

**Another Determinant of Household Leverage:  
Evidence from Japan's Mortgage Loan Data**

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**Abstract**

We prove that the household leverage determinants derived from analyses of U.S. households are not universal. Accordingly, we investigate determinants of household leverage in Japan, which did not experience the sharp rise in real estate prices and dramatic securitized mortgage market developments in the 2000s. We employ household sample data collected by the Japan Housing Finance Agency and the Nikkei NEEDs Radar Financial Survey, totaling to 28,561 samples between 2001 and 2010. We find that the degree of household interest rate risk preference, which proxies the constitutional factor in mortgage finance, positively relates to the household debt to income ratio. Thus, the household debt determinant for Japanese households differs from that for U.S. households. We also find that in the case of residential mortgage loans, the external monetary condition also influences the degree of propensity to borrow. This study also shows similarities between household mortgage debt determinants in Japan and the U.S., namely, that the degree of regional bank market competition and the state of bank management soundness influence the aggressiveness of the residential mortgage loan business.

*JEL Classification:*    G21

*Keywords:*    Household Leverage, Residential Mortgage Loan, Hyperbolic Discount Utility, Constitutional Risk Preference, Household Borrowing

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## 1. Introduction

A number of articles analyzing the causes and consequences of the residential mortgage loan market collapse in the United States have been published since 2008. Pennington-Cross and Chomsisengphet (2007) have pointed out that 65 percent of additional loan borrowing households that were stimulated by the real estate property price rise already owned residences in the pre-bubble period. Other studies empirically concluded that the creditworthiness of the securitized credited mortgage loan borrowers was overrated by the residential property asset price rise, because creditworthiness was measured by the secondary market interest rate spread from the government bond yield. Thus, recent articles analyzing the U.S. household leverage assert that the dramatic increase in household debt in the mid-2000s was caused by the increase in additional external borrowing accompanied by the price rise in real estate and excessive expansion of the mortgage loan securitization business.

Meanwhile, many researchers have also observed a significant household leverage increase in other countries where the rise in mortgage asset prices is not dramatic or where mortgage securitization markets are less developed, although these facts are hard to spot in the shadow of the U.S. mortgage loan market crisis. For example, in December 2011, the Japanese government officially announced that the leverage of Japanese households increased on average by 10 percent compared to the observed value in 2001. Recently, the *Chosun Daily News* (June 18, 2012) also reported that the number of Korean credit card debtors who applied to the government bailout program exceeded the number of applicants in 2011 by 1.2 million. Cecchetti et al. (2011) reported that Denmark, Finland, the Netherlands, and Norway increased their household debt to GDP ratio by more than 30 percent in 2000–2010. Thus, even though some of the abovementioned countries did not experience soaring prices in the real estate market or dramatic securitization market expansion during the last decade, they did experience a household leverage increase.

This paper focuses on Japan, where neither the sharp rise in real estate prices nor dramatic securitized mortgage market developments were experienced in the 2000s. We focus on Japan in this study, because we believe that the household leverage determinants derived from analyses of U.S. households are not universal (that is, they do not always apply to other countries) and that other determinants can explain the recent household debt increase in other countries. On the basis of this research motivation, this study focuses on identifying other determinants of household leverage, using household loan contracts and survey data from Japan. In this paper, we set two goals. The first goal is to discover a household leverage determinant

not found in the existing literature. The second goal is to confirm whether household leverage determinants listed in the existing literature are consistent in the Japanese context.

In the next section, we review the existing literature to show how it relates to our study and the types of empirical methodologies employed therein. In Section 3, we introduce our hypothesis explaining the recent household leverage increase in Japan. In Section 4, we present the data used to examine our hypothesis. In Section 5, we discuss our empirical model and introduce new empirical evidence. In Section 6, we present our conclusions.

## **2. Existing Literature**

As noted in the previous section, numerous studies have analyzed the causes and consequences of the rise and fall of the U.S. residential mortgage market. Among these, some researchers have studied the wealth effect of residential property asset value. This topic was also studied before the subprime crisis, because researchers are interested in studying this effect over a long-term period (see Table 1). Naturally, post 2007, the number of related articles increased exponentially. Mian and Sufi (2011), Bostic et al. (2007), Lustig and Nieuwerburgh (2005), Benjamin et al. (2004), and Bostic et al. (2009) are examples of studies that belong to what we shall term as the first group in the literature relevant to our discussion. On the basis of their empirical analysis using household survey data from the U.S. Inland Revenue Service, Mian and Sufi (2011) concluded that a sharp fall in residential mortgage property asset values induces a decrease in household demand for durable consumer goods. Bostic et al. (2007) sourced data from *Survey of Consumer Finances* and *Consumer Expenditure Survey* published by the Federal Reserve Board and the Ministry of Labor, respectively, and provided empirical evidence that the wealth effect caused by the change in the residential mortgage asset price is larger than that caused by the change in household financial asset value. The result is consistent with that of Lustig and Nieuwerburgh (2005), who also provided empirical evidence of the same by analyzing household long-term quarterly aggregated data between 1952 and 2001. Benjamin et al. (2004) also asserted that the wealth effect from owned residential property is four times as large as that from the rise in household financial asset value. Bostic et al. (2009) shared the abovementioned views and were the first to prove that the residential property wealth effect mainly increases nondurable good consumption, while the household financial asset wealth effect increases durable good consumption.

The second group in the literature focuses on the relationship between the development of the mortgage-backed securities (MBS) market and household debt increase.

These studies hypothesize that market development negatively influences the examination of loan applications by commercial banks and empirically examine if this market development consequently increases household debt. Purnanandam (2011), Keys et al. (2010, 2009), Mian and Amir (2010), and Loutskina and Strahan (2009) are studies we tentatively include in this second group. They provide important empirical findings regarding the relationship between the development of the MBS market and household mortgage loan leverage. Purnanandam (2011) verified bank managerial reports submitted to the Federal Reserve Board from 2006–2008 and concluded that the development of the MBS market consequently distorted scrutiny of bank loan applications. Purnanandam (2011) also concluded that banks with constrained capital adequacies tended to promote residential mortgage loans and the securitization business. Keys et al. (2010) also examined household survey data from 2001 to 2006 and reconfirmed their previous finding (Keys et al., 2009), namely, that the MBS market development discouraged banks from strict examination of loan applications. Keys et al. (2009) also verified the relationship between the development of the MBS market and household leverage from the viewpoint of moral hazards in commercial bank lending. On analyzing 7,000 home equity loan user samples as of December 2006, they concluded that securitization market development encourages banks to securitize loans of low creditworthiness. By matching data from 2,900 households in the U.S. and the responders' zip codes, Mian and Amir (2010) found a positive relationship between outstanding household mortgage loans and the real estate prices in 2001–2005 and 2005–2007. They concluded that many defaults in the latter period could be attributed to households increasing their outstanding mortgage debt—that was dramatically expanded by the MBS market—during the former period. Loutskina and Strahan (2009), by using mortgage loan survey data collected by the Federal Reserve Board under the Home Mortgage Discount Act from 1992–2007, examined the relationship between distribution of bank branches and household leverages by region. Consequently, they pointed out that banks operating in limited areas generally have better access to creditworthiness information of households in their respective areas. Accordingly, they concluded that such banks are not as aggressive in the mortgage loan business in these areas, even when real estate prices increase. As a result, there are no consequent increases in household leverage in such regions.

The third group of studies in the literature consists of Demyanyk and Hemert (2011) and Pennington-Cross and Chomsisengphet (2007), who analyzed which household characteristics increase household leverages. By using residential mortgage loan survey data from 2006, Demyanyk and Hemert (2011) verified the factors that deteriorate household creditworthiness and proved that the household loan to value ratio (hereafter, “LTV”) and the

default probability are positively correlated. An important empirical finding of this study is that the interest rate spread of the MBS securities of these loan contracts are, however, statistically small in comparison to those of the other high-yield securities. They discussed the reasons for this result and concluded that a real estate price rise prevents the MBS interest rate spread from reflecting the deterioration in creditworthiness in the secondary market. In other words, market investors underestimate the quantitative credit risk of household borrowers in the MBS market, and this encourages continuous increases of residential mortgage loans by commercial banks to households with low creditworthiness. Pennington-Cross and Chomsisengphet (2007) employed survey data between 1996 and 2003 to examine the characteristics of high leverage households. They concluded that most high leverage households transact with only one bank, while low leverage households transact with multiple banks. They also concluded that households that conduct financial transactions with one bank only are statistically low-income households. In addition, these households also have a high propensity to apply for home equity loans, which is likely to result in an increase in the household leverage<sup>1</sup>.

**< Table 1 >**

### **3. Hypothesis**

Our overall hypothesis is that a change in household constitutional appetite in financial activities increases the household mortgage debt to income ratio. Of course, we do not deny the influences of regional real estate values and the commercial bank mortgage loan market strategies on the household debt increase (which is also asserted by the literature). We examine the following hypotheses. We first hypothesize that the household debt to income ratio increases even in a country where the real estate price does not dramatically rise and real estate securitization does not progress, in addition to the regional residential mortgage market-related

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<sup>1</sup> There are, of course, other papers that have studied the determinants of household indebtedness, using various other datasets (e.g., cross-country data on household indebtedness, European panel data for households lending and arrears, and time-series data for household lending and insolvencies). Particularly, Mason and Jayadev (2012) have attempted a decomposition of public debt to household sector debt and showed interesting results, namely that if the average rates of growth, inflation, and interest in the U.S. remained the same after 1980 as before 1980, household debt burdens in 2011 would have been roughly the same as they were in the early 1950s, despite the sharp increase in borrowing in the early 2000s. Thus, according to Mason and Jayadev (2012), a large fraction of changes in household leverage are owing to Fisher effects rather than changes in household borrowing.

variables. We examine households that prefer interest rate risk in funding, risk in personal asset investment, and frequent credit card loan use and show that they tend to seek utility maximization in residential purchases by a significant value of external borrowing compared to their annual income. To capture the borrower's constitutional factors concerning the degree of risk preference attitude and accessibility to external finance as proxies of possible household constitutional factors that influence the propensity to borrow, we specifically employ the following: (1) the ratio of outstanding variable interest rate residential mortgage debt to the total outstanding debt, (2) the ratio of household financial assets with possibilities of the loss of principal to the total financial assets, and (3) the household experience of frequent credit card loan use.

We choose these variables to proxy household constitutional factors because the existing literature concerning the hyperbolic discount rate utility function empirically supports the positive relationship between the above variables, that is, the degree of borrower's risk preference or accessibility to external consumer borrowings and the time discount rate of the utility function. For instance, on the basis of experimental surveys, Hiruma and Ikeda (2007) concluded that the degree of the consumer's risk-averse attitude and the individual time discount rate are negatively related. The result was also previously confirmed by Van Praag and Booij (2003) through their personal time discount rate surveys. Moreover, to the best of our knowledge, few studies deny this empirical evidence. Ikeda et al. (2005) examined the common characteristics of survey responders with high time discount rates and concluded that, statistically, those with low income, the elderly, and males have high time discount rates. Hiruma and Ikeda (2007) also confirmed the positive relationship between the time discount rate and experiences of credit card loan use. Quantitative data concerning the household time discount rate is not included in our empirical data, and hence, we cannot directly estimate the discount rate for each borrower. Therefore, we employ the abovementioned variables suggested in the literature to examine the relationship with the time discount rate.

Our second hypothesis concerns the relationship between household mortgage debt to income ratio and the characteristics of the regional residential loan market. We verify this hypothesis to confirm the similarity of the household leverage determinants between U.S. and Japanese households, as verified by the literature. Demyanyk and Hermert (2011) conducted an empirical analysis and asserted that a rise in residential property prices increases the leverage of low-income households, since the rise in residential property asset values induces the illusion of enhanced repayment capability of low-income and low creditworthy households. In line with this literature, we examine the hypothesis that a rise in residential property prices increases the

household mortgage debt to income ratio in Japan. We also hypothesize that the size of the regional secondary residential market is an important factor that positively influences the household debt to income ratio. Our hypothesis here is that the larger the regional residential secondary market, the higher the household debt to income ratio. Unlike other durable goods, residential property assets are tradable when a household faces a high probability of repayment default. Barclay et al. (2003) empirically concluded that a firm's high fixed tangible asset liquidity allows it to have a high debt to equity ratio in the corporate finance world. We apply this theory to household finance and hypothesize that the household is allowed to have high debt to income ratio when the owned residence is located in an area with a large secondary market.

Our third hypothesis is that the commercial bank loan business strategy influences the household leverage. Loutskina and Strahan (2009) point out that banks focusing on one specific area for a long-term period do not operate aggressively in the residential mortgage loan business in that area. This is because banks that have historical credit records of borrowers in one area refrain from increasing the debt of high leverage households. Accordingly, this study employs the ratio of the number of branches of the top three city banks to the total number of branches of all financial institutions by region and hypothesizes that the household debt to income ratio is high when the degree of residential mortgage market competition is high in the respective region. Meanwhile, Keys et al. (2010) and Purnanadam (2011) asserted that commercial banks facing constraints in bank capital adequacy are aggressive toward the residential mortgage loan business and their securitization. This is because the capital adequacy ratio formula allows banks to behave in this manner, since the risk weight of the formula's denominator is low for residential mortgage loan assets. Consequently, this study hypothesizes that the lower the bank weighted average capital adequacy ratio in the region, the fiercer the competition in the residential mortgage loan market.

As the fourth hypothesis, we suppose that the increase in mortgage loan securitization also promotes household debt increase in Japan. Mian and Amir (2010) and Keys et al. (2009) pointed out that mortgage loan securitization promoted household leverage increase in the 2000s. Similarly, we also regard that the Special Corporation Rationalization Plan encouraged commercial banks to increase residential mortgage loan contracts and household debts in the 2000s. This study empirically examines this hypothesis by comparing borrowing behaviors between direct loan borrower and securitized loan borrower samples. Our data comprises individual loan contract data from the Japan Housing Finance Agency (hereafter JHFA), including direct loan contract data for 2001–2005 and securitized data for 2006–2010. We compare these two sample groups.

#### 4. Data

To examine the hypotheses proposed in the previous section, we employ household survey data from the *JHFA Loan Master Data File* of the JHFA and *Nikkei NEEDs Radar Financial Survey* of Nikkei Media Marketing, Inc. (see Table 2). The former data sample period spans 2001–2011, and the latter, 2007–2009. We use these two different data sets because each data set covers the shortcomings of the other. The former data includes various quantitative details about residential mortgage loan borrowers who avail the financial services of the JHFA. However, as JHFA data is not collected through a survey, qualitative information on household financial activities, other than residential mortgage borrowing, is lacking. Meanwhile, the *Nikkei NEEDs Radar Financial Survey* data includes more qualitative data such as the credit card loan usage data and allocation of household financial assets. However, as this data is sourced through a survey, the quantitative household data is not as large as that in the *JHFA Loan Master Data File*. In addition, by using these two data sets, we hope to verify the robustness of our empirical model. Namely, we try to check the robustness of our empirical results by estimating one empirical model using two data sets.

The original source of the *JHFA Loan Master Data File* is the individual mortgage loan contract information compiled directly by the JHFA or by other commercial banks. Where the loan contract data is compiled by other commercial banks, the JHFA supports their securitization of the residential mortgage loan. Since 1950, the JHFA has operated in the residential mortgage direct loan business. Since 2006, following its reorganization under the Reorganization and Rationalization Plan for Government Sponsored Enterprises, the JHFA has also provided securitization support for commercial banks. Consequently, the JHFA's household loan contract data from 2001–2005 originated from the JHFA's *Residential Mortgage Direct Loan Contract Files*. Loan contract data from 2006–2010 originated from the *Flat 35 Customer Files*, where the number “35” refers to the 35-year maturity fixed interest rate loan contracts concluded with commercial banks, wherein the JHFA financially supports the securitization. Commercial banks must submit various required loan contract details to the JHFA in response to demands from the latter's securitization support service. Ultimately, both the original direct and the indirect loan contract information are included in the *JHFA Loan Master Data File*. One of the merits of using data from both periods is that we can empirically compare the change in household financial activities between these two periods. The data also includes other pertinent information, such as the amounts additionally borrowed by each household from other



commercial banks, variable interest rates (other than the fixed interest rate), whether the loan was sanctioned directly by the JHFA, or whether the loan was provided by another commercial bank and supported by the JHFA. Besides, the data also pinpoints in which of Tokyo's 23 wards the borrower purchased the property, which can allow us to match it with various pieces of information pertaining to the regional real estate market (i.e., the real estate price, the size of secondary market turnover, and how each financial institution operates therein).

On the other hand, the *Nikkei NEEDs Radar Financial Survey* comprises data from household surveys conducted in November every year. The survey uses a two-step stratified sampling method to cover households within a 40-kilometer radius of Tokyo Central Station. The survey is confined to 25–74 year old males and females, with the number of total samples averaging to 4,500 respondents per survey (about 57 percent of targeted subjects respond). The survey is a paper-based questionnaire survey. As noted above, the merit of using this survey result is that it includes not only the book values of outstanding residential borrowing, household financial assets, residential property, etc., but also records their market values in addition to the qualitative responses of survey respondents.

< Table 2 >

< Table 3 >

< Table 4 >

## 5. Empirical Study

### 5.1 Model

In this study, we first examine the following factors that may influence household leverage, namely, (a) individual household factors including the degree of individual household constitution in financial risk taking and consumer finance accessibility ( $X^H$ ); (b) factors affecting the regional residential mortgage market ( $X^R$ ); (c) factors pertaining to the commercial bank strategy for the residential mortgage loan business ( $X^B$ ); and (d) the external monetary environment, the degree of securitization market development, and other factors ( $X^M$ ). We employ the following empirical equation to verify our hypotheses.

(1) Empirical Equation for the *JHFA Loan Master Data File*

$$Debt \cdot to \cdot Income_{ij} = X_i^H \beta_1 + X_j^R \beta_2 + X_j^B \beta_3 + X_i^M \beta_4 + \mu_{ij}$$

(2) Empirical Equation for the *Nikkei NEEDs Radar Financial Survey data*

$$Debt \cdot to \cdot Income_k = X_k^H \gamma + v_k$$

The dependent variable is the ratio of the residential mortgage loan contract debt book value to the annual household income (*Debt to Income I*, *Debt to Income III*) for household  $i$  (*household k*). We also employ another dependent variable, defined as the residential mortgage loan contract debt book value plus the total amount of scheduled interest payment values divided by the annual household income as of contract conclusion (*Debt to Income II*) for household  $i$ . The independent variables of  $X^H$  are variables pertaining to the constitutional factors concerning financial activities and are represented by interest rate risk taking, consumer finance accessibility, household financial data, and household attributes data. Here, we employ either (a) the ratio of the outstanding variable interest rate on the residential mortgage loan to the total outstanding mortgage loan (*Variable Loan Ratio*) for empirical equation (1), or (b) the ratio of financial assets that have a risk of loss of the original principal value to the total financial assets (*Risk Assets*) or (c) credit card loan use experience (*Credit Card*), as the household constitutional proxied variable for empirical equation (2). We use the independent variable *Variable Loan Ratio* as defined in Table 3 in the case of our ordinary least squares (OLS) estimation for empirical model (1). We use *Variable Loan Ratio* as the dependent variable of the probit equation in the case of the Heckman two-step estimation. We set this variable as one when the household's variable interest loan ratio exceeds 10 percent (and zero otherwise). The other independent (dependent) variable, *Credit Card*, equals one when

household  $k$  has had experience of credit card loans and zero otherwise, in the case of empirical model (2). For empirical model (2), *Risk Assets* equals one when more than 10 percent of household  $k$ 's financial assets have a risk of loss in the original principal value. The independent variables of our empirical equation are household  $i$ 's ( $k$ 's) annual income (*Income*), head of household  $i$ 's ( $k$ 's) age (*Age*), sex of the household  $i$ 's ( $k$ 's) head (*Sex*), total financial assets (*Financial Assets*) of household  $i$  ( $k$ ), household  $i$ 's ( $k$ 's) head occupational status dummy (*Job Dummy1-4*), and year dummy (*year dummy*). *Sex* equals one when the household  $i$ 's ( $k$ 's) head is a male and zero otherwise. The *JHFA Loan Master Data File* includes occupational information of the head of household  $i$ , that is, part-timer, regular firm employee, regular government employee, self-employed, employer at a mercantile store, fixed-term contract employee, pensioner, agricultural worker, forestry and fisheries workers, temporary staff dispatched by temporary agencies, unknown, and others. *Job Dummy 1* equals one when the head of the household is a regular firm employee and zero otherwise. *Job Dummy 2* equals one when the head of the household is a regular government employee and zero otherwise. *Job Dummy 3* equals one when the head of the household is self-employed, or an employer at a mercantile store, or a fixed-term contract employee and zero otherwise. The *Nikkei NEEDS Radar Financial Survey* data also includes occupational information of the head of household  $k$ , namely, whether the head is a regular firm employee. Thus, *Job Dummy 4* equals one when the head of the household is a regular firm employee and zero otherwise.

Independent variables pertaining to the regional factor variables  $X^R$  are the residential property price growth rate (*Property Value Growth*) and the number of the residential market turnover deals (*Second Market Size*) for each Tokyo ward  $j$ . Independent variables that represent bank management strategy  $X^B$  are the number of the three largest city bank branches divided by the total number of branches of all financial institutions in Tokyo Ward  $j$  (*Bank Competition*) and the weighted averages of the capital adequacy ratio of financial institutions (*Bank Soundness*) located in each Tokyo ward  $j$ . We calculate the weights by using the ratio of the number of branches in ward  $j$  to the total number of branches of all financial institutions in ward  $j$ . We also add the concluded loan interest rate (*Fixed Loan Interest*) as one of the independent variables. In the case of the JHFA's residential mortgage loan contracts, the initial 10-year fixed lending interest rate data and the rest of the maturity fixed interest data are contained in the 2001–2005 loan contract data. Besides this information, loan contract data for 2006–2010 are the “flat 35” loan data, that is, the maximum 35-year fixed interest rate loan data, and contract fixed interest rate data are also included in the data file. We add the securitization market

development dummy (*Securitization Dummy*), which equals one for all loan contracts of household  $i$  for 2006–2010 and zero otherwise.

In line with Hiruma and Ikeda (2007), we suppose that households with lower income, male heads, elderly heads, interest rate risk taking, frequent use of credit cards, and risky financial asset investments have a high debt to income ratio. Accordingly, we expect that the sign of the parameter for independent variable *Income* is negative and those for the independent variables *Variable Loan Ratio*, *Credit Card*, *Risk Assets*, *Age*, and *Sex*, are positive. More importantly, we suppose that the parameter of intersected variables between *Income* and *Variable Loan Ratio* is negative. The parameter of *Property Value Growth* and *Second Market Size* are also expected to be positive, because the household debt to income ratio is high when the household purchases property at a high unit price. We also believe that a high household debt to income ratio is allowable when the property exists in a region with a large secondary market size, because foreclosure is easy when they become insolvent.

The parameter of the independent variable *Bank Competition* is expected to be positive, because we hypothesize that a high degree of competition in the bank mortgage loan business promotes household leverage increase. We assume that the higher the branch share of the largest three banks, the more competitive the local residential mortgage market. The positive sign of the parameter *Bank Soundness* is also expected, because in line with Keys et al. (2010) and Purnanandam (2011), we hypothesize that banks with a low capital adequacy ratio are aggressive in concluding residential mortgage contracts.

Empirical estimations are made by the following income class categories. We divide the *JHFA Loan Master Data File* into (a) all income households, (b) households with income under 3.5 million JPY, and (c) households with income over 10 million JPY corresponding to 26,956, 1,514, and 4,160 samples, respectively. We do not divide the *Nikkei NEEDs Radar Financial Survey* data by income class due to the limited number of observations. (We have only 1,605 samples in this case.)

## 5.2 Empirical Results with the *JHFA Loan Master Data File*

We estimate the empirical model by OLS and the Heckman two-step estimations. Estimation results using data from the *JHFA Loan Master Data File* are indicated in Table 5. Here, the independent variable of equation (1) is *Debt to Income I* and *Debt to Income II* for the OLS estimation results and *Variable Loan Ratio*, *Debt to Income I* or *Debt to Income II* for the Heckman two-step estimation results. These results indicate that the signs of parameters for  $\ln(\text{Income})$  vary across income classes. Specifically, both positive and negative signs exist for

“A. All Income Households.” In the case of “B. Below 3.5 million JPY Income Households,” all the  $\ln(\text{Income})$  parameters are negative while both positive and negative signs of  $\ln(\text{Income})$  parameters exist in the case of “C. Over 10 million JPY Income Households.” These results suggest that for low-income households, the lower the household income, the higher the debt to loan ratios.

Meanwhile, the parameters of *Variable Loan Ratio* are significantly positive for all the empirical results in the case of the OLS estimation. This suggests that, statistically, interest risk-taking households have a high debt to income ratio in residential mortgage finance. *Variable Loan Ratio* is employed as one of dependent variables in the case of the Heckman two-step estimation and the parameters of  $\ln(\text{Income})$  are significantly negative in “A. All Income Households” and “B. Below 3.5 million JPY Income Households.” These results also suggest the existence of a negative relationship between the degree of household interest rate risk preference and the annual income level, especially for lower-income households.

Parameters of the intersected variables between  $\ln(\text{Income})$  and *Variable Loan Ratio* in equations A. and B. are significantly negative. These results support our belief that the degree of interest risk-taking attitude and the debt to income ratio are negatively related for low-income households. To summarize, the results of empirical equations A.-C. can be translated as follows: Households with incomes below 3.5 million JPY prefer interest rate risks when they increase household debt, while those whose incomes exceed 10 million JPY avoid interest rate risks as they increase household debt. These results support our hypothesis that low-income households generally face high leverage, and the evidence also suggests that these households pursue loan contracts with interest rate risks aggressively.

As for the relationship between household debt and regional factors pertaining to residential property, the parameters of both the real estate price (*Property Value Growth*) and the secondary residential property turnovers (*Second Market Size*) are significantly positive for all samples, namely, all income households and those earning under 3.5 million JPY and over 10 million JPY. Our hypothesis that higher residential property unit prices and larger secondary residential market sizes are realistic for households with a high debt to income ratio is empirically supported by this result. This result also suggests that impacts from residential property price and the secondary market size on household debt are common and universal across income levels. These factors influence household debt irrespective of household income levels and do not increase the debt for any particular level of household income.

Regarding the relationship between commercial banks’ regional residential mortgage loan market strategy and household debts, the empirical results suggest that the parameter of

*Bank Competition* positively and significantly relates to the household debt to income ratio (*Debt to Income I* and *Debt to Income II*) for all income levels. Regional areas with a high share of city banks are generally competitive in the residential mortgage loan business. Although many branches of regional banks and cooperative financial institutions do exist, city banks have increased branches in areas where households have had strong funding demands in the past. Consequently, the result indicates that the more competitive the regional residential mortgage loan market, the higher the household debt. The parameters of the weighted average of capital adequacy ratio (*Bank Soundness*) are negatively significant for all income levels. Our hypothesis that households have high debt to income ratio in areas where many banks have restricted capital adequacy, is empirically supported. These positive significant parameters are shown by several equation results across all income classes, and therefore, the results are robust.

Finally, regarding our examination on the relationship between the development of the residential mortgage securitization market and household debt, the parameters of the securitization market development dummy variable (*Securitization Dummy*) are insignificant for all income classes. This empirical evidence can be translated as follows: few households are influenced by securitization market development. In other words, unlike the empirical evidence derived from the literature for households in the U.S., Japanese households do not experience an increase in residential mortgage debt owing to market development, irrespective of the income class to which the household belongs.

### **< Table 5 >**

#### 5.3 Empirical Results with the *Nikkei NEEDs Radar Financial Survey*

To reconfirm the empirical results of the previous section, we also estimate the empirical model listed in Section 5.1 (2) by the OLS and Heckman two-step estimations using the *Nikkei NEEDs Radar Financial Survey* data. The results are indicated in Table 6. Here, dependent variable of equation (2) is *Debt to Income III* for “A. OLS Estimation Results” and *Loan Type, Risk Assets, Credit Card, and Debt to Income III* for “B. Heckman Two-Step Estimation Results”. For the OLS estimation results, empirical equations (A)-(C) indicate that the parameters of  $\ln(\text{Income})$  are all negatively significant. These results suggest that the lower the annual income, the higher the mortgage debt to income ratio, which is also in line with the empirical results in Table 5. Regarding the variables commonly employed in equations (A)-(C), the parameters of  $\ln(\text{AGE})$  and *Sex* are insignificant while those of  $\ln(\text{Financial Asset})$  and

$\ln(\text{Loan Maturity})$  are significantly positive. These results suggest that the household head's age and sex do not affect household leverage. However, as we intuitively recognized earlier on, the size of the household head's financial assets and the length of loan contract maturity are related with household leverage.

The three variables representing the household's constitutional factors and that we suppose influence the leverage are *Loan Type*, *Risk Assets*, and *Credit Card*. The results show that the parameters are significantly positive in equations (A)-(C). We also employ the intersection of the variables with  $\ln(\text{Income})$ , and note that the parameters are also significantly negative in equations (A)-(C). The significant results of *Loan Type* suggest that the degree of interest rate risk preference in mortgage finance and the household leverage are positively related, and the relationship is enhanced as the level of income decreases. We also obtained a positive relationship between these two variables by using the *JHFA Master Loan Data File* samples in the previous empirical analysis. Consequently, the results of both analyses agree, thus pointing to their robustness. *Risk Assets* and *Credit Card* are additionally employed as proxy variables for the household's constitutional factors in finance, and the significant parameters suggest that both variables and household leverage are positively related. Interestingly, negative significant parameters of the intersection of these variables with  $\ln(\text{Income})$  suggest that the relationship between these variables and the leverage is also enhanced for low-income households.

The Heckman two-step estimation results are indicated in Table 6B, and they are entirely consistent with those of the OLS estimations in Table 6A. The (d-1)–(d-3) probit model results indicate that the parameters of  $\ln(\text{Income})$  are all negatively significant, and this suggests that the low-income households prefer to bear not only the interest rate risk in mortgage contracts, but also prefer taking market risks in personal investments and have frequently availed of credit card loans in the past. We test the difference between the predicted values when *Loan Type*, *Risk Assets*, and *Credit Card* equal one and zero and find that the means of the former predicted values are higher than those of the latter. This also supports our thinking that household constitutional factors in finance are related with the level of household leverage.

< Table 6 >

## 6. Discussions and Conclusions

The empirical results of this paper entirely support our hypotheses. First, the results support that low-income households prefer interest rate risk in the residential mortgage loan contract and that these interest rate risk-taking households tend to have high accessibility to non-mortgage consumer finance. As a result, these households also tend to have a high residential mortgage debt to annual income ratio. We added the age of the household head and mortgage loan contract maturity as control variables to our empirical model. Therefore, the significant relationship between the degree of the household's interest rate risk preference and its level of debt to income ratio was not influenced by other possible determinants. These results provided an answer as to why the household debt to income ratio has increased despite a long-term easing of monetary conditions in Japan. It is because borrowers' constitutional appetite for interest rate risk preference, which has a positive relationship with their external financing appetite, was strengthened, especially for low-income households, even though there is no evidence of a dramatic residential property asset value rise or securitization market development. Of course, although we understand that it is inappropriate to conclude that our empirical results directly support the positive relationship between household debt and household time discount rate, we nevertheless believe that it is at least possible to conclude that factors pertaining to the constitutional household appetite for interest rate risk preference influence the increase of household mortgage debt.

One piece of remarkable evidence reconfirming the mortgage-borrowing pattern for low-income households is the increase in outstanding debt accompanied with the increase in the variable interest rate loan. In addition, high-income household borrowers tended to avoid the interest rate risk in residential mortgage loan contracts. How should we interpret these curious results? As pointed by Thaler (1981) and Laibson (1997), these results can be theoretically explained if we assume that the background of this financing pattern lies in an intertemporal choice of household purchase of residential mortgage. Utilities obtained from the immediate purchase of residential property are more satisfactory and larger than those derived by a far-distant future purchase, irrespective of the household repayment capacity, in the case of low-income households. On the other hand, immediate property purchase by high-income households does not always bring larger utilities than those derived by a far-distant future purchase. Of course, as indicated by Loewenstein and Prelec (1992) and Prelec and Loewenstein (1998), the existence of "sign effects" raised by household mortgage debt decreases the total utility of immediate mortgage purchase. However, external finance is still encouraged as long as the utilities of an immediate purchase under a high time discount rate exceed the disutility raised by the mortgage debt sign effect. This differing appetite for the interest rate risk in the mortgage



loan contract between low- and high-income households stresses that the determinant of low-income household debt is not applicable to high-income households; thus, the household debt to income ratio for high-income households did not increase compared with that for low-income households. This is the major household debt determinant for Japanese households, thus, proving our implication—the first of its kind—that the household debt determinant for Japanese households differs from that listed in the existing literature for U.S. households.

We also confirmed that a change in the level of the loan contractual interest rate, coupled with the borrower's income, empirically influences the household debt to income ratio, particularly in the case of low-income households. Our empirical results of the negative significant parameter of contractual interest rate and positive parameter of the intersection between the contractual interest rate and household income suggest that an additional “golden egg” utility is demanded by low-income households as the level of residential mortgage loan variable interest reduces. This suggests that the relationship between the degrees of a household's interest risk-taking attitude and a household's external funding demand are strengthened with the reduction in, and subsequent prolonging of, the loan contractual interest rate. This result was confirmed by two empirical tests, which proved its robustness. Moreover, to the best of our knowledge, while the existing literature notes that in the case of consumer finance, the borrower's constitutional factors are related to his/her propensity to borrow, the influences of the external monetary condition are not discussed. Meanwhile, our study contended that the external monetary condition also influences the degree of propensity to borrow, coupled with the borrower's constitutional factors, in the case of residential mortgage loans. This is the second conclusion derived from our empirical analyses.

As for other determinants of household mortgage debt (besides the borrower's constitutional factors), this study also showed similarities between household mortgage debt determinants in Japan and the U.S. Our empirical evidence indicated that the residential real estate value and the turnover of the mortgage secondary market also influence the level of household mortgage debt. Many previous studies have supported the relationship between household leverage and residential property asset price rise, while only a few have mentioned the relationship between household leverage and regional mortgage market liquidity. Although Japan did not experience a dramatic rise in residential property asset values in the 2000s (as frequently noted in this paper), these values vary across Tokyo's 23 wards. Among the 23 wards, the Minato ward recorded the highest 10-year (2001–2010) average increase—10.2 percent (the standard deviation being 12.6 percent)—in the posted residential property prices, while the Toshima ward recorded the lowest—minus 2.9 percent (the standard deviation being 5.9

percent). Thus, some wards experienced a rise and others a fall in residential property values. In the remaining, residential property values remained unchanged. Notably, Our results showed that the positive influence in the household mortgage debt with the rise in regional property asset values is duplicable when the regional secondary market size is large. Unlike various consumer loans, in the case of residential mortgage loans, it is possible to liquidate mortgage assets once a borrower becomes seriously insolvent. In this regard, the residential mortgage property assets automatically cover agency costs between lenders and borrowers. Kiyotaki and Moore (1997) asserted that this fact prevails even in the case of personal residential mortgage loan contracts. The positive relationship between the household debt to income ratio and the two regional factors mentioned above were empirically supported by our results. Barclay et al. (2003) analyzed the relationship between a firm's tangible asset liquidity and the corporate capital structure. According to our result, the theory derived by them is also applicable to household mortgage finance. Thus, the household mortgage debt is determined not only by the constitutional factors of the borrowers, but is also influenced by complementary regional factors. Moreover, these regional determinants apply universally, that is, they are applicable to not just to low-income households, but to all the income classes of households. This was the third conclusion derived from our empirical analysis.

The fourth implication obtained from our empirical evidence is that the household mortgage debt to income ratio is also influenced by the degree of competition in the regional mortgage loan market. For the sample periods under consideration, Tokyo's 23 wards had various degrees of mortgage loan market competition. Our empirical results showed that the more competitive the mortgage market, the higher the household mortgage debt to income ratio. How should we, in turn, translate these empirical results? These findings are also consistent with the empirical literature (Loutskina and Strahan, 2009). Unlike Loutskina and Strahan (2009), however, we did not directly examine financial transaction data between a household borrower and each bank. Our results suggest that the bank-household relationship varies by region, as the degree of competition in the residential mortgage market varies. In other words, the more the competition among banks in the residential mortgage loan market, the keener the banks are to conclude loan contracts. We also obtained empirical evidence indicating the negative significant relationship between the state of soundness of commercial bank management and the degree of aggressiveness in promoting residential mortgage loans, which agrees with Keys et al. (2010) and Purnanandam (2011). Accordingly, our fourth conclusion is that the degree of regional bank market competition and the state of bank management soundness influence the aggressiveness of the bank's residential mortgage loan business, which

is similar to the empirical evidence in literature focusing on the U.S. residential mortgage loan market. In other words, a household tends to increase its debt to income ratio when the mortgage loan market is competitive and the capital of the participating commercial banks is restricted. Again, this determinant applies universally; it is applicable not just to low-income households, but for all the income classes of households.

Finally, we would like to conclude this paper by presenting our fifth conclusion. We used direct and indirect loan data from the JHFA, and discovered that the residential mortgage securitization market developed in the latter sample period. All the indirect loan contracts of our data in 2006–2010 were securitized with financial support from the JHFA. As asserted by the literature analyzing U.S. household data, such as Mian and Amir (2010), we expected market development to relate positively to the household debt to income ratio. However, the insignificant parameter for the securitization dummy variable in our study suggests that securitization market development did not trigger excess household borrowing for the sample period for Japanese households, and this result does not support our fourth hypothesis. Therefore, we recognize that more elaborate analyses are necessary to conclude the relationship between securitization market development and household leverage in Japan.

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**Table 1. Existing Literature Pertaining to Household Mortgage Debt Determination**

<b>Relationship/Topic Being Studied</b>	<b>Literature</b>	<b>Sample Country</b>	<b>Sample Period</b>	<b>Main Conclusions</b>
a. Residential Property Asset Value and the Wealth Effect	Mian and Amir (2011)	United States	2002–2008	<p>a) The wealth effect derived by the increase in the household residential property asset value is larger than that derived by the increase in financial asset value.</p> <p>b) The residential property wealth effect mainly increases nondurable good consumption, while the household financial asset wealth effect increases durable good consumption.</p>
	Bostic et al. (2007)	United States	1989–2001	
	Lustig and Nieuwerburgh (2005)	United States	1929–2000	
	Benjamin et al. (2004)	United States	1952–2000	
b. Relationship Between the Development of the Mortgage Securitization Market and Household Mortgage Debt	Purnanandam (2011)	United States	2006–2008	<p>a) Development of the mortgage securitization market and household debt increase are positively related.</p> <p>b) Progress in the development of the mortgage securitization market and the household mortgage debt default probability are positively related.</p> <p>c) Development of the securitization market negatively influences the examination of bank loan applications.</p> <p>d) Banks with constrained capital conduct the residential mortgage loan business and its securitization aggressively.</p>
	Keys et al. (2010)	United States	2001–2006	
	Mian and Amir (2010)	United States	2001–2007	
	Keys et. al. (2009)	United States	2006	
	Loutskina and Strahan (2009)	United States	1992–2007	
c. Characteristics of High Leverage Households	Demyanyk and Hermert (2011)	United States	2006	<p>a) High property asset prices conceal high LTV household creditworthiness to MBS secondary market interest rates.</p> <p>b) High leverage households generally conduct transactions with a limited number of banks.</p>
	Pennington-Cross and Chomsisengphet (2007)	United States	1996–2003	

**Table 2. Overviews of *JHFA Loan Master Data File* and the *Nikkei NEEDs Radar Financial Survey***

	<i>JHFA Loan Master Data File</i>	<i>Nikkei NEEDs Radar Financial Survey</i>
<b>Data Providers</b>	The Japan Housing Financial Agency	Nikkei Media Marketing, Inc.
<b>Data Abstract</b>	<p>a) Each individual mortgage loan contract data on the basis of JHFA's direct loans (–2005)</p> <p>b) “Flat 35” loan contract data approved and concluded by commercial banks that seek JHFA's securitization support services (2006–2010)</p>	Household questionnaire survey data for people those living within a 40 kilometer radius of Tokyo Central Station
<b>Method of Data Collection</b>	The contract data is collected through contract forms filled in by borrowers and submitted to the JHFA or to commercial banks that utilize the JHFA's securitization support services.	The survey is conducted using questionnaire survey sheet placement methods (response rate = 57 percent)
<b>Potential Number of Observations in this Study</b>	26,956	1,605
<b>Sample Period in this Study</b>	2001–2010	2007–2009

**Table 3. Definition of Variables**

	<b>Variables</b>	<b>Definition</b>	<b>Expected Sign of Parameter</b>	<b>Source</b>
<i>X<sup>H</sup></i> : <i>Individual Household Factor Variables</i>	<i>Debt to Income I</i>	The Value of the Total Mortgage Contract Loan Amount to the Annual Income of Household <i>i</i>	Dependent Variable	<i>JHFA Loan Master Data File</i>
	<i>Debt to Income II</i>	The Value of the Total Mortgage Contract Loan Amount Plus Total Scheduled Interest Payments During the Maturity Period to the Annual Income of Household <i>i</i>	Dependent Variable	<i>JHFA Loan Master Data File</i>
	<i>Debt to Income III</i>	The Value of the Total Mortgage Contract Loan Amount to the Annual Income of Household <i>k</i>	Dependent Variable	<i>Nikkei NEEDS Radar Financial Survey</i>
	<i>Income</i>	Annual Income of Household <i>i</i> (Household <i>k</i> )	-	<i>JHFA Loan Master Data File and Nikkei NEEDS Radar Financial Survey</i>
	<i>Variable Loan Ratio</i>	Outstanding Variable Interest Rate on Residential Mortgage Debt to Total Outstanding Mortgage Debt of Household <i>i</i>	+	<i>JHFA Loan Master Data File</i>
	<i>Loan Type</i>	Equals One When a Household Chooses the Variable Interest Rate on the Mortgage Loan Contract and Zero Otherwise	+	<i>Nikkei NEEDS Radar Financial Survey</i>
	<i>Credit Card</i>	Equals One When a Household has Credit Card Loan Use Experience and Zero Otherwise	+	<i>Nikkei NEEDS Radar Financial Survey</i>
	<i>Risk Assets</i>	Equals One When More Than 10 Percent of Household Financial Assets Have a Risk of Loss in the Original Principal Value and Zero Otherwise	+	<i>Nikkei NEEDS Radar Financial Survey</i>
	<i>Age</i>	Age of Household <i>i</i> 's Head (Household <i>k</i> 's Head)	-	<i>JHFA Loan Master Data File and Nikkei NEEDS Radar Financial Survey</i>
	<i>Sex</i>	Sex of Household <i>i</i> 's Head (Household <i>k</i> 's Head)	+	<i>JHFA Loan Master Data File and Nikkei NEEDS Radar Financial Survey</i>
	<i>Financial Asset</i>	Outstanding Financial Assets of Household <i>i</i> (Household <i>k</i> )	-	<i>JHFA Loan Master Data File and Nikkei NEEDS Radar Financial Survey</i>



				Survey
	<i>Loan Maturity</i>	Maturity of Mortgage Loan Contract of Household <i>i</i> (Household <i>k</i> )	+	<i>JHFA Loan Master Data File and Nikkei NEEDS Radar Financial Survey</i>
	<i>Job Dummy 1</i>	Equals One When the Head of Household <i>i</i> is a Regular Firm Employee and Zero Otherwise	+/-	<i>JHFA Loan Master Data File</i>
	<i>Job Dummy 2</i>	Equals One When the Head of Household <i>i</i> is a Regular Government Employee and Zero Otherwise	+/-	<i>JHFA Loan Master Data File</i>
	<i>Job Dummy 3</i>	Equals One When the Head of Household <i>i</i> is Self-employed or an Employee at a Mercantile Store or a Fixed Term Contract Employee and zero otherwise	+/-	<i>JHFA Loan Master Data File</i>
	<i>Job Dummy 4</i>	Equals One When the Head of Household <i>k</i> is a Regular Firm Employee and Zero Otherwise	+/-	<i>Nikkei NEEDS Radar Financial Survey</i>
<i>X<sup>R</sup>: Regional Factor Variables</i>	<i>Property Value Growth</i>	Annual Growth Rate of the Official Residential Property Price in Tokyo Ward <i>j</i>	+	Tokyo Kantei, Inc.'s <i>Real Estate Market Monthly Report</i> (various months)
	<i>Second Market Size</i>	Size of the Residential Mortgage Secondary Market in Tokyo Ward <i>j</i>	+	Tokyo Kantei, Inc.'s <i>Real Estate Market Monthly Report</i> (various months)
<i>X<sup>B</sup>: Bank Management Variables</i>	<i>Bank Competition</i>	Ratio of the Number of Branches of the Three Largest City-based Banks to the Total Number of Branches of all Financial Institutions in Tokyo Ward <i>j</i>	+	Nikkīn, Inc.'s <i>Nikkīn Directory Book in Banking (Nikkīn Siryou Nempou)</i> (various years)
	<i>Bank Soundness</i>	Weighted Average of the Capital Adequacy Ratio of Banks and Other Financial Institutions Located in Tokyo Ward <i>j</i> . Weight = Total Number of Bank <i>l</i> 's Branches in the Region Divided by the Total Number of Bank Branches of All Financial Institutions in Tokyo Ward <i>j</i>	-	The Japanese Bankers' Association's <i>(Zenginkyo) Commercial Bank Financial Statements (Zenkoku Ginko Zaimushohyo Bunseki)</i> , The Kinyu Tosho Consultant Inc.'s <i>Credit Union Financial Statements and Credit Association Financial Statements</i> (various

				years)
$X^M$ : Monetary Condition and Securitization Development Variables	Fixed Loan Interest	Household $i$ 's Mortgage Loan Fixed Interest Rate with JHFA(or Commercial Banks) divided by 2001-2010 Average of Mortgage Fixed Loan Interest Rate	-	JHFA Master Data File The Japanese Bankers' Association's (Zenginkyo) Finance (various years)
	Variable Loan Interest	Household $i$ 's Mortgage Loan Fixed Interest Rate with JHFA(or Commercial Banks) minus Average of Major Commercial Bank Mortgage Loan Variable Interest Rate in year $t$	-	JHFA Master Data File The Japanese Bankers' Association's (Zenginkyo) Finance (various years)
	Securitization Dummy	Equals one if Household $i$ 's contract concluded in 2006–2010 and zero otherwise	-	JHFA Loan Master Data File

**Table 4. Descriptive Statistics**

**1. JHFA Loan Master Data File (2001–2010)**

A. Household Data

<i>(A) All Income Class Households</i>										
		<i>Debt to Income I</i>	<i>Debt to Income II</i>	<i>Variable Loan Ratio</i>	<i>ln(Income)</i>	<i>ln(Financ ial Asset)</i>	<i>ln(Loan Maturity)</i>	<i>ln(Age)</i>	<i>Fixed LoanRate</i>	<i>Variable Loan Rate</i>
(i) 2001-2005	Mean	4.224	6.677	0.178	15.669	5.960	3.476	3.617	0.965	0.507
	S.D.	1.558	5.168	0.265	0.404	2.364	0.228	0.226	0.095	0.050
	N	13,593	13,593	13,593	13,593	13,593	13,593	13,593	13,593	13,593
(ii) 2006-2010	Mean	4.636	6.778	0.996	15.713	5.675	3.464	3.647	1.045	0.544
	S.D.	1.716	2.781	3.418	0.494	1.754	0.214	0.210	0.105	0.054
	N	13,363	13,363	13,363	13,363	13,363	13,363	13,363	13,363	13,363
(iii) Mean(i) - Mean(ii) = 0		-20.643 ***	-0.106	26.022 ***	-8.134 ***	-19.215 ***	-5.553 ***	10.698 ***	-8.359 ***	-8.338 ***
<i>(B) Below JPY 3.5 million Income Households</i>										
(i) 2001-2005	Mean	4.717	9.535	0.215	14.896	7.001	3.483	3.635	0.958	0.528
	S.D.	1.580	4.024	0.384	0.169	1.408	0.228	0.304	0.095	0.056
	N	651	651	651	651	651	651	651	651	651
(ii) 2006-2010	Mean	5.370	11.356	1.322	14.840	5.943	3.483	3.678	1.039	0.547
	S.D.	1.694	16.006	3.164	0.293	2.397	0.240	0.335	0.106	0.060
	N	863	863	863	863	863	863	863	863	863
(iii) Mean(i) - Mean(ii) = 0		-7.642 ***	-2.833 ***	-8.446 ***	4.316 ***	10.038 ***	-0.137	-2.436 ***	-3.910 ***	-6.909 ***
<i>(C) Over JPY 10 million Income Households</i>										
(i) 2001-2005	Mean	2.807	4.070	0.205	16.371	7.009	3.368	3.753	0.980	0.503
	S.D.	1.226	1.823	0.321	0.251	1.553	0.303	0.199	0.105	0.049
	N	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764
(ii) 2006-2010	Mean	3.059	4.015	1.092	16.471	6.491	3.360	3.781	1.015	0.547
	S.D.	1.342	2.088	3.420	0.350	1.914	0.301	0.197	0.112	0.056
	N	2,396	2,396	2,396	2,396	2,396	2,396	2,396	2,396	2,396
(iii) Mean(i) - Mean(ii) = 0		-6.212 ***	-0.887 ***	-8.436 ***	-10.237 ***	8.471 ***	1.013	-0.455 ***	-3.190 ***	-3.190 ***

**Note:** \*\*\*, \*\*, and \* denote significance at 1, 5, and 10 percent, respectively.

B. Household Attributes

	Male ( <i>Sex=1</i> )	Female ( <i>Sex=0</i> )	Firm Employee ( <i>JobDum1=1</i> )
2001-2005	10,980 (80.8%)	2,613 (19.2%)	11,764 (86.5%)
2006-2010	10,732 (80.3%)	2,631 (19.7%)	10,963 (82.0%)
	Government Employee ( <i>JobDum2=1</i> )	Individual Business Owners ( <i>JobDum3=1</i> )	Other Occupations
2001-2005	1,119 (8.2%)	69 (0.5%)	641 (4.7%)
2006-2010	1,486 (11.1%)	172 (1.3%)	742 (5.6%)

C. Regional Residential Mortgage Market Data

	<i>Property Value Growth</i>		<i>ln(Second Market Size)</i>		<i>Bank Competition</i>		<i>Bank Soundness</i>	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Chiyoda Ward	0.016	(0.087)	4.565	(0.319)	0.475	(0.032)	0.092	(0.020)
Chuo Ward	0.022	(0.118)	5.740	(0.360)	0.254	(0.004)	0.095	(0.014)
Minato Ward	0.102	(0.126)	6.369	(0.256)	0.438	(0.016)	0.093	(0.014)
Shinjuku Ward	-0.001	(0.062)	6.077	(0.325)	0.293	(0.043)	0.091	(0.016)
Bunkyo Ward	-0.001	(0.076)	5.823	(0.199)	0.563	(0.000)	0.089	(0.018)
Taito Ward	-0.012	(0.076)	5.411	(0.316)	0.227	(0.004)	0.094	(0.012)
Sumida Ward	-0.011	(0.035)	5.538	(0.298)	0.255	(0.000)	0.094	(0.012)
Koto Ward	0.005	(0.042)	6.715	(0.174)	0.386	(0.041)	0.104	(0.019)
Shinagawa Ward	0.034	(0.094)	6.017	(0.146)	0.261	(0.022)	0.093	(0.013)
Meguro Ward	-0.010	(0.072)	5.883	(0.402)	0.377	(0.006)	0.093	(0.019)
Ohta Ward	-0.008	(0.051)	6.179	(0.300)	0.254	(0.002)	0.096	(0.011)
Setagaya Ward	-0.014	(0.057)	6.725	(0.110)	0.370	(0.002)	0.093	(0.015)
Shibuya Ward	-0.007	(0.072)	6.008	(0.171)	0.362	(0.008)	0.091	(0.017)
Nakano Ward	-0.012	(0.055)	5.624	(0.326)	0.341	(0.000)	0.088	(0.015)
Suginami Ward	0.004	(0.058)	5.721	(0.283)	0.375	(0.087)	0.093	(0.016)
Toshima Ward	-0.029	(0.059)	5.656	(0.229)	0.305	(0.004)	0.098	(0.016)
Kita Ward	-0.023	(0.031)	5.330	(0.244)	0.255	(0.001)	0.090	(0.012)
Arakawa Ward	0.002	(0.060)	5.314	(0.212)	0.207	(0.000)	0.096	(0.014)
Itabashi Ward	-0.013	(0.056)	6.294	(0.208)	0.358	(0.002)	0.093	(0.015)
Nerima Ward	-0.022	(0.044)	6.149	(0.174)	0.353	(0.000)	0.095	(0.018)
Adachi Ward	0.007	(0.068)	5.996	(0.103)	0.141	(0.003)	0.094	(0.010)
Katsushika Ward	-0.014	(0.035)	5.682	(0.120)	0.207	(0.001)	0.099	(0.010)
Edogawa Ward	-0.019	(0.049)	5.999	(0.067)	0.237	(0.001)	0.090	(0.011)

## 2. Nikkei NEEDs Radar Financial Survey (2007–2009)

### A. Household Quantitative Survey Data

		<i>Debt to Income III</i>	<i>ln(Income)</i>	<i>ln(Financial Asset)</i>	<i>ln(Age)</i>	<i>ln(Loan Maturity)</i>
2007	Mean	3.590	4.252	3.556	3.843	2.678
	S.D.	2.027	0.557	1.251	0.212	0.776
	N	549	549	549	549	549
2008	Mean	3.163	4.242	5.296	3.853	2.928
	S.D.	2.270	0.535	1.291	0.209	0.844
	N	545	545	545	545	545
2009	Mean	3.429	4.233	5.474	3.821	2.922
	S.D.	3.164	0.555	1.371	0.207	0.860
	N	511	511	511	511	511

### B. Household Qualitative Survey Data

	<i>Variable Rate Mortgage Loan Contract (Loan Type=1)</i>	<i>Fixed Rate Mortgage Loan Contract (Loan Type=0)</i>	<i>Experience of Credit Card Loan (CreditCard=1)</i>	<i>No Experience of Credit Card Loan (CreditCard=0)</i>	<i>Risky Asset Investment Ratio (Risk Assets=1)</i>	<i>Risky Asset Investment Ratio (Risk Assets=0)</i>
2007	296 (53.9%)	253 (46.1%)	66 (12.0%)	483 (88.0%)	145 (26.4%)	404 (73.6%)
2008	279 (47.1%)	313 (52.9%)	101 (17.1%)	491 (82.9%)	179 (30.2%)	413 (69.8%)
2009	251 (52.2%)	230 (47.8%)	75 (15.6%)	406 (84.4%)	128 (26.6%)	353 (73.4%)

	<i>Male (Sex=1)</i>	<i>Female (Sex=0)</i>	<i>Firm Employee (JobDum4=1)</i>	<i>Others (JobDum1=0)</i>
2007	338 (61.6%)	211 (38.4%)	445 (81.1%)	104 (18.9%)
2008	353 (59.6%)	239 (40.4%)	564 (95.3%)	28 (4.7%)
2009	294 (61.1%)	187 (38.9%)	400 (83.2%)	81 (16.8%)

**Table 5. Empirical Results: JHFA Loan Master Data File**

A. All Income Households

		Dependent Variable					
Independent Variables		(A) Debt to Income I	(B) Debt to Income II	(c) Variable Loan Ratio	(c-1) Debt to Income I	(c-2) Debt to Income II	
<i>X<sup>H</sup> : Individual Household Factor Variables</i>	<i>ln(Income)</i>	8.822 *** (14.350)	8.200 *** (16.790)	-0.350 ** (-2.020)	-2.902 *** (-8.700)	-5.568 *** (-8.660)	
	<i>ln(Income)^2</i>	-0.323 *** (-16.600)	2.970 *** (19.000)				
	<i>Variable Loan Ratio</i>	0.239 *** (4.840)	0.175 *** (3.710)				
	<i>ln(Income) x Variable Loan Ratio</i>	-0.009 *** (-3.410)	-0.110 *** (-14.030)				
	<i>ln(AGE)</i>	-0.119 *** (-11.200)	-0.014 *** (-5.270)	-0.022 *** (-21.320)	-0.012 * (-1.930)	-0.058 *** (-4.960)	
	<i>Sex</i>	0.032 (1.600)	0.704 * (1.750)	0.153 *** (7.210)	-0.171 *** (-3.190)	0.652 *** (6.290)	
	<i>ln(Financial Asset)</i>	-0.158 *** (-39.970)	-0.231 *** (-22.710)	1.115 *** (3.220)	-0.072 *** (-13.750)	-0.109 *** (-10.710)	
	<i>ln(Loan Maturity)</i>	0.088 *** (52.780)	0.194 *** (43.800)		0.061 *** (19.310)	0.128 *** (20.710)	
	<i>Job Dummy 1</i>	-0.127 *** (-3.640)	-0.142 (-1.580)	0.024 (0.640)	-0.156 ** (-2.350)	-0.497 *** (-3.880)	
	<i>Job Dummy 2</i>	0.166 *** (4.060)	0.316 *** (2.990)	-0.080 * (-1.780)	0.201 ** (2.450)	-0.314 ** (-1.990)	
	<i>Job Dummy 3</i>	-0.376 *** (-4.350)	-2.130 *** (-9.540)	-0.162 * (-1.710)	-0.389 ** (-2.170)	-1.892 *** (-5.470)	
	<i>X<sup>R</sup> : Regional Factor Variables</i>	<i>Property Value Growth</i>	0.121 *** (5.130)	0.681 *** (11.140)		0.346 *** (9.780)	0.880 *** (12.380)
		<i>ln(Second Market Size)</i>	0.005 ** (2.090)	0.294 *** (5.680)		0.160 *** (5.680)	0.405 *** (7.430)

(-continued.)

(-continued.)

$X^B$ :Bank Management Variables	Bank Competition	0.345 *** (3.290)	1.319 *** (4.850)		0.369 ** (2.440)	0.954 *** (3.270)
	Bank Soundness	-0.042 *** (-2.770)	-0.061 * (-1.640)		-0.085 *** (-3.680)	-0.022 *** (-3.480)
	Fixed Loan Interest	-0.120 ** (-2.040)	-0.319 *** (-3.860)		-0.106 *** (-4.860)	-0.086 ** (-2.040)
	$\ln(\text{Fixed Loan Interest})^2$	-0.009 *** (-3.410)	0.802 *** (5.280)		0.678 *** (4.720)	0.608 ** (2.200)
	$X^M$ : Monetary Condition and Securitization Development Variables	Var Loan Interest			-4.840 *** (-4.600)	
	$\ln(\text{Var Loan Interest})^2$			0.382 *** (5.760)		
	$\ln(\text{Fixed Loan Interest}) \times$ Variable Loan Ratio	-0.527 * (-1.650)	-0.012 *** (-2.710)		-0.407 *** (-3.280)	-0.537 ** (-2.240)
	$\ln(\text{Var Loan Interest}) \times$ Variable Loan Ratio			-0.137 ** (-2.130)		
	Securitization Dummy	0.005 (0.090)	-0.277 (-1.200)		0.315 (0.770)	0.509 (0.420)
	constant	-56.323 *** (-11.510)	80.222 *** (26.430)	-9.972 *** (-3.630)	53.157 *** (9.200)	69.568 *** (6.270)
Year Dummy	Year Dummy	yes	yes	yes	yes	yes
Methodology		OLS	OLS	Probit	OLS	OLS
Observations		26,956	26,956	26,956		
R-squared		0.455	0.423			
Mills Ratio					-1.850 *** (-4.450)	3.574 *** (4.440)
					4.874	6.288
					2.357	3.238
					100.000% ***	100.000% ***
(a) Predicted Debt to Income ( <i>Variable Loan Ratio</i> = 1)						
(b) Predicted Debt to Income ( <i>Variable Loan Ratio</i> = 0)						
p-value of t test (a) > (b)						

Note: \*\*\*, \*\*, and \* denote significance at 1, 5, and 10 percent, respectively.



B. Below JPY 3.5 million Income Households

		<i>B. Below JPY 3.5 million Income Households</i>					
		Dependent Variable					
Independent Variables		(A) Debt to Income I	(B) Debt to Income II	(C) Variable Loan Ratio	(c-1) Debt to Income I	(c-2) Debt to Income II	
<i>X<sup>H</sup> : Individual Household Factor Variables</i>	<i>ln(Income)</i>	-1.377 (-0.330)	-0.930 *** (-55.420)	-2.001 ** (-2.390)	-2.183 ** (-2.310)	-6.647 ** (-1.980)	
	<i>ln(Income)^2</i>	0.041 (0.290)	3.469 *** (12.220)				
	<i>Variable Loan Ratio</i>	0.178 ** (2.290)	0.564 ** (2.190)				
	<i>ln(Income) x Variable Loan Ratio</i>	-0.008 *** (-3.200)	-0.363 ** (-2.140)				
	<i>ln(AGE)</i>	-0.011 *** (-2.930)	0.093 *** (6.180)	-0.011 *** (-3.370)	-0.014 (-0.390)	-0.072 (-0.440)	
	<i>Sex</i>	-0.118 (-1.480)	1.431 *** (4.360)	0.099 (1.320)	-0.257 (-0.720)	1.482 (0.890)	
	<i>ln(Financial Asset)</i>	-0.109 *** (-5.430)	-0.586 *** (-7.040)	-0.222 *** (-4.610)	-0.011 ** (-2.280)	-0.428 ** (-2.510)	
	<i>ln(Loan Maturity)</i>	0.117 *** (15.320)	0.458 *** (14.400)		0.075 ** (2.340)	0.305 ** (2.210)	
	<i>Job Dummy 1</i>	0.076 (0.570)	0.648 (1.170)	0.221 * (1.660)	0.026 (0.030)	2.145 (0.570)	
	<i>Job Dummy 2</i>	0.257 * (1.780)	1.469 ** (2.460)	-0.002 (-0.020)	0.543 (1.460)	0.883 (0.440)	
	<i>Job Dummy 3</i>	-0.111 (-0.630)	0.162 (0.220)	-0.190 (-1.050)	0.178 (0.230)	-2.827 (-0.780)	
	<i>X<sup>R</sup> : Regional Factor Variables</i>	<i>Property Value Growth</i>	0.109 *** (5.430)	0.731 * (1.740)		1.131 *** (4.270)	1.529 (1.280)
		<i>ln(Second Market Size)</i>	0.162 * (1.660)	0.825 * (1.920)		0.536 ** (2.580)	1.181 (1.230)

(-continued.)

(-continued.)

$X^B$ : Bank Management Variables	Bank Competition	0.746 *	0.759 ***		0.306 **	0.368 **
		(1.690)	(2.800)		(2.150)	(2.070)
	Bank Soundness	-0.028 **	-0.042 *		-0.032 *	-1.080 *
		(-2.370)	(-1.630)		(-1.720)	(-1.800)
	Fixed Loan Interest	-0.788	-12.813 **		-7.109	-3.648
	(-0.520)	(-2.060)		(-0.130)	(-1.500)	
	$\ln(\text{Fixed Loan Interest})^2$	0.120	3.088 ***		0.224	2.528
		(0.430)	(2.670)		(0.300)	(0.620)
$X^M$ : Monetary Condition and Securitization Development Variables	Var Loan Interest			-1.153 *		
				(-1.880)		
	$\ln(\text{Var Loan Interest})^2$			1.020		
				(0.520)		
	$\ln(\text{Fixed Loan Interest}) \times$ Variable Loan Ratio	-0.014 **	-0.117 *		-0.290 **	-0.249 *
	(-2.290)	(-1.810)		(-2.290)	(-1.900)	
	$\ln(\text{Var Loan Interest}) \times$ Securitization Dummy			-1.020 *		
				(-1.860)		
	constant	-0.190	-0.555		0.007	-0.447
		(-0.770)	(-0.540)		(0.001)	(-0.440)
		14.746	68.513 ***	29.107	24.035	29.107
		(0.500)	(55.900)	(1.360)	(0.240)	(1.360)
Year Dummy	Year Dummy	yes	yes	yes	yes	yes
Methodology		OLS	OLS	Probit	OLS	OLS
Observations		1,514	1,514	1,514	1,514	1,514
R-squared		0.322	0.789			
Mills Ratio					-0.869 ***	12.782 ***
					(-4.180)	(6.620)
(a) Predicted Debt to Income (Variable Loan Ratio = 1)					5.888	9.449
(b) Predicted Debt to Income (Variable Loan Ratio = 0)					2.091	3.389
p-value of t test (a) > (b)					100.000% ***	100.000% ***

Note: \*\*\*, \*\*, and \* denote significance at 1, 5, and 10 percent, respectively.

C. Over JPY 10 million Income Households

		<i>C. Over 10.0 mil JPY Income Households</i>					
		Dependent Variable					
Independent Variables		(A) Debt to Income I	(B) Debt to Income II	(C) Variable Loan Ratio	(c-1) Debt to Income I	(c-2) Debt to Income II	
<i>X<sup>H</sup> : Individual Household Factor Variables</i>	<i>ln(Income)</i>	-11.266 *** (-4.410)	-16.619 *** (-4.370)	0.118 (0.106)	0.482 (0.290)	3.785 (1.360)	
	<i>ln(Income)^2</i>	0.285 *** (3.740)	0.423 *** (3.730)				
	<i>Variable Loan Ratio</i>	0.392 *** (3.320)	0.453 *** (2.580)				
	<i>ln(Income) x Variable Loan Ratio</i>	-0.019 (-2.940)	0.028 *** (2.840)				
	<i>ln(AGE)</i>	-0.009 *** (-3.960)	-0.005 (-1.530)	-0.024 *** (-9.220)	-0.045 ** (-2.200)	-0.071 ** (-2.080)	
	<i>Sex</i>	0.126 ** (2.440)	0.093 (1.190)	0.136 * (1.880)	0.392 * (1.930)	0.612 * (1.810)	
	<i>ln(Financial Asset)</i>	-0.110 *** (-13.040)	-0.121 *** (-9.580)		-0.078 *** (-4.420)	-0.095 *** (-3.250)	
	<i>ln(Loan Maturity)</i>	0.052 *** (18.620)	0.107 *** (24.890)		0.040 *** (5.360)	0.092 *** (7.410)	
	<i>Job Dummy 1</i>	-0.289 *** (-5.520)	-0.436 *** (-5.550)	-0.036 (-0.490)	-0.373 ** (-2.250)	-0.452 * (-1.660)	
	<i>Job Dummy 2</i>	-0.012 (-0.200)	0.099 (1.070)	-0.112 (-1.290)	-0.352 (-1.590)	-0.546 (-1.500)	
	<i>Job Dummy 3</i>	0.534 (0.940)	0.536 (0.630)	0.178 (0.210)	-0.356 (-0.190)	-0.764 (-0.250)	
	<i>X<sup>R</sup> : Regional Factor Variables</i>	<i>Property Value Growth</i>	0.224 *** (5.080)	0.431 *** (6.520)		0.418 *** (4.150)	0.731 *** (3.880)
		<i>ln(Second Market Size)</i>	0.146 *** (3.680)	0.154 *** (2.600)		0.282 *** (3.110)	0.355 ** (2.380)

(-continued.)

(-continued.)

$X^B$ : Bank Management Variables	Bank Competition	0.484 ** (2.360)	0.761 ** (2.480)		0.168 (0.350)	0.095 (0.120)
	Bank Soundness	-0.013 (-0.420)	-0.087 * (-1.950)		-0.161 ** (-2.100)	-0.171 (-1.350)
	Fixed Loan Interest	-2.317 *** (-3.560)	-5.307 *** (-5.440)		-2.358 ** (-1.970)	-5.237 *** (-2.670)
	$\ln(\text{Fixed Loan Interest})^2$	0.496 *** (4.240)	1.140 *** (6.500)		0.010 (0.020)	0.093 (0.100)
	$X^M$ : Monetary Condition and Securitization Development Variables	Var Loan Interest			6.177 (1.420)	
	$\ln(\text{Var Loan Interest})^2$			-0.554 *** (-3.170)		
	$\ln(\text{Fixed Loan Interest}) \times$ Variable Loan Ratio	-0.021 ** (-2.140)	-0.022 (-1.510)		-1.147 (-0.910)	-2.610 (-0.640)
	$\ln(\text{Var Loan Interest}) \times$ Variable Loan Ratio			-0.147 (-0.560)		
	Securitization Dummy	0.324 ** (2.320)	0.280 ** (2.130)		0.601 ** (2.350)	-0.278 (-0.660)
	constant	10.725 *** (5.130)	15.556 *** (5.010)	-7.790 (-0.650)	-16.793 (-0.610)	-7.636 * (-1.770)
Year Dummy	Year Dummy	yes	yes	yes	yes	yes
Methodology		OLS	OLS	Probit	OLS	OLS
Observations		4,160	4,160	4,160	4,160	4,160
R-squared		0.432	0.462			
Mills Ratio					-0.992 (-1.110)	1.048 (0.960)
	(a) Predicted Debt to Income (Variable Loan Ratio = 1)				3.339	3.618
	(b) Predicted Debt to Income (Variable Loan Ratio = 0)				2.260	2.418
	p-value of t test (a) > (b)				100.000%	100.000%

Note: \*\*\*, \*\*, and \* denote significance at 1, 5, and 10 percent, respectively.

**Table 6. Empirical Results with the Nikkei NEEDs Radar Financial Survey**

6A. OLS Estimation Results

Independent Variables		Dependent Variable		
		(A) Debt to Income III	(B) Debt to Income III	(c) Debt to Income III
<i>X<sup>H</sup></i> : Individual Household Factor Variables	<i>ln(Income)</i>	-12.378 *** (-16.530)	-12.469 *** (-15.890)	-12.897 *** (-16.180)
	<i>ln(Income)^2</i>	2.489 *** (14.570)	2.281 *** (13.440)	2.387 *** (14.190)
	<i>Loan Type</i>	4.336 *** (2.940)		
	<i>ln(Income) x Loan Type</i>	-0.948 *** (-2.760)		
	<i>Risk Assets</i>		6.632 *** (3.760)	
	<i>ln(Income) x Risk Assets</i>		(-1.455) *** (-3.630)	
	<i>Credit Card</i>			2.425 *** (3.210)
	<i>ln(Income) x Credit_Card</i>			(-0.518) ** (-2.110)
	<i>ln(AGE)</i>	-0.717 (-1.350)	-0.447 (-0.850)	-0.537 (-1.000)
	<i>Sex</i>	-0.143 (-0.720)	-0.086 (-0.430)	-0.155 (-0.760)
	<i>ln(Financial Asset)</i>	0.024 * (1.760)	0.058 * (1.740)	0.027 * (1.730)
	<i>ln(Loan Maturity)</i>	1.241 *** (8.530)	1.254 *** (8.690)	1.244 *** (8.550)
	<i>Job Dummy 4</i>	0.445 (1.560)	0.463 (1.540)	0.521 * (1.730)
	<i>constant</i>	40.542 *** (13.320)	40.190 *** (13.320)	40.436 *** (13.780)
	<i>Year Dummy</i>	<i>Year Dummy</i> yes	<i>Year Dummy</i> yes	<i>Year Dummy</i> yes
	Methodology	OLS	OLS	OLS
Observations	1,605	1,605	1,605	
R-squared	0.339	0.345	0.333	

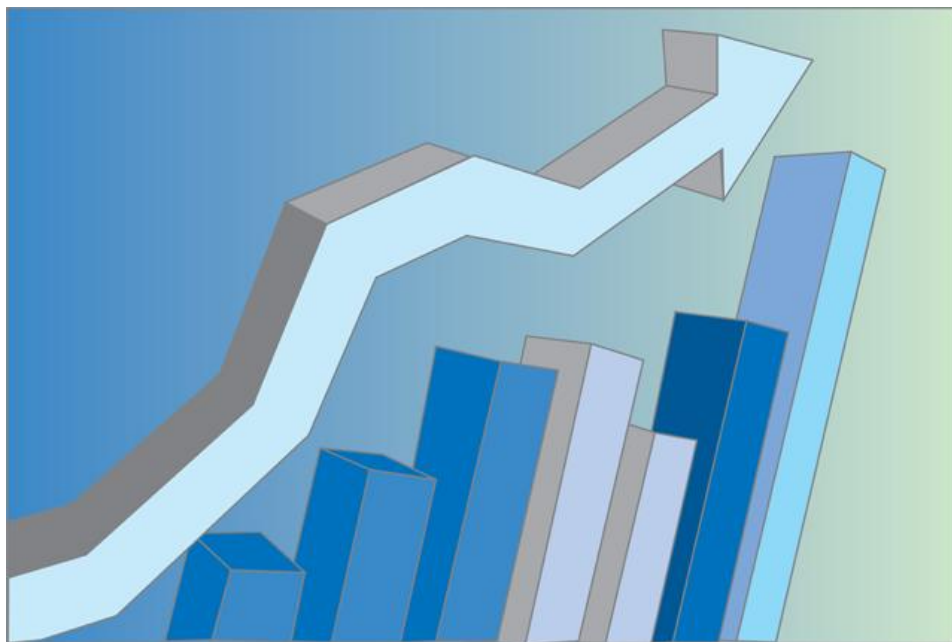
Note: \*\*\*, \*\*, and \* denote significance at 1, 5, and 10 percent, respectively.

6B. Heckman Two-step Estimation Results

	Independent Variables	(D) Debt to Income III	(d-1) Loan Type	(d-2) Risk Assets	(d-3) Credit Card
$X^H$ :	<i>ln(Income)</i>	-2.111 (-0.880)	-0.075 * (-1.890)	-0.646 *** (-9.290)	-0.048 *** (-3.680)
<i>Individual Household Factor Variables</i>	<i>ln(AGE)</i>	-0.659 (-0.390)	0.603 *** (3.980)	0.746 *** (4.280)	0.313 * (1.670)
	<i>Sex</i>	0.003 (0.410)	-0.033 (-0.480)	0.402 *** (5.074)	0.041 (0.480)
	<i>ln(Financial Asset)</i>	0.179 *** (3.620)			
	<i>ln(Loan Maturity)</i>	1.349 ** (2.380)			
	<i>Job Dummy 4</i>	2.216 ** (2.400)	0.173 ** (2.520)	-0.106 (-0.890)	0.267 ** (1.960)
	<i>constant</i>	-35.145 (-0.290)	-2.868 *** (-4.440)	-6.500 *** (-8.590)	-2.265 *** (-2.820)
<i>Year Dummy</i>	<i>Year Dummy</i>	yes	yes	yes	yes
Methodology		OLS	Probit	Probit	Probit
Observations		1,605	1,605	1,605	1,605
R-squared					
Mills Ratio			6.575 (0.350)	0.555 *** (3.060)	-10.982 (-0.360)
(a) Predicted Debt to Income (Variable Loan Ratio = 1)			3.150	2.511	2.639
(b) Predicted Debt to Income (Variable Loan Ratio = 0)			1.230	0.417	0.372
p-value of t test (a) > (b)			100.000% ***	100.000% ***	100.000% ***

Note: \*\*\*, \*\*, and \* denote significance at 1, 5, and 10 percent, respectively.

# Japanese Financial Markets: Corporate Finance, Institutions, and Investments



## Another Determinant of Household Leverage: Evidence from Japan's Mortgage Loan Data

International Review of Finance  
Nippon Finance Association Conference  
2013

Mamoru Nagano  
Dong-Ho Yeom

# 1. Paper Overview



## 1. Research Goal

This paper aims to show a new evidence which increases household leverage.

## 2. Hypotheses

- H1:** The interest rate risk preferring household has the higher mortgage loan leverage.
- H2:** The securitization market development does not always promote the leverage rise.
- H3:** The more competitive the mortgage loan market, the higher the household leverage is.

## 3. Methodology

28,561 household samples in 2001-2010

## 4. Conclusions

- A1:** The household interest risk preference and the leverage ratio are positively related.
- A2:** The other related household constitutional factors also influence the loan leverage.
- A3:** The securitization market development does not increase the household leverage.
- A4:** Bank competition in the mortgage market also increases the mortgage loan leverage.

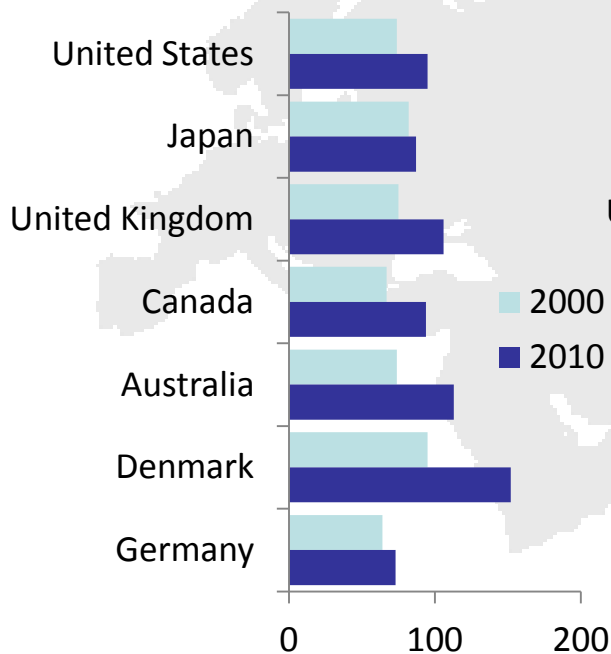


# 2. Research Motivation



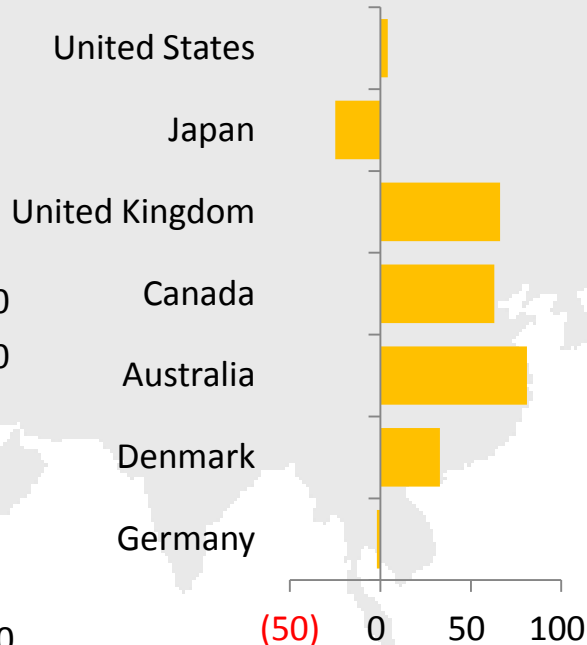
Are real estate price and the securitization the two major household leverage determinants?  
 No, some countries have experienced household leverage increase under the undeveloped securitization market in the deflationary economy.

**Graph 1. Household Debt**  
 as a percent of GDP



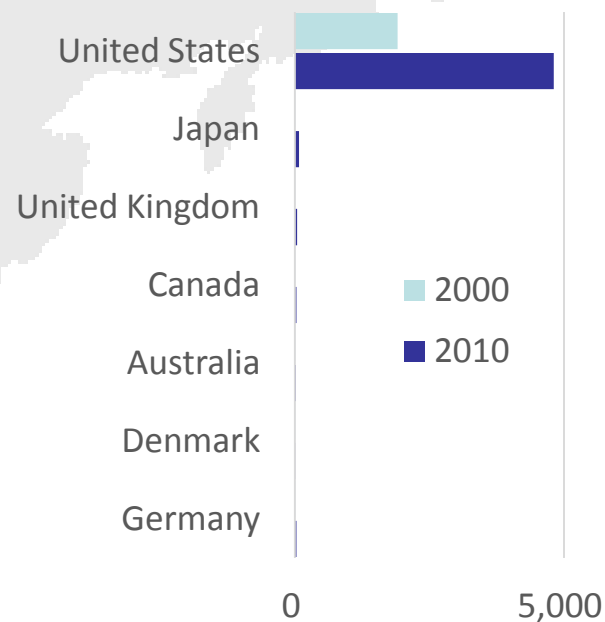
Source: OECD, national data

**Graph 2. House Price Index**  
 as a percent change in 2000-2010



Source: *The Economist*, House-Price Indicator

**Graph 3. Outstanding MBS Value**  
 in bil. USD



Source: Authors Calculation based on *Thomson Reuter Data*

# 3. Existing Literature 1



**Table. Main Conclusions on the Relationship between MBS Market Development and Household Mortgage Debt**

	Sample Country	Sample Period	Main Conclusions
Purnanandam (2011)	United States	2006-08	MBS market development distorted scrutiny of bank loan applications.
Demyanyk & Hermert (2011)	United States	2006	The low creditworthiness households increase LTV (plus default probability), but MBS interest spreads did not reflect it, due to the real estate value rise.
Keys et al. (2010)	United States	2001-06	MBS market development encourages banks to securitize loans of low creditworthiness.
Keys et. al. (2009)	United States (7,000 Samples)	2006	
Mian and Amir (2010)	United States (2,900 Samples)	2001-07	Many defaults in 2005-07 attributes to increasing outstanding mortgage loan securitization.

# 4. Existing Literature 2



**Table. Main Conclusions on the Relationship between Regional Mortgage Loan Market and Household Mortgage Debt**

	Sample Country	Sample Period	Main Conclusions
Loutskina & Strahan (2009)	United States	1992-07	Banks are not aggressive in the mortgage loan business when operating in the limited areas.
Pennington-Cross & Chomsisengphet (2007)	United States	1996-03	High leverage households transact with only one bank, while low leverage household transact with multiple banks.
Loutskina & Strahan (2009)	United States	1992-07	Households where the regional mortgage loan market is less competitive have low.

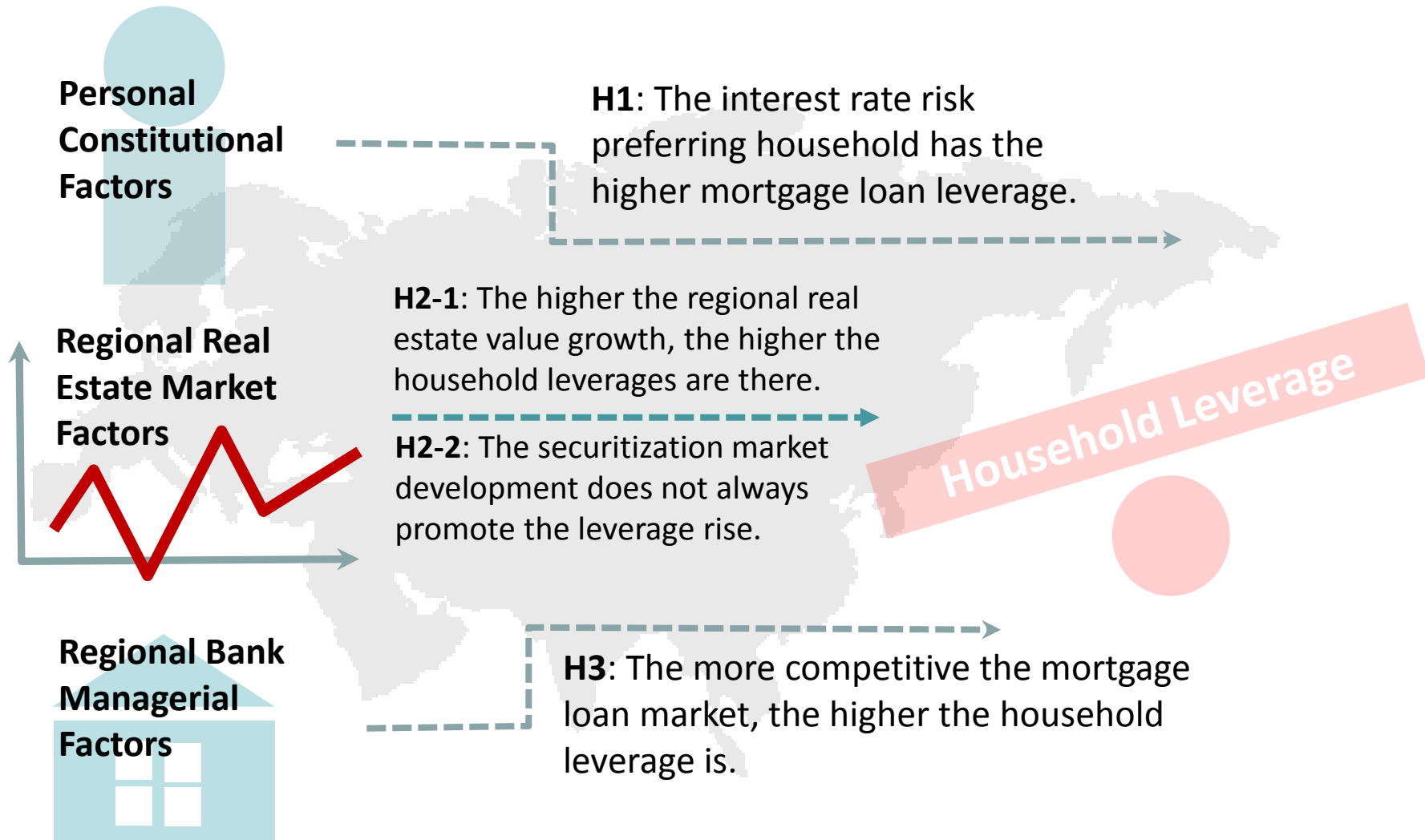
# 5. Existing Literature 3



**Table. Main Conclusions on the Personal Finance and Constitutional Factors**

	Sample Country	Sample Period	Main Conclusions
Loewenstein & Perec (1992, 1998)	Theoretical Analysis		The existence of “sign effects” raised by the debt decreases the utility and this negative marginal utility exceeds the net increase of immediate consumption.
Thaler (1981) Laibson (1997)	Theoretical Analysis		Utilities obtained from immediate consumption are larger than those derived by a far-distant future consumption.
Hiruma & Ikeda (2007) Van Praag & Booji (2003)	Japan Netherland	2005	The degree of the consumer’s risk-averse attitude and the individual time discount rate are negatively related.

# 6. Hypotheses



# 7. Empirical Model 1



## <1> Empirical equation for the Dataset 1 (JHFA Loan Master Data File)

$$Debt\ to\ Income_{ij} = X^H_i \beta_1 + X^R_j \beta_2 + X^B_j \beta_3 + X^M_i \beta_4 + \mu_{ij}$$

### Dependent Variable:

Value of the Total  
Mortgage Contract Loan  
Amount / Annual  
Income of Household  $i$   
in Region  $j$

### Individual Household Factors:

$Income_i$   
 $Variable\ Loan\ Ratio_i$   
 $Age_i$   
 $Sex_i$   
 $Financail\ Assets_i$   
 $Loan\ Maturity_i$   
 $Job\ Dummy_i$

### Regional Factors: Regional Bank Factors:

$Property\ Value_j$   
 $Second\ Mkt\ Size_j$   
 $Bank\ Competition_j$   
 $Bank\ Soundness_j$

### Other Factors:

$Securitization$   
 $dummy_i$   
 $Fixed\ Loan$   
 $Interest_i$   
 $Variable\ Loan$   
 $Interest_i$

# 8. Empirical Model 2



## <2> Empirical equation for the Dataset 2 (Nikkei NEEDs Radar Financial Survey Data)

$$\text{Debt to Income}_k = X_k^H \gamma + \varepsilon_k$$

### Dependent Variable:

Value of the Total  
Mortgage Contract  
Loan Amount /  
Annual Income of  
Household  $k$

### Individual Household Factors:

$\text{Income}_k$   
 $\text{LoanType}_k$   
 $\text{CreditCard}_k$   
 $\text{RiskAssets}_k$   
 $\text{Age}_k$   
 $\text{Sex}_k$   
 $\text{Finanvail Assets}_k$   
 $\text{Loan Maturity}_k$   
 $\text{Job Dummy}_k$

# 9. Data



**Table. Overviews of JHFA Loan Master Data File and the Nikkei NEEDS Radar Financial Survey**

	JHFA Loan Master Data File	Nikkei NEEDS Radar Financial Survey
<b>Data Providers</b>	The Japan Housing Financial Agency	Nikkei Media Marketing, Inc.
<b>Method of Data Collection</b>	The contract data is collected through contract forms filled in by borrowers and submitted to the JHFA.	The survey is conducted using questionnaire survey sheet placement methods (response rate = 57 percent)
<b>Potential Number of Observations</b>	26,956	1,605
<b>Sample Period</b>	2001–2010	2007–2009



# 10. Results 1



**Table. Empirical Results: JHFA Loan Master Data File (Below JPY 3.5 mil. Income Households)**

Independent Variables	(A) Debt to Income I	(B) Debt to Income II	(C) Variable Loan Ratio	(c-1) Debt to Income I
<i>ln(Income)</i>	-1.377 (-0.330)	-0.930 *** (-55.420)	-2.001 ** (-2.390)	-2.183 ** (-2.310)
<i>ln(Income)^2</i>	0.041 (0.290)	3.469 *** (12.220)		
<i>Variable Loan Ratio</i>	0.178 ** (2.290)	0.564 ** (2.190)		
<i>ln(Income) x Variable Loan Ratio</i>	-0.008 *** (-3.200)	-0.363 ** (-2.140)		
<i>ln(AGE)</i>	-0.011 *** (-2.930)	0.093 *** (6.180)	-0.011 *** (-3.370)	-0.014 (-0.390)
<i>Sex</i>	-0.118 (-1.480)	1.431 *** (4.360)	0.099 (1.320)	-0.257 (-0.720)
<i>ln(Financial Asset)</i>	-0.109 *** (-5.430)	-0.586 *** (-7.040)	-0.222 *** (-4.610)	-0.011 ** (-2.280)
<i>ln(Loan Maturity)</i>	0.117 *** (15.320)	0.458 *** (14.400)		0.075 ** (2.340)
<i>Job Dummy 1</i>	0.076 (0.570)	0.648 (1.170)	0.221 * (1.660)	0.026 (0.030)
<i>Job Dummy 2</i>	0.257 * (1.780)	1.469 ** (2.460)	-0.002 (-0.020)	0.543 (1.460)
<i>Job Dummy 3</i>	-0.111 (-0.630)	0.162 (0.220)	-0.190 (-1.050)	0.178 (0.230)

# 10. Results 1 *(-continued.)*



*(-continued.)*

<i>Independent Variables</i>	<i>(A) Debt to Income I</i>	<i>(B) Debt to Income II</i>	<i>(C) Variable Loan Ratio</i>	<i>(c-1) Debt to Income I</i>
<i>Property Value Growth</i>	0.109*** (5.430)	0.731* (1.740)		1.131*** (4.270)
<i>ln(Second Market Size)</i>	0.162* (1.660)	0.825* (1.920)		0.536** (2.580)
<i>Bank Competition</i>	0.746* (1.690)	0.759*** (2.800)		0.306** (2.150)
<i>Bank Soundness</i>	-0.028** (-2.370)	-0.042* (-1.630)		-0.032* (-1.720)
<i>Fixed Loan Interest</i>	-0.788 (-0.520)	-12.813** (-2.060)		-7.109 (-0.130)
<i>ln(Fixed Loan Interest)^2</i>	0.120 (0.430)	3.088*** (2.670)		0.224 (0.300)
<i>Var Loan Interest</i>			-1.153* (-1.880)	
<i>ln(Var Loan Interest)^2</i>			1.020 (0.520)	
<i>ln(Fixed Loan Interest) x Variable Loan Ratio</i>	-0.014** (-2.290)	-0.117* (-1.810)		-0.290** (-2.290)
<i>ln(Var Loan Interest) x Variable Loan Ratio</i>			-1.020* (-1.860)	
<i>Securitization Dummy</i>	-0.190 (-0.770)	-0.555 (-0.540)		0.007 (0.001)

*(-continued.)*

# 10. Results 1 *(-continued.)*



*(-continued.)*

<i>Independent Variables</i>	<i>(A) Debt to Income I</i>	<i>(B) Debt to Income II</i>	<i>(C) Variable Loan Ratio</i>	<i>(c-1) Debt to Income I</i>
<i>constant</i>	14.746	68.513***	29.107	24.035
	(0.500)	(55.900)	(1.360)	(0.240)
<i>Year Dummy</i>	yes	yes	yes	yes
<i>Methodology</i>	OLS	OLS	Probit	OLS
<i>Observations</i>	1,514	1,514	1,514	1,514
<i>R-squared</i>	0.322	0.789		
<i>Mills Ratio</i>				-0.869***
				(-4.180)
<i>(a) Predicted Debt to Income (Variable Loan Ratio = 1)</i>				5.888
<i>(b) Predicted Debt to Income (Variable Loan Ratio = 0)</i>				2.091
<i>p-value of t test (a) &gt; (b)</i>				100.000%***

# 11. Results 2



**Table. Empirical Results: the *Nikkei NEEDs Radar Financial Survey* (All Income Households)**

Independent Variables	(A) <i>Debt to Income III</i>	(B) <i>Debt to Income III</i>	(c) <i>Debt to Income III</i>
<i>ln(Income)</i>	-12.378*** (-16.530)	-12.469*** (-15.890)	-12.897*** (-16.180)
<i>ln(Income)^2</i>	2.489*** (14.570)	2.281*** (13.440)	2.387*** (14.190)
<i>Loan Type</i>	4.336*** (2.940)		
<i>ln(Income) x Loan Type</i>	-0.948*** (-2.760)		
<i>Risk Assets</i>		6.632*** (3.760)	
<i>ln(Income) x Risk Assets</i>		-1.455*** (-3.630)	
<i>Credit Card</i>			2.425*** (3.210)
<i>ln(Income) x Credit_Card</i>			-0.518** (-2.110)
<i>ln(AGE)</i>	-0.717 (-1.350)	-0.447 (-0.850)	-0.537 (-1.000)
<i>Sex</i>	-0.143 (-0.720)	-0.086 (-0.430)	-0.155 (-0.760)

# 11. Results 2 (-continued.)



(-continued.)

Independent Variables	(A) <i>Debt to Income III</i>	(B) <i>Debt to Income III</i>	(c) <i>Debt to Income III</i>
<i>ln(Financial Asset)</i>	0.024 * (1.760)	0.058 * (1.740)	0.027 * (1.730)
<i>ln(Loan Maturity)</i>	1.241 *** (8.530)	1.254 *** (8.690)	1.244 *** (8.550)
<i>Job Dummy 4</i>	0.445 (1.560)	0.463 (1.540)	0.521 * (1.730)
<i>constant</i>	40.542 *** (13.320)	40.190 *** (13.320)	40.436 *** (13.780)
<i>Year Dummy</i>	yes	yes	yes
Methodology	OLS	OLS	OLS
Observations	1,605	1,605	1,605
R-squared	0.339	0.345	0.333

# 12. Conclusions



1. The degree of household interest rate risk preference in finance, positively relates to the household leverage.
2. A rise in real estate property value influences the household leverage also in Japan.
3. The securitization market development does not increase the household leverage in Japan.
4. The degree of regional bank market competition and the state of bank management soundness influence the household leverage in the region.

Discussion of, “Another  
Determinant of Household  
Leverage: Evidence from Japan’s  
Mortgage Loan Data,”  
by Nagano and Yeom

Jay Hartzell

The University of Texas at Austin  
Japan Financial Markets Conference  
July 3, 2013

# Summary

- Question: What drives households' choices of the degree of leverage (mortgage debt)?
- Authors seek to explain amount of mortgage debt (scaled by income) as a function of household characteristics, regional characteristics, bank management/competition characteristics, and mortgage conditions
- Four hypotheses surrounding these four groups of variables. Basic ideas:
  - Households that tolerate more risk will have larger mortgages
  - Households will choose more leverage in more liquid markets, and where prices are increasing
  - Households will have more leverage when banking competition is more severe or where banks are less well capitalized
  - Households will undertake more leverage in the post-securitization period



# Results

- Results generally support these hypotheses
  - Low-income households take on more leverage, bear more interest rate risk
  - Significant differences between high- and low-income households in their appetites for risk, in apparent contrast to the U.S. case
  - Market conditions matter -- both price changes and market size (liquidity) influence leverage
  - Bank competition and conditions also matter -- greater leverage in more competitive markets, and where capital adequacy is worse

# Comments

- Clearly interesting and timely questions
- Nice contrast between Japan and U.S. cases
  - Price changes
  - Securitization development
- Good data
- Potential for important conclusions on risk-taking behavior by households in a different market setting (versus the U.S. case)

# Comments (2)

- These interesting results raise some further questions or opportunities to elaborate further:

## I. Institutional background

- Depends on reader/potential outlet, but I (at least) could have used some help on the Japanese residential mortgage market
  - Contract specifics
    - Fixed vs. ARMS
    - Borrowing constraints (e.g., maximum LTV)
  - Degree of securitization
  - Is data provider typical lender?

# Comments (3)

## 2. Time series versus cross-section

- Much of paper's motivation relies on changes over time -- e.g., comparing and contrasting the rise in mortgage debt in the U.S. to the Japan case (where prices did not rise as much and securitization did not boom as much)
- References to possibility that changes in household characteristics drove increased leverage in Japan
- But, paper's results focus on the cross-section
  - Regressions use time dummies
  - Would be helpful to provide some indication of time-series trends, ability to extrapolate paper's cross-sectional results to explain time series patterns
  - Otherwise, could better reconcile paper's motivation with cross-sectional approach

# Comments (4)

## 3. Affordability versus appetite for risk

- Would be helpful to better understand degree (i) to which households are choosing (a) to buy bigger houses relative to their income, (b) to take on more leverage, while buying similarly-sized houses (relative to their incomes and/or capacity to pay), and/or (c) taking on different types of mortgages (e.g., adjustable rather than fixed-rate) holding the size of the mortgage constant, and (ii) banks are pricing the increased risk
- Current measures do not really allow reader to disentangle these issues
  - Mortgage amount relative to income; mortgage amount + total scheduled interest; variable rate on mortgage relative to size of mortgage
- Does data include house price?
- Second data set, with financial assets, potentially important
  - Ability to pay versus appetite for risk

# Comments (5)

## 4. Remaining questions, mainly data

- Economic significance?
- How much does a variable-rate mortgage save a household in terms of the contracted or initial interest rate?
  - Impression: Fixed rates already low
  - Can authors use time-series variation in the yield curve?
- Are authors using full time series of local housing returns, or most recent year(s)?
- How can authors estimate securitization dummy (2006-2010 contracts), along with year fixed effects?
  - Could they use size of securitization market instead?
- Would be helpful to see more background on bank competition and why top-three banks are important (e.g., why total number of branches or Herfindahl is not measure of competition)
- What do authors mean by size of secondary mortgage market in a particular Tokyo ward? Is this just transaction volume in the market?