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Willingness to Purchase a House during Economic Lost Decades in Japanese Urban Housing Market

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The willingness to purchase a house is closely related to previous experiences with housing market changes. This paper establishes the variable effects of willingness to purchase a house based on experience to analyze how experience with the Lost Decade (1991 to 2001) in Japan has influenced its housing market. This study finds that when the regional house-price levels are less deviated from those of Tokyo, willingness to purchase a house is relatively higher, which inhibits the growth of rent prices. Grouping data into urban and non-urban areas shows that the negative impact of willingness to purchase a house is higher in non-urban areas. This indicates an urban–rural gap in the country and house prices in the urban areas can self-adjust so that

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willingness to purchase a house does not reflect significantly on the rental market. Experience with the cumulative house prices of each prefecture from 1985 to 2015 relative to the Tokyo standard is calculated for deviation to determine whether the cumulative experience of long-term past losses could be used to analyze divergence in the regional housing markets.

Keywords

Lost Decade, experience effects, house-price deviation, willingness to purchase a house, housing market

1. Introduction

When making a decision, people usually rely on their related past experiences; this phenomenon is known as "experience effects". Experience effects is a psychological concept proposed by Tversky and Kahneman (1974) who note that when exposed to an environment of high levels of uncertainty and large quantities of information, the demand to make an immediate decision creates the tendency to make snap judgments based on available information by referencing the most readily available data, namely the results of their past experiences. A number of past studies have discussed how personal experiences affect beliefs and behaviors. For example, Malmendier and Shen (2019) find that past experiences with recession significantly affect consumption preferences. Other examined areas on the effects of personal experience include investment decisions, inflation expectations, and the labor market (Graham and Narasimhan, 2004; Kaustia and Knüpfer, 2008; Oreopoulos et al., 2012; Malmendier and Nagel, 2011, 2016). Concerned with experiences from housing market downturns, Collins and Choi (2010) and Bracha and Jamison (2012) find that housing downturns influence pessimistic beliefs about the housing market. After experiencing recessions and housing market crashes, renters are discouraged from becoming homeowners. Therefore, decisions made by individuals around the real-estate market are closely related to the real-estate market cycles that they have experienced in the past. In other words, past experience in the real-estate market affects intentions to own real estate.

Economic and real-estate recessions have taken place in many developed countries, but their effects on the Japanese real-estate market have been the most pronounced.[1] In 1985, Japan signed the Plaza Accord with the United

[1] Although the government responded with fiscal and monetary policies, some studies

States and the other capitalist countries of the Group of Five (G5) to appreciate the Japanese yen, which led to its dramatic increase in value and sent the country spiraling into a prolonged depression. To stabilize the economy, the Japanese government subsequently adopted an easy money policy and reduced the loan rate five times, in hopes of stimulating private consumer demand through large quantities of low-interest loans. However, the policy boosted the trading volumes of stocks, real estate, and other capital market instruments and caused real-estate prices to skyrocket for a short period of time. In the early 1990s, real-estate prices began to plummet, and the overall economy fell into a great recession, which came to be known as the "Lost Decade". It was not until 2005 that the economic situation began to gradually improve. However, from a long-term perspective, the economic situation is still in a depressed state, which has given rise to talk of the Lost Three Decades.

A closer look at the Japanese economic climate in recent decades reveals that the Nikkei 225 index has continued to fall since 1990, exposing the vulnerability of the economy in general. Moreover, there have been several major natural disasters over the past few years such as the great earthquake of March 11, 2011, coupled with the current serious population contraction and the emergence of a super-aging society, thus resulting in labor shortage and decline in overall consumption capacity. The housing market has also been affected by the overall economic recession, and house prices continued to decline after the burst of the housing bubble (1986 to 1991). Since 1990, land prices have dropped by about 49.6%; the transaction volume of real estate has also dropped by nearly 50%; and the proportion of real estate in the total assets of Japanese households has continuously declined from 41.96% in 1994 to 24.25% in 2018. The current average homeownership rate in Japan is about 60%, which has been consistent since 1990. This means that a strong rental market may cause house prices to fall while rent prices remain high. This also shows that the great economic significance attributed to homeownership has gradually faded away in Japanese families, and people no longer actively try to own houses (Moriizumi and Naoi, 2011). Thus, many families have shifted their capital to other uses after experiencing a long period of downturn in the housing market, which has dealt a great blow to the demand for house-purchase.

Generally house ownership has an important wealth effect, and with it comes an effect on quality of life; consequently, people will opt to reduce their spending to save for their house purchase (Moriizumi, 2003). Tachibanaki (1994) also points out that Japanese households usually strive to save and accumulate wealth so as to own higher-quality houses, but excessively high land and construction prices wear the patience of renters who are biding their time to purchase a house. However, the current house price levels in Japan are

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believe that the poor policies in Japan caused loss of confidence and impeded economic recovery (Delong and Sims, 1999; Hayashi and Prescott, 2002; Kuttner and Posen, 2002; Leigh, 2010).

only half of those during the housing bubble in the late 1980s. The housing downturn has not only caused the wealth effect to plummet but also depressed the house-purchase desire of Japanese households, thereby providing a strong incentive for people to enter the rental market. Moriizumi and Naoi (2011) reject the null hypothesis that every family in Japan is certain to buy a house in their lifetime and provide evidence that unemployment risk and income uncertainty would adversely affect house-purchase behavior and severely delay homeownership. This conclusion essentially runs counter to the conventional wisdom that homeownership is a universal pursuit and represents a paradigm shift in attitude toward homeownership. Low price levels may be one of the factors that negatively affect purchase demand for houses. If real-estate prices are too low, on the one hand, the wealth effect will be limited, and this will affect consumption (Miyamoto, 2005; Horioka, 2006). Thus, from the perspective of consumption, there does not appear to be any strong incentive to own real estate. On the other hand, from the perspective of investment, Iwaisako (2009) points that there is a risk-diversifying effect between homeownership and stock assets. Iwaisako et al. (2015) find that expansion of the housing market helps to invigorate the stock market and diversify portfolio risk. However, Japan's stock market has been consistently low since the 1990s, and the current house prices are half of their previous price, which causes a low return on investment. Thus, after a long period of decreasing real estate prices, people have greatly lost incentive in housing consumption and investment based on the dual characteristics of house-purchase. They are reluctant to purchase a house and more likely to enter the rental market.

As previously stated, past experiences generally provide the basis for future decisions. In other words, is it the long-term downturn in the housing market that has led to reluctance to purchase a house, and hence high demand for rentals and low homeownership rate? The Japanese economy, in particular, has been in the doldrums for years, and its housing market has been affected accordingly. Furthermore, this phenomenon could be the fate of other countries with similar economic characteristics.

First, this study analyzes whether the housing downturn has affected the Japanese rental market by gleaning information from house-price deviations that have established willingness to purchase a house. Nagayasu and Inakura (2009) examine commodity prices in Japanese prefectures that have corresponded to the purchasing power parity (PPP) hypothesis. They found that the PPP hypothesis holds across prefectures in the long-term, that is, people in all prefectures expect that the ratio of regional price level to Tokyo is a constant in the long-term. Based on their method, this study examines the deviation of house prices in all of the prefectures in Japan from the level of Tokyo, to determine the degree of willingness to purchase a house. In other words, when people think that the relative value of house-prices deviates too far from the Tokyo level, they will hold a negative view of the housing market. They will be

reluctant to enter the housing market and choose to stay in the rental market instead.

Second, this study further explores whether willingness to purchase a house is affected by urban and non-urban discrepancies. Unbalanced regional development is a common issue in both developing and developed countries. There are significant differences between the development of urban and rural areas. Deviations in house prices from the Tokyo level may give way to different reactions in house-purchase intentions so that "catching up to the Tokyo level" may exist in urban areas, but not in rural areas. Therefore, this study further divides all of the prefectures into two major categories, namely, urban and non-urban areas, in the effort to divulge whether the two categories have different effects on the housing-market demand due to the experience of house-price deviation from the Tokyo level. Furthermore, there may be a threshold for whether the willingness to purchase a house can affect the changes of house-purchase behavior because temporary deviation is allowed. The changes in house price is similar to those in commodity price. Since the PPP hypothesis allows a certain degree or a short period of deviation, it is reasonable to assume that only a certain level of deviation in house prices matters. Thus, this study analyzes the extent to which house-price deviation from the Tokyo level will actually have an impact on the housing-market demand and even in different directions.

Finally, this study analyzes the differences in the regional housing market through the accumulated experience of willingness to purchase a house. According to the experience effects, people who experience a housing downturn and prolonged deviation from the Tokyo level are less willing to be owners, which results in discrepancies in the housing market in different regions. Therefore, this study calculates the cumulative value of the house-price deviation experienced in each prefecture to analyze the disparities between rent prices and homeownership rate in the different prefectures.

This study contributes to research work on the impact of experiences of the housing downturn on willingness to purchase a house. Previous studies have pointed out that past experiences affect the formation of beliefs and decision-making behaviors including investment, inflation expectations, and consumption behaviors. However, there are few studies that explore the impact of housing downturns on changes in house-purchase intention. Previous studies have indicated that personal experiences can affect future beliefs and decision-making behaviors significantly. For instance, Malmendier and Nagel (2011) and Malmendier et al. (2020) note that individuals who have experienced stock market crashes have a more pessimistic view of future stock market returns and are less willing to invest in the stock market. In the real-estate market, this study takes Japan as an example to discuss whether such experiences also affect behaviors in the real-estate market.

Furthermore, this study provides an insight that the changes in the housing market are caused by changes in homeownership intention. Common factors that affect homeownership are income, wealth, borrowing constraints, and demographic characteristics (Bostic et al., 2009; Moriizumi, 2000). However, focus on the impact of housing downturn experiences on housing behaviors and the real-estate market has been largely scarce. Furthermore, there are few direct research studies on how changes in homeownership intention due to the experiences with recession might affect house-purchase and rent prices of owner-occupied houses in the real-estate market. The results of this research can act as a reference for policy makers and future studies on the subject.

This paper is organized as follows: the second section is the literature review and offers a discussion that explains the origin of the experience effects and its recent application in the market, as well as the related literature on the factors that affect the entry of Japanese people into the housing market. The third section presents the research design, and explains the research data sources, sampling criteria, and regression model used to validate the hypothesis. The fourth section includes an analysis of the empirical results and the validation of the hypotheses in view of housing-market development. The final section presents the conclusion and implications.

2. Literature Review

2.1 Experience Effects

The concept of experience effects can be traced back to Tversky and Kahneman (1974) who proposed this psychological concept and posited that in an environment of uncertainty, thinking patterns are influenced by representativeness and availability heuristics at the same time, so that judgments tend to be made by relying on past experiences when people are exposed to massive amounts of information coupled with the need to make a decision in real-time. Furthermore, the beliefs formed in this process affect their decisions, i.e., experience effects.

Past experiences provide investors with an important frame of reference, which influence their views when making decisions on the same issues. For example, stock investors will likewise base predictions for future returns on personal experience with stock returns to decide whether they will invest. Malmendier and Nagel (2011) and Ampudia and Ehrmann (2017) find that those who have experienced low returns in the stock market are less willing to take financial risks and less likely to participate in the stock market. Similarly, those who have experienced low-paying bond markets are less likely to hold bonds. Graham and Narasimhan (2004) find firms had low debt during the 1940s if they had high leverage during the Great Depression. Other studies that focus on the use

of experience effects in the financial markets include Kaustia and Knüpfer (2008), and Amromin and Sharpe (2013).

In addition to the experience effects on the financial market, experiences from recessions have a similar impact on the labor market and consumption behaviors. Oreopoulos et al. (2012) observe the post-graduation career development of fresh graduates in the United States during an economic recession and find that their salaries fell over an extended 10-year period of time. Malmendier and Shen (2019) find that challenging times in a labor market will significantly affect the consumption behaviors of households. They find that the challenging times scar consumers, so that those who experienced low economic growth and high unemployment rates consume less food and tend to purchase clearance items.

Inflation experiences also affect anticipation and behavioral decision-making. Based on the inflation experiences of the Federal Open Market Committee members, Malmendier et al. (2021) find that their previous personal inflation experiences strongly affect either the dovish or hawkish attitude of the central bank and have significant ability for predicting the future voting behavior and inflation expectations of the members, which is helpful for explaining the target loan rate of the central bank. Reviewing the inflation experiences of the Japanese people, there is a strong cohort effect in individual inflation expectations. Diamond et al. (2020) point out that the differences in inflation experiences strongly predict the differences in the inflation expectations of each individual, thus providing a reasonable explanation for why the attitude of households in loan contracts and choice of mortgage rate differ between ages. Collin-Dufresne et al. (2017) confirm that the proportion of age demographics in the market will have different degrees of impact when economic shocks occur. Moreover, expectations will influence the perceptions of individuals with regard to real returns, which in turn influence actual expenditures and personal decisions, such as whether to enter the housing market.

In considering whether to purchase or rent a house, households are also influenced by macroeconomic factors, which result in discrepancies in the homeownership rate across areas. For example, Collins and Choi (2010) and Bracha and Jamison (2012) find that housing downturns give households a pessimistic view of the future housing market. After experiencing recessions and housing market crashes, renters are discouraged from becoming homeowners. Kuchler and Zafar (2019) find that experience with house price volatility affect individual belief about the housing market and the unemployed is more likely to be pessimistic. However, Sinai and Souleles (2005) find that young renters have greater incentive to purchase a house and become owners if they experienced large house price volatility. Brounen et al. (2014) and Malmendier and Steiny (2017) also point out that inflation experience strongly influences the house-purchasing behavior of households.

2.2 Economic Recession and Homeownership Rate

Among the previous studies that have discussed the real-estate market, many deem income uncertainty as a significant key impactor that affects the timing for a family to purchase a house. On the one hand, Haurin and Gill (1987) confirm that increases in income uncertainty will cause a decline in house-purchase demand. Researching on American families, Haurin (1991) finds that households will try to reduce the uncertainties associated with income in the effort to purchase a house. Robst et al. (1999) measure income changes in a variety of ways and also point out that income uncertainty will reduce the possibility of households owning their own house. On the other hand, the uncertainty posed by unemployment also reduces the probability of purchasing a house. DeSalvo and Eeckhoudt (1982) find a negative relationship between unemployment rate and housing cost for households who often commute to urban centers and have uncertain income. Moriizumi and Naoi (2011) also show that changes in unemployment risk have a strong negative impact on the purchase of houses by Japanese households. They propose that when unemployment rates increase by 10%, the probability of house-purchase decreases by 2%, which is even more drastic than the 0.2-0.3% decrease caused by the income variable. More importantly, their results reject the null hypothesis that families will eventually purchase a house. Moriizumi and Naoi (2012) believe that even though house prices and mortgage rates fell in the wake of the housing bubble, the increasing uncertainty of income brought about by the rising unemployment rate has led young Japanese households to hesitate about purchasing a house.

The slowing economic performance of Japan has also affected the rate of household wealth accumulation. If the level of welfare subsidies does not rise, this will indirectly delay the holding of real-estate rights. Due to high house prices and the inelasticity between house price and demand, the time required for household wealth to accumulate in Japan is longer than in other developed countries. Deutsch et al. (2006) find that when monthly mortgage payments exceed 25 percent of household income, the family will be discouraged from entering the housing market, opting instead to accumulate savings until they can afford a certain amount of down payment, which results in a higher average homebuyer age. Moriizumi (2003) shows that families will actively save up for a house and reduce their daily consumption by about 30% – 40% to reduce the burden of subsequent loans. Yukutake and Moriizumi (2018) find that credit constraints directly delay the timeline of homeownership for young Japanese families. In other words, credit conditions affect both the timing of purchase and the value of a house in a serious economic environment.

According to the discussions above, the Japanese real estate market has yet to recover and is affected by a number of factors such as income uncertainty, unemployment risk, wealth accumulation, and loan policies. Under the Lost Decade, households have gradually formed a pessimistic attitude toward the

uncertainty of being able to own a house, which seriously affects their willingness and ability to enter the real-estate market. These not only reduce the transaction volume of owner-occupied houses but also cause an imbalance between supply and demand in the rental market, ultimately leading to a decline in quality.

3. Research Design

3.1 Hypothesis Formation

Experience effects indicate that individuals form beliefs to make decisions based on their past experiences and this feature can be applied to investment in the financial commodities or other markets. During the long and torturous economic downturn of Japan, low market returns have gradually given rise to a pessimist attitude toward homeownership. Consequently, the housing market has lost its strong incentive for investment or consumption. Furthermore, taking the price level in Tokyo as the benchmark, Nagayasu and Inakura (2009) confirm that the price adjustment in different regions is in line with the PPP hypothesis. The ratio of the price level in the prefectures to Tokyo should be a constant and the temporary deviation converges. The deviation of prices from the Tokyo level increases negative public opinion. Therefore, this study intends to refer to this practice to measure the degree of deviation of the house-price levels in various regions from that in Tokyo so as to determine the degree of willingness to purchase a house. When people think that their beliefs about regional prices have deviated far from the Tokyo level, high expectations for house prices will wane, and thus they will be reluctant to enter the housing market and choose to stay in the rental housing market. Based on this, the following hypothesis is established.

Hypothesis 1.1: The less that past house-price levels of a region deviate from the Tokyo level, the higher the degree of willingness to purchase a house, which will negatively affect the rental market.

$$Y_{i,t} = \alpha_0 + \beta_1 \cdot willing_{i,t-1} + \theta \cdot Z_{i,t} + \rho_i + \tau_t + \epsilon_{i,t} \quad (1)$$

where the subscript i represents each prefecture, t is the t-th period, ρ_i is the regional fixed effect, τ_t is the time fixed effect, and the dependent variable $Y_{i,t}$ is the per-tsubo[2] rent prices ($Rent_{i,t}$) in i prefecture at time t. The independent variable $willing_{i,t-1}$ is the willingness to purchase a house in the first-period lag, which represents the impact of willingness to purchase a house in the first-period lead in the current housing market. The set of control variables for regional heterogeneity and the macro-economy $X_{i,t}$ includes the number of new houses (*New_House*), real income per capita (*Income*), per-unit area population

[2] 1 tsubo is equal to 3.3 m^2 or 35.5 ft^2

density (*POP_Dentisy*), and real loan rate (*LOA*). β_1 represents the degree of impact of the willingness to purchase a house in the housing market.
The uneven regional development in Japan means that differences in housing-market conditions are prevalent.

Hypothesis 1.2: After further classifying all the prefectures, the degree of the influence of willingness to purchase a house in the housing market differs between the non-urban and urban areas.

$$Y_{i,t}^{j} = \alpha_0^j + \beta_1^j \cdot willing_{i,t-1}^{j} + \theta^j \cdot Z_{i,t}^{j} + \rho_i^j + \tau_t + \epsilon_{i,t}^{j} \quad (2)$$

where the superscript *j* represents the urban and non-urban areas. We estimate Equation (2), which is modified from Equation (1), for the urban and non-urban areas, respectively. Due to the competitive growth of the urban areas, the house-price deviation is not as severe among the urban areas. As such, it is expected that the coefficient of β_1 of the non-urban areas will be higher than that of the urban areas.

Nagayasu and Inakura (2009) show that under the PPP hypothesis, temporary deviations of commodity prices are allowed, but will adjust back to the target Tokyo level in the long-term. Therefore, this study speculates that a brief deviation of the house prices in a region does not actually affect the rental market. However, when certain highs or lows are reached, willingness to purchase a house will then significantly affect the development of the housing market. In other words, willingness to purchase a house may not have an impact on the rental market when there is a deviation from the Tokyo level as the regional house price is lower. This nonlinear pattern in the housing market is also applied for examining the supply side, such as housing production (Bahmani-Oskooee and Ghodsi, 2019). To explore the extent and direction of the different effects that the independent variable (willingness to purchase a house) may have on the rental market under a range of observed values and to find this threshold value, a second hypothesis has been established by referring to the Hansen panel threshold regression model in Hansen (1999).

Hypothesis 2.1: When house prices in an area deviate from those in Tokyo to a certain level, willingness to purchase a house will lead to changes in demand in the housing market.

$$\begin{aligned} Y_{i,t} = \alpha_0 + \beta_{21} \cdot willing_{i,t-1} \cdot I\left(RES_{i,t-1} \le \gamma_1\right) + \beta_{22} \cdot willing_{i,t-1} \\ \cdot I\left(RES_{i,t-1} > \gamma_1\right) + \theta \cdot Z_{i,t} + e_{i,t} \end{aligned} \quad (3)$$

where the subscript *i* represents each prefecture; *t* is the *t*th period; the dependent variable *Y* is the per-tsubo[3] rent prices (*Rent*); and the independent variable *willing* is the willingness to purchase a house. *RES* is the threshold variable of house-price deviation, which represents the difference in the

[3] 1 tsubo is equal to 3.3 m^2 or 35.5 ft^2

perceived and actual house prices. That is, the percentage of regional house-price deviation from the Tokyo level house-prices in the long-run. γ_1 is the threshold value and *I* is the indicator function. When *RES* does not exceed the threshold value, the correlation between willingness to purchase a house and rent price is β_{21}; conversely, if *RES* exceeds a certain threshold value, the correlation between willingness to purchase a house and rent price is β_{22}. The impact of the deviation of house price in two different segments in the housing market will cause willingness to purchase a house to affect rent prices at different levels or have positive and negative effects on rent prices. For example, when *RES* exceeds the threshold value which points to a higher degree of deviation, willingness to purchase a house should positively impact rent prices. Since more deviation represents less confidence in the housing market which causes pessimism about the housing market, there is no incentive to own real estate, thus increasing demand for rentals. This study aims to understand the extent to which house-price deviation from the Tokyo level would have different impacts on the housing market. The control variable $Z_{i,t}$ is the same as that in Equation 1.

We suppose that there may be a more pronounced threshold effect in non-urban areas as compared to urban areas not only because of the competitive growth among the urban areas but also the large discrepancy between urban and non-urban areas.

Hypothesis 2.2: After further classifying all of the prefectures, the degree of deviation of the house prices in the non-urban areas from the Tokyo level is different from that in the urban areas.

$$Y_{i,t}^{j} = \alpha_0^{j} + \beta_{21}^{j} \cdot willing_{i,t-1}^{j} \cdot I\left(RES_{i,t-1}^{j} \le \gamma_1^{j}\right) + \beta_{22}^{j} \cdot willing_{i,t-1}^{j} \cdot I\left(RES_{i,t-1}^{j} > \gamma_1^{j}\right) + \theta \cdot Z_{i,t}^{j} + e_{i,t}^{j} \quad (4)$$

where the superscript *j* represents urban and non-urban areas. γ_1^{j} represents the threshold value in *j* and *I* is the indicator function. We estimate Equation (4), which is modified from Equation (3), for urban and non-urban areas, respectively. We suppose that the threshold value and this nonlinear relation are different between urban and non-urban areas.

3.2 Use of Economic Recession Experiences to Analyze Regional Housing Market Differences

Based on experience effects, this study holds that long-term experiences with the deviation of house-price level from that of Tokyo should have an adverse effect on the housing market. Therefore, the cumulative response discrepancies in the regional housing market are examined to see whether long-term accumulated experience could explain for the differences in the housing-market development between the different regions. Besides examining housing rentals,

Malmendier and Steiny (2017) are referenced to also analyze the disparities in regional homeownership rates.

Beliefs often change over time, which consequently affects decisions. The works of Malmendier and Nagel (2011) and Malmendier and Steiny (2017) are referenced, and in this study, the calculations of the accumulated experience effects of each prefecture are based on the demographic makeup. We calculate the long-term relative deviation in house prices from Tokyo's levels experienced in each prefecture, and that experience is reflected in the house-purchase intention to explain for the differences in the housing market. Weighted averages are used for the accumulated experience of the different age stages. Different weights are then adopted and used to measure the total sum of the accumulated experience with housing-market deviation in each region on average that determines the accumulated experience of willingness to purchase a house ($willing'$); the equation is as follows:

$$willing'_{i,t} = \frac{\sum_{k=1}^{age,t-1} \omega_{i,t-1}(k) \cdot \overline{willing}_{(t-5,t-1)}}{\sum_{k=1}^{age,t-1} \omega_{i,t-1}(k)}$$

The measurements of the different weights for the accumulated experience of each age group ($\omega_{i,t}(k)$) are given as follows:

$$(k, \mathrm{t}) = (1,2016)\ (6,2011)\ (11,2006)\ (16,2001)\ (21,1996)\ (26,1991)\ (31,1986) \quad (6)$$

In the above formula, *i* denotes the prefecture; *t* denotes the years 1986, 1991, 1996, 2001, 2006, 2011, and 2016, respectively; and *k* denotes the weight value. We assume the contribution of each year to weight is equal. $\overline{willing}$ denotes the average willingness to purchase a house for the prefectures every 5 years; for example, when *t*=2016, then $\overline{willing}$ is the average intention for house-purchase from 2011 to 2015. Age is the median population age within each prefecture, which is used to represent the core demographics and collective experience of the majority of people in these areas.[4] Since previous studies mainly conclude that it is not common for inter-prefecture migration to take place in Japan is uncommon, beliefs about the housing market will directly affect the local housing market when true regional house prices deviate from their idealized level.

Using the above measures, this study calculates the housing-market deviation experience through to 2016 for each prefecture, which is reflected in the differences between prefectures in the degree of willingness to purchase a house. We employ an index of willingness to purchase a house to observe the recent differences in rent and the homeownership rate between prefectures. The accumulated experience of willingness to purchase a house is through to 2015,

[4] Since the regional population median data in Japan is updated on a 5-year basis, *k* and *t* have been adjusted to fit the every-5-year criterion to preserve data integrity.

and the dependent variables, rent prices and homeownership rate are based on 2016 and 2018 numbers, respectively.[5]

3.3 Definition of willingness to purchase a house

Willingness to purchase a house measures the level of willingness to own a house at various stages in life. It is assumed that the PPP theory will hold over the long term. Nagayasu and Inakura (2009) use Tokyo as the basis for standardization because Tokyo, the capital of Japan, is not only the most populated city in the country but also a place where all major economic activities and good exchanges are concentrated. Thus, the Tokyo metropolitan area is used as the benchmark from the perspective of long-term urban development. This study holds that commodity prices in various prefectures will over time, converge to a relative level with Tokyo, which means that those who are residing in the prefectures of Japan have a target price in mind relative to Tokyo. Thus, the ratio of house to commodity prices in each district is proportional to Tokyo:

$$\frac{hp_t^i}{p_t^i} = \emptyset \frac{hp_t^T}{p_t^T}$$

where *hp* is house price, *p* is the consumer price index, the superscript *T* is Tokyo, *i* are the prefectures outside of Tokyo, and *t* is *t*th period. After transposition, we obtain:

$$\frac{hp_t^i}{hp_t^T} = \emptyset \frac{p_t^i}{p_t^T}$$

The natural logarithm obtained in the above formula is rewritten as:

$$HP_t^i = \emptyset P_t^i$$

where $HP_t^i = \left(\frac{hp_t^i}{hp_t^T}\right)$ expresses the house prices in the prefectures relative to the house prices in Tokyo. $P_t^i = \left(\frac{p_t^i}{p_t^T}\right)$ expresses the commodity prices in the prefectures relative to the commodity prices in Tokyo. The coefficient of $\emptyset$ represents the ratio of those residing in the prefectures outside of Tokyo with a target price in mind relative to Tokyo. We estimate the equation, and the residual represents the target house-price level that the homebuyer has in mind and the true price deviation in that period of time, i.e., the difference in the perceived and actual house prices (*RES*):

$$RES_{i,t} = HP_t^i - \widehat{HP_t^i} \tag{7}$$

[5] The application of the 2018 homeownership rate data is the most appropriate comparative data because it is updated every 5 years.

In the formula above, *RES* can be regarded as the regional house prices relative to the Tokyo level - the difference between the real and expected prices. For example, when *RES* is higher than zero, the *i* regional house-price relative to the Tokyo level is higher than the expected price. If there is trust that government policy plays a role in the housing market, the policy would keep the real relative house price to the anticipated level. Then *RES* should tend towards zero, which turns this into the confidence index of government housing policy:

$$willing_{i,t} = \frac{1}{1 + \lambda(HP_t^i - \widehat{HP_t^i})^2} \tag{8}$$

In Equation 8, $willing_{i,t}$ represents the confidence index in government policy for the housing market and the degree of willingness to purchase a house for i prefecture at time t, which lies between a value of zero and one. λ represents the sensitivity coefficient of the housing market at the time. This study assumes housing-market information to be symmetrical; therefore, λ=1. A higher value means higher confidence; that is, there is more willingness to purchase a house with less deviation. That is, when willingness to purchase a house equals one, the residual is zero which means that there is no deviation of the regional house prices from the Tokyo level.

This study observes the effects of past loss experiences on current housing demand; therefore, the lag period of willingness to purchase a house is treated as an independent variable. In other words, when the lag of willing is lower, price deviation is higher. This means that there is the absence of trust in the government housing-market policy, with the belief that the true house price has deviated from the ideal.

3.4 Dependent and Control Variables

This study explores the impact of experience effects under long-term house-price deviation from the Tokyo level, along with the ongoing economic recession and the question of whether there is a major change in demand of the Japanese people to enter the housing market. Therefore, to understand the impact of willingness to purchase a house on the housing market, the per-tsubo rent (*Rent*) is used to observe the dependent variable of housing-market changes. The significance of using rent is that when regional house prices show deviation from the Tokyo level, the willingness to purchase a house will be decreased, thus lowering housing demand. This not only brings a direct adverse shock to housing purchase demand but also causes housing rental market demand to surge, and rent prices to rise. The per-tsubo rental data is the average per-tsubo rents for privately-owned flats for each prefecture and measured by deflating the price index for each period and then obtaining a logarithm.

Additionally, in terms of a robust analysis, housing transaction volume was used as a substitute of the dependent variables. The significance of the use of

transaction volume as a robustness test is that excessively high house prices will cause loss of patience of those who are waiting for the opportune moment to purchase a house (Tachibanaki, 1994), thus resulting in reluctance to purchase a house, which is further reflected in the overall real estate transaction volume. The opposite is also true; when the house prices that have been experienced previously fall within a reasonable range, house-purchase intention will increase, and this study anticipates that this has a positive impact on real-estate transaction volume, which is measured by the number of transfers of land ownership registrations of the prefectures.

Control variables include the number of newly built houses (*New_House*) which represents the supply side of real-estate, real income per capita (*Income*) and the per-unit area population density (*POP_Dentisy*) that control regional heterogeneity, and the real loan rate (*LOA*) that controls macroeconomic conditions.

3.5 Data Sources

In this study, we use the annual data from 47 administrative prefectures of Japan. In the selected sampling year, the dependent variable that this study wishes to observe is split into the two major categories of per-tsubo rent and transaction volume. Due to the statistical data available in Japan, there is a discrepancy in the period covered by the two variables. The complete period for the rent price data sample is from 1978 to 2016. The period of the regional housing transaction volume sample only covers a portion of the urban areas and times of years, thus taking into account the continuity differences in the years covered by the regional data; the transaction volume data is for the eight prefectures,[6] and the sampling period ranges from 1989 to 2016.

The source of the data of the rent, house and commodity prices, income per capita, and population density is e-Stat, a Japanese government statistical data portal. Due to the lack of a long-term series of housing price data for the prefectures, we use land prices as a proxy variable of housing prices.[7] Housing transaction volume and newly built houses information were sourced from The Land Institute of Japan and Ministry of Land, Infrastructure, Transport and Tourism of Japan, respectively. Loan interest rates were sourced from the Bank of Japan. For detailed definitions of the variables and data, please see Appendix 1.

[6] The eight prefectures include Saitama, Chiba, Tokyo, Kanagawa, Kyoto, Osaka, Hyogo, and Nara.

[7] This is not uncommon in many previous Japanese studies, such as Othake and Shintani (1996) and Nagahata et al. (2004).

4. Analysis of the Empirical Results

According to PPP hypothesis, regional prices will converge to a relative level with the capital city (Nagayasu and Inakura, 2009). To understand if the deviation experience from house price in the local regions relative to the Tokyo level would affect willingness to purchase a house, and hence the real-estate market, this study measures willingness to purchase a house for each prefecture which is then applied to examine the impact on rent prices, to validate Hypothesis 1.1. Furthermore, allowing the regional house-price levels to deviate from the Tokyo level and more closely watching the extent that this would have an impact and when, we use a threshold regression model to capture the degree and direction of the impact generated by willingness to purchase a house on the housing market, to validate Hypothesis 2.1. In our empirical strategy, we also split prefectures into urban and non-urban areas, to validate Hypotheses 1.2 and 2.2. We also use transaction volume as a substitute dependent variable for a robust check to identify whether willingness to purchase a house might possibly impact real estate transaction volume. Finally, we observe the relation between accumulated experience and regional housing market (rent prices and homeownership rate).

4.1 Sample Statistics

Our variables include the dependent variable which uses rent prices as a proxy variable for real-estate market development. Transaction volume is the substitution variable in the robustness testing. The main independent variable is willingness to purchase a house, and the control variables are newly built houses, income per capita, population density, and loan interest rate.

Due to the extent of inequality in regional development in developed countries, the economic resources are mainly concentrated in cities which naturally attract population influx and capital inflow. This shows the gap between the urban and non-urban areas. Therefore, apart from observing the average of all the prefectures in Japan, this study also further divides the prefectures into urban and non-urban areas and compares them with each other to obtain a better understanding of this urban–rural gap. The urban areas are the 13 largest prefectures, which are Aichi, Chiba, Fukuoka, Hokkaido, Hyogo, Kanagawa, Kyoto, Mie, Miyagi, Nara, Osaka, Saitama, and Tokyo.[8] The non-urban areas are the 34 remaining prefectures. Figure 1 is a map of the prefectures in the urban and non-urban areas. The purpose is to explore whether there are any

[8] Refer to the classification of urban and non-urban areas in Hamaaki et al. (2019), with Aichi, Chiba, Fukuoka, Hyogo, Kanagawa, Kyoto, Osaka, Saitama, and Tokyo as the urban areas. We also consider Hokkaido, Miyagi, Mie, and Nara as urban areas. This is because the former two are the main prefectures in the northeast, and the latter two are adjacent to Osaka and are the main prefectures in the Kansai region.

differences in the impact of willingness to purchase a house on the real-estate market between the urban and non-urban areas.

Figure 1. Urban areas (gray) and non-urban areas in Japan based on 47 prefectures

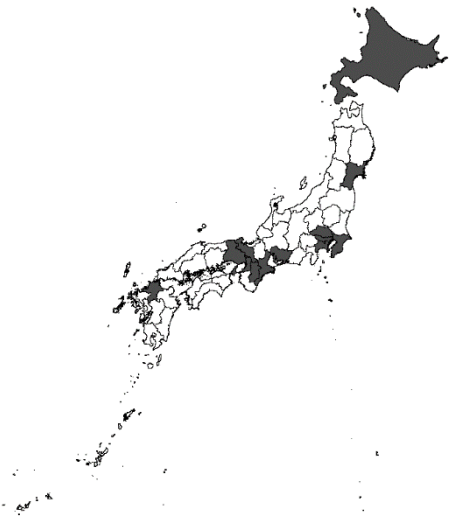


Table 1 presents the basic statistics. All of the variables are regional variables except for loan interest rates, and the series of rent prices and income per capita are deflated by the CPI index. In Table 1, rent prices range from 1204 to 8547 yen (1 USD = 146 yen) and transaction volume ranges from 10,741 to 175,258. For willingness to purchase a house, the average value is 0.985 for all of the prefectures. The average value of willingness to purchase in urban areas is smaller than the non-urban areas and the standard deviation in the urban areas is larger. Real estate is a non-tradable commodity, and the structural changes in city development in recent years may be one of the reasons why willingness to purchase a house measured by the PPP hypothesis is lower in urban areas than in non-urban areas (as the standard deviation is larger in urban areas).[9] The

[9] We estimate the deviation based on the PPP hypothesis. When the deviation is larger, the willingness to buy a house is lower, thus implying that the PPP hypothesis does not hold. The common reasons for the failure of the PPP hypothesis include the proportion of non-traded commodities, differences in development structure between regions, trade barriers, and price systems. Real estate is a non-tradable commodity and has no transportation costs. In addition, the Japanese housing market system is transparent (λ=1), Therefore it is inferred that compared with the gap between urban and rural areas, uneven development within the urban's prefectures deserves attention.

average value of the difference between the real and expected prices, *RES*, is positive in the urban areas and negative in the non-urban areas. This means that there is a gap in the regional housing markets in terms of development.

Before performing our empirical analysis, we implement the Levin, Lin, and Chu (LLC) unit root test to confirm that all of the variables are stationary. All of the variables of the unit root test results can be viewed in Table 2. For most level series, the null hypothesis is rejected, which shows their stationarity, but after differentiating the deviation value of willingness to purchase a house and the degree of deviation in house-price levels, they demonstrate stability.

Table 1 Basic statistics

Variable	N	Mean	Median	Max.	Min.	S.D.
Rent price (yen)	1833	3413.54	3369.01	8547.70	1204.17	1081.63
Transaction volume	224	73913.59	78898.00	175258.0	10741.40	36429.18
Willingness to purchase a house	1833	0.985	0.995	1.000	0.812	0.030
Urban	507	0.971	0.991	1.000	0.812	0.050
Non-Urban	1326	0.990	0.996	1.000	0.902	0.015
RES	1833	-0.004	-0.011	0.482	-0.330	0.129
Urban	507	0.068	0.044	0.482	-0.269	0.168
Non-Urban	1326	-0.032	-0.027	0.275	-0.330	0.097
Newly built houses	1833	26544.67	14236.00	228160.0	2076.00	31856.33
Income per capita (1,000 yen)	1833	2334.70	2384.94	5278.52	917.25	601.45
Population density	1833	1350.23	848.20	9609.40	239.20	1630.45
Loan interest rate (%)	1833	0.950	0.938	3.503	-2.400	1.241

Note: Our sample period for the rent price is from 1978 to 2016 (39 years) for 47 prefectures and the transaction volume range is from 1989 to 2016 (28 years) for 8 prefectures due to availability issues. The sample size for the rent price is 1,833 and the transaction volume is 224.

Table 2 Unit root test

Variable	Level	First Difference
Rent price	-14.124***	
Transaction volume	-2.481***	
Willingness to purchase a house	4.989	-14.842***
RES	-0.554	-18.985***
Newly built houses	-3.340***	
Income per capita	-1.515*	
Population density	-2.401***	
Loan interest rate	-7.593***	

Notes: *, **, and *** indicate significance at the 0.1, 0.05, 0.01 levels respectively.

4.2 Impact of willingness to purchase a house on the housing market

To understand the impact of willingness to purchase a house on the real-estate market, we first present the results of the impact of willingness to purchase a house on the housing market, and rent prices. The estimated results in the first part, Part A, are those of all of the prefectures and the second part, Part B, are those of the urban and non-urban areas.

4.2.1 Impact of willingness to purchase a house on the housing market

Table 3 contains the regression results of the impact of willingness to purchase a house on rent prices. First, Columns (1) and (2) present the estimated results with and without control variables. The coefficient value of willingness to purchase a house is statistically significant at −2.76 and −1.28. The significant coefficient with a negative value of willingness to purchase a house in Columns (1) and (2) means an increase in willingness to purchase a house reduces rent prices. This is consistent with our expectation, that is, willingness to purchase a house measured by deviation from house price in the local regions relative to the Tokyo level has an impact on the housing market.

Table 3 Impact of willingness to purchase a house on housing market: all prefectures

Dependent variable: *log(rent prices)*				
Independent variable	(1)	(2)	(3)	(4)
$Willing_{t-1}$	-2.76***	-1.28*	0.15	0.03
	(-3.22)	(-2.47)	(0.39)	(0.08)
New_House_t		0.02***	-0.26***	0.07***
		(2.66)	(-23.98)	(3.69)
$Income_t$		0.75***	0.86***	-0.03***
		(40.05)	(49.56)	(-0.61)
$POP\_Density_t$		0.07***	0.43***	-0.16
		(8.56)	(5.35)	(-2.12)
LOA_t		-0.05***	-0.03***	
		(-12.74)	(-9.89)	
Intercept	8.08***	1.65***	1.30**	8.93***
	(1093.59)	(11.93)	(2.43)	(15.14)
Prefectural fixed effect	NO	NO	YES	YES
Time fixed effect	NO	NO	NO	YES
N	1833	1833	1833	1833

Notes: The t-values are shown in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, 0.01 levels respectively.

Second, Columns (3) and (4) consider the prefectures and time fixed effects. The impacts of willingness to purchase a house on rent prices are positive but not statistically significant. The results in the table show that when the prefectures and the fixed effects of time are added, the significant effect of willingness to purchase a house on rent prices becomes insignificant. We assume that the control variables used in this study contain tracked data of

region and time, which mean that they have a substantial degree of control over the effects of the divergence between the prefectures and time-trends. Therefore, the results in Column (2) are used as the primary explanation for this study. That is, willingness to purchase a house has a significant impact on the housing market. Specifically, an increase by one unit of willingness to purchase a house negatively inhibits rent appreciation by 1.28 units; this is consistent with Hypothesis 1.1.

4.2.2 Urban and Non-Urban Areas

We then divide the prefecture sample into urban and non-urban areas. Panels A and B of Table 4 show the empirical results for urban and non-urban areas, respectively. Columns (1) to (4) of Panel A show that the impact of willingness to purchase a house on rent prices is insignificant. However, Panel B shows that willingness to purchase a house has a statistically significant effect on rent prices without controlling for the prefectures and time fixed effects. In Columns (1) and (2), the rental market in non-urban areas is negatively and significantly affected by willingness to purchase a house compared to the urban areas. Moreover, rent prices are adversely reduced by 1.53 units in non-urban areas (Column (2) in Table 4) when willingness to purchase a house increases by one unit, and the coefficient even exceeds all of the prefectures by 1.28 units (Column (2) of Table 3).

The above results verify that a significant disparity exists between urban and rural developments in the real estate market, thus proving Hypothesis 1.2. The reason for this is assumed to be the continuous population influx and rapid flow of information between the major cities. Therefore, we propose that the self-correction of house prices in the metropolitan areas of Japan should be just as quick, which would result in small deviations in house prices between the metropolitan areas and the Tokyo level. This causes statistical insignificance because of the impact of changes in willingness to purchase a house on the rental market. However, the deviation of house prices is serious in non-urban areas, which causes a widening gap in the willingness to purchase a house between the urban and non-urban areas, eventually giving rise to a negative impact on the rental market.

The empirical results in Table 4 show the different results for impacts of willingness to purchase a house on rent prices between the urban and urban areas. We further examine the threshold effect, which provides insight into the urban-rural gap on the degree of price deviation.

4.3 Does impact of willingness to purchase a house on rent prices have a threshold effect?

In this section, we test Hypothesis 2.1 that house-purchase willingness significantly affects the housing market when the deviation reaches a certain

high or low threshold. This is because a temporary deviation is allowed under the PPP hypothesis in the long-term. The house-price deviation, *RES* is taken as our threshold variable, which is used to measure willingness to purchase a house in different ranges and whether the impact on rent prices and direction differs. Table 5 lists the results of the threshold effect.

Table 4 Impact of willingness to purchase a house on housing market: Urban and non-urban areas

Panel A: Urban area				
Dependent variable: *log(rent prices)*				
Independent variable	(1)	(2)	(3)	(4)
$Willing_{t-1}$	-1.02	-0.47	0.46	-0.72
	(-0.68)	(-0.57)	(0.60)	(-1.32)
New_House_t		0.03***	-0.20***	0.15***
		(2.76)	(-9.62)	(4.38)
$Income_t$		0.88***	1.04***	-0.10***
		(23.55)	(19.65)	(-0.87)
$POP\_Density_t$		0.04***	0.13	-0.50
		(3.18)	(0.84)	(-3.44)
LOA_t		-0.05***	-0.03***	
		(-6.90)	(-5.42)	
Intercept	8.26***	0.75***	1.46	11.46***
	(528.95)	(2.8)	(1.60)	(10.00)
Prefectural fixed effect	NO	NO	YES	YES
Time fixed effect	NO	NO	NO	YES
N	507	507	507	507
Panel B: Non-urban area				
Dependent variable: *log(rent prices)*				
Independent variable	(1)	(2)	(3)	(4)
$Willing_{t-1}$	-5.03***	-1.53**	-0.03	0.51
	(-5.27)	(-2.42)	(-0.07)	(1.35)
New_House_t		-0.04***	-0.29***	0.05**
		(-4.58)	(-21.53)	(2.17)
$Income_t$		0.70***	0.81***	0.09**
		(33.51)	(44.51)	(-1.32)
$POP\_Density_t$		0.01	0.38***	-0.14
		(0.52)	(3.08)	(-1.21)
LOA_t		-0.04***	-0.03***	
		(-10.63)	(-7.88)	
Intercept	8.01***	3.03***	2.22***	8.30***
	(1070.32)	(16.56)	(2.76)	(11.11)
Prefectural fixed effect	NO	NO	YES	YES
Time fixed effect	NO	NO	NO	YES
N	1326	1326	1326	1326

Notes: The t-value is shown in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels respectively.

It can be observed in Table 5 that there is the presence of a threshold value for a deviation from the house-price level relative to that of Tokyo. As for all prefectures, the threshold test rejects the null hypothesis that holds there is no double threshold (F-statistic is 32.08 with p-value of 0.00). This means that three regimes with two threshold values do exist. The threshold values are −0.0160 and 0.0030. The result of the threshold test supports Hypothesis 2.1.

Table 5 Threshold test for all prefectures, and urban and non-urban areas

Dependent variable: *log(rent prices)* Threshold variable: *RES*			
Area	all prefectures	urban areas	non-urban areas
F (p-value)			
Single	9.02 (0.02)	2.52 (0.40)	7.24 (0.06)
Double	32.08 (0.00)		5.5 (0.47)
Triple	5.72 (0.74)		
Threshold value (95% confidence level)			
First (γ_1)	-0.0160 (-0.0203, -0.0151)		0.0406 (0.0399, 0.0408)
Second (γ_2)	0.0030 (0.0003, 0.0041)		

Turning now to the urban areas, the null hypothesis, which holds that there is no threshold effect, is accepted (F-statistic = 2.52 with a p-value of 0.40). This means that a threshold effect based on house-price deviation does not exist. As for the non-urban areas, the null hypothesis, which holds that there is no single threshold effect, is rejected (F-statistic = 7.24 with a p-value of 0.06). This indicates the presence of a threshold effect in non-urban areas with a threshold value of 0.0406. The threshold of willingness to purchase a house on rent prices in the non-urban areas is different from that of the urban areas, thus resulting in inconsistent effects of willingness to purchase a house on rent prices between the two regions, and subsequently validating Hypothesis 2.2.

4.3.1 All Prefectures

According to the threshold test in Table 5, we obtain three regimes with two threshold values for all of the prefectures. Table 6 presents the estimated results of the threshold regression for all of the prefectures. The first regime ($RES \leqq$ -0.016) in which regional house prices relative to the Tokyo level are lower than their expected value by 1.6 percent shows that the impact of willingness to purchase a house on rent prices is negative but insignificant. The second regime, in which the discrepancy between the relative house prices lies at −1.6 percent to −0.3 percent ($-0.016 < RES \leqq 0.003$), shows that willingness to purchase a

house has a significantly positive effect on rent prices. However, the third regime, in which regional house prices relative to Tokyo exceed their expected value by 0.3 percent, shows that greater willingness to purchase a house will significantly and positively affect rent prices. Broadly speaking, an examination of the estimated coefficient shows that willingness to purchase a house in the prefectures has different impacts on rent prices during the different regimes based on house-price deviation from the Tokyo level.

Table 6 Threshold regression for all prefectures

Dependent variable: *log(rent prices)* Threshold variable: *RES*			
Regime	$RES \leqq -0.016$	$-0.016 < RES \leqq 0.003$	$0.003 < RES$
$willing_{t-1}$	-0.21	-13.92***	1.13**
	(-0.69)	(-6.65)	(2.78)

Notes: The estimated regression, number of newly built houses, income per capita, population density, and loan rate are included (not reported). The t-value is shown in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

It is found after a comprehensive review of the general linear regression and threshold regression results that, on average, an increase in willingness to purchase a house exerts a downward pressure on rent prices, which is consistent with Hypotheses 1.1 and 2.1. Therefore, this study holds that when there is comparatively no deviation in the regional house-price levels relative to that of Tokyo, the degree of willingness to purchase a house will be higher. With a higher demand for owner-occupied houses, there will be a subtle adverse effect on the rental market. However, if regional house prices relative to the Tokyo level exceed the expected value by 0.3 percent, then it will have the opposite effect, which will cause willingness to purchase a house to escalate the appreciation of rent.[10] The result of the threshold effect for all of the prefectures is consistent with Hypothesis 2.1.

4.3.2 Urban and Non-Urban Areas

Since we obtained a threshold effect in the non-urban areas instead of the urban areas in Table 5, we show the estimated result of the threshold regression for the non-urban areas in Table 7. The threshold effect in non-urban areas can be considered as two regimes with one threshold value. The first regime in which the house-price level relative to that of Tokyo is lower than the expected value by 0.4 percent shows a negative but insignificant correlation. The second regime in which the house-price level relative to that of Tokyo exceeds the expected value by 0.4 percent shows willingness to purchase a house has a significantly positive effect on rent prices.

[10] We suppose the few areas may have investment demand as one of the reasons.

The prefectures are further categorized into urban and non-urban samples for testing, and willingness to purchase a house in non-urban areas has a significantly negative effect on rent prices as shown in Table 4. However, the negative effect in urban areas is insignificant, which confirms an urban–rural gap and validates Hypothesis 1.2. We assume that the house-price levels in the urban areas of Japan will continue to adjust in a competitive manner, thereby

giving rise to an ambiguous correlation between willingness to purchase a house and rent prices. As Tsai and Lin (2019) find with the use of data from the U.S., the most influential housing markets are in the west coast metropolitan areas, so the adjustment in the housing market in those urban areas might be quicker. Moreover, there is also a certain threshold value for the deviation in house prices from those of Tokyo in the non-urban areas. This proves Hypothesis 2.2, and the threshold effect is only found for non-urban areas. As shown in Table 7, when the price deviation in non-urban areas is lower than the expected value by 0.4 percent, increase in willingness to purchase a house has a negative impact on the rental market. However, when the price deviation exceeds the expected value by 0.4 percent, willingness to purchase a house will conversely promote the growth of the housing rental market.

Table 7 Threshold regression in non-urban areas

Dependent variable: *log(rent prices)* Threshold variable: *RES*		
Regime	*RES*≦0.0406	0.0406<*RES*
$willing_{t-1}$	-0.54	2.20*
	(-1.70)	(2.25)

Notes: The estimated regression, number of newly built houses, income per capita, population density, and loan rate are included (not reported). The t-value is shown in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

4.4 Robustness Testing

In this section, we conduct a robustness check to verify that willingness to purchase a house which measures price deviation from the Tokyo level has a significant impact on the real estate market. This study applies real estate transaction volume as a substitute independent variable for the robustness check. We first show the result of the linear regression and implement a threshold test. Table 8 presents the effects of willingness to purchase a house on real-estate transaction volume based on the eight major prefectures of Japan. It can be seen that regardless whether the prefectures and the time fixed effects are controlled, the effect of the willingness to purchase a house on real-estate transaction volume is statistically insignificant; however, it is positive most of the time (the

coefficients are 1.27, 0.77, and 0.41), which is consistent with the hypothesis put forward in this study. A smaller deviation of the regional house-price from the Tokyo level translates into greater willingness to purchase a house which would have a positive effect on the real-estate transaction volume.

The insignificant impact of willingness to purchase a house on transaction volume is found in Table 8. Since the eight major prefectures are mainly concentrated in the urban metro areas, the rate at which house prices adjust is consistent, and there is a competitive relationship between them. This is more helpful for investments rather than consumer demand and would not have a significantly critical impact on the real estate transaction volume. This will promote the development of the real-estate market while simultaneously proving Hypotheses 1.1 and 1.2.

Table 8 Impact of willingness to purchase a house in housing market eight major prefectures

Dependent variable: *log(transaction volume)*				
Independent variable	(1)	(2)	(3)	(4)
$Willing_{t-1}$	1.27	0.77	0.41	-0.24
	(0.32)	(0.77)	(0.51)	(-0.30)
New_House_t		0.83***	0.58***	0.57***
		(42.86)	(17.05)	(6.82)
$Income_t$		-0.24***	-0.58***	-0.32
		(-3.02)	(-3.52)	(-1.22)
$POP\_Density_t$		-0.09***	2.18***	2.01***
		(-3.03)	(6.27)	(6.56)
LOA_t		-0.05***	-0.02**	
		(-4.47)	(-2.39)	
Intercept	11.04***	4.69***	-7.22**	-2.51
	(249.58)	(9.47)	(2.47)	(-0.91)
Prefectural fixed effect	NO	NO	YES	YES
Time fixed effect	NO	NO	NO	YES
N	224	224	224	224

Notes: The t-value is shown in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels respectively.

It is worth noting the sign of the control variables which has the opposite direction of the impact of income on transaction volume and rent prices. In Tables 3 and 8, the impact of income on transaction volume is negative, while that on rent prices is positive. The opposite sign may show that people will choose to rent a better house when they can afford to do so. As Tiwari (2002) points out, the quality of rental housing is low in Japan. Under the condition of controlling supply, rent prices reflect investment, and transaction volume reflects consumption and investment. The significant impact on rent prices may

also imply that investment in housing is growing. As for other control variables, including those in Tables 3, 4, and 8, the population density is to control the size of each prefecture, and the loan interest rate is the cost of buying a house.

Table 9 shows the threshold test of willingness to purchase a house on transaction volume in the eight major prefectures. The table shows the failure to reject the null hypothesis for the sampling from the eight major prefectures, which means that there are no threshold effects for house-price deviation value. This result is similar to that of the linear regression on urban areas in Table 5 which shows that willingness to purchase a house does not significantly affect transaction volume. From this, Hypotheses 2.1 and 2.2 can be further confirmed; that is, house-price heterogeneity in urban areas is generally quite low, so there is likewise no threshold effect.

Table 9 Threshold test for eight major prefectures

Dependent variable: *log(transaction volume)* Threshold variable: *RES*	
Threshold	F (p-value)
Single	2.15 (0.77)

Compared with the rental housing market, willingness to purchase a house has no direct impact on transaction volume throughout the eight major prefectures. Although the direction of the two impacts is consistent with expectations, and there is a positive correlation, it is statistically insignificant. The following are some of the reasons. First, the house prices in each metropolitan area will adjust in a competitive manner because these eight prefectures are all located within the three major megalopolises of Japan. Second, the period of the transaction volume starts from the time of the housing bubble in 1989, and the relationship before and after the bubble in Japan cannot be captured. Briefly speaking, our robustness check finds that the empirical results of changing the dependent variable of the housing market to transaction volume are consistent with the above conclusions on rent prices.

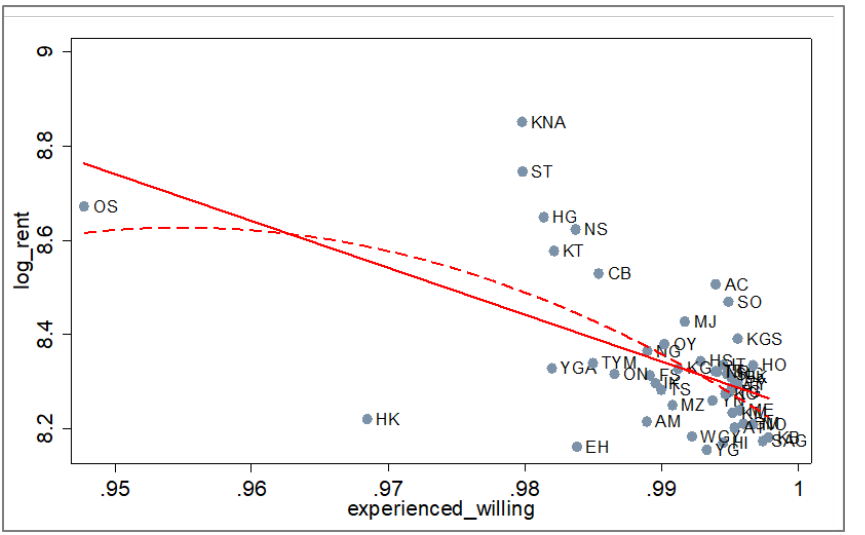
4.5 Does Accumulated Experience with Willingness to Purchase a House Explain Regional Heterogeneity?

The concept of experience effects refers to the final decision that people tend to make based on their past experience and beliefs. The regional house-price deviation relative to that of Tokyo long experienced by the Japanese people could in the same manner affect housing-market conditions. With reference to the equation in Malmendier and Nagel (2001), this study calculates the accumulated experience of regional house-price deviation reflected through the willingness to purchase a house. The equation is adopted to explain the

heterogeneity in regional rent prices and homeownership rate, as shown in Figures 2 to 5[11].

Figures 2 and 3 plot a scatter and a regression line for the relationship between the accumulated experience with willingness to purchase a house and rent prices for all prefectures and urban versus non-urban prefectures in Japan from 1985 to 2015 excluding Tokyo.[12] The x-axis is the accumulated experience with willingness to purchase a house measured by price deviation from the Tokyo level and y-axis is the 2016 per-tsubo rent prices. In Figure 2, we can see more experience with willingness to purchase a house, which involves less deviation of regional house-price from the Tokyo level, and lower regional rent prices in 2016. In Figures 3(a) and 3(b), a negative relationship is also found for both the urban and non-urban areas. These are consistent with the conclusion offered in this study, that is, long-term cumulative experience with house-price deviation will cause reluctance to enter the real-estate market, thus inhibiting rent price appreciation.

Figure 2 Impact of accumulated experience with willingness to purchase a house on rent prices: all prefectures

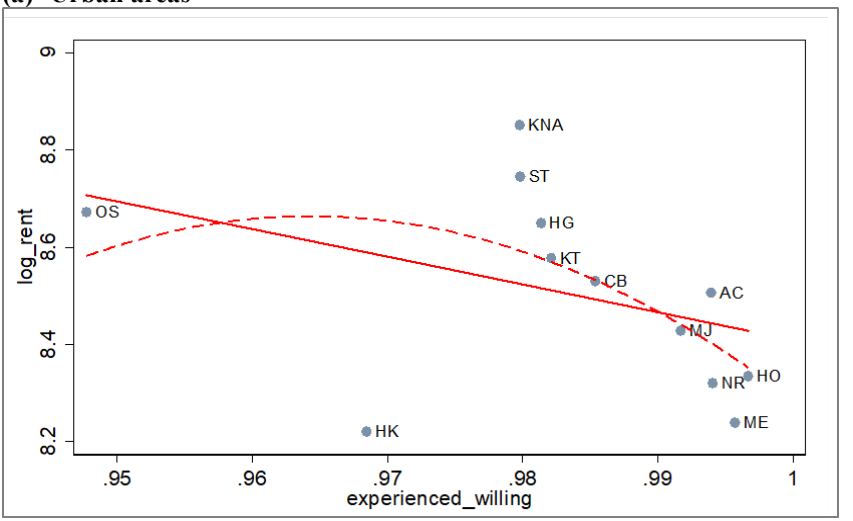


[11] For the codes of the prefectures and estimated regression, please see Appendixes 2 and 3.

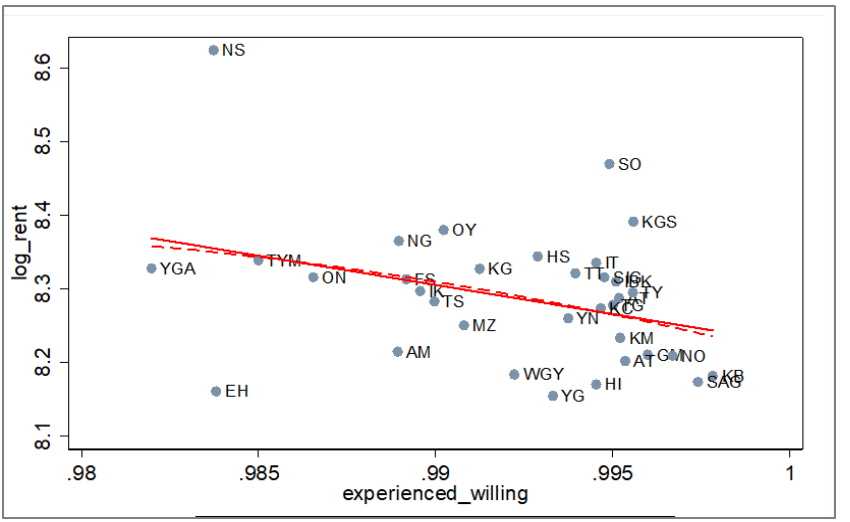
[12] Due to the fact that the Tokyo prefecture sample deviates from the other prefectures, the Tokyo prefecture outliers have been excluded to more accurately interpret the housing rental market conditions.

Figure 3 Impact of accumulated experience with willingness to purchase a house on rent prices: urban and non-urban areas

(a) Urban areas



(b) Non-urban areas

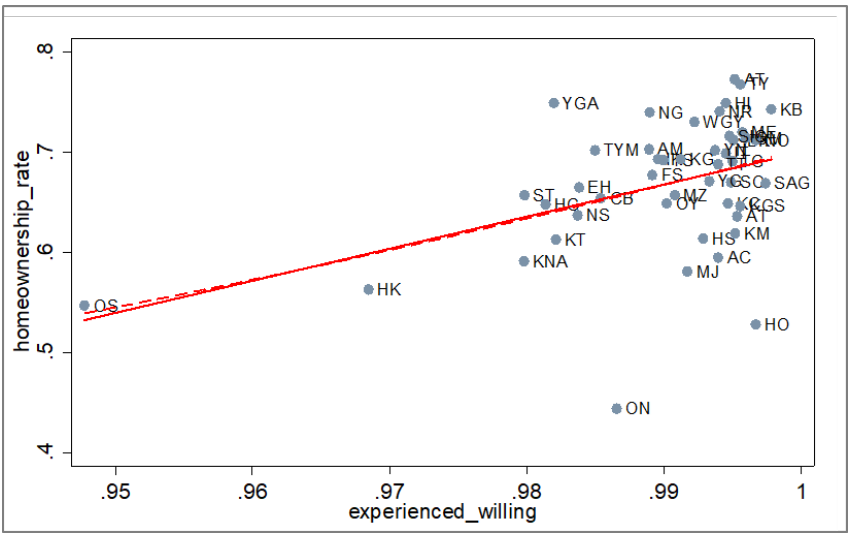


Figures 4 and 5 plot the relationship between accumulated experience with willingness to purchase a house and homeownership. The x-axis is the experience with willingness to purchase a house measured by price deviation from the Tokyo level and y-axis is the 2015 homeownership rate.[13]

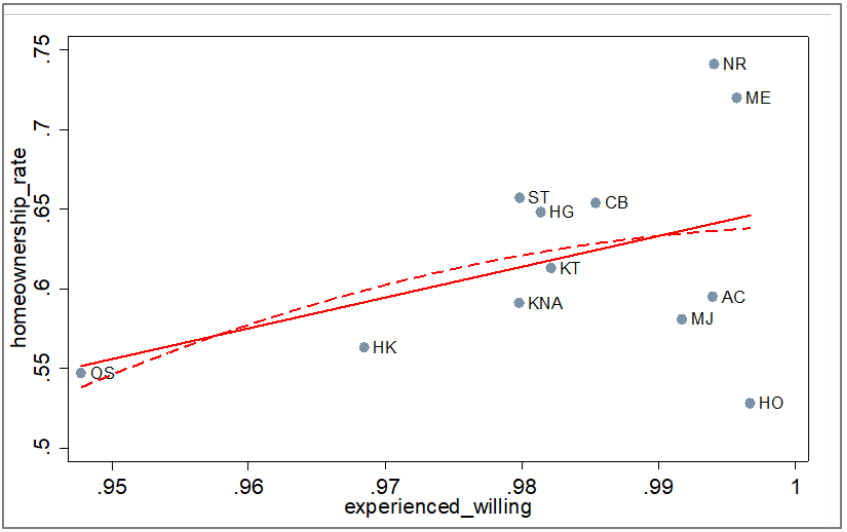
[13] We use homeownership rate of 2015 by prefecture and not 2016 because the

Figure 4 Impact of accumulated experience with willingness to purchase a house on homeownership rate: all prefectures

(a) Urban areas



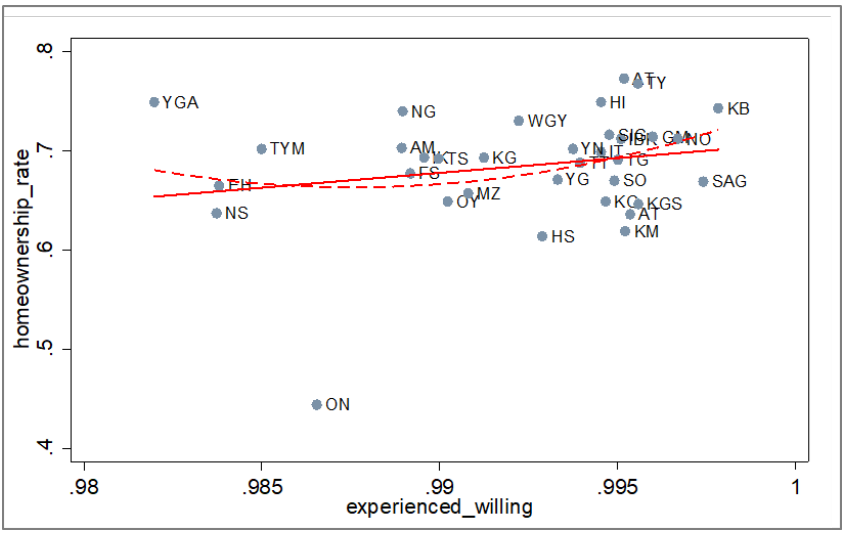
(b) Non-urban areas



homeownership rate in the prefectures is surveyed every five years and there is no available data for 2016.

In terms of all of the prefectures in Figure 4, there is a positive relationship between accumulated experience with willingness to purchase a house and homeownership rate. When the price level does not deviate from that of Tokyo, the average willingness to purchase a house will be higher, and there is more willingness to enter the real-estate market, thus causing the homeownership rate to follow suit. It is helpful to use house-price deviation to explain for the difference in the regional homeownership rate. In contrast, Malmendier and Steiny (2017) find that compared with inflation experiences, house-price fluctuation experiences have less significance in explaining the divergence in homeownership rates in European countries. Our finding demonstrates that regional price parities are applied to measure house-price deviation experiences that help to explain the differences in regional homeownership rates. To view the further differences in the urban and non-urban area samples, Figures 5(a) and 5(b) show a positive relationship between willingness to purchase a house and homeownership rates for both the urban and non-urban areas.

Figure 5 Impact of accumulated experience with willingness to purchase a house on homeownership rate: urban and non-urban areas



5. Conclusion and Implications

The experience effects indicate that past experiences affect beliefs and decisions. The global financial market has experienced some major economic shocks, which have also affected the real-estate market. Recently, many countries have experienced an adverse impact on their housing market due to the COVID-19 epidemic. This study supposes that the willingness of every individual to purchase a house is related to the housing-market cycles that have been experienced, which affects the overall real-estate market development, of which Japan's case is the most obvious. After 30 years of economic recession and losses in the wake of the housing bubble, many Japanese families have had the long-term experience of low returns from the housing market and believe that house prices have deviated from what they desire. They are reluctant to own or purchase a house which has led to an increasing demand in the rental market and a decline in homeownership rate. There is the issue of uneven regional development in Japan. The PPP hypothesis of commodity price across prefectures holds, which implies that there is the belief that the regional price will adjust to the Tokyo standard in the long-term, and this is also embodied in house prices. Therefore, the relative deviation from the Tokyo standard will likely cause reluctance to purchase residential property.

This study has established that individual willingness to purchase a house in the prefectures, which is measured by the deviation of house prices relative to the Tokyo levels, and examined whether this experience in a prefecture affects the rent and transaction volume in the real-estate market. We also employ accumulated experience with willingness to purchase a house to capture the pattern of rent prices and homeownership rate and observe the discrepancy across prefectures. The current study has examined the rent and found that on average, there is a significantly adverse impact on willingness to purchase a house in the prefectures of Japan. When the local house-price level is nearly identical to that of Tokyo, the degree of willingness to purchase a house will be relatively high, which unintentionally has a subtle adverse effect on the housing rental market. This adverse effect is at its most severe when the difference between the actual and expected house-price level relative to the Tokyo level is between −1.6 percent and 0.3 percent. This means that increased willingness to purchase a house will certainly inhibit rent appreciation, but if the house price deviates to a certain extent, the opposite effect will result. However, after separating the prefectures into urban and non-urban areas, it can be found that willingness to purchase a house in the non-urban areas have a prominent effect on rent, while the effect on the urban areas is not significant. Therefore, the disparity between urban and rural areas in the country is assumed to be the reason. Compared with non-urban areas, house prices between the urban areas tend to adjust, so that there is less heterogeneity with Tokyo. As such, willingness to purchase a house is not being significantly reflected in the housing rental market. In robustness testing, housing transaction volume is used instead of rent as an independent variable, and it is found that despite

willingness to purchase a house in one of the eight major prefectures positively affects transaction volume, the effect is also not significant.

Finally, experience with the cumulative house prices of each prefecture from 1985 to 2015 relative to the Tokyo standard is calculated for deviation to see whether the cumulative experience of long-term past losses could be used to analyze the divergence in the regional housing markets. Rent and homeownership rates are used as the objects of inquiry. More cumulative willingness to purchase a house in an area means that less house-price deviation is expected when more people are willing to enter the real-estate market, which can reasonably explain for the adverse impact on rent. This can also reflect the difference in homeownership rates in the region.

In terms of policy implications, the results of this study show that the future housing-market development of Japan will most likely suffer from excessive urban concentration. Excessive urban concentration will exacerbate the problem of uneven regional development, thus causing a large population influx from non-urban areas into urban areas, leaving the suburbs and outlying areas facing serious labor shortages because of population loss and aging, and leading to the necessary restructuring of the prefectures and redistribution of resources. Therefore, with regard to the aforementioned urban shrinkage issue, the government must be vigilant and take action to prevent serious incidents and implement preventive policies to balance regional development. To avoid aggravating the situation, the development of regional housing rental markets should be strengthened, and subsidies that can effectively restrain house prices and control social problems should be issued.

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Appendix

Appendix 1 Data Definition and Source

Variable	Content	Source
Rent prices	The average annual rent (private) per tsubo	Statistics Bureau of Japan
Transaction volume	The number of transfers of land ownership registration	The Land Institute of Japan
Homeownership rate	The number of households living in their own house / The number of households living in a house	Statistics Bureau of Japan
House price	Land price per tsubo	Statistics Bureau of Japan
Commodity price	Consumer price index	Statistics Bureau of Japan
Newly built houses	The number of new housing units	Ministry of Land, Infrastructure, Transport and Tourism
Income per capita	Prefectural income per capita	Statistics Bureau of Japan
Population density	The number of inhabitants per square kilometer	Statistics Bureau of Japan
Loan interest rate	Basic loan rate	Bank of Japan

Appendix 2 Codes for the Prefectures

id	Prefecture	id	Prefecture	id	Prefecture	id	Prefecture
HK	Hokkaido	TK	Tokyo	SIG	Shiga	KG	Kagawa
AM	Aomori	KNA	Kanagawa	KT	Kyoto	EH	Ehime
IT	Iwate	NG	Niigata	OS	Osaka	KC	Kochi
MJ	Miyagi	TY	Toyama	HG	Hyogo	HO	Fukuoka
AT	Akita	IK	Ishikawa	NR	Nara	SAG	Saga
YGA	Yamagata	HI	Fukui	WGY	Wakayama	NS	Nagasaki
FS	Fukushima	YN	Yamanashi	TT	Tottori	KM	Kumamoto
IBK	Ibaraki	NO	Nagano	TYM	Shimane	AT	Otia
TG	Tochigi	KB	Gifu	OY	Okayama	MZ	Miyazaki
GM	Gunma	SO	Shizuoka	HS	Hiroshima	KGS	Kagoshima
ST	Saitama	AC	Aichi	YG	Yamaguchi	ON	Okinawa
CB	Chiba	ME	Mie	TS	Tokushima		

Appendix 3 Impact of Accumulated Experience of Willingness to purchase a house on Regional Rent prices and Homeownership Rate

Panel A. Dependent variable: log(rent prices)						
Independent variable	All prefectures		Urban areas		Non-urban areas	
Experience with willingness to purchase a house	-9.94*** (-4.26)	416.06 (1.65)	-5.70 (-1.35)	574.10 (1.18)	-7.92** (-2.10)	421.26 (0.23)
Squared of the experience of willingness to purchase a house		-217.9* (-1.69)		-297.66 (-1.19)		-216.69 (-0.24)
Constant	18.18***	-190.0	14.11***	-268.14	16.15***	-196.36
N	46	46	12	12	34	34
Adjusted R-squared	0.28	0.31	0.07	0.11	0.09	0.07
Panel B. Dependent variable: homeownership rate						
Independent variable	All prefectures		Urban areas		Non-urban areas	
Experience with willingness to purchase a house	3.21*** (3.10)	-15.87 (-0.14)	1.93 (1.42)	63.95 (0.38)	3.01 (1.24)	-1092.80 (-0.96)
Squared of the experience of willingness to purchase a house		9.75 (0.17)		-31.84 (-0.37)		
Constant	-250.61*** (-2.45)	6.81 (0.12)	-1.25 (-0.95)	-31.47 (-0.38)	-2.30 (-0.96)	540.29 (0.96)
N	46	46	12	12	34	34
Adjusted R-squared	0.16	0.14	0.08	0.00	0.02	0.01

Note: The t-value is shown in parentheses. *, **, and *** indicate significance at the 0.1, 0.05, and 0.01 levels respectively.