CAES Working Paper Series

The Speculative Saving Hypothesis

Junmin Wan

Faculty of Economics, Fukuoka University, Japan

WP-2016-002

Center for Advanced Economic Study
Fukuoka University
(CAES)

8-19-1 Nanakuma, Jonan-ku, Fukuoka,
JAPAN 814-0180
+81-92-871-6631

The Speculative Saving Hypothesis[1]

Junmin Wan[2]

Faculty of Economics, Fukuoka University

March 1, 2016

Abstract

Speculative saving occurs when households predict a bubble. If households do (not) face borrowing constraints, they over-(under-)save due to the positive expected net capital gain from the bubble, and the saving rate increases (decreases) with housing prices but decreases (increases) with interest rates (and the leverage ratio). This would explain domestic and global imbalances simultaneously, and explain why some countries like the U.S. and Greece undersave, while other countries like China and Japan oversave during bubble eras. Furthermore, lowering interest rates reduces consumption, thus it is also consistent with the conjecture of the Liquidity Trap.

JEL classification: E21, G12

Keywords: housing bubble, oversave, undersave, speculative saving hypothesis, Liquidity Trap

---

[1] This research is supported by funds (#144002, ``Study on Credit Constraint, Bubble, and Economic Development") from the Central Research Institute of Fukuoka University. The author gratefully acknowledges the support of these funds.

[2] The author thanks Takao Fujimoto, Yukinobu Kitamura, Tomoya Nakamura, Kazuo Ogawa, Sebastian Siegloch, Myung Jae Sung, Mitsuo Takase, especially Masao Ogaki, and the participants of the presentation at universities including Fukuoka, Hokkaido, Nankai, Nanyang Technological, Peking, Qingdao, Technological University Dresden, and Tamkang for their beneficial discussions and encouragements. Any remaining errors here are the author's responsibility. Correspondence: Nanakuma 8-19-1, Jounan Ward, Fukuoka City, Fukuoka 8140180, Japan; (e-mail) wan@econ.fukuoka-u.ac.jp; (tel) +81-92-871-6631(ext.4208); (fax) +81-92-864-2904.

1 Introduction

Our currently unstable world ensues, largely, from a very unstable economy, and the unstable economy is mainly caused by bankruptcies among households, banks, firms and governments.[3] Why are there so many bankruptcies now?[4] This paper tries to give a theoretical explanation of this issue and to undertake some related empirical studies using macro and individual data. The answer is that saving and consumption have been unbalanced domestically and globally by both speculative saving and the distortion in financial markets during housing bubble periods.

The saving-consumption problem is still a hot topic, even though it has been studied theoretically and empirically for a long time.[5] For example, Chen, et al. (2006) and Takase (2009) found that total factor productivity can explain the Japanese saving rate well. Shi and Zhu (2004) found that there exists a precautionary saving motive in Chinese household saving, although it is not strong, while Chamon, Marcos, and Eswar Prasad (2010) argued that the rising saving rates of urban households in China from 1995 to 2005 are best explained by the rising private burdens of expenditures on housing, education, and healthcare, and these effects and precautionary motives may have been amplified by financial underdevelopment, including constraints on borrowing against future income. Yalta (2011) analyzed down payment saving. Wei and Zhang (2011) provided a

---

[3] Ogawa (2009) sets out reasons why Japan has lost decades from the viewpoint of households, firms, banks, and government.

[4] Stiglitz (2009) and Rogoff (2010) have said that the current world economy is involved in a big crisis, and the situation is also challenging from a macroeconomics perspective.

[5] For example, see Guan (BC645), Smith (1776), Marx (1867), Ramsey (1928), Keynes (1936), Friedman (1957), Tobin (1958), Ando and Modigliani (1963), Leland (1968), Deaton (1992), Karry (2000), Modigliani and Cao (2004), Kuijs (2005), etc. Wan (2011c) does a comprehensive global survey on saving from about BC 2500.

competitive saving hypothesis and related evidence. Wang and Wen (2011) reported that housing price has little impact on saving in China, and Chakrabarti, et al. (2011) analyzed household debt and saving in the U.S. during the recent recession period. The undersaving problem in Ireland, Greece, the U.S., and Spain during housing bubble periods is mentioned in recent literature such as Arellano and Bentolila (2009), Connor, et al. (2010), and the International Monetary Fund (IMF; 2011). Recently, Wan and Gao (2015) and Xie and Mo (2015) also found that Chinese firms have huge corporate savings due to fruitful investment opportunities and the underdevelopment of financial services as well as the systematic factors of a transitional economy. However, to our best knowledge, there is still no research that can sufficiently explain why there are domestic and global saving-consumption imbalance issues simultaneously.

We can see that China is facing a big housing boom in Figure 1. Many scholars such as Dreger and Zhang (2010) and Ueda (2011) argue that China has a housing bubble. According to the Yearbook of China Real Estate Statistics in 2009, the vacancy rate of newly sold housing in big cities such as Beijing and Shanghai was about 40 percent in 2008. In this context, the intent of households to save has shown an upward trend since 2005, as shown in Figure 2. Additionally, according to a report by the People's Bank of China, the first reason for saving is for investments, including housing purchases. The correlation between the intent of households to save and housing price is significantly positive, 0.877 (p-value = 0.000). Turning to Figure 3, we can see that the national saving rate in China has shown an upward trend during the period 1952-2010, rising sharply upward since 2000. As shown in Figure 4, we can see that the saving rate of rural households had upward, downward, and upward trends during 1995-1999, 2000-2005, and 2006-2010, respectively. The saving rate of urban households had an upward trend during 1995-2010, and was sharply upward during 2005-2010. The saving rate of all households in China had an upward trend during 1995-2010. The correlations between the household saving rate and housing price in urban and all sectors are significantly positive, 0.457 (p-value = 0.000) and 0.302 (p-value = 0.000), respectively. In Japan's case, as shown in Figure 5, the household saving rate had an upward trend during the housing bubble era from 1985-1991. The correlation between the household saving rate and land price is also significantly positive, 0.436 (p-value = 0.016). This situation in Japan is very similar to the current case in China.

In contrast, the household saving rate in the U.S., as shown in Figure 6, had a downward trend during the IT bubble period from 1991 to 2000 and the housing bubble era from 2001 to 2007, but switched to an upward trend following the housing bubble crash in 2007. The correlation between the household saving rate and the housing price index is significantly negative, -0.743 (p-value = 0.000). Figure 7 shows that the household saving rate decreased with the housing price rise during the housing price boom in Greece. The correlation between the household saving rate and the housing price during the period from 2000 to 2006 is also significantly negative, -0.916 (p-value = 0.004), though it is -0.174 (p-value = 0.609), which is negative but not significant when including the period of 2007-2010. The cases in the U.S. and Greece are opposite to those in both Japan and China. This seems puzzling. In the next section we will give a plausible explanation of these facts.

This paper will present a model to explain why some countries, like the U.S. and Greece, may undersave while other countries, like China and Japan, may oversave during a housing bubble era.[6] Here we will also present the speculative saving hypothesis, which indicates that households save for speculative investments, like the purchase of 'bubbly housing' (not for living in but for reselling). It is found that a household with a speculative saving motive has an incentive to over- or undersave depending on the degree of distortion of both housing policy and the financial market. The distortion is measured by the expectation of an increase in housing prices, the household's human capital, and the limit of outstanding debt.

Wan (2015a) tested the speculative saving hypothesis using provincial data from 1995-2010 and micro household data for six big cities in 2005 in China. It was found that there was a bubble in the capital cities (also in Wan 2015b), and that a bubbly housing price, especially in the urban sector, significantly raised the aggregate household saving rate in cities as well as nationwide after controlling for life cycle and other related factors, and he also found increases in housing price and housing loans have significantly positive impacts on saving from individual data, even after controlling for potentially related factors. These findings are consistent with the speculative saving hypothesis.

Our theory is different from that of Farhi and Tirole (2011), who analyze the bubbly liquidity of financially constrained firms in an overlapping generation economy. Our findings are also different from Kichuchi and Saguragawa (2012), who found that the rise in interest rates increased savings, while in our model, oversaving decreases with interest rates. The difference could arise from the different model setting. Kichuchi and Saguragawa (2012) consider that an investor faces borrowing constraints from limited

[6] There are many studies in the literature on bubbles. See Shiller (1981), Scheikman and Xiong (2003), Dreger and Zhang (2010), Xiong and Yu (2011), Ueda (2011), and Wan (2011a) etc. for details.

pledgeability in a general equilibrium framework of an overlapping generation economy, while we consider that a household faces problems regarding consumption plans and purchase of bubbly assets simultaneously as in Ramsey's (1928) framework.

Therefore, this paper contributes new insights not only with regard to the literature on why there is a saving-consumption imbalance issue domestically and globally but also in relation to policies that might be pursued to overcome the issue of a shortage of domestic demand in China today, and prevent bankruptcies in the U.S. and E.U. economies after the bubble crash. Consequently, we must carefully consider how to prevent the occurrence of a bubble, especially in housing markets, in order to achieve a stable economy.

The paper is organized as follows. Section 2 shows historical facts and related empirical evidence. Section 3 presents a model to show that a household with a speculative saving motive has an incentive to over- or undersave. Section 4 contains the concluding remarks, and discusses the implications and issues left for future research.

2 Empirics on Saving and Housing Price

During a bubble period, a household undersaves due to overconsumption, but will show a sharp consumption decrease after the bubble crash. Bostic, Gabriel and Painter (2009) find that the housing boom significantly raised U.S. household consumption, using a micro dataset. Along the same lines, Dynan (2012) finds that highly leveraged homeowners had larger declines in consumption between 2007 and 2009, after the housing bubble burst, using broad U.S. micro household data. Using U.K. micro data, Campbell and Cocco (2007) also found that rising housing prices significantly raised consumption for older homeowners, implying that the increase in housing price has a negative impact on saving.

As for the relation between interest payments for housing loans and the saving rate, Moriizumi (2003) found that household saving was increased by higher housing prices for renters using a Japanese micro dataset. Ogawa and Wan (2007) found that the Japanese households with larger housing loans had a lower propensity for consumption after the housing bubble crash, implying that interest payments on loans raised the saving rate. Lin et al. (2000) found in Taiwan that mortgage payments increased the saving for owners with mortgages and for renters as well.

As for the higher bubbly housing price being related to a higher saving rate in a bubble era, Horioka (1996) and Ogawa et al. (1996) found that the wealth effect on consumption was small during Japan's housing bubble era, implying that the saving rate may increase with housing price. In China some recent studies have also yielded very similar results. Chen et al. (2012) and Xie et al. (2012) found that increasing urban housing prices significantly reduced urban household consumption, implying that increased urban housing prices raised urban household savings. Chen and Yang (2013) directly estimated the impact of urban housing prices on urban household saving using an urban household survey in China conducted by the National Bureau of Statistics from 2002 to 2007, and found that the rising housing prices accounted for 45% of the increasing saving rate during the sample period. Li and Huang (2015) found that rising housing prices have induced households to save more for buying housing and repaying housing debt using a multi-suite decision model and individual data of China Household Finance Survey 2011. Fan and Liu (2015) used changes in property taxes in Chongqing and Shanghai as a natural experiment, and used the panel individual data of the Chinese Household Panel Survey of 2010 and 2012 to identify the causal effect of housing price on household saving rate, and found that the exogenous housing price growth significantly raised the saving rate especially for low income households by compressing their cloth and transportation expenses. In current China, households especially those in the low income group are more easily affected by financial constraints related to the underdevelopment of the financial system (Wan, 2015a, b).

Wan (2015a) also used macro and micro data in China to perform some formal tests on the speculative saving hypothesis. From a macro panel dataset for the period of 1995-2010, it was found that the increase of real housing prices in capital cities has significantly raised the saving rates for urban households and households in general, and for the pooled sample of urban and rural households. From the micro dataset of 1,500 Chinese households in the six biggest cities - Shanghai, Beijing, Chengdu, Guangzhou, Shenyang, and Wuhan, respectively - it was found that the increase of housing prices and housing loans had significantly positive impacts on saving, even after controlling for other potential factors. For those who have borrowing constraints, the impact of the increase of housing prices on saving was larger, as anticipated by the speculative saving theory.[7] We will build a model to give a theoretical explanation for the above facts and empirical evidence.

3 The Model

3.1 The Benchmark

[7] We also call it speculative income or consumption hypothesis.

Following Ramsey (1928), we consider a representative household that faces the problem

$$\max_{c_t} \int_0^\infty e^{-\rho t} \ln c_t dt \tag{1}$$

$$\text{s.t. } \dot{a}_t = ra_t + y - c_t \tag{2}$$

$$\lim_{t \to \infty} e^{-rt} a_t = 0 . \tag{3}$$

The household with the constant discounted rate, ρ $(\rho > 0)$, chooses consumption c_t subjected to the budget constraint with the financial or real asset a_t, the constant wage income y, and the constant interest rate r $(r > 0)$ at time t, respectively. Every price here is expressed not in nominal but real value. Under this setting, we can find the optimal solution for c_t,

$$c_t = c_0 e^{(r-\rho)t} , \tag{4}$$

$$c_0 = \rho(a_0 + \frac{y}{r}) , \tag{5}$$

where the initial asset a_0 is given at $t = 0$, and the discounted value of the wage sequence, $\frac{y}{r}$, is equal to the household's human capital. The total wealth of the household can be expressed by $a_0 + \frac{y}{r}$. The optimal consumption c_t is equal to a part of total wealth. This is simply derived from the implications of the life cycle and permanent income hypothesis (Friedman, 1957; Ando & Modigliali, 1963). The optimal saving rate SR_t at time t is

$$SR_t = \frac{ra_t + y - c_t}{ra_t + y} = \frac{r - \rho}{r}, \tag{6}$$

$$\frac{\partial SR_t}{\partial r} = \frac{\rho}{r^2} > 0 \quad \text{for} \quad \rho > 0. \tag{7}$$

Thus, the household saving rate increases with the interest rate.

3.2 Loan Contract

Next, we consider the situation wherein the household with speculative motive makes a loan contract for a bubbly asset as shown in Figure 8, like housing, with a financial institution in a distorted asset market. The bubble can be the rational one in Diamond (1965). The household has an expectation of the increase of asset price with a rate γ, and $\gamma > r$ during the period τ. The household buys the bubble asset with volume b_0 at time $t = 0$, then plans to resell it at $t = \tau$, and pay the interest at constant rate r.[8] For simplicity, here we assume that the external finance premium is sufficiently low to be considered zero in extreme cases. On the debt side, the discounted value of interest payment is

$$\int_0^\tau b_0 r e^{-rs} ds = b_0(1 - e^{-r\tau}), \tag{8}$$

and the present discounted value of the debt principal is

$$b_0 e^{-r\tau}. \tag{9}$$

Thus, the present discounted value of total payment of the debt at $t = 0$ is

[8] This problem is essentially similar to the one in Chapter 3 of Wan (2004, 2014) and Wan (2005), in which the household hoards storable consumption goods for its own consumption after exact information on a consumption tax increase is obtained. The difference here is that the household buys for reselling under the expectation of price increase, which is not assured.

$$b_0(1-e^{-r\tau}) + b_0 e^{-r\tau} = b_0, \tag{10}$$

the present discounted value of the bubbly asset sold at $t = \tau$ is

$$b_0 e^{(\gamma - r)\tau}, \tag{11}$$

and the present discounted value of the expected net capital gain at $t = 0$ is

$$b_0 e^{(\gamma - r)\tau} - b_0. \tag{12}$$

Then the household has the following balance sheet after the loan contract is signed at time $t = 0$.

Table 1: Balance sheet with a loan contract for a bubbly asset

	asset	net wealth + debt
	$a_0 + \frac{y}{r}$	$a_0 + \frac{y}{r}$
		$b_0 e^{(\gamma - r)\tau} - b_0$
	$b_0 e^{(\gamma - r)\tau}$	b_0
(in total)	$(a_0 + \frac{y}{r}) + b_0 e^{(\gamma - r)\tau}$	$(a_0 + \frac{y}{r}) + b_0 e^{(\gamma - r)\tau}$

Source: Written by the author.

We also assume that the household chooses the debt volume b_0 by the following equation,

$$b_0 = \frac{1}{\iota}, \tag{13}$$

where the leverage ratio is measured by ι with $\iota \in (0,\ 1]$.

Definition 1:

Over debt: if $b_0 > 0$, the household has an overdebt. This is because the expected increase rate γ and the expected period τ are not only expectations but are also misbelieved; thus, realization is not assured.

Property 1:

The larger γ, τ, and the lower r, ι, then the larger the loan b_0, and the household has a larger expected net capital gain.

Proof:

From Equation (13), it is obvious that b_0 decreases with ι, and from Equation (12) we obtain the expected net capital gain decreasing with r but increasing with γ and τ. Q.E.D.

3.3 Undersaving

3.3.1 Undersaving in a Bubble

Since the household has a contract on a bubbly asset, she or he changes to believe in a new initial total wealth,

$$(a_0 + \frac{y}{r}) + \frac{e^{(\gamma - r)\tau} - 1}{\iota}, \tag{14}$$

and from equations (4) and (5), the consumption will change to be

$$c'_t = c'_0 e^{(r-\rho)t}, \tag{15}$$

where $$c'_0 = \rho\left[(a_0 + \frac{y}{r}) + \frac{e^{(\gamma - r)\tau} - 1}{\iota}\right].$$

Property 2:

The household undersaves due to the positive expected net capital gain from the bubbly asset. The saving rate decreases with γ and τ but increases with r and ι. There is a negative saving rate even if $r > \rho$, if and only if the household's initial total wealth with the bubbly asset can be refinanced in the financial market at any time.

Proof: See Appendix.

For the case without bubbly saving, the saving rate should be positive if $r > \rho$, because $SR_t = \frac{r - \rho}{r} > 0$ according to Equation (6). Equation (A7) tells us that the household, which should have positive saving without the bubbly asset, switches to have negative saving due to the bubbly asset, and realizes negative saving by the refinance of the bubbly asset. We consider this type of refinance of the bubbly asset in the financial market as a type of financial distortion. The negative saving rate of households in Greece shown in Figure 7 may be explained by this property. Ando and Modigliani (1963) also have the same implication. In line with the life cycle saving theory, expectation of an increase of wealth would raise consumption. It would also be the cause of financial risk and make an unstable economy, as argued by Minsky (1992).

3.3.2 Undersaving by Expectation of a Bubble in the Future

Assume that after a period ν in the future a housing bubble will arise and will last for period τ. Then we can obtain the following property by solving a similar problem in subsection 3.3.1, and obtain the following property.

Property 3:

The undersaving during the periods ν and τ are the same. The optimal saving rate increases with the period ν, the interest rate r and the ι, and decreases with the bubble period τ and the growth rate of price bubble γ.

Proof: See Appendix.

3.4 Oversaving

3.4.1 Oversaving in a Bubble

We consider that a household has financial constraints. The household can take a housing loan at some initial point, but cannot borrow anything to pay for the loan and consumption. The household also cannot refinance the house before the house is sold to the market. The household faces the problem of finding an optimal size for housing loan b_0 to maximize lifetime utility.[9]

The household problem is complex, because the optimization of consumption and housing loan payment should be considered simultaneously. For simplicity, we further assume that the discounted rate ρ is equal to the interest rate r, and the initial wealth a_0 is assumed to be zero; then, the saving rate will be zero, the consumption is equal to income y, and the lifetime utility U_0 without speculative housing purchase should be,

$$U_0 = \frac{\ln y}{r}. \tag{16}$$

The household divides the lifetime into two periods, $[0,\ \tau)$ and $[\tau,\ \infty)$. The household solves the problem during $[0,\ \tau)$ first, given that the housing loan b_0 is chosen, then utility maximization will be,

$$U_1 = \max_{c_t} \int_0^{\tau} e^{-rt} \ln c_t dt \tag{17}$$

$$\text{s.t.} \quad \dot{a}_t = ra_t + y - c_t \tag{18}$$

$$0 \le ra_t + y - c_t \tag{19}$$

---

[9] If down payment d_0 is needed, when $a_0 < d_0$, the household is bound by the down payment. Even if the household has an expectation for a net positive capital gain, it cannot have a loan contract. Thus, it has another incentive to save for the down payment (the difference $d_0 - a_0$) of the bubbly asset. This incentive induces the household to oversave, and the saving rate will be higher than the one in Equation (6). For the case in which the household cannot accumulate enough wealth to cover the down payment d_0 at time $\tau' \in (0,\ \tau)$, it has to give up the loan contract, and then optimal saving will be realized. During the expected period τ, if the household can accumulate the wealth to be d_0 at time $\tau' \in (0,\ \tau)$, the household will sign a housing loan $b_{\tau'}$ at time τ', and at time 0 the discounted presented value of $b_{\tau'}$ will be $b_{\tau'}(e^{(\gamma-r)(\tau-\tau')} - 1)$. We will consider a similar case in the next subsection. For simplicity, we assume that the down payment d_0 is zero here.

$$a_0 = -b_0 \tag{20}$$

$$\underset{t \to \tau}{a_t} = b_0(e^{\gamma\tau} - 1). \tag{21}$$

We obtained the solution for c_t for $t \in [0, \ \tau)$, which is constant c_1^* and is dependent on the housing loan b_0,

$$c_1^* = y - rb_0. \tag{22}$$

Note that if b_0 is larger than zero, then the household is oversaving, and the size is just the rb_0.

Next, the household starts to solve the problem of the second period $[\tau, \ \infty)$.

$$U_2 = \max_{c_t} \int_{\tau}^{\infty} e^{-rt} \ln c_t dt \tag{23}$$

$$\text{s.t.} \quad \dot{a}_t = ra_t + y - c_t \tag{24}$$

$$0 \le ra_t + y - c_t \tag{25}$$

$$a_\tau = b_0(e^{\gamma\tau} - 1) \tag{26}$$

$$\lim_{t \to \infty} e^{-rt} a_t = 0. \tag{27}$$

We obtained the solution for c_t for $t \in [\tau, \ \infty)$, which is constant c_2^*, and dependent on the housing loan b_0,

$$c_2^* = y + rb_0(e^{\gamma\tau} - 1). \tag{28}$$

After solving the above two problems in the two periods, the household starts to find the optimal size of housing loan to maximize lifetime utility, and the problem can be written,

$$U = \max_{b_0}(U_1 + U_2) = \max_{b_0}\left(\int_0^{\tau} e^{-rt} \ln c_1^{*} dt + \int_{\tau}^{\infty} e^{-rt} \ln c_2^{*} dt\right). \qquad (29)$$

By solving the above problem, we obtain the following proposition.

Proposition 1:

The household oversaves due to its belief in the expected net capital gain from the bubbly asset if the household is financially constrained by the interest of the loan payment. The household can find the optimal housing loan. The rate of oversaving rb_0 to income y is larger than zero but smaller than $\frac{\gamma - r}{\gamma}$, which decreases with interest rate r and the bubble period τ and increases with the rate of housing price increase γ.

Proof: See Appendix.

The negative interest elasticity of saving here is also consistent with the target or forced saving argued by Elmendorf (1996), though the mechanism here is much different. Elmendorf (1996) described an example of saving for a child's college education where an increase in the interest rate reduces the saving needed each year in order to reach the target. A similar target saving case will also be discussed in the next subsection. There is also an empirical study on negative interest rate elasticity of saving, similar to Mukherjee (2015).

Next, we calculate the utility change with the bubbly saving. By incorporating housing loan b_0^{*} from Equation (A19) into the object function in Equation (29), we obtain

$$U(b_0^*) = U_1(b_0^*) + U_2(b_0^*),$$

$$= \int_0^{\tau} e^{-rt} \ln\left(y - \frac{y(e^{(\gamma - r)\tau} - 1)}{e^{\gamma\tau} - 1} \right) dt + \int_{\tau}^{\infty} e^{-rt} \ln\left(y + y(e^{(\gamma - r)\tau} - 1) \right) dt,$$

$$= \frac{\ln y}{r} + \frac{(\gamma - r)\tau e^{-r\tau}}{r} + \frac{\ln\left(\frac{1 - e^{-r\tau}}{1 - e^{-\gamma\tau}} \right)^{1 - e^{-r\tau}}}{r},$$

$$= U_0 + \frac{(\gamma - r)\tau e^{-r\tau}}{r} + \frac{\ln\left(\frac{1 - e^{-r\tau}}{1 - e^{-\gamma\tau}} \right)^{1 - e^{-r\tau}}}{r}, \tag{30}$$

and the utility gain is,

$$\frac{(\gamma - r)\tau e^{-r\tau}}{r} + \frac{\ln\left(\frac{1 - e^{-r\tau}}{1 - e^{-\gamma\tau}} \right)^{1 - e^{-r\tau}}}{r} > 0 \quad for \ \ \tau >> 0. \tag{31}$$

For example, when we set some parameter values, $\gamma = 0.2$, $r = 0.1$, $\tau = 10$, then we obtain the utility gain as 0.1691 from Equation (31). Consequently, we obtain the following proposition.

Proposition 2:

The household obtains a positive utility gain from the bubbly saving at time zero if and only if the bubbly period τ is strictly positive.

Next, we discuss the changes in saving when the borrowing constraint is partially relaxed.

Property 4:

If the financial constraint is partially relaxed so the household only borrows the interest payment of the housing loan, even if the household has a speculative saving motive and the financial market is distorted, the household can realize optimal savings during the bubble period.

By Proposition 1, the household has a strictly positive net capital gain from the purchase of the bubbly asset. Thus, consumption sequence c_t should be larger than the income y, and it will induce the undersaving issue. When the interest payment of the housing loan can be exactly borrowed from the financial market at the interest rate r, the household can only consume y even if more than y is wanted. It is clear in this case that the optimal savings in the benchmark model will be realized after the contract on the bubbly asset is signed and the borrowing constraint is partially relaxed after the loan contract is signed.

For the above propositions, we have a conceptual intuition on undersaving and oversaving from Figure 9.

3.4.2 Oversaving from Expectation of a Bubble in the Future

Assume that after a period ν in the future a housing bubble will occur and the bubble will last for period τ. Then we can obtain the following proposition by solving a similar problem in subsection 3.4.1.

Proposition 3:

The oversaving during the periods ν and τ are the same. The optimal saving rate decreases with the period ν and the interest rate r, while it increases with the bubble period τ and the growth rate of price bubble γ, and

$$SR_{\mathrm{t}} = \frac{rb_0}{y} = \frac{e^{(r-r)\tau} - 1}{e^{r\nu+\gamma\tau} - 1}. \tag{32}$$

Proof: See Appendix.

The saving during the period ν and the current value of accumulated saving at time ν, $\frac{y(e^{(r-r)\tau} - 1)(e^{r\nu} - 1)}{\mathrm{r}(e^{r\nu+\gamma\tau} - 1)}$, could also be considered a type of down payment. The implication of the above proposition is that even if there is no bubble now, oversaving may occur at time = 0 if households have an expectation of a future bubble and have incentive to speculate regarding the coming bubble. This would also be consistent with the speculative motive of liquidity preference argued by Keynes (1936). We will discuss their link in the following subsection.

3.5 Link with the Liquidity Preference and Liquidity Trap

In the IS-LM framework, consumption is a function of income, and income is determined by the summation of expenditure of household consumption and corporate investment. The corporate investment is expected to decrease with the interest rate, thus consumption is indirectly affected by the interest rate, and consumption indirectly decreases with the interest rate, then saving increases with the interest rate. Lowering the interest rate is expected to raise consumption then raise domestic demand. However, if the interest rate is low enough, lowering the interest rate would not raise the domestic demand: this is Keynes's so-called Liquidity Trap (1936). To our best knowledge, there is still no micro foundation of the Liquidity Trap, even though this hypothesis has been widely included in college-level textbooks all over the world.

The above Liquidity Trap, wherein monetary easing attempted by lowering interest does not necessarily raise consumption, can be explained easily by the speculative saving hypothesis. The speculative saving hypothesis conjectures that lowering interest may decrease consumption and worsen the effective domestic demand when households with borrowing constraints engage in speculation during a bubble. If all households have an incentive to speculate in a bubble, they cannot borrow from each other. Thus, they will be under a resource constraint. This resource constraint would be another source of borrowing constraints for households.

3.6 Endogenous Interest Rate, Speculative Saving, and Global Imbalance

3.6.1 Market Equilibrium under the Expectation of a Bubble

Figure 10 illustrates the market equilibrium between the undersaving and oversaving households in different countries. Assume that there are two types of households. The first type does not face borrowing constraints, thus they undersave to demand saving. The second type, with borrowing constraint, oversave to supply saving. We can obtain the equilibrium interest rate as follows.

$$
\begin{aligned}
r^E &= \frac{\tau y}{e^{\gamma\tau} - e^{-r\nu}} \\
&= \frac{\tau y}{e^{\gamma\tau} - 1} \quad for\ \nu \to 0.
\end{aligned}
\tag{33}
$$

Property 5

The equilibrium interest rate exists and decreases with the period ν.

Proof: See the Appendix.

3.6.2 Global Imbalance

Suppose there are two countries, Country A and Country C, with an income endowment y. All other factors, except financial situation, are the same for each of these two countries. Country C faces borrowing constraints while Country A does not. A housing bubble occurs at the same time in both countries. It is presumed that under these circumstances, Country A will under-save and Country C will over-save, and that Country A will be forced to borrow from Country C to finance its overconsumption. Financially underdeveloped Country C becomes a pure capital exporter, while financially developed Country A becomes a pure borrower. This type of global imbalance will be amplified as the magnitude of the housing bubble increases and as interest rates decrease. The interest rate could be endogenously determined by the discussion in the above subsection.

Figure 11 shows the U.S. and China imbalance issue. This mirror relationship between these countries is also called a global imbalance. This issue could be easily explained by the speculative saving hypothesis presented in this paper. A similar case also took place between U.S. and Japan in the 1980s, as reported in Hayashi (1985).

4 Conclusions

We have presented a model to explain why some countries like the U.S. and Greece may undersave while some countries like China and Japan may oversave during a housing bubble era. We found that a household with a speculative saving motive has an incentive to over- or undersave, depending on the degree of distortion in housing policy and the financial market. The distortion is measured by the expectation of an increase in housing prices, the household's human capital, and the limit of outstanding debt. The speculative saving hypothesis first presented here is consistent with the evidence from panel macro and micro data from China, and gives a new explanation for the global imbalance between the U.S. and China. Furthermore, the speculative saving hypothesis also shows the negative interest rate elasticity of saving being consistent with the conjecture of the Liquidity Trap by Keynes (1936).

As for the policy implications for China, to decrease the very high saving rate, the government needs to reduce the housing bubble and raise the interest rate, and to make it easier for households to borrow. For the U.S. and Greece, the undersaving problem could be solved by curbing the easing in the financial services sector and reducing the housing bubble. The current global saving-consumption imbalance among China, the U.S., and the E.U. may have resulted from the freedom of financial services ensuing from the housing bubble. Therefore, this paper may contribute not only a new view in the literature on why there is a saving-consumption imbalance issue domestically and globally, but also new insights for policies on how to overcome the issue of the shortage of domestic demand in present-day China as well as how to prevent bankruptcies in the U.S. and E.U. economies following the bubble crush. Consequently, we have to carefully consider how to implement strategies against bubbles occurring in asset markets, especially in housing markets, for a stable economy.

There are also some issues left for future research. The first is that we should apply the speculative saving hypothesis in a general equilibrium framework with an endogenous rational bubble. The second is that we should test the speculative saving hypothesis using worldwide data at macro as well as micro levels.

Appendix

Proof of Property 2

From equations (4), (5), (16) and (17), we obtain

$$c_0^{'} - c_0 = \frac{\rho(e^{(\gamma - r)\tau} - 1)}{\iota}, \tag{A1}$$

and the saving rate,

$$SR_t^{'} = \frac{ra_t + y - c_t^{'}}{ra_t + y}$$

$$= \frac{ra_t + y - c_t - (c_t^{'} - c_t)}{ra_t + y}$$

$$= \frac{r - \rho}{r} - \frac{(c_t^{'} - c_t)}{ra_t + y}$$

$$= \frac{r-\rho}{r} - \frac{\rho(e^{(\gamma-r)\tau}-1)e^{(r-\rho)t}}{\iota(ra_t+y)}, \qquad \text{(A2)}$$

thus,

$$\frac{\partial SR_t^{'}}{\partial \gamma} < 0, \qquad \text{(A3)}$$

$$\frac{\partial SR_t^{'}}{\partial \tau} < 0, \qquad \text{(A4)}$$

$$\frac{\partial SR_t^{'}}{\partial r} = \frac{\partial}{\partial r}\left[\frac{r-\rho}{r} - \frac{\rho(e^{(\gamma-r)\tau}-1)e^{(r-\rho)t}}{l(ra_t+y)}\right]$$

$$= \frac{\partial}{\partial r}\left[\frac{r-\rho}{r} - \frac{\rho(e^{(\gamma-r)\tau}-1)e^{(r-\rho)t}}{l(ra_0+y)e^{(r-\rho)t}}\right]$$

$$= \frac{\rho}{r^2} - \frac{\rho}{\iota(ra_0+y)^2}\left[-e^{(\gamma-r)\tau}(\tau ra_0 + \tau y + a_0) + a_0\right]$$

$$> 0, \qquad \text{(A5)}$$

$$\frac{\partial SR_t^{'}}{\partial l} = \frac{\rho(e^{(\gamma-r)\tau}-1)e^{(r-\rho)t}}{\iota^2(ra_t+y)} > 0, \qquad \text{(A6)}$$

$$SR_t^{'} < 0 \quad \text{when} \quad ra_t + y - c_t^{'} < 0 \quad \text{even for} \quad r > \rho. \qquad \text{(A7)}$$

Q.E.D.

Proof of Property 3

From equations (4), (5), (16) and (17), we obtain

$$c_0^{'} - c_0 = \frac{\rho(e^{(\gamma-r)\tau}-1)\mathrm{e}^{-\tau\nu}}{\iota}, \qquad \text{(A8)}$$

and the saving rate,

$$SR_t^{'} = \frac{ra_t + y - c_t^{'}}{ra_t + y}$$

$$= \frac{ra_t + y - c_t - (c_t^{'} - c_t)}{ra_t + y}$$

$$= \frac{r-\rho}{r} - \frac{(c_t^{'} - c_t)}{ra_t + y}$$

$$= \frac{r-\rho}{r} - \frac{\rho(e^{(\gamma-r)\tau} - 1)e^{(r-\rho)t}e^{-r\nu}}{\iota(ra_t + y)}, \qquad \text{(A9)}$$

thus,

$$\frac{\partial SR_t^{'}}{\partial \gamma} < 0, \qquad \text{(A10)}$$

$$\frac{\partial SR_t^{'}}{\partial \tau} < 0, \qquad \text{(A11)}$$

$$\frac{\partial SR_t^{'}}{\partial r} = \frac{\partial}{\partial r}\left[\frac{r-\rho}{r} - \frac{\rho(e^{(\gamma-r)\tau} - 1)e^{(r-\rho)t}\mathrm{e}^{-r\nu}}{\iota(ra_t + y)}\right]$$

$$= \frac{\partial}{\partial r}\left[\frac{r-\rho}{r} - \frac{\rho(e^{(\gamma-r)\tau} - 1)e^{(r-\rho)t}e^{-r\nu}}{\iota(ra_0 + y)e^{(r-\rho)t}}\right]$$

$$= \frac{\rho}{r^2} - \frac{\rho}{\iota(ra_0 + y)^2}\left[-e^{(\gamma-r)\tau}(\tau ra_0 + \tau y + a_0) + a_0\right] - (-r)e^{-r\nu}\,\frac{\rho(e^{(\gamma-r)\tau} - 1)}{\iota(ra_0 + y)}$$

$$> 0, \qquad \text{(A12)}$$

$$\frac{\partial SR_t^{'}}{\partial l} = \frac{\rho(e^{(\gamma-r)\tau} - 1)e^{(r-\rho)t}e^{-r\nu}}{\iota^2(ra_t + y)} > 0, \qquad \text{(A13)}$$

$$SR_t^{'} < 0 \quad \text{when} \quad ra_t + y - c_t^{'} < 0 \quad \text{even for} \quad r > \rho. \qquad \text{(A14)}$$

Q.E.D.

Proof of Proposition 1

For Equation (29), the first and the second order conditions are,

$$\frac{\partial U}{\partial b_0} = \frac{e^{-r\tau}-1}{y-rb_0} + \frac{e^{(\gamma-r)\tau}-e^{r\tau}}{y+rb_0(e^{\gamma\tau}-1)}$$

$$>0 \quad for\ b_0 < \frac{y(e^{(\gamma-r)\tau}-1)}{r(e^{\gamma\tau}-1)}, \tag{A15}$$

$$=0 \quad for\ b_0 = \frac{y(e^{(\gamma-r)\tau}-1)}{r(e^{\gamma\tau}-1)}, \tag{A16}$$

$$<0 \quad for\ b_0 > \frac{y(e^{(\gamma-r)\tau}-1)}{r(e^{\gamma\tau}-1)}, \tag{A17}$$

$$\frac{\partial^2 U}{\partial {b_0}^2} = -\frac{r(1-e^{-r\tau})}{(y-rb_0)^2} - \frac{re^{-r\tau}(e^{\gamma\tau}-1)^2}{[y+rb_0(e^{\gamma\tau}-1)]^2}$$

$$<0. \tag{A18}$$

The optimal housing loan ${b_0}^*$ is,

$${b_0}^* = \frac{y(e^{(\gamma-r)\tau}-1)}{r(e^{\gamma\tau}-1)}. \tag{A19}$$

From Equation (A19), we obtain,

$$\frac{r{b_0}^*}{y} = \frac{e^{(\gamma-r)\tau}-1}{e^{\gamma\tau}-1}, \tag{A20}$$

and,

$$\underset{\tau\to\infty}{0} < \frac{r{b_0}^*}{y} < \underset{\tau\to 0}{\frac{\gamma-r}{\gamma}}, \tag{A21}$$

$$\frac{\partial(rb_0^*/y)}{\partial r} = -\frac{\tau e^{(\gamma-r)\tau}}{e^{\gamma\tau}-1} < 0\,, \tag{A22}$$

$$\frac{\partial(rb_0^*/y)}{\partial\tau} = \frac{\gamma e^{-\gamma\tau} - re^{-r\tau} - (\gamma-r)e^{-(\gamma-r)\tau}}{(1-e^{-\gamma\tau})^2}\,, \tag{A23}$$

$$= \frac{\gamma e^{r\tau} - re^{\gamma\tau} - (\gamma-r)}{(1-e^{-\gamma\tau})^2 e^{(\gamma-r)\tau}}$$

$$< 0\,.$$

$$\frac{\partial(rb_0^*/y)}{\partial\gamma} = \frac{\tau(e^{\gamma\tau} - re^{(\gamma-r)\tau})}{(e^{\gamma\tau}-1)^2}\,, \tag{A24}$$

$$> 0\,.$$

Q.E.D.

Proof of Proposition 3

The household divides the lifetime into three periods, $[0,\ \nu)$ $[\nu,\ \nu+\tau)$ and $[\nu+\tau,\ \infty)$. The household solves the problem during $[0,\ \nu+\tau)$ first, given that the housing loan b_0 is chosen at time = ν, then utility maximization will be,

$$U_1' = \max_{c_t} \int_0^{\nu+\tau} e^{-rt} \ln c_t dt \tag{A25}$$

$$\text{s.t.}\quad \dot{a}_t = ra_t + y - c_t \tag{A26}$$

$$0 \le ra_t + y - c_t \tag{A27}$$

$$a_0 = 0 \tag{A28}$$

$$\underset{t\to\nu^-}{a_t} = b_\nu(e^{r\nu}-1)\,;\ \underset{t\to\nu^+}{a_t} = b_\nu(e^{r\nu}-1) - b_\nu \tag{A29}$$

$$\underset{t \to \nu+\tau}{a_t} = b_\nu(e^{\gamma\tau}-1) + b_\nu(e^{r\nu}-1)e^{\gamma\tau}. \tag{A30}$$

We obtained the solution for c_t for $t \in [0,\ \nu+\tau)$, which is constant c_1^* and is dependent on the housing loan b_ν at time = ν,

$$c_1^{'} = y - rb_\nu. \tag{A31}$$

Note that if the b_ν is larger than zero, then the household is oversaving, and the size is just the rb_ν. Note that the household accumulated the surplus saving,

$$a_{t \to \nu^-} = b_\nu(e^{r\nu}-1), \tag{A32}$$

which can be considered as a type of down payment for the purchase of housing.

Next, the household starts to solve the problem of the second period $[\nu+\tau,\ \infty)$.

$$U_2^{'} = \max_{c_t} \int_{\nu+\tau}^{\infty} e^{-rt} \ln c_t dt \tag{A33}$$

$$\text{s.t.} \quad \dot{a}_t = ra_t + y - c_t \tag{A34}$$

$$0 \le ra_t + y - c_t \tag{A35}$$

$$a_{\nu+\tau} = b_\nu(e^{\gamma\tau}-1) + b_\nu(e^{r\nu}-1)e^{\gamma\tau} \tag{A36}$$

$$\lim_{t \to \infty} e^{-rt} a_t = 0. \tag{A37}$$

We obtained the solution for c_t for $t \in [\nu+\tau,\ \infty)$, which is constant c_2^*, and dependent on the housing loan b_ν,

$$c_2^{'} = y + rb_\nu(e^{\gamma\tau}-1) + rb_\nu(e^{r\nu}-1)e^{\gamma\tau}. \tag{A38}$$

After solving the above problems, the household starts to find the optimal size of the housing loan to maximize the lifetime utility, and the problem can be written,

$$U^{'} = \max_{b_\nu}(U_1^{'} + U_2^{'}) = \max_{b_\nu}\left(\int_0^{\nu+\tau} e^{-rt}\ln c_1^{'}dt + \int_{\nu+\tau}^{\infty} e^{-rt}\ln c_2^{'}dt\right). \tag{A39}$$

By solving the above problem, we obtain the following solution,

$$b_\nu^{*} = \frac{y(e^{(\gamma-r)\tau}-1)}{r(e^{r\nu+\gamma\tau}-1)}, \tag{A40}$$

$$\underset{\nu\to 0}{b_\nu^{*}} = \frac{y(e^{(\gamma-r)\tau}-1)}{r(e^{\gamma\tau}-1)}. \tag{A41}$$

Q.E.D.

Proof of Property 5

Where the parameter of time preference is assumed to be equal to the interest rate, by equations (A9) and (A40) we obtain the undersaving and oversaving at time = 0, then the excess market demand of saving should be zero under equilibrium,[10]

$$-\frac{r(e^{(\gamma-r)\tau}-1)e^{(r-\rho)t}e^{-r\nu}}{\iota y} + \frac{e^{(\gamma-r)\tau}-1}{e^{r\nu+\gamma\tau}-1} = 0, \tag{A42}$$

$$r = \frac{\iota y}{e^{\gamma\tau}-e^{-r\nu}}, \tag{A43}$$

$$\underset{\nu\to 0}{=} \frac{\iota y}{e^{\gamma\tau}-1}, \tag{A44}$$

$$\frac{\partial r}{\partial \nu} = -\frac{r^2}{e^{r\nu+\gamma\tau}-1+r\nu} < 0. \tag{A45}$$

Q.E.D.

---

10 By intermediate value theorem, we obtained the stability conditions of Walras equilibrium. The proof is available upon requests.

5 References

Ando, Albert and Franco Modigliani, 1963. The Life Cycle Hypothesis of Saving: Aggregate Implications and Tests. *American Economic Review* 53, 55–84.

Arellano, Manuel, and Samuel Bentolila, 2009. La Crisis de la Economía Española: Lecciones y Propuestas, *FEDEA. Artículo en El País*, 22 de febrero. http://www.crisis09.es/PDF/la-crisis-de-la-economia-espanola.pdf

Bostic, Raphael, Stuart Gabriel and Gary Painter, 2009. Housing Wealth, Financial Wealth, and Consumption: New Evidence from Micro Data. *Regional Science and Urban Economics* 39, 79-89.

Campbell, John Y., and Joao F. Cocco, 2007. How Do House Prices Affect Consumption? Evidence from Micro Data. *Journal of Monetary Economics* 54, 591-621.

Chakrabarti, Rajashri, Donghoon Lee, Wilbert van der Klaauw, and Basit Zafar, 2011. Household Debt and Saving During the 2007 Recession. National Bureau of Economic Research, Inc, *NBER Working Papers* No.16999.

Chamon, Marcos, and Eswar Prasad, 2010. Why Are Saving Rates of Urban Households in China Rising: Determinants of Household Saving in China. *American Economic Journal: Macroeconomics* 2(1), 93-130.

Chen, Binkai and Rudai Yang, 2013. Land Supply, Housing Price and Household Saving in Urban China: Evidence from Urban Household Survey. *Economic Research Journal*, 110-122. (in Chinese, *Jingji Yanjiu*)

Chen, Jian, Jie Chen and Bo Gao, 2012. Financial Constraint, Housing Price and

Household Consumption. *Journal of Financial Research*, General No.382, 45-57. (in Chinese, *Jinrong Yanjiu*)

Chen, Kaiji, Ayşe İmroharoğlu, and Selahattin İmrohoroğlu, 2006. The Japanese Saving Rate. *American Economic Review* 96(5), 1850-1858.

Connor, Gregory, Flavin, Thomas, and Brian O'Kelly, 2010. The U.S. and Irish Credit Crises: Their Distinctive Differences and Common Feature. *Irish Economy Note* No. 10. http://www.irisheconomy.ie/Notes/IrishEconomyNote10.pdf

Deaton, Angus, 1992. *Understanding Consumption*. Oxford: Clarendon Press.

Diamond, Peter A., 1965. National Debt in a Neoclassical Growth Model. *American Economic Review* 55, 1126–1150.

Dreger, Christian and Yanqun Zhang, 2010. Is There a Bubble in the Chinese Housing Market? *DIW Berlin, German Institute for Economic Research, Discussion Papers* 1801.

Dynan, Karen, 2012. Is A Household Debt Overhang Holding Back Consumption? *The Spring Edition of the Brookings Papers on Economic Activity*, 299-362.

Elmendorf, Douglas W., 1996.The Effect of Interest Rate Changes on Household Saving and Consumption: A Survey. Federal Reserve Board, *Finance and Economics Discussion Series* No 96-27, June, pp.1-84.

Fan, Ziying and Jiayan Liu, 2015. Saving for Housing: the Distribution Effects of Property Tax. *Management World*, 5, 18-27. (in Chinese, *Guanli Shijie*)

Farhi, Emmanuel and Jean Tirole, 2011. Bubbly Liquidity. *Review of Economic Studies* 79, 1-29.

Friedman, Milton, 1957. A Theory of the Consumption Function, Princeton University Press.

Guan, Zi, BC645. *Guanzi: ``Political, Economic, and Philosophical Essays from Early China*," translated by W. Allyn Rickett. Volume 1, 2. Princeton University Press, 1985.

Hayashi, Fumio, 1986. Why Is Japan's Saving Rate So Apparently High? *NBER Macroeconomics Annual*, Volume 1, pp.147-234.

Horioka, Charles Yuji, 1996. Capital Gains in Japan: Their Magnitude and Impact on Consumption. *Economic Journal* 106, 560-577.

Horioka, Charles Yuji and Junmin Wan, 2007. The Determinants of Household Saving in China: A Dynamic Panel Analysis of Provincial Data. *Journal of Money, Credit and Banking* 39, 2077-2096.

Horioka, Charles Yuji and Junmin Wan, 2008. Why Does China Save So Much? The final chapter (Chapter 14, pp.371-391) of `*China, Asia, and the New World Economy*,' Oxford University Press, edited by Barry Eichengreen, Yung Chul Park, and Charles Wyplosz.

International Monetary Fund, IMF 2011. Greece: Third Review Under the Stand-By Arrangement, *Country Report* No. 11/68, March.

Keynes, John Maynard, 1936. *The General Theory of Employment, Interest and Money.* London: Macmillan, 1974.

Kikuchi, Tomoo and Masaya Saguragawa, 2012. Saving Boost in a Bubbly Economy with Financial Friction. *National University of Singapore, Working Papers.*

Kraay, Aart, 2000. Household Saving in China. *World Bank Economic Review* 14(3), 545-570.

Kuijs, Louis, 2005. Investment and Saving in China. *World Bank Policy Research Paper* Series No. 3633 (June). Available at SSRN: http://ssrn.com/abstract=756985.

Leland, H. E. 1968. Saving and Uncertainty: the Precautionary Demand for Saving. *Quarterly Journal of Economics* 82, 465-73.

Li, Xuesong and Yanyan Huang, 2015. Rising Housing Price, Multi-Suite Decision and Household Savings Rate in Urban China. *Economic Research Journal*, 9, 100-113. (in Chinese, *Jingji Yanjiu*)

Lin, Chu-Chia, Chien-Liang Chen, and Sue-Jing Lin, 2000. Life Cycle, Mortgage Payment, And Forced Savings. *International Real Estate Review* 3, 109-141.

Marx, Karl, 1867. Capital: *The Process of Capitalist Production*. Edited by Frederick Engels. Chicago, C.H. Kerr, 1909-1921.

Minsky, Hyman P., 1992. The Financial Instability Hypothesis. *The Jerome Levy Economics Institute of Bard College, Working Paper* No. 74, pp.1-10, May.

Modigliani, Franco, and Shi Larry Cao, 2004. The Chinese Saving Puzzle and the Life-Cycle Hypothesis. *Journal of Economic Literature* 42(1), 145-170.

Moriizumi, Yoko, 2003. Targeted Saving by Renters for Housing Purchase in Japan. *Journal of Urban Economics* 53, 494-509.

Mukherjee, Sanchita and Rina Bhattacharya, 2015. Do the Keynesian Monetary Transmission Mechanisms Work in the MENA Region? *Empirical Economics* 48, 969–982.

Ogawa, Kazuo, 2009. *The Truth of the Lost Decade* (Ushinawareta Junen No Shijitsu, in Japanese). Toyo Keizai, Inc.

Ogawa, Kazuo, Shin-ichi Kitasaka, Hiroshi Yamaoka, Yasuharu Iwata (1996) An Empirical Re-evaluation of Wealth Effect in Japanese Household Behavior. *Japan and World Economy* 8, 423-442.

Ogawa, Kazuo and Junmin Wan, 2007. Household Debt and Consumption: A Quantitative Analysis Based on Household Micro Data for Japan. *Journal of Housing Economics* 16, 127-142.

Ramsey, Frank P., 1928. A Mathematical Theory of Saving. *Economic Journal* 38, 543-559.

Rogoff, Kenneth, 2010. Three Challenges Facing Modern Macroeconomics. *White paper submitted to the National Science Foundation*, September 21. http://www.vanderbilt.edu/AEA/econwhitepapers/white_papers/Kenneth_Rogoff.pdf

Scheinkman, Jose A. and Wei Xiong, 2003. Overconfidence and Speculative Bubbles. *Journal of Political Economy* 111, 1183-1219.

Shi, Jianhuai and Haiting Zhu, 2004. Household Precautionary Saving and Strength of the Precautionary Motive in China: 1999-2003. *Economic Research Journal*, 10, 66-74. (in Chinese, *Jingji Yanjiu*)

Shiller, Robert J., 1981. Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends? *American Economic Review* 71, 421–436.

Smith, Adam, 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations.* University Of Chicago Press, 1977.

Stiglitz, Joseph E., 2009. The Current Economic Crisis and Lessons for Economic Theory. *Eastern Economic Journal* 35, 281-296.

Takase, Mitsuo, 2009. Effect of Total Factor Productivity on Japanese Saving Rate in an Economic Growth Model. Paper presented at the International Conference on Econometrics and the World Economy, 23 - 24 March, *The Center for Advanced Economic Study (CAES)*, Fukuoka University, Fukuoka, Japan. http://www.econ.fukuoka-u.ac.jp/english/researchcenter/paper24/5-3_Takase.pdf

Tan, Xiaofen, Min Zhang, and Jingjing Sun, 2013. Empirical Analysis of Impacts of Real Interest Rate on Household Saving in China. *Modern Economic Science*, 3, 11-22. (in Chinese, *Dangdai Jingji Kexue*)

Tobin, James, 1958. Liquidity Preference as Behavior Towards Risk. *Review of Economic Studies* 67, 65-86.

Ueda, Kazuo, 2011. Japan's Bubble, the USA's Bubble and China's Bubble. *China and World Economy* 19(1), 47-62.

Wan, Junmin, 2004. Habit, Information and Uncertainty: Some Evidence from Natural Experiments. *PhD dissertation*, Osaka University, December. http://ir.library.osaka-u.ac.jp/metadb/up/LIBCLK003/f_2004-19174h.pdf

Wan, Junmin, 2005. Rational Addiction with Optimal Inventories: Theory and Evidence from Cigarette Purchases in Japan. The Seventh ISER-Moriguchi Prize Awarded Paper, *ISER Discussion Paper* No. 641, Osaka University, Japan. http://www.iser.osaka-u.ac.jp/library/dp/2005/DP0641.pdf

Wan, Junmin, 2011a. Preventing the Bubble Effect. *CAES Working Paper Series*

WP-2011-003, Fukuoka University, Japan, March.
http://www.econ.fukuoka-u.ac.jp/english/researchcenter/workingpapers/WP-2011-003.pdf

Wan, Junmin, 2011b. Bubbly Saving. *CAES Working Paper Series* WP-2011-010, Fukuoka University, Japan.
http://www.econ.fukuoka-u.ac.jp/english/researchcenter/workingpapers/WP-2011-010.pdf

Wan, Junmin, 2011c. Saving: Thought, Theory, and Evidence. *CAES Working Paper Series* WP-2011-012, Fukuoka University, Japan.
http://www.econ.fukuoka-u.ac.jp/english/researchcenter/workingpapers/WP-2011-012.pdf

Wan, Junmin, 2014. *Consumer Casualities: Exploring the Economics of Habit, Information and Uncertainty in Japan*. Palgrave Macmillan, New York, 208 pages, November 6.

Wan, Junmin, 2015a. Household Savings and Housing Prices in China. *The World Economy* 39(1), pp.172-192.

Wan, Junmin, 2015b. Non-performing Loans in Housing Bubbles. *CAES Working Paper Series* WP-2015-006, Fukuoka University, Japan.

Wan, Junmin and Yan Gao, 2015. Why Do China Firms Save So Much? Presented at the *Spring Meeting of Japanese Association of Applied Economics*.

Wang, Xin and Yi Wen, 2011. Can Rising Housing Prices Explain China's High Household Saving Rate? *Federal Reserve Bank of St. Louis Review* 93, 67-87.

Wei, Shang-Jin and Xiaobo Zhang, 2011. The Competitive Saving Motive: Evidence from Rising Sex Ratios and Savings Rates in China. *Journal of Political Economy* 119, 511-564.

Xie, Jieyu, Binzhen Wu, Hongbin Li and Siqi Zheng, 2012. Urban Housing Price and

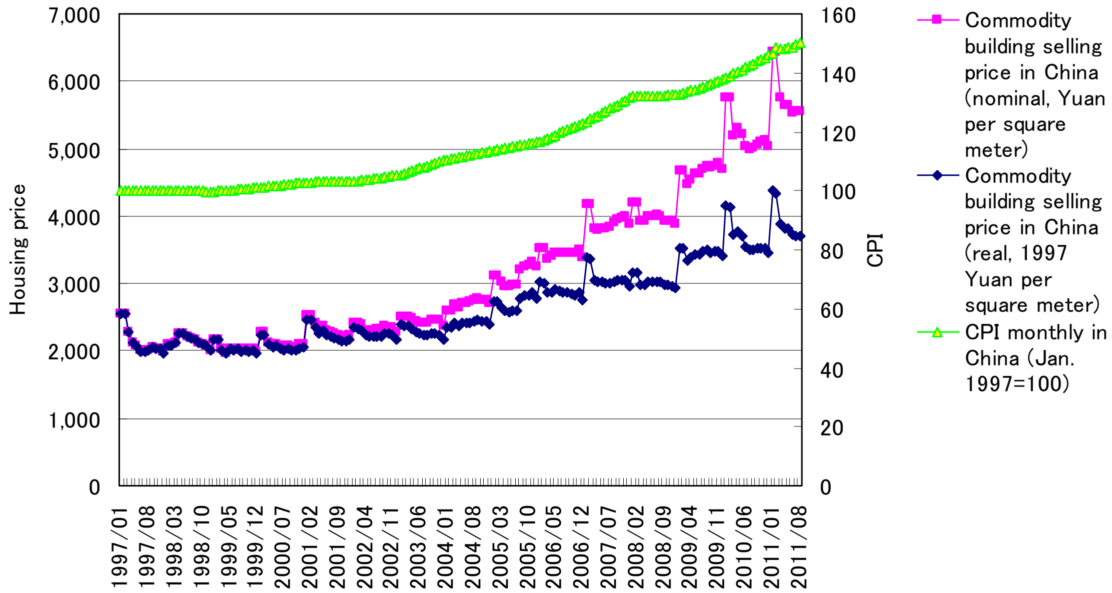
Household Consumption in China. *Journal of Financial Research*, General No.384, 13-27. (in Chinese, *Jinrong Yanjiu*)

Xie, Shiqing and Taiping Mo, 2015. Differences in Corporate Saving Rate in China: Ownership, Monopoly, and Financial Development. *China Economic Review* 33, 25-34.

Xiong, Wei and Jialin Yu, 2011. The Chinese Warrants Bubble. *American Economic Review* 101(6), 2723-2753.

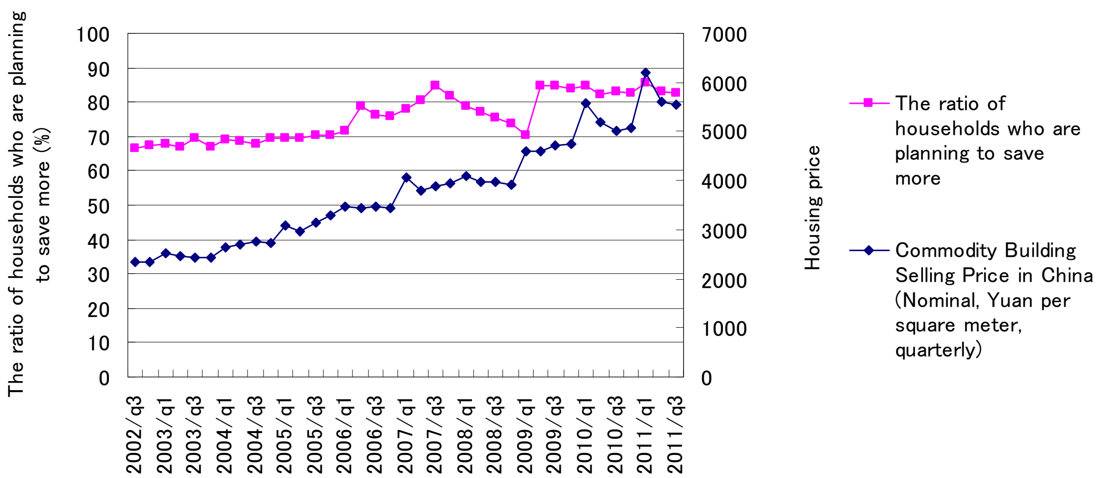
Yalta, A. Talha, 2011. A Model of Down Payment Saving. *TOBB University of Economics and Technology, Department of Economics, Working Papers* 1101.

Figure 1: Housing prices in China, Jan. 1997-Aug. 2011



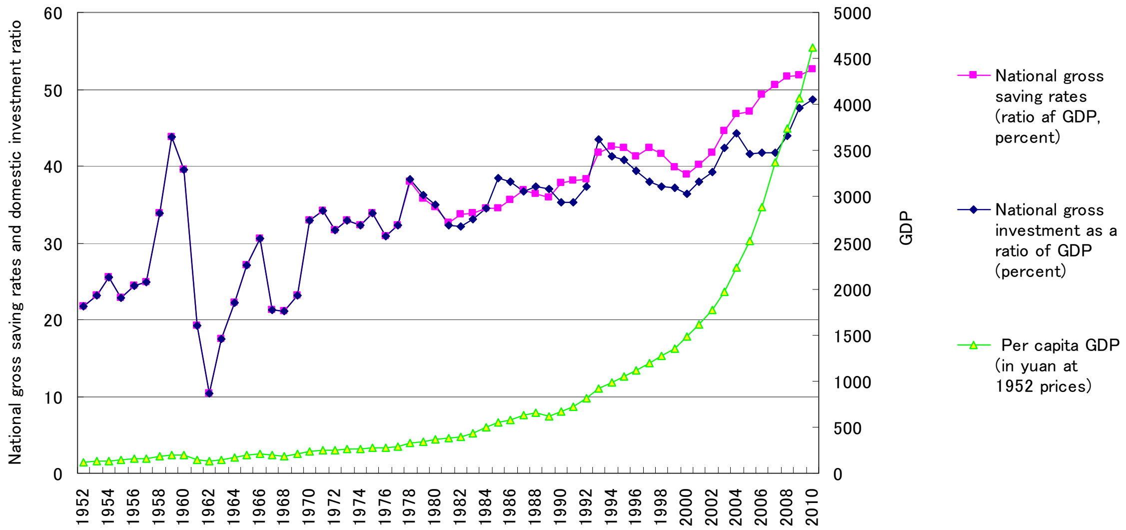
Source: The author's calculations based on the China Statistical Yearbook 1998-2011, the China Real Estate Statistics Yearbook 1999-2011, and the CEIC Database

Figure 2: The intent of households to save and the housing price in China, Autumn 2002-Autumn 2011



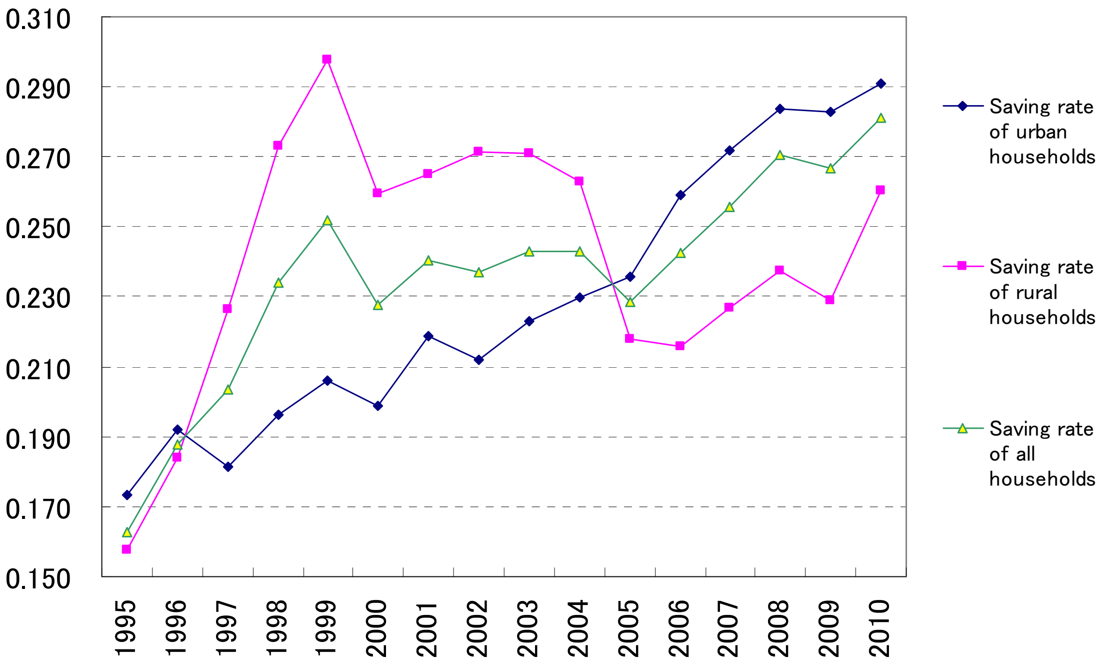
Source: The author's calculations based on data from The People's Bank of China, the China Real Estate Yearbook 2003-2011, and the CEIC Database

Figure 3: National gross saving rates, domestic investment, and per capita GDP in China, 1952-2010



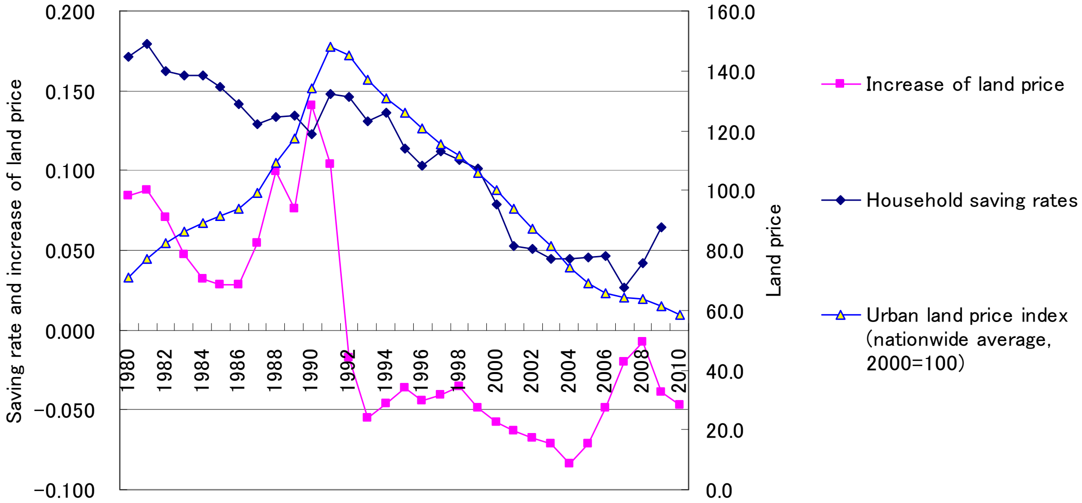
Source: The author's calculations based on data from the China Statistics Yearbook, 1991-2011

Figure 4: Household saving ratio in China, 1995-2010



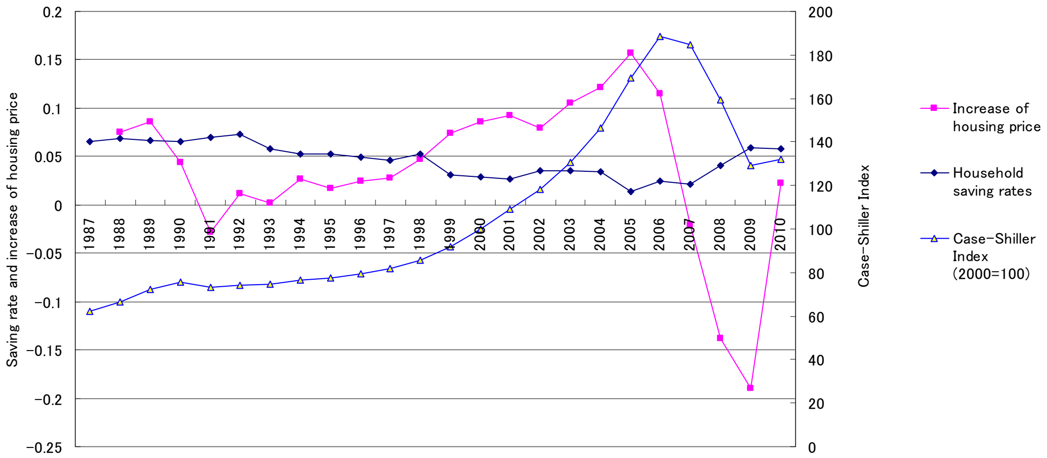
Source: The authors' calculations based on the China Statistics Yearbook, 1996-2011

Figure 5: Household saving rate and land prices in Japan, 1980-2010



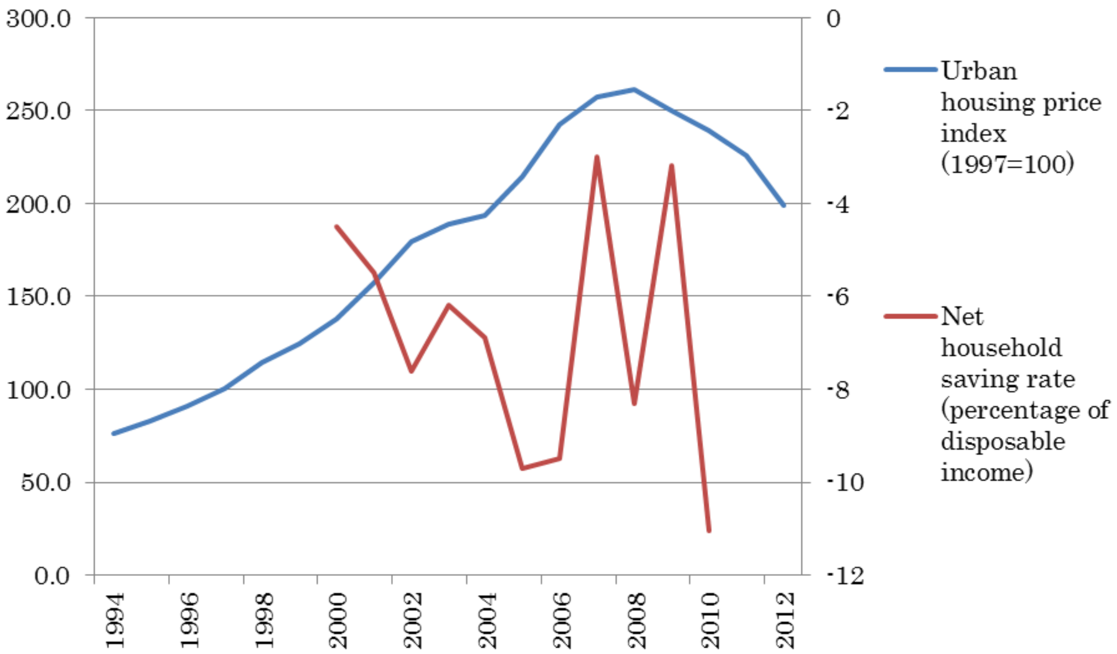
Source: The author's calculations based on data from the “Annual Report on National Accounts 1981-2011” of Japan, and the “Urban Land Price Index 1980-2010” by the Japan Real Estate Institute

Figure 6: Household saving rates and housing prices in the U.S., 1987-2010



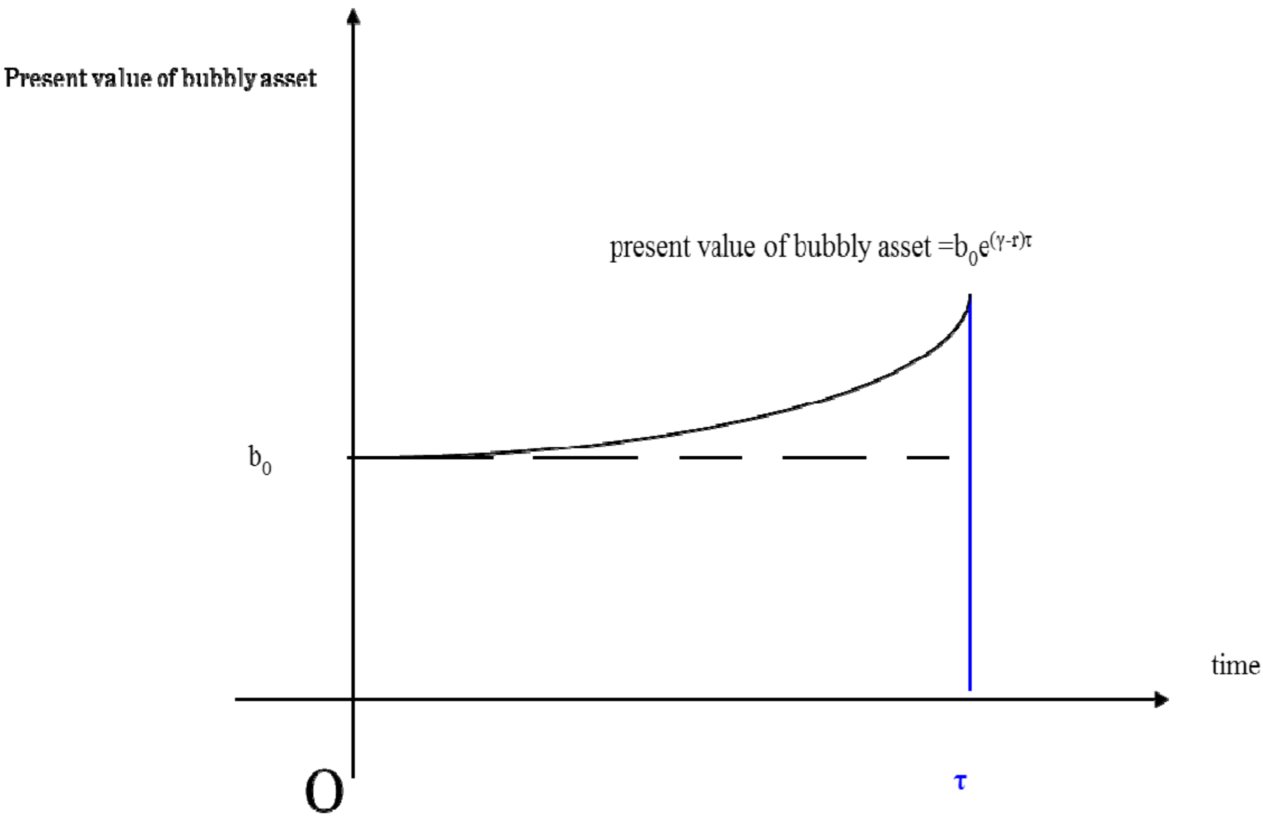
Source: The author's calculations based on data from the U.S. Census Bureau and "Standard & Poor's/Case-Shiller Home Price Indices"

Figure 7: Household saving rates and housing prices in Greece, 1994-2012



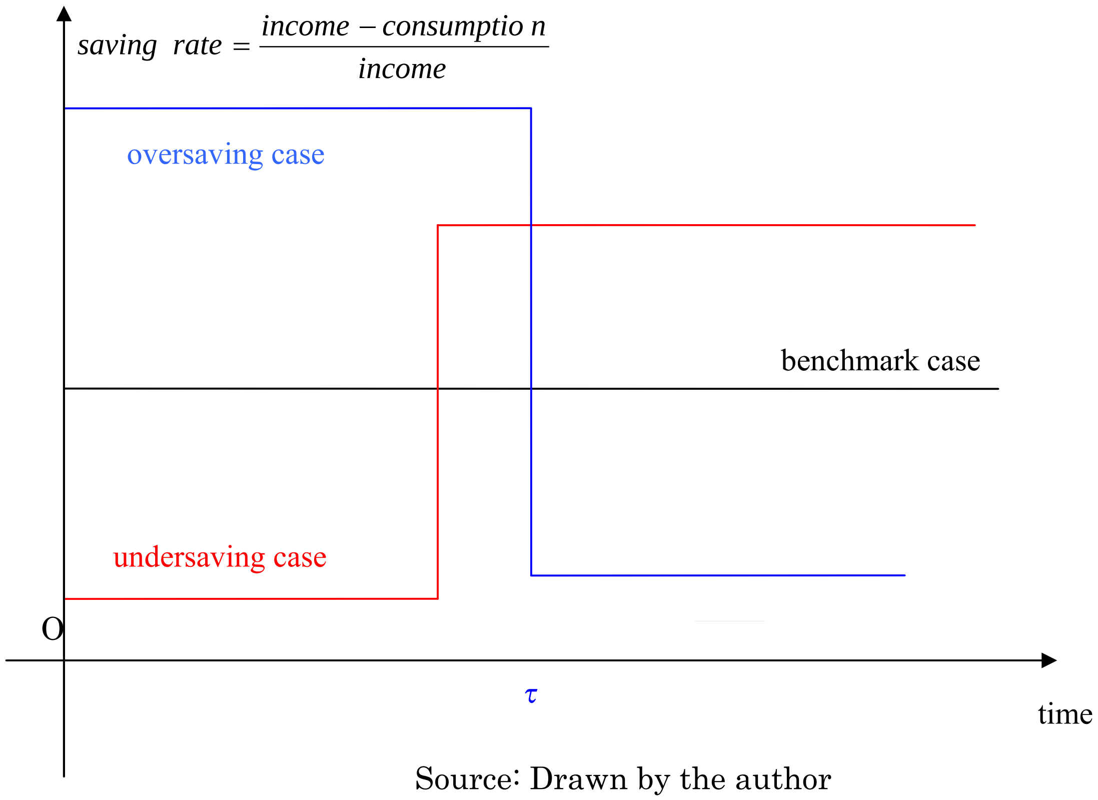
Source: The author's calculations based on data from the Bank of Greece and the national accounts of OECD countries database

Figure 8: Bubbly asset



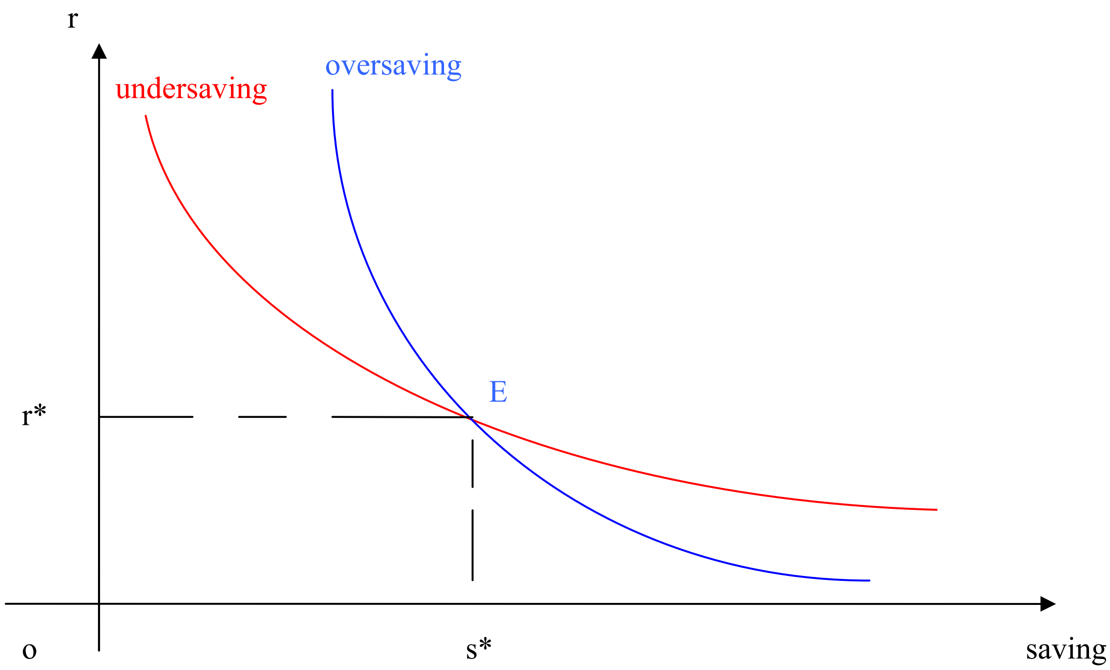
Source: Drawn by the author

Figure 9: The intuition of optimal saving, undersaving, and oversaving



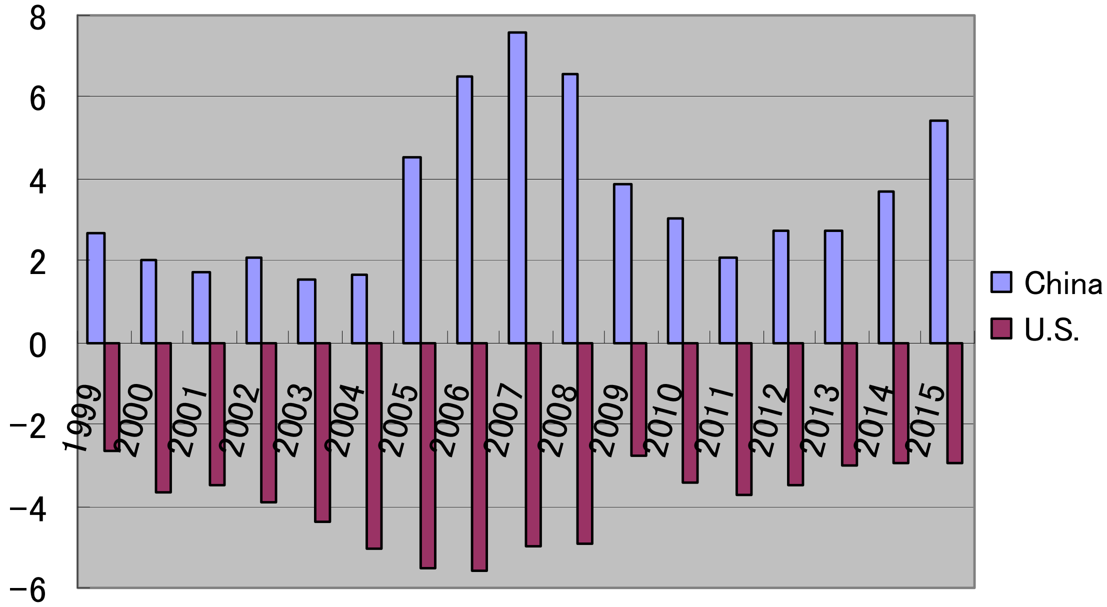
Source: Drawn by the author

Figure 10: Oversaving, undersaving, and interest rate



Source: Drawn by the author

Figure 11: External balance on goods and services in China and U.S., 1999-2015, (% of GDP)



Source: The author's calculations based on data from the World Bank, National Bureau of Statistics of China, Bureau of Economic Analysis of U.S.