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Bubbly Saving

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Abstract

We present a theory to explain why some countries, like the U.S and Greece, undersave while other countries, like China and Japan, oversave during a housing bubble era. We found that a household with a speculative saving motive under- or oversaves depending on the bubbly housing price and the degree of distortion of housing policy and financial market. When households do not face borrowing constraints, they undersave due to the positive expected net capital gain from the bubbly asset, and the saving rate decreases with the housing price but increases with the interest rate and the leverage ratio. In contrast, when households face borrowing constraints, they oversave due to their beliefs in the expected net capital gain from the bubbly asset, and the rate of oversaving to income increases with the housing price but decreases with interest rate.

JEL classification: D11, D12, E21, E22, G12, G18

Keywords: housing bubble, overdebt, oversaving, speculative saving hypothesis, undersaving

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 panel macro and cross sectional individual data from China. The answer is that saving and consumption have been unbalanced domestically and globally by both the speculative saving motive and the distortion in financial markets during the housing bubble era.

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 competitive saving hypothesis and the 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 current recession period. The undersaving problem

[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 (2011b) does a comprehensive global survey on saving from about BC2500.

in Ireland, Greece, the U.S., and Spain during the housing bubble period is mentioned in recent literature such as Arellano and Bentolila (2009), Connor, et al. (2010), and the International Monetary Fund (IMF; 2011). However, to our knowledge, there is still no research that can sufficiently explain why there is a domestic and global saving-consumption imbalance issue.

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 the 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 have 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 with 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 with p-value 0.000 and 0.302 with 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 the land price is also significantly positive, 0.436 with 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 with 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 with p-value 0.004, though it is -0.174 with p-value 0.609, which is negative but not significant when including the period 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 financial market. The distortion is measured by the expectation of an increase in housing prices, the household's human capital, and the limit of debt outstanding.

Wan (2013) tested the speculative saving hypothesis using provincial data during 1995-2010 and micro household data for six big cities in 2005 in China. It is found that the bubbly housing price, especially in the urban sector, significantly raises the aggregate household saving rate in cities as well as nationwide after controlling for life cycle and other related factors, and he also finds increases in housing price and housing loans have significantly positive impacts on

[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.

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 rate increased savings while in our model, oversaving decreases with interest rate. The difference could arise from the different model setting. Kichuchi and Saguragawa (2012) consider that an investor faces borrowing constraints by limited 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) partial equilibrium 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 on how to overcome the issue of a shortage of domestic demand in China today, as well as how to prevent bankruptcies in the U.S. and E.U. economies after the bubble crash. Consequently, we have to 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 presents a model to show that a household with a speculative saving motive has an incentive to over- or undersave. Section 3 shows empirical evidence in the literature. Section 4 contains the concluding remarks, and discusses the implications and issues left for future research.

2 The Model

2.1 The Benchmark

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

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

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

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

The household with the constant discounted rate ρ, 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. 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, if the household considers the increase rate of asset price and the leverage ratio of

loan as a type of interest, by Equation (7) he or she would raise the saving rate in this framework.

2.2 Loan Contract

Next, we consider that 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 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 with constant rate r.[7] For simplicity, here we assume that the external finance premium is sufficiently low to be considered as 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 discounted value of the debt principal is,

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

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

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

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

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

and the present 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 $t = 0$.

[7] This problem is essentially similar to the one in Chapter 3 of Wan (2004) and Wan (2005), in which the household hoards 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.

	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)	$(a_0 + \frac{y}{r}) + b_0 e^{(\gamma - r)\tau}$	$(a_0 + \frac{y}{r}) + b_0 e^{(\gamma - r)\tau}$

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

$$b_0 = \frac{1}{l} \text{ if } a_0 \geq d_0, \tag{13}$$

$$= 0 \text{ if } a_0 < d_0, \tag{14}$$

where the leverage ratio is measured by $\boldsymbol{l}$ with $l \in (0,1]$, and the down payment is measured by d_0 with $d_0 \in (0, \infty)$, which is exogenously determined by the financial policy, respectively. d_0 is assumed to be zero by the financial easing.

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, its realization is not assured.

Property 1:

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

Proof:

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

2.3 Undersaving

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

$$(a_0 + \frac{y}{r}) + \frac{e^{(\gamma - r)\tau} - 1}{l}, \tag{15}$$

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

$$c'_t = c'_0 e^{(r-\rho)t}, \tag{16}$$

where

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

Proposition 1:

The household undersaves due to the positive expected net capital gain from the bubbly asset. The saving rate decreases with the γ and the τ but increases with the r and the l. There is a case of a negative saving rate even for the case $r > \rho$ 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:

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

$$c_0^{'} - c_0 = \frac{\rho(e^{(\gamma-r)\tau} - 1)}{l}, \tag{17}$$

and the saving rate,

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

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

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

$$= \frac{r-\rho}{r} - \frac{\rho(e^{(\gamma-r)\tau} - 1)e^{(r-\rho)t}}{l(ra_t + y)}, \tag{18}$$

thus,

$$\frac{\partial SR_t^{'}}{\partial \gamma} < 0, \tag{19}$$

$$\frac{\partial SR_t^{'}}{\partial \tau} < 0, \tag{20}$$

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

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

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

$$> 0, \tag{21}$$

$$\frac{\partial SR_t^{'}}{\partial l} = \frac{\rho(e^{(\gamma-r)\tau}-1)e^{(r-\rho)t}}{l^2(ra_t+y)} > 0, \tag{22}$$

$$SR_t^{'} < 0 \quad \text{when} \quad ra_t + y - c_t^{'} < 0 \quad \text{even for} \quad r > \rho. \tag{23}$$

Q.E.D.

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 (23) 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 the 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 proposition.

2.4 Oversaving

We consider that a household has financial constraints. The household can take a housing loan at the 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 the lifetime utility. [8]

[8] For the case $a_0 < d_0$, 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.

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 and independent from the interest rate, the consumption is equal to be income y, and the lifetime utility U_0 without speculative housing purchase should be,

$$U_0 = \frac{\ln y}{r} \tag{24}$$

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,

$$U_1 = \max_{c_t} \int_0^{\tau} e^{-rt} \ln c_t dt \tag{25}$$

$$\text{s.t.} \quad \dot{a}_t = ra_t + y - c_t \tag{26}$$

$$0 \le ra_t + y - c_t \tag{27}$$

$$a_0 = -b_0 \tag{28}$$

$$\underset{t \to \tau}{e^{-rt} a_t} = b_0 (e^{(\gamma - r)\tau} - 1). \tag{29}$$

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,

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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 $b_{\tau'}(e^{(\gamma - r)(\tau - \tau')} - 1)$. Here we do not consider these cases. For simplicity, we assume that the down payment d_0 is zero here.

$$c_1^* = y - rb_0 . \tag{30}$$

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

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

$$U_2 = \max_{c_t} \int_\tau^\infty e^{-rt} \ln c_t dt \tag{31}$$

$$\text{s.t.} \quad \dot{a}_t = ra_t + y - c_t \tag{32}$$

$$0 \le ra_t + y - c_t \tag{33}$$

$$a_\tau = b_0 (e^{(\gamma - t)\tau} - 1) e^{r\tau} \tag{34}$$

$$\lim_{t \to \infty} e^{-rt} a_t = 0 . \tag{35}$$

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

$$c_2^* = y + rb_0 (e^{\gamma\tau} - 1) . \tag{36}$$

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

$$U = \max_{b_0} (U_1 + U_2) = \max_{b_0} \left(\int_0^\tau e^{-rt} \ln c_1^* dt + \int_\tau^\infty e^{-rt} \ln c_2^* dt \right). \tag{37}$$

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

Proposition 2:

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:

For Equation (37), the first and the second order conditions are,

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

$$> 0 \quad for\ b_0 < \frac{y(e^{(\gamma - r)\tau} - 1)}{r(e^{\gamma\tau} - 1)}, \tag{38}$$

$$= 0 \quad for\ b_0 = \frac{y(e^{(\gamma - r)\tau} - 1)}{r(e^{\gamma\tau} - 1)}, \tag{39}$$

$$< 0 \quad for\ b_0 > \frac{y(e^{(\gamma - r)\tau} - 1)}{r(e^{\gamma\tau} - 1)}, \tag{40}$$

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

$$< 0. \tag{41}$$

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

$${b_0}^* = \frac{y(e^{(\gamma - r)\tau} - 1)}{r(e^{\gamma\tau} - 1)}. \tag{42}$$

From Equation (42), we obtain,

$$\frac{r{b_0}^*}{y} = \frac{e^{(\gamma - r)\tau} - 1}{e^{\gamma\tau} - 1}, \tag{43}$$

and,

$$\underset{\tau\to\infty}{0} < \frac{rb_0^{\ *}}{y} < \underset{\tau\to 0}{\frac{\gamma - r}{\gamma}} \quad , \tag{44}$$

$$\frac{\partial(rb_0^{\ *}/y)}{\partial r} = -\frac{\tau e^{(\gamma-r)\tau}}{e^{\gamma\tau}-1} < 0\,, \tag{45}$$

$$\frac{\partial(rb_0^{\ *}/y)}{\partial \tau} = \frac{\gamma e^{-\gamma\tau} - re^{-r\tau} - (\gamma - r)e^{-(\gamma-r)\tau}}{(1-e^{-\gamma\tau})^2}\,, \tag{46}$$

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

$$< 0\,.$$

$$\frac{\partial(rb_0^{\ *}/y)}{\partial \gamma} = \frac{\tau(e^{\gamma\tau} - re^{(\gamma-r)\tau})}{(e^{\gamma\tau}-1)^2}\,, \tag{47}$$

$$> 0\,.$$

Q.E.D.

Next, we calculate the utility change by the bubbly saving. By incorporating housing loan $b_0^{\ *}$ in the Equation (42) into the object function in the Equation (37), we obtain

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

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

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

$$= U_0 + \frac{(\gamma - r)\tau e^{-r\tau}}{r} + \frac{\ln\left(\frac{1-e^{-r\tau}}{1-e^{-\gamma\tau}}\right)^{1-e^{-r\tau}}}{r}, \tag{48}$$

and the utility gain is,

$$\frac{(\gamma - r)\tau e^{-r\tau}}{r} + \frac{\ln\left(\frac{1-e^{-r\tau}}{1-e^{-\gamma\tau}}\right)^{1-e^{-r\tau}}}{r} > 0 \quad for \;\; \tau >> 0. \tag{49}$$

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 by Equation (49). Consequently, we obtain the following proposition.

Proposition 3:

The household obtains a positive utility by 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.

Proposition 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.

Proof:

By Proposition 2, the household has a strictly positive net capital gain by 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. Q.E.D.

For the above propositions, we have a conceptual intuition on undersaving and oversaving from Figure 9. Here the expected net capital gain from trading the bubbly asset is equivalent to the non-satisfaction of the No Ponzi Game condition in Equation (3). It can be expressed by

$$-b_0 e^{(\gamma - r)\tau} = \lim_{t \to \infty} e^{-rt} a_t < 0 . \tag{50}$$

When the majority of the households in the economy have 'bubbly beliefs', the bubble will occur in a self-fulfilling manner, while the bubble crashes when they revise their beliefs. Hence we need a mechanism to prevent the asset bubble occurrence as proposed by Wan (2011a).

2.5 An Explanation of Global Imbalance

Suppose there are two countries, Country A and Country B, with an income endowment *y*. All other factors, except financial situation, are the same for each of these two countries. Country B faces borrowing constraints, 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 B will over-save, and that Country A will be forced to borrow from Country B to finance its overconsumption. Financially underdeveloped Country B 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.

3 Empirics in the Literature

During the bubble period, the 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 the U.K. micro data, Campbell and Cocco (2007) also found that the rising housing price significantly raised consumption for older homeowner, implying that the increase in housing price has negative impact on saving. These findings are consistent with the predictions of Proposition 1.

Proposition 2 is a testable hypothesis on the relation between the interest payment of housing loan and the saving rate. Moriizumi (2003) found that the household saving was increased by a higher housing price for renters using Japanese micro dataset. Ogawa and Wan (2007) found that the Japanese households who have larger housing loan had lower consumption propensity after the housing bubble crash, implying that interest payment on loans raised the saving rate. Lin et al. (2000) found that the mortgage payment increased the saving for the owners with mortgage and for renters as well in Taiwan.

Proposition 2 also conjectures that the higher bubbly housing price will induce a higher saving rate in the bubble era. Horioka (1996) and Ogawa et al. (1996) found that the wealth effect on consumption was small during the Japan housing bubble era, implying that the saving rate may increase with housing price. In China three recent studies are closely related to Proposition 2. Chen et al. (2012) and Xie et al. (2012) found that the increasing urban housing price significantly

reduced the urban household consumption, implying that the increased urban housing price raised the urban household savings. Chen and Yang (2013) directly estimated the impact of urban housing price 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. These results are consistent with the prediction of the above proposition.

Wan (2013) also used macro and micro data in China to have some formal tests on speculative saving hypothesis. By the macro panel dataset during the period of 1995-2010, it is found that the increase of real housing prices in capital cities have significantly raised the saving rates for urban and all households and for the pooled sample of urban and rural households. The increase of real housing prices at the provincial level has a significantly negative impact on saving for rural and all households and for the pooled sample of urban and rural households. Considering that the speculative housing trading took place in not the rural but the urban sector, we may conclude that this result is consistent with the prediction of the speculative saving hypothesis. By the micro dataset of 1,500 Chinese households in the six biggest cities, Shanghai, Beijing, Chengdu, Guangzhou, Shenyang, and Wuhan, respectively, it is found that the increase of housing price and housing loans have significantly positive impacts on saving, even after controlling for potentially possible factors. For those who have borrowing constraints, the impact of the increase of housing price on saving is more large, as expected by the speculative saving theory. This result is also consistent with the prediction of the speculative saving hypothesis.[9]

4 Conclusions

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

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 of housing policy and financial market. The distortion is measured by the expectation on the increase of housing price, the household's human capital, and the limit of debt outstanding.

The speculative saving hypothesis first presented here is consistent with the evidence from the panel provincial data during 1995-2010 in China. We found that the bubbly housing price, especially in the urban sector, significantly raises the saving rate in cities as well as nationwide after controlling for the life cycle and the other related factors. A decreasing interest rate may also raise the urban saving rate. Based on micro household data for six major cities in China in 2005 (Wan, 2013), we also find that the increase in housing price and housing loans have significantly positive impacts on saving, even after controlling for other possible factors. The contributing rates of housing price increase to the urban households' savings and to all households' savings during 1996-2010 are 0.347 and 0.245, respectively. These findings are consistent with the predictions of the speculative saving hypothesis.

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 E.U. may have resulted from the freedom of the financial services ensuing from the housing bubble. Therefore, this paper may contribute not only a new view to 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 the bubble occurrence 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. The second is that we should test the speculative saving hypothesis using worldwide data at macro as well as micro levels.

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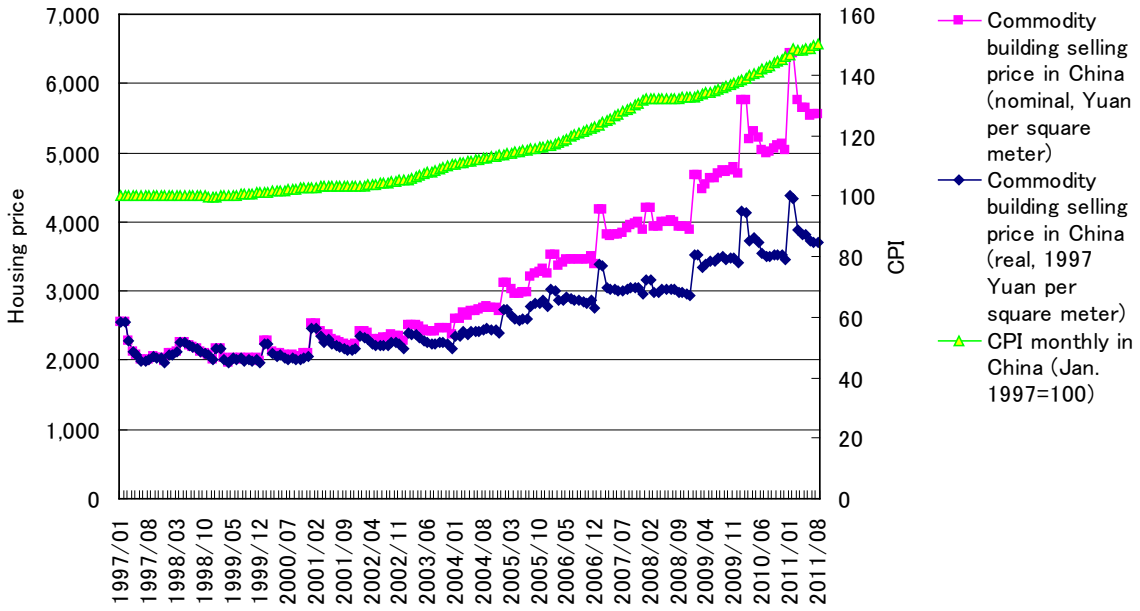
Figure 1: Housing prices in China, Jan. 1997-Aug. 2011



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

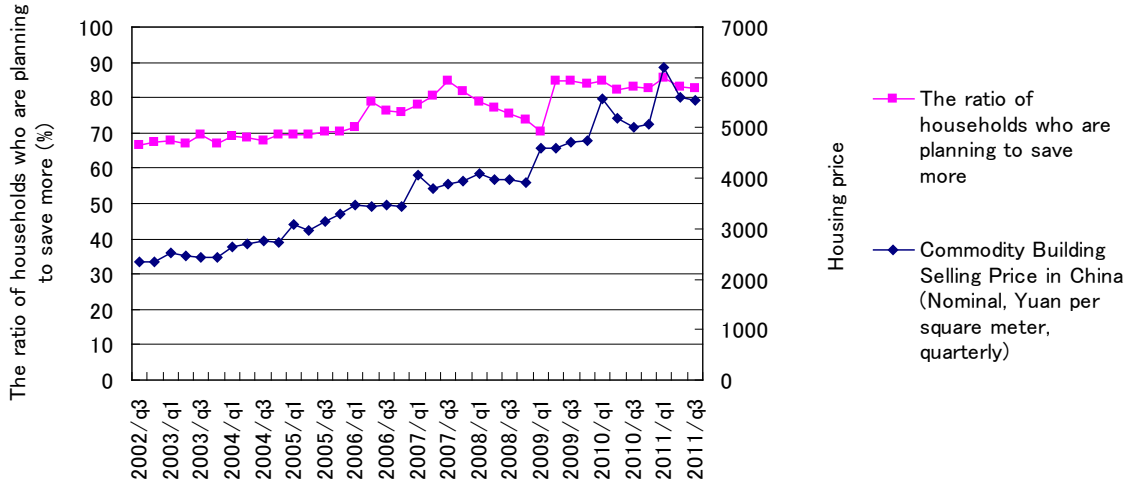


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Figure 3: National gross saving rates, domestic investment, and per capita GDP in China, 1952-2010

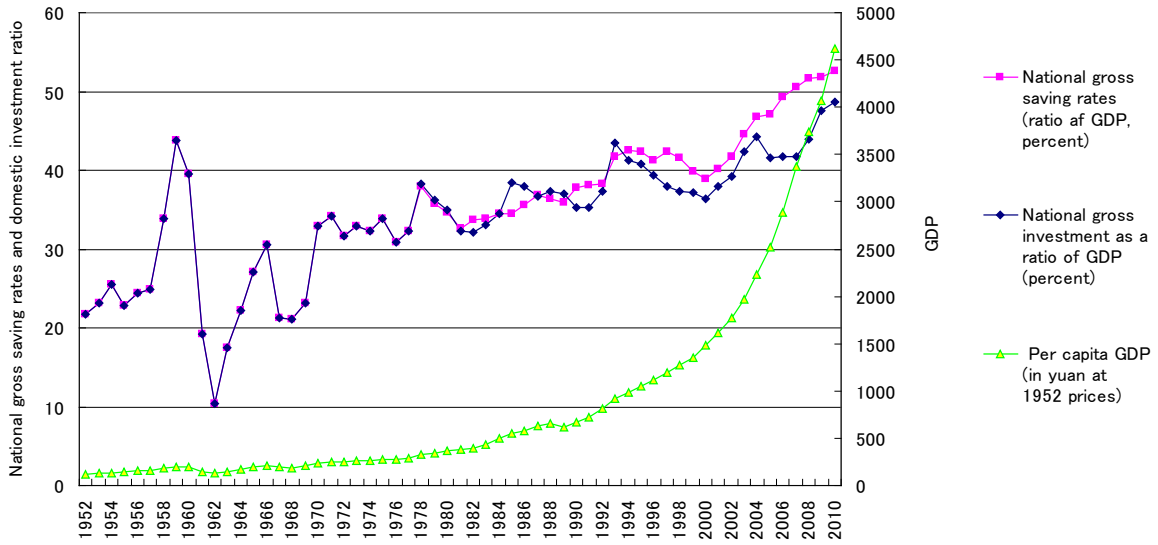

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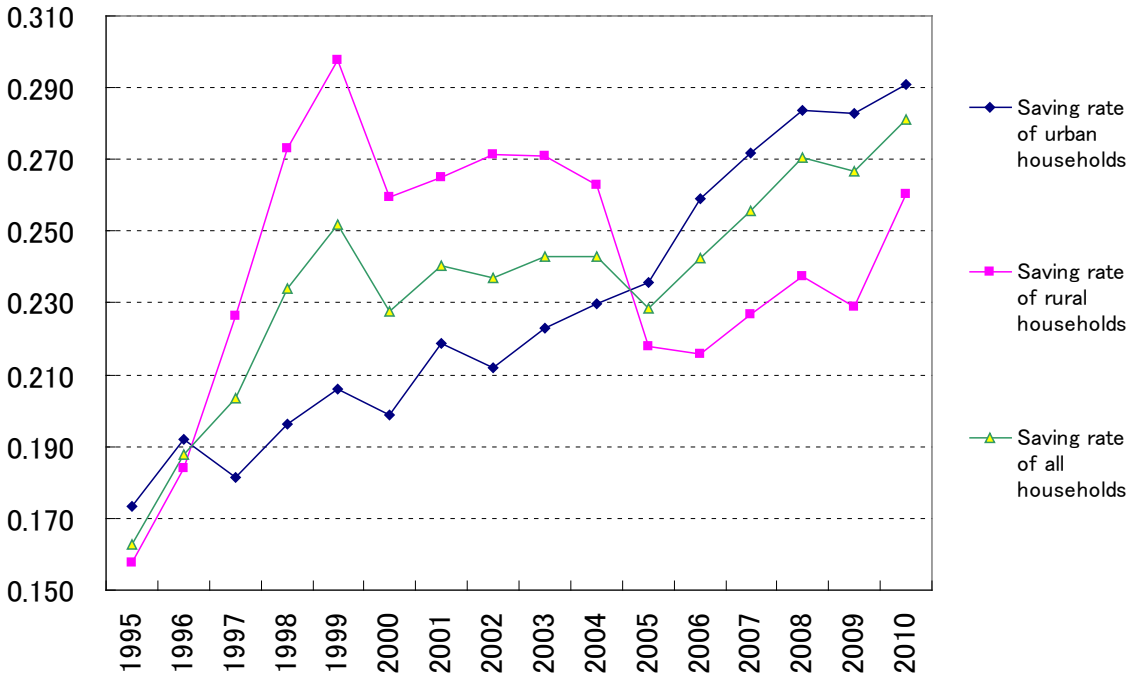
Figure 4: Household saving ratio in China, 1995-2010



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

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

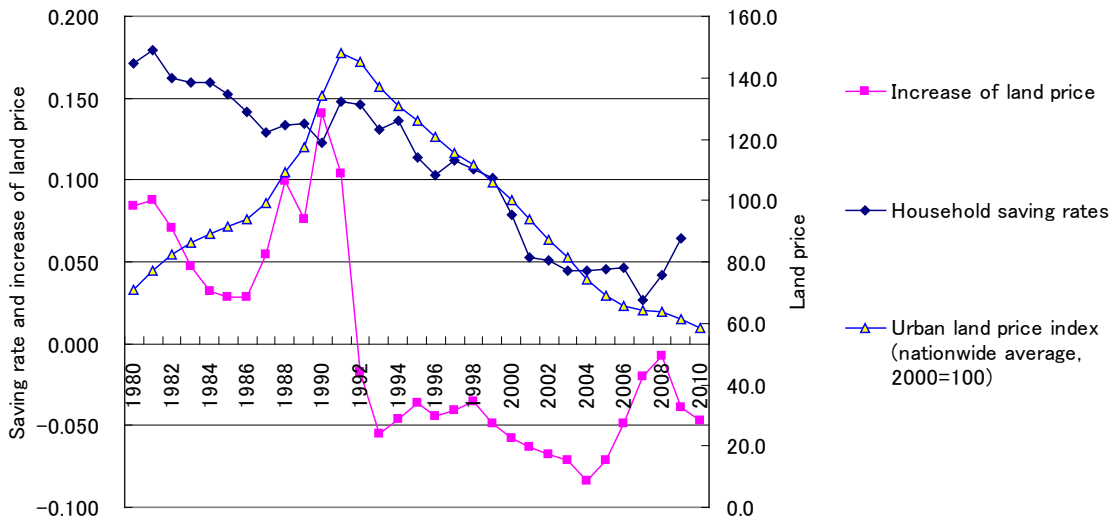


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Figure 6: Household saving rates and housing prices in the U.S., 1987-2010

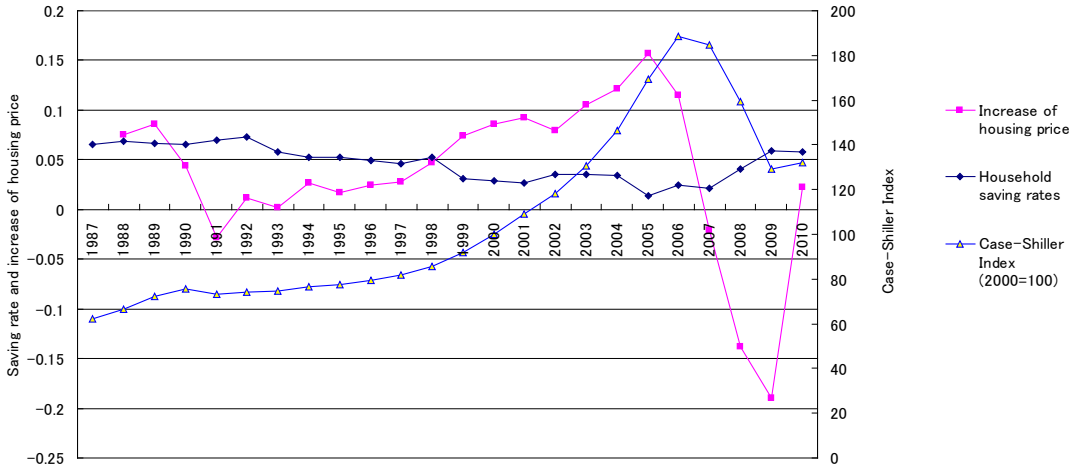

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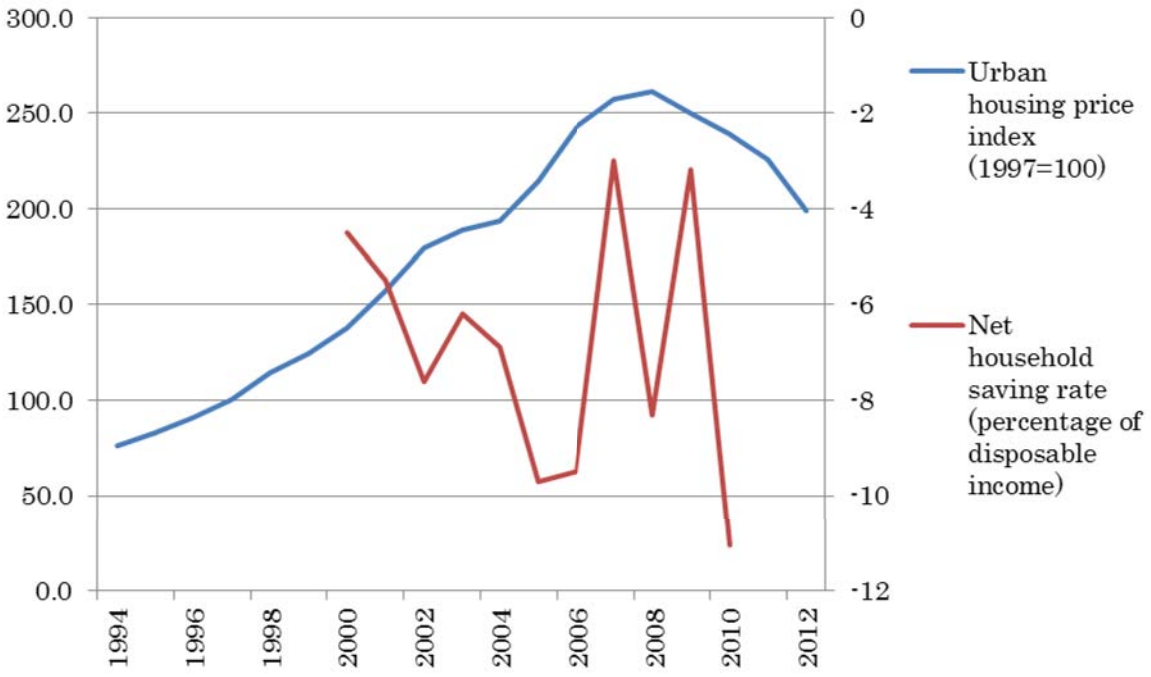
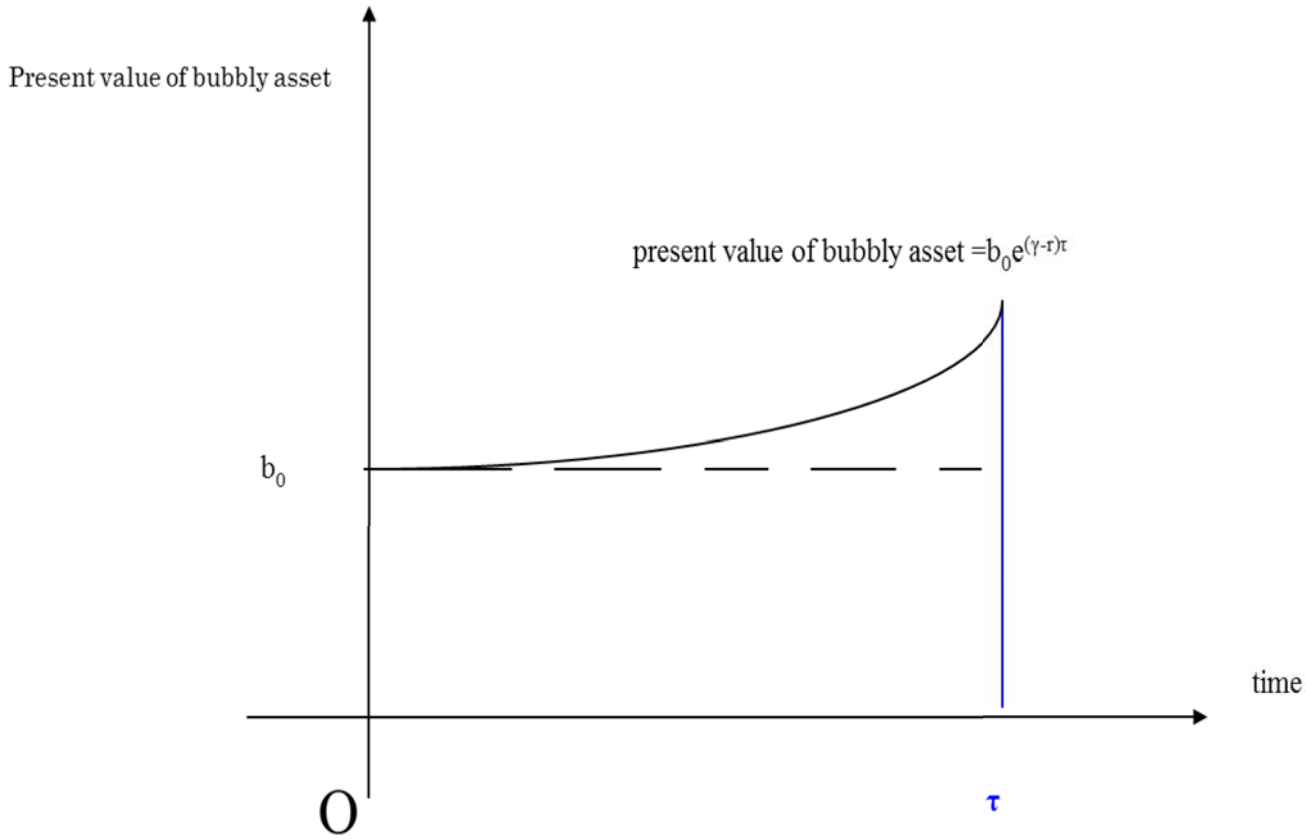
Figure 7: Household saving rates and housing prices in Greece, 1994-2012



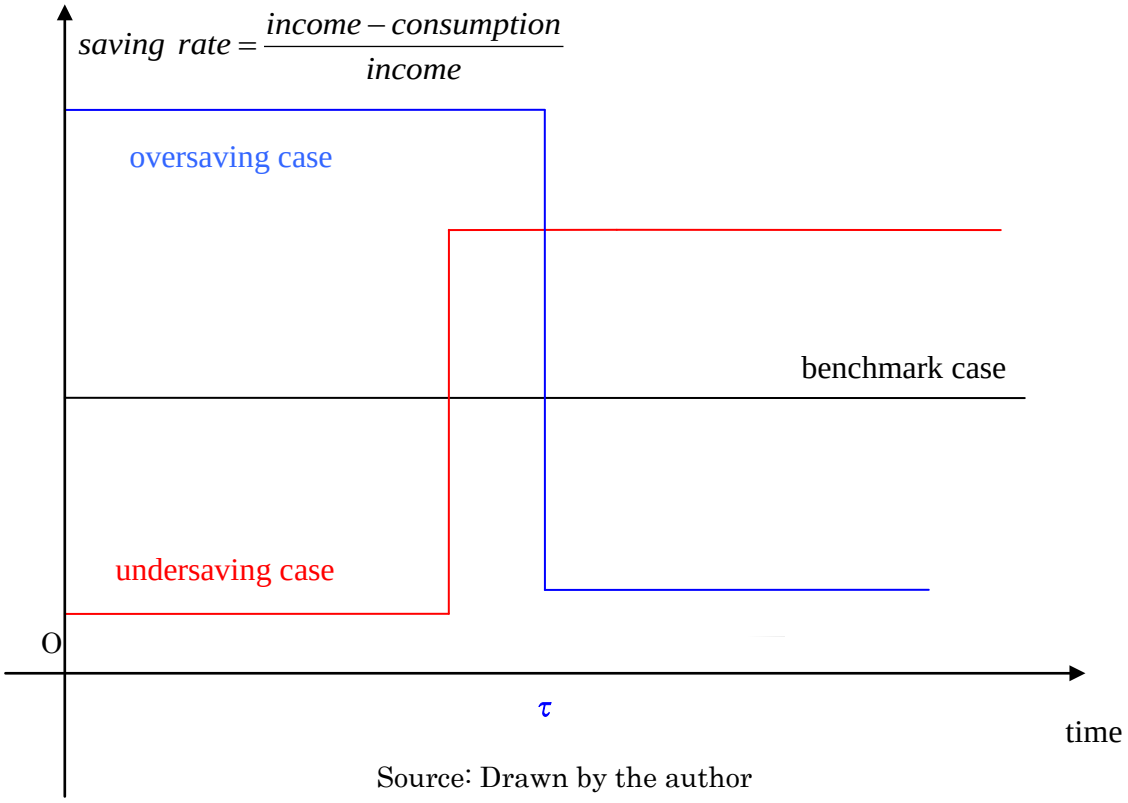
Source: The author's calculations based on data from the Bank of Greece and the national accounts of OECD countries database

Figure 8: Bubbly asset



Source: Drawn by the author

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



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