66	Surselva	93	La Broye
13	Biel/Seeland	40	La Gruyère	67	Engiadina bassa	94	Goms
14	Jura bernois	41	Sense	68	Oberengadin	95	Brig-Östliches Raron
15	Oberaargau	42	Murten	69	Mesolcina	96	Visp-Westliches Raron
16	Burgdorf	43	Glâne/Veveyse	70	Aarau	97	Leuk
17	Oberes Emmental	44	Olten/Gösgen/Gäu	71	Brugg/Zurzach	98	Sierre
18	Aaretal	45	Thal	72	Baden	99	Sion
19	Schwarzwasser	46	Solothurn	73	Rohrdorf/Mutschellen	100	Martigny
20	Thun/Innertport	47	Basel-Stadt	74	Freiamt	101	Monthey/St-Maurice
21	Saanen/Oberes Simmental	48	Unteres Baselbiet	75	Fricktal	102	Neuchâtel
22	Kandertal	49	Oberes Baselbiet	76	Thurtal	103	La Chaux-de-Fonds
23	Oberland-Ost	50	Schaffhausen	77	Untersee/Rhein	104	Val-de-Travers
24	Grenchen	51	Appenzell Ausserrhoden	78	Oberthurgau	105	Genève
25	Laufental	52	Appenzell Innerrhoden	79	Tre Valli	106	Jura
26	Luzern	53	St. Gallen/Rorschach	80	Locarno		
27	Sursee/Seetal	54	Rheintal SG	81	Bellinzona		

wüestpartner

Source: Wüest Partner, (n, d.). Map of Regions. Retrieved from https://www.wuest.io/online_services_classic/allgemeine_informationen/raeumliche_gliederung/pdf/map_of_regions.pdf

Figure: Legend for Monitoring (Market) Regions and Cantons (NUTS)



Market regions

The market regions used for the **residential indices** are defined as follows:

Market region	Cantons
Zurich	SH, ZH
Eastern Switzerland	AI, AR, SG, TG
Central Switzerland	GL, LU, NW, OW, SZ, UR, ZG
North-western Switzerland	AG, BL, BS, SO
Bern	BE
Southern Switzerland	GR, TI, VS
Lake Geneva	GE, VD (municipalities by Lake Geneva)
Western Switzerland	FR, JU, NE, VD (rural municipalities)

The market regions used for the **commercial indices** are based on Switzerland's main business centres (Zurich, Basel, Bern and Geneva).

Further details on the asking price indices are provided in the methodology (german).

This **free service** provides a fast and comprehensive overview of trends in the various property market segments.

Note: Market Region and corresponding cantons in Switzerland. Source: Wüest Partner, (n, d.). Retrieved from: https://www.wuest.io/online_services_classic/angebotspreisindex/information/index_e.phtml

Appendix D: Results of the Hausman Test

```
        Hausman Test

data:  Conception ~ delta_price + delta_price_lag_cum3 + EDYEAR + IFAMY +  ...
chisq = 7817.4, df = 42, p-value < 2.2e-16
alternative hypothesis: one model is inconsistent

>         print(hausman_test_renter)

        Hausman Test

data:  Conception ~ delta_price + delta_price_lag_cum5 + EDYEAR + IFAMY +  ...
chisq = 3334.5, df = 42, p-value < 2.2e-16
alternative hypothesis: one model is inconsistent


>  print(hausman_test_owner)

        Hausman Test

data:  Conception ~ delta_price + delta_price_lag_cum3 + EDYEAR + IFAMY +  ...
chisq = 7817.4, df = 42, p-value < 2.2e-16
alternative hypothesis: one model is inconsistent

>         print(hausman_test_renter)

        Hausman Test

data:  Conception ~ delta_price + delta_price_lag_cum5 + EDYEAR + IFAMY +  ...
chisq = 3334.5, df = 42, p-value < 2.2e-16
alternative hypothesis: one model is inconsistent
```

Note: Hausman test performed for model 7 (M7) where all control variables were included. The low p-value suggests that the null hypothesis can be rejected and that fixed effects is an appropriate modulation.

Appendix E: Results of the Breusch-Pagan Test

```
>         print(bptest_owner)

        studentized Breusch-Pagan test

data:  mod7
BP = 568.11, df = 43, p-value < 2.2e-16

>         print(bptest_renter)

        studentized Breusch-Pagan test

data:  mrd27
BP = 1158.9, df = 43, p-value < 2.2e-16
```

Note: Breusch-Pagan test was performed for model 7 (M7) where all control variables were included for owners and renters respectively. The p-value suggests that the null hypothesis of homoscedasticity is rejected, and heteroscedasticity can be assumed. This is in line with the characteristics of the linear probability model.

Appendix F: Results of the Breusch-Godfrey Test

```
        Breusch-Godfrey test for serial correlation of order up to 1

data:  mod7
LM test = 1.0154, df = 1, p-value = 0.3136

>         print(bg_test_renter)

        Breusch-Godfrey test for serial correlation of order up to 1

data:  mrd27
LM test = 0.12344, df = 1, p-value = 0.7253
```

Note: Breusch-Godfrey test performed for model 7 (M7) where all control variables were included. The high value suggests that we fail to reject the null hypothesis and we do not find evidence of serial correlation in the model.

Appendix G: Types of Community Typology

Figure: Community Typology 2

8 COM2_99 Recoded USER <= all

Typologie de commune 2	Gemeindetypologie 2	Tipologia di comune 2	Community typology 2
-8 autre erreur	-8 anderer Fehler	-8 altro errore	-8 other error
-7 erreur de filtre	-7 Filterfehler	-7 errore di filtro	-7 filter error
-3 inapplicable	-3 trifft nicht zu	-3 inapplicabile	-3 inapplicable
-2 pas de réponse	-2 keine Antwort	-2 nessuna risposta	-2 no answer
-1 ne sait pas	-1 weiss nicht	-1 non sa	-1 does not know
1 Centres	1 Zentren	1 Centri	1 Centres
2 Communes suburbaines	2 Suburbane Gemeinden	2 Comuni suburbani	2 Suburban communes
3 Communes riches	3 Reiche Gemeinden	3 Comuni ricchi	3 Wealthy communes
4 Communes périurbaines	4 Periurbane Gemeinden	4 Comuni periurbani	4 Peripheral urban communes
5 Communes touristiques	5 Touristische Gemeinden	5 Comuni turistici	5 Tourist communes
6 Communes industrielles et tertiaires	6 Industriell-tertiäre Gemeinden	6 Comuni industriali e terziari	6 Industrial and tertiary sector communes
7 Communes rurales de navetteurs	7 Ländliche Pendlergemeinden	7 Comuni agricoli di pendolari	7 Rural commuter communes
8 Communes agricoles mixtes	8 Agrarisch-gemischte Gemeinden	8 Comuni agricoli misti	8 Mixed agricultural communes
9 Communes agricoles périphériques	9 Agrarisch-periphere Gemeinden	9 Comuni agricoli periferici	9 Peripheral agricultural communes

Source: SHP- Fors (1999). Household Questionnaire Wave 1 (1999). Retrieved from: QuestionML-H-W1.pdf.

Appendix H: Output for Homeowners: Small and Sufficient Accommodation Size

Comparison of the price change effect on small and adequate sized housing seperately

	Dependent variable:	
	Conception	
	(Small Housing)	(Adequate Housing)
Δprice t-1	-.0081* (.0045)	-.0010 (.0008)
Δprice t-5 to t-2	.0038*** (.0015)	.0009** (.0004)
Years of Education	.0066** (.0028)	.0009* (.0005)
Family government support	-.0599*** (.0225)	-.0022 (.0066)
Annual income	-.0017 (.0019)	.0020*** (.0007)
Annual income of partner	.0007 (.0009)	-.0003** (.0002)
Partner (not living together)	-.0828*** (.0239)	-.0345*** (.0048)
Partner (living together)	.1251*** (.0481)	.0247** (.0111)
Married (not living together)	-.0628 (.0385)	-.0117 (.0156)
Married (living together)	.0495 (.0304)	.0368*** (.0070)
Number of kids born	-.0139* (.0083)	-.0149*** (.0020)
Number of children wanted	-.0002 (.0048)	.0059*** (.0014)
Age	-.0025** (.0011)	-.0027*** (.0003)
usual weekly hours worked	-.00001 (.0004)	-.0003** (.0001)
usual weekly hours worked for partner	-.0001 (.0004)	.0009*** (.0001)
Wanting to move (1-10)	-.0006 (.0031)	-.0032*** (.0006)
Constant	.1287** (.0590)	.1050*** (.0114)
Fixed Effects	Yes	Yes
Observations	738	12,676
R^2	.1036	.0366
Significance levels		*p<0.1; **p<0.05; ***p<0.01

NOTE 1: Income and subsidy variables are in 10'000 CHF | NOTE 2: Four partnership dummies have been interacted with quality

Appendix I: Output for Renters Based on Reported Rent in the SHP

Effect of price changes on fertility rates | renters | Main independent var: Rent from SHP, regional Δmedian

	Dependent variable:						
	Conception						
	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)	(M7)
Δrents t-1	.00002 (.00002)	.00003 (.00002)	-.000004 (.00002)	-.000001 (.00002)	-.000001 (.00002)	-.00001 (.00002)	-.00002 (.00002)
Δrents t-5 to t-2			.00001 (.00002)	.00002 (.00002)	.00002 (.00002)	.00001 (.00002)	.00001 (.00002)
Years of Education				.0058*** (.0009)	.0051*** (.0010)	.0044*** (.0009)	.0036*** (.0009)
Family government support					-.0202** (.0098)	-.0344*** (.0094)	.0127 (.0101)
Annual income					.0010 (.0006)	.0005 (.0006)	.0019** (.0009)
Annual income of partner					.0012 (.0007)	.0002 (.0003)	-.0002 (.0001)
Partner (not living together)						-.0176*** (.0042)	-.0310*** (.0041)
Partner (living together)						.0477*** (.0076)	.0148* (.0084)
Married (not living together)						.2077** (.1056)	.1813* (.1033)
Married (living together)						.0991*** (.0066)	.0891*** (.0081)
Number of kids born							-.0270*** (.0025)
Number of children wanted							.0098*** (.0018)
Age							-.0021*** (.0003)
usual weekly hours worked							-.0004** (.0002)
usual weekly hours worked for partner							.0011*** (.0001)
Wanting to move (1-10)							.0017*** (.0006)
Constant	.0579*** (.0021)	.0817*** (.0064)	.0734*** (.0112)	-.0036 (.0147)	-.0043 (.0147)	-.0221 (.0140)	.0474*** (.0155)
Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,158	17,158	12,535	12,535	12,535	12,535	12,535
R^2	.0001	.0142	.0156	.0215	.0246	.0496	.0704
Significance levels							*p<0.1; **p<0.05; ***p<0.01

NOTE 1: Income and subsidy variables are in 10'000 CHF | NOTE 2: Four partnership dummies have been interacted with quality

Appendix J: Output for VIF Tests

	Owners.GVIF	Owners.Df	Owners.GVIF..1..2.Df..	Renters | SHP.GVIF	Renters | SHP.Df	Renters | SHP.GVIF..1..2.Df..	Renters | Wüest Partner.GVIF	Renters | Wüest Partner.Df	Renters | Wüest Partner.GVIF..1..2.Df..	Owners small.GVIF	Owners small.Df	Owners small.GVIF..1..2.Df..	Owners adequate.GVIF	Owners adequate.Df	Owners adequate.GVIF..1..2.Df..
Δprice t-1	2.284	1.000	1.511	1.244	1.000	1.115	2.972	1.000	1.724	2.287	1.000	1.512	2.301	1.000	1.517
Δprice t-5 to t-2	3.995	1.000	1.999	1.544	1.000	1.243	2.847	1.000	1.687	4.155	1.000	2.038	4.049	1.000	2.012
Years of Education	1.542	1.000	1.242	1.287	1.000	1.135	1.587	1.000	1.260	2.057	1.000	1.434	1.527	1.000	1.236
Family government support	1.163	1.000	1.078	1.210	1.000	1.100	1.176	1.000	1.084	1.277	1.000	1.130	1.161	1.000	1.077
Annual income	1.786	1.000	1.336	2.132	1.000	1.460	2.223	1.000	1.491	2.189	1.000	1.480	1.776	1.000	1.333
Annual income of partner	1.546	1.000	1.243	1.295	1.000	1.138	1.320	1.000	1.149	2.055	1.000	1.433	1.533	1.000	1.238
Partner (not living together)	1.445	1.000	1.202	1.365	1.000	1.168	1.339	1.000	1.157	1.439	1.000	1.199	1.451	1.000	1.205
Partner (living together)	1.329	1.000	1.153	1.746	1.000	1.322	1.694	1.000	1.302	1.481	1.000	1.217	1.327	1.000	1.152
Married (not living together)	1.008	1.000	1.004	1.020	1.000	1.010	1.008	1.000	1.004	1.060	1.000	1.030	1.008	1.000	1.004
Married (living together)	2.605	1.000	1.614	2.164	1.000	1.471	2.026	1.000	1.423	2.605	1.000	1.614	2.626	1.000	1.621
Number of kids born	1.882	1.000	1.372	1.889	1.000	1.374	1.750	1.000	1.323	1.997	1.000	1.413	1.880	1.000	1.371
Number of children wanted	1.750	1.000	1.323	1.502	1.000	1.225	1.603	1.000	1.266	1.832	1.000	1.354	1.757	1.000	1.325
Age	2.095	1.000	1.447	1.547	1.000	1.244	1.497	1.000	1.224	1.811	1.000	1.346	2.119	1.000	1.456
usual weekly hours worked	1.707	1.000	1.307	1.988	1.000	1.410	2.092	1.000	1.446	1.871	1.000	1.368	1.708	1.000	1.307
usual weekly hours worked for partner	2.015	1.000	1.420	1.737	1.000	1.318	1.698	1.000	1.303	2.381	1.000	1.543	2.017	1.000	1.420
Wanting to move (1-10)	1.344	1.000	1.159	1.129	1.000	1.062	1.151	1.000	1.073	1.260	1.000	1.122	1.368	1.000	1.170
Regional FE	1.715	7.000	1.039	3.651	123.000	1.005	1.696	7.000	1.038	2.272	7.000	1.060	1.758	7.000	1.041
Time FE	8.084	15.000	1.072	1.556	15.000	1.015	6.412	15.000	1.064	14.598	15.000	1.093	8.126	15.000	1.072

Appendix K: Variable Description for Creation of the Dataset

Describes	Name	Original	Logic	Availability	Na values	Na treatment
Conception	Conception	children birthdate	birthdate – 9 months	all years	-	-
Education	EDYEAR	EDYEAR$$		all years	when no answer set to NA	Trying to estimate NA from earlier values
Income	INCOME	I$$PTOTG, I$POSY	added, with certain conditions	all years	-	When income is error (negative value), but WORKH >0 we take WORKH*20CHF*52
Income of partner	partner_INCOME	-	-	-	-	-
4 distinct dummies, later in interaction term	Partner dummies	COHAST$$, P$$D29	mutually exclusive dummies	all years	-	-
Number of weekly hours worked	WORKH	P$$W610, P$$W77	Taking either depending on the reporting	P$$W77 all years	-	-