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The Impact of Housing Price-to-Income Ratio on Fertility Rate

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Abstract

This study uses a regression analysis with a fixed model to explore the impact of housing price-to-income ratio on fertility rate as a whole, and also discusses the effect of related factors on fertility rate. This study uses panel data of 31 provinces (except Hong Kong, Macao and Taiwan) from 2017 to 2020 from the Statistical Yearbook of National Bureau of Statistics and Provincial Statistics Bureau. Research findings: (1) Housing price-to-income ratio has a significant negative effect on fertility rate; (2) Unemployment rate has no significant correlation with fertility intention; (3) Urbanization and educational attainment are negatively correlated with fertility intentions; (4) GDP per capita has a positive correlation with fertility; (5) Economic factors have become an important consideration in people's fertility decisions.

Keywords

Housing Price-to-Income Ratio; Fertility Rate; Regression Analysis; Fertility Intention.

1. Introduction

Housing price and population have been the hot research areas. And the adjustment of fertility policy has always been a big news in recent years. The current fertility policy is that the state encourages late marriage and late childbirth, advocates a couple to have two children, and those who meet the legal and regulatory conditions can have more children. We can see from thae graph that China's birth rate has been on a downward trend. Although there was a brief rebound within a year after the implementation of the two-child policy, the birth rate dropped sharply after 2017. This trend will directly lead to the reduction of population and the aggravation of aging population, and further lead to a series of social problems, such as increased social burden. This series of problems has also attracted scholars' attention to the fertility rate and related factors.

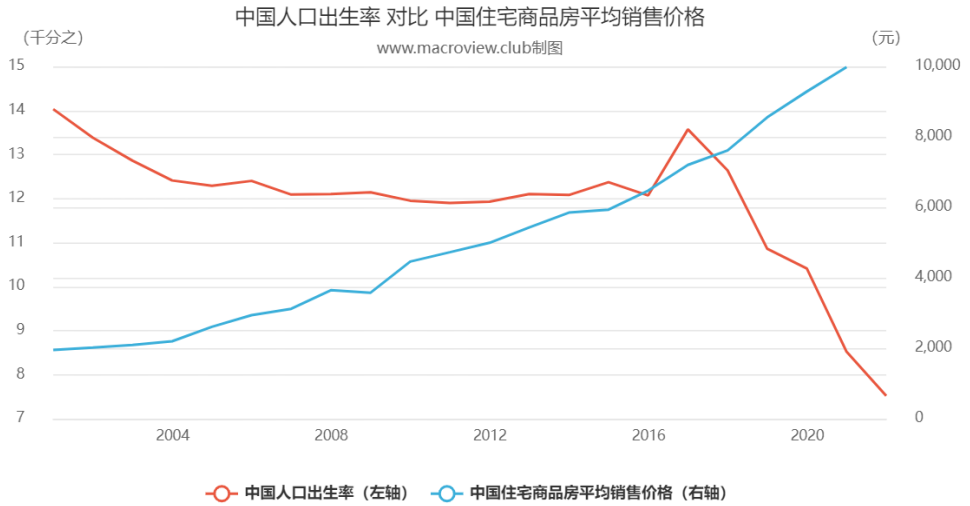

Figure 1: China's Birth Rate Compared to the Average Sales Price of Residential Commercial Housing in China

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In addition, with the constant rise of real estate prices in the 21st century, housing has gradually become the largest expense of family life, which would cause a series of social problems, such as increased burden on families. Scholars began to focus on the impact of housing prices on fertility rate. Based on data analysis in different regions, some scholars have found a significant negative effect of housing prices on fertility rate or family formation. Overall, most studies have found a significant negative relationship between housing or rent prices and fertility. The above studies give us a lot of insights.

Therefore, we introduce the concept "housing price-to-income ratio" into the study of "fertility change and its impact" to explore the impact of "housing price-to-income ratio" on fertility rate and also the impact of related factors on fertility rate, which can help to solve the problem of low fertility rate and open new ideas for related policies.

2. Literature Review

Based on the research questions, this part will review relevant studies and mainly include the following dimensions.

2.1. The Studies of Factors Influencing Fertility

Fertility ideology refers to attitude, perception and value about fertility behavior that is formed under certain conditions. It reflects people's wishes and needs regarding the number, sex, timing and quality of children, and to a certain extent influence fertility decision.

Fertility ideology is influenced by a variety of self and external factors. The literatures have tended to discuss the factors that influence fertility ideology in terms of their own factors (demographic factors). Demographic factors include gender, age, ethnicity, marital status, age at first marriage, number of siblings, etc. In terms of gender, men's fertility ideology is higher than women's because the costs of childbearing and childcare are greater for women than for men (Liang Hong, 2007). In terms of age, the fertility ideology of the lower age group is lower than that of the higher age group (Liang Hong, 2007; Zhou Yun, 2016). The fertility ideology of the Han Chinese population is lower than that of ethnic minorities (Chen Wei, 2002). In terms of the life-cycle stage of an individual, the fertility ideology of the unmarried population is lower than that of the population with a history of marriage (Liang Hong, 2007). The higher the age of first marriage, the lower the fertility. Moreover, the effect of age at first marriage on fertility ideology is moderated by both urban and rural areas and by gender - the higher the age at first marriage, the lower the fertility for urban males, females and rural females, but the fertility ideology of rural males do not vary by age at first marriage. The number of siblings is positively related to fertility ideology - the higher the number of siblings the higher the fertility ideology (Zhou Yun, 2016).

Socio-economic factors include educational attainment, type of occupation, urban/rural attributes, income and gender preference. Among these, the relationship between educational attainment and fertility ideology is unclear: most scholars believe that they are inversely related, i.e., higher educational attainment is associated with lower fertility ideology (Chen, Wei, 2002; Liang, Hong, 2007). In terms of urban-rural attributes, the fertility ideology of the urban population is lower than those of the rural population due to the different demand for labor in urban and rural areas (Chen, 2002). Most studies suggest that income is inversely related to fertility ideology, i.e., the higher the income, the lower the fertility ideology (Chen Wei, 2002; Liang Hong, 2007), the reason being that the higher cost of raising a child reduces the standard of living of the group with higher income levels; while Zhou Yun's (2016) study in Jiangsu found a positive relationship between income and fertility ideology. Therefore, the relationship between income and fertility ideology is not yet clear.

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The combing reveals some shortcomings in previous studies, leading to no consistent conclusions in the research on the existing factors influencing fertility ideology, which may be related to two problems in the existing studies: (1) Although the existing research in China is rich in analyzing the factors influencing fertility ideology, the scattered studies do not sufficiently take into account the direct factors affecting fertility ideology, and therefore do not provide enough in-depth opinions and policy references. (2) Among the existing studies, the choice of indicators is uneven. For example, the concepts of "desired number of children" and fertility ideology are often confused and not even distinguished from the ideal number of children. The consequence of this is that fertility ideology and fertility levels tend to be overestimated.

2.2. The Studies of The Impact of Housing Prices on Fertility

Some scholars have studied the effects of house prices and housing on fertility rate, generally concluding that high house prices reduce fertility rate. Based on data from the 2010 National Census and the 2011 Chinese Social Survey, Liu's (2020) findings suggest that higher house prices significantly reduce women's probability of having children. This conclusion is more evident in three groups of women: those who are under 30 years old (including 30 years old), married for three to five years, and childless. Yi Junjian and Yi Xingjian (2008) worked on the effect of house prices on fertility in Hong Kong, by including the house price index in the standard fertility equation and using Johansen's test with the ECM model to conduct a cointegration analysis of the relationship between house prices and fertility in Hong Kong from 1971 to 2005. The result shows that with 1% increase in house price index, the total fertility rate significantly decreases by 0.45%. Using panel data for 31 provinces in China from 1999 to 2010, Li et al. (2012) show that house prices have a significant negative effect on the fertility rate, and that excessive growth in house price suppresses the fertility rate of residents. Based on 2010 national census data, Pan and Xu (2012) find that urban fertility rates are strongly correlated with house prices. In particular, fertility rates are higher in cities with larger housing areas or cheaper housing prices, where high housing prices imply a heavy cost of living, and thus high housing prices reduce the resources available for raising children and the willingness to have children.

Most scholar are focusing on the relationship between house prices and fertility rate, and few of them have studied on the effect of housing price-to-income ratio on fertility rate. The income is an important index both in fertility rate and house prices. It has a direct influence on the demand of having children and different levels of income will also affect the role of house prices on fertility demand. Fang Huifen et al. (2021) include housing price-to-income as a main explanatory variable and their paper shows that the housing price-to-income ratio in the current period has a significant negative effect on the fertility rate, and the suppressive effect of the housing price-to-income ratio on fertility is stronger in both the current and prior periods than that of house prices on fertility. This result in large part proves that house price only measures the price of housing while housing price-to-income ratio represents resident's ability to purchase a house.

Given the reality of low fertility rates and the progressive relaxation of fertility policies, it is all the more necessary to study the fertility ideology of the Chinese population in depth. Based on this, this study draws on the strengths of previous research by Hou Jiawei et al. in using data from multiple time points and the socio-economic indicator of the "housing price-to-income ratio" and integrates the factors that may affect fertility ideology in existing research to explore the factors that affect fertility ideology in China in more details. In addition, this study will optimize the model setting in order to improve on the weaknesses of previous studies in terms of model selection.

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3. Economic Theory and Hypothesis

3.1. Theory

Both "housing price-to-income ratio" and fertility rate are macro-level issues. The former reflects people's ability to buy houses in a certain region, while the latter reflects the overall people's fertility intention in a certain region. However, to study the relationship between them, it is necessary to explore their mechanism of action at the micro level and control other variables. By referring to Becker's economic elaboration on residents' fertility demand at the individual level in 1981 and Willis's economic analysis of fertility behavior, the fertility rate of a certain region is generally affected by many factors such as regional characteristics, household factors, and individual attributes. In addition, we further simplify the factors influencing fertility decisions by referring to the mechanism of action of housing prices on fertility intention established by Fang Huifen. By transforming social, cultural and other unquantifiable factors into quantifiable economic concepts, we obtain that fertility rate is directly related to the regional economic development level, also is affected by the values, such as the level of education and urban- rural differences.

In our calculation model, we choose certain indicators to represent the above factors. The variables used include housing price-to-income ratio, crude birth rate, GDP per capita, urbanization rate, the number of people with a vocational education or above per 100,000 people, and unemployment rate. Housing price-to-income ratio is to measure the ability of residents to buy a house. The fertility rate is measured by the crude birth rate (the average number of births per 1,000 people in a city in a given year). We note that in previous studies, the total fertility rate or crude birth rate is often used to characterize people's fertility decisions. Although the former is a more accurate indicator of fertility behavior, it is difficult to obtain complete TFR data, so we use crude birth rate to replace this index in the study, and existing studies have demonstrated the validity of this proxy for fertility research. GDP per capita is to measure economic development levels of different provinces, the urbanization rate is to measure the urbanization level of different provinces, and the number of people with a vocational education or above per 100,000 people is to measure the average education level of residents in different provinces. In addition, the unemployment rate is closely related to economic income. So, the unemployment rate is to measure the unemployment of different provinces, to a certain extent, to reflect the impact of COVID-19.

3.2. Hypothesis

Combined with the above background introduction and related theories, most of the studies argued that there is a significant negative relationship between housing prices or rent prices and fertility rate. Therefore, for the relationship between housing price-to-income ratio and fertility rate, we hypothesize that housing price-to-income ratio is negatively correlated with fertility rate.

4. Data

4.1. Data Source

This paper collected data from the National Bureau of Statistics, China Statistical Yearbook and Municipal and Provincial Bureau of Statistics. The data includes variables, such as housing price-to-income ratio, crude birth rate, GDP per capita, education, urbanization rate and unemployment in 31 provinces, except Hong Kong, Macao and Taiwan from 2017 to 2020.

The two-child policy was fully implemented in October 2015 and the birth rate surged in 2016 but began to decline sharply in the following year. In order to offset the impact of the policy and to ensure the stability of date, this paper finally chose the time span of 2017-2020.

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However, since some provinces have not published their data in the seventh national census yet, such as the variable birth rate, this paper, for the sake of data accuracy and a uniform standard, used the average value of the previous three years.

4.2. Definition of Variables and Descriptive Statistics

The core explanatory variable of this paper is housing price-to-income ratio. It is generally known as attainability and especially used to measure the long-term affordability of homes in a region. The response variable is crude birth rate. It is the average number of births per 1,000 people in a year in a region. In this paper, the crude birth rate is considered as a proxy for the fertility rate.

And there are four controlled variables in this paper. GPD per capita is related to the economic development level of a region which determines residents' spending. Spending or expenditure will influence people's fertility intentions. Education is another controlled variable, it is measured by the number of people with vocational education or above per 100,000 people. Education may convert people's views about childbearing. Urbanization rate can reflect the difference in fertility attitudes between urban and rural areas. Unemployment rate is, to some extent, related to residents' income and likely reflects the impact of the epidemic.

Tab.1 The Descriptive Statistics of Main Data

Variables	SZ	Mean	SD	Min	Max
Crude Birth Rate	124	10.79	2.77	3.75	17.54
Housing Price to Income Ratio	124	12.49	3.25	6.51	23.79
GDP per capita	124	66541	29459	29103	164889
Urbanization Rate	124	62.00	11.32	33.28	89.30
Unemployment	124	3.13	0.60	1.30	4.60
The Number of People With Vocational Education or Above Per 100,000	124	15007	7393	6427	47306

Figure 1: The Descriptive Statistics of Main Data

5. Method

5.1. Model

This paper uses the dynamic panel data of 31 provinces for 4 years. There are three models to analyze panel data: mixed model, fixed model and random model. We assume that individual-specific unobservable effects and time-specific unobservable effects are correlated with variables in the paper. For example, because Beijing is the political center of China, as the statistics indicates, people in Beijing are relatively well educated. In this assumption, political center serves as Beijing-specific unobservable, and it does influence the variable, education. In a similar vein, 2020 is marked by the outbreak of the COVID-19, which may give rise to a higher unemployment rate or a lower GDP per capita. Here the year 2020 with pandemic is a time-specific unobservable. In sum, due to the correlation between individual effects and time effects and variables, this paper chose fixed model.

5.2. Regression Equation

$$BR_{i,t}=\beta_0+\beta_1 Ratio_{i,t}+\beta_2 log(GDP)_{i,t}+\beta_3 URB_{i,t}+\beta_4 EDU_{i,t}+\beta_5 UNE_{i,t}+\mu_i+\upsilon_t+\varepsilon_{i,t}$$

BR refers to the crude birth rate. Ratio refers to housing price-to-income ratio. GDP refers to GDP per capita. URB refers to urbanization rate. EDU refers to education, which is measured by the number of people with vocational education or above per 100,000 people. UNE refers to unemployment rate. i refers to region. t refers to year. μ is individual effects of regions and υ is time effects of years.

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6. Analysis of Results: Effects on Birth Rate

According to the aforementioned theoretical hypothesis, the main factor influencing the population's fertility intentions is economic factor, which, could be divided into economic costs and economic income, while the direct correlation between other factors and fertility intentions is not significant. From the table 2, the direct correlation between these inertia quantities and fertility can be summarized as follows:

1. Unemployment rate has no significant correlation with fertility intention
2. GDP per capita has a positive correlation with fertility
3. Housing price-to-income ratio, urbanization and educational attainment are negatively correlated with fertility intentions

	Dependent variable:	
	birth	
	fixed model	pooling model
	(1)	(2)
ratio	-0.495***	-0.021
	(0.130)	(0.070)
log(GDP)	4.200**	3.264***
	(2.011)	(0.841)
edu	-0.003***	-0.003***
	(0.001)	(0.001)
une	0.224	-0.936***
	(0.302)	(0.339)
urb	-0.450***	-0.118***
	(0.128)	(0.037)
Constant		-13.553
		(8.448)
Observations	124	124
R2	0.717	0.520
Adjusted R2	0.604	0.499
Residual Std. Error		1.961 (df = 118)
F Statistic	44.530*** (df = 5; 88)	25.545*** (df = 5; 118)
Note:		*p<0.1; **p<0.05; ***p<0.01

Figure 3: The Overall Regression Analysis Based on Fixed Model

6.1. Housing price-to-income ratio

Becker family economics states that the higher the level of income, the greater the demand for fertility, controlling for other factors that are consistent. From an economic perspective, income and cost are the two factors that constrain people's consumption, and income becomes the main factor limiting people's fertility when the relative price of fertility is consistent.

By incorporating the income variable into the housing price variable for analysis, we obtain that the housing price-to-income ratio has a significant negative effect on the crude birth rate. The housing price-to-income ratio measures people's ability to purchase a house; or, an increase in the ability to pay, stimulates people's willingness to have children, while a decrease in the ability to purchase a home reduces people's willingness to have children. In the current environment, the level of housing prices in China's big cities is generally high, and although people's income levels have increased along with economic development, the overall home purchasing ability of residents is insufficient. Most of the young people working in big cities

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have to carry huge financial pressure (mortgage and car loan), which is a deep-seated reason for the overall decrease of residents' willingness to have children.

6.2. Unemployment

It is important to note that unemployment has a relationship with fertility, but it is not significant. This is because although unemployment has a weakening effect on the ability to pay, it does not act directly on fertility and does not constitute a direct correlation with fertility. In this paper we try to find the factors that affect fertility more directly, so even the unemployment rate is a significant macro-level measure of regional incomes, we would not analyze it in detail.

6.3. GDP per capita

GDP per capita has a significant positive effect on fertility. This is most likely because the level of economic development affects not only other economic costs but also the expected income. When income expectations are greater than cost expectations, residents are more optimistic about future income expectations and thus the level of economic development, as measured by GDP per capita, has a positive effect on fertility. In contrast, if cost expectations are greater than income expectations, the level of economic development has a dampening effect on fertility intentions.

6.4. Urbanization

Urbanization rate has a negative effect on fertility. That is, the higher the urbanization, the lower the fertility intentions of residents, reflecting the differences in fertility attitudes between urban and rural areas in China. The fertility ideology of China's rural population is more traditional urban, while the urban population is influenced by modernization and urbanization, and their fertility ideology is more modern.

Specifically, the fertility ideology of China's rural population is more traditional than that of its urban counterparts, holding on to traditional fertility ideology such as having more children and raising children for the old (养儿防老). The urban population, on the other hand, is influenced by modernization and urbanization and is able to participate in the production and life of society in more ways, and their fertility ideology has also moved from traditional to modern. This has led to a significant difference in fertility decisions between the urban and rural populations.

6.5. Education Level

Education level has a dampening effect on fertility demand, i.e., the higher the average education level, the lower the fertility rate of residents in the area. This is largely due to the fact that more people have access to good education in regions with higher levels of education, which contributes to a shift in people's fertility attitudes, and the lower fertility intentions of most residents eventually leads to an overall low level of fertility intentions in the region.

7. Conclusion and Discussion

This study uses a regression analysis with a fixed model to explore the effect of housing price-to-income ratio on fertility intention (fertility rate) as a whole, and also discusses the effect of related factors on fertility rate. The result is that, the housing price-to-income ratio is correlated with fertility rate, which in turn leads to a negative relationship between the housing price-to-income ratio and fertility (intention). The greater the upward pressure on housing prices, the greater the degree of disincentive to birth rate. In addition, the higher the level of economic development, the higher the birth rate; the higher the urbanization rate and the higher the level of education, the lower the birth rate. In short, economic factors have become an important consideration in people's fertility decisions. Although there are a variety of social and cultural

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influences on the fertility decisions of individual households, economic factors are a common basis for consideration, and housing prices are undoubtedly a major part of all economic expenditure. As housing prices rise, people's willingness to have children decreases, and this change in micro-level willingness ultimately leads to a decline in the country's overall birth rate, which in turn affects the country's demographic structure and development. Therefore, regulating the rate of increase in housing prices should be the focus of future policy formulation and regulation.

The results of the impact of home ownership on fertility, as measured by the housing price-to-income ratio, also confirm the current situation of China's urban residents: their incomes have risen considerably compared to the past, but housing prices have risen even more, and the rise in income has fallen far short of the rise in housing prices. Therefore, there is also a need to raise the income level of households and their ability to purchase a home through economic means such as increasing education subsidies, granting childcare allowances and increasing medical reimbursement rates.

However, there are some weaknesses in the research process. While we have made specific discussions at an overall level, we have not conducted a disaggregated study. Based on provincial-level data, this study analyzes the impact of the housing price-to-income ratio on fertility rate at the macro level but neglects to ignore meso-scale and micro-scale studies, does not discuss these 31 provinces in groups, and is not specific to city-based units. While this would lead to overall conclusions at the national level, it ignores local differences. The one-size-fits-all policies developed accordingly do not correspond to the regions concerned, thus reducing the effectiveness of the policies. In addition, due to the seventh census, very few provinces did not publish the 2020 birth rate, and there is a certain lack of data.

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