‘Perfect’ Real Estate Liquidity and Adjustment Paths to Long-run Equilibrium

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Abstract

The purpose of this paper is to formulate an example of the international macroeconomic climate with 'perfect' real estate liquidity and identify the crucial implications brought about by such extreme degrees of real estate liquidity, or 'financial' real estate. For this, we will extend the traditional Keynesian international macroeconomic model, revisited and modified in the study of Branson and Buiter (1983), and construct a simple analytical framework with reference to the recent economic climate with extreme degrees of real estate liquidity. It will be shown that, after the increase in the foreign interest rate, real estate liquidity may help reduce the fluctuations of home output along an adjustment path between one equilibrium position and another. This finding suggests that real estate liquidity may serve as a buffer against influences from foreign countries, although within the setting of a theoretical perfect market.

Keywords: Real estate liquidity, Securitization products, Adjustment paths, Keynesian open-macro framework

JEL Classification: G12, F41, E12

1. Introduction

Real estate is still a real asset, but its characteristics are becoming closer to those of financial assets. Evidence of this trend is the increased volume of securitization activities,[1] which have been stimulated by both technological progress and special law frameworks; tranquil market conditions have made securitization products seem profitable and safe,[2] attracting a wider range of investors.[3] Although the global securitization markets led to a collapse after the onset of the

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[1] See, e.g., Jobst (2008) for back-to-basics discussions of securitization activities. As any type of asset with a stable cash flow could in principle be securitized, real estate can be seen as a potential asset for securitization. Since the volume of securitization activities could also be considered a reflection of real estate liquidity, in a state where that volume is being increased, the degree of real estate liquidity would be increased and move closer to the 'perfect' level.

[2] While the term "securitization products" in this paper describes financial products derived from loans, *i.e.*, cash flows from real estate, it generally includes those products derived from student loans, credit card receivables, etc., as well. By adopting a limited definition of securitization products, we try to pose a stereotype towards which recent asset markets seem to be heading.

[3] See, e.g., IMF (2009) and Blommestein et al. (2011) for the rise and fall of the global securitization markets. IMF (2009) reported that the peak of the global private-label securitization gross issuance was at most $5 trillion in 2006, the volumes of which dropped off sharply the following year; Blommestein et al. (2011) focused on the comparison of securitization markets between the U.S. and Europe.

U.S. subprime mortgage crisis, and have not yet recovered to pre-crisis levels, this has not prevented the characteristics of real estate from changing in the direction of financial assets;[4] this change has crucial implications for the asset market and the overall economy. Rosengren (2010) pointed out that securitization, *i.e.*, financial real estate in the context of this paper, would interact with the real economy. However, such an interaction, *i.e.*, the theoretical and practical implications of financial real estate, has not yet been examined in a rigorous economic framework.[5]

The purpose of this paper is to formulate an example of the recent international macroeconomic climate with 'perfect' real estate liquidity[6] and identify the crucial implications brought by such extreme degrees of real estate liquidity, or 'financial' real estate. For this, we will extend the traditional Keynesian international macroeconomic model, revisited and modified in the study of Branson and Buiter (1983),[7] and construct a simple analytical framework with reference to the recent economic climate, which has shown extreme degrees of real estate liquidity. Firstly, we will include financial real estate, *i.e.*, liquidized real estate, in the traditional Keynesian framework and secondly, suppose an increase in the foreign interest rate, which is usually considered to be a typical influence from foreign countries.[8] We will use the model to examine the effects of this foreign interest rate hike on the levels of home output both in the short-run and long-run equilibriums. We will also examine the link between these two effects, *i.e.*, foreign interest rate effects in the short-run and long-run equilibriums, by drawing figures which reveal the relationships between the directions, *i.e.*, indicators, of each effect and the money-market environment.[9]

It will be shown that, after the increase in the foreign interest rate, real estate liquidity may help reduce the fluctuations of home output along an adjustment path between one equilibrium position and another.[10] The model with the liquidized real estate indicates the positive effect on home output both in the short-run and in the long-run, which may suggest that, after the foreign interest rate hike, the home output will adjust smoothly towards the new position in the long-run

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[4] Reports by various institutions worldwide, including IMF (2009), Blommestein et al. (2011), in the OECD Journal, and Jobst (2008), an IMF economist, have suggested that the revival of securitization markets would be a key to global economic recovery, which reflects their view on the need for securitization markets and also supports our view on changing real estate characteristics.

[5] Rosengren (2010) also pointed out that those financial links to the real economy were only crudely incorporated into most macroeconomic modeling. He called for better understanding of the links between financial intermediaries, *i.e.*, securitizers in the context of this paper, financial markets, *i.e.*, securitization markets, and the real economy, *i.e.*, GDP. IMF (2009) tracked the rise and fall of securitization markets, and evaluated the various initiatives aimed at restarting those securitization markets on a sounder footing. The IMF analysis attempted to discern how securitization, *i.e.*, increased liquidity of real estate in the context of this paper, could positively contribute to sustainable economic growth.

[6] The assumption of perfect real estate liquidity can be taken to mean that all real estate in the system is perfectly securitized and thereby exists as a securitization product in a financial asset portfolio. Note that this definition of liquidity is different from market liquidity; see, e.g., Pagano and Volpin (2008). It might also be argued that the assumption of perfect real estate liquidity is not far from the truth, as will be presented in the body of this paper.

[7] Branson and Buiter (1983) revisited the Mundel-Dornbusch model, the flexible-rate version of the Mundell-Flemming model dynamized by Dornbusch (1976). They found that Mundell's (1963) flexible-rate fiscal policy result, *i.e.*, that fiscal policy has no effect on output and employment under a flexible exchange rate, is a special case, dependent on the assumption of insensitivity of price level to movement in the exchange rate. For a discussion of the origins of the Mundell-Flemming model, see, e.g., Boughton (2003).

[8] This supposition of an increase in the foreign interest rate is in line with previous studies. See, e.g., Ehrmann and Frazcher (2009) and Wongswan (2009); they have documented that U.S. monetary policy is a global influence, which dissipates through various channels.

[9] We will take the wealth effect divided by the interest rate effect ratio as a benchmark of the money-market environment. For details, see the analysis in Section 3 and Section 4.

[10] Generally, an increase in the foreign interest rate is considered to be a typical example of the changes in key exogenous variables. It would be expected, as a result, that the patterns of increase and/or decrease in home output would also be altered.

equilibrium. Note that such a smooth transition will be dependent on the role of liquidized real estate; if we remove the effects brought about by the real estate liquidity, the same model will indicate the same positive effect only in the short-run. Simply put, without the real estate liquidity, we could expect an increase in home output in the short-run but not in the long-run, where the adjustment path will turn towards an unstable growth path.

This finding suggests that real estate liquidity may serve as a buffer against influences from foreign countries, although within the setting of a theoretical perfect market. Moreover, such a buffering effect may reverse the long-run negative effect; which is in line with the well-known situation brought by diversified investments, where a well mixed portfolio will enhance long-term performance.[11] In contrast, many recent studies have focused on the rather pessimistic idea that securitization products, with highly levered structures, were the critical factor in the magnifying effects of the crisis.[12] But if we remove leverages from the same analytical framework and analyze the same situation, we could also expect to see some positive implications of real estate liquidity.

The remainder of the paper is set out as follows. Section 2 formulates an example of the international macroeconomic climate with 'perfect' real estate liquidity; further explanation will be presented in APPENDIX 1. Section 3 examines the effects of a foreign interest rate hike on the levels of home output both in the short-run and long-run equilibriums. Section 4 examines a link between these two effects by drawing figures which reveal and highlight the relationships between the direction of each effect and a benchmark of the money-market environment. The assumptions underlying the figures will be presented in APPENDIX 2. Lastly, Section 5 states the main results and gives some concluding remarks.

2. Global Economy with 'Perfect' Real Estate Liquidity

With perfect real estate liquidity, it is appropriate to classify real estate as a financial asset, not as a real asset. In this section, we will include such a 'financial' real asset, *i.e.*, liquidized or securitized real estate, in the standard neo-Keynesian open-economy model[13] in the simplest possible way. We will try to present an example of a recent global economy with perfect real estate liquidity, which coincides with expanded securitization markets in the real world. Further notes will be presented on this model building in APPENDIX 1.

2.1 Assumption of Perfect Real Estate Liquidity

Firstly, we will explain the assumption of perfect real estate liquidity. We note that this assumption, *i.e.*, the assumption of perfect real estate liquidity, is not far from the truth in the advanced financial centers of the U.S., U.K., Germany and Japan, and also in the emerging financial centers of Australia, Singapore, and Hong Kong. These may be taken as examples where companies and investors have enjoyed the benefits associated with listed Real Estate Investment Trust (REIT) markets such as access to new investors or new capital, tax transparency, access to property for minimal outlay, portfolio diversification, liquidity, and so on. These open markets have not faded

[11] As a newly added option in private asset portfolios, liquidized real estate, *i.e.*, securitization products, will be shown to disperse the influences from foreign countries. For details, see the analysis in Section 3 and Section 4.

[12] See, e.g., Devereux and Yetman (2010). As asset values declined, highly levered financial institutions found their net worth sharply eroded; they were forced to shed assets to avoid unacceptable risks of insolvency.

[13] The setting of the neo-Keynesian open-economy model is that (1) the country is assumed to be small regarding the market for its imports and the world capital market, but (2) is assumed to be large regarding the market for its exportables.

but rather expanded despite the occurrence of the subprime mortgage crisis in 2007.[14] It would be plausible to suppose extreme degrees of real estate liquidity, *i.e.*, perfect real estate liquidity, and highlight an economy in which more companies, investors, and citizens have commonly accepted this liquid characteristic of real estate.[15] It can also be said that the assumption of perfect real estate liquidity will overstate the case, but the assumption makes it possible to formulate the simplest example of the recent international macroeconomic climate with expanded securitization markets.

Following traditional literature, we will assume perfection also in capital mobility.[16] As Mundell (1963) explained, the assumption of perfect capital mobility can be taken to mean that all securities in the system are perfect substitutes. This implies that existing exchange rates are expected to persist indefinitely. We note that Flemming (1962) also introduced capital mobility as an important aspect of exchange determination.[17] Papers by Mundell and Fleming introduced capital mobility as an important aspect of exchange determination and presented a first formulation of the assets market view.[18]

2.2 Liquidized Real Estate in the Asset Menu

Secondly, we will include liquidized real estate, *i.e.*, financial real estate, in the traditional Keynesian framework. Under the assumption of perfect real estate liquidity, and in light of the standard Keynesian open-macro model, real estate, which exists as a financial asset, *i.e.*, liquidized real estate denoted by ***LRE***, would be included in the asset menu as follows:

$$W = M + B + eF + LRE \tag{1}$$

where, on the left-hand side of Equation (1), ***W*** denotes private financial wealth, *i.e.*, a financial asset portfolio with a menu of financial assets measured in home currency. On the right-hand side, four elements, *i.e.*, ***M***, nominal stock of domestic money, ***B***, nominal stock of domestic-currency-dominated bonds, ***F***, stock of net private sector claims on the rest of the world denominated in foreign currency, and ***LRE***, liquidized real estate, construct the asset menu.[19]

In Equation (1), we have simply added ***LRE*** to the traditional asset menu. We will follow the traditional literature also in assuming that domestic and foreign bonds are perfect substitutes in private portfolios.

Note that we use ***e***, foreign exchange rate, *i.e.*, the number of units of home currency per unit of foreign currency, to convert the unit of ***F*** into domestic currency. Definitions of symbols are given in the list in Table 1.

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[14] IMF (2009) pointed out that, in light of the current constraints on lending capacity, restarting securitization could help get credit growth moving again. This IMF suggestion was based on the study by Sabry and Okongwu (2009), which demonstrated that, in the U.S. context, securitization had had positive impacts in the past on increasing the availability and lowering the cost of credit.

[15] This fact is consistent with the assumption of perfect real estate liquidity.

[16] The assumption of perfect capital mobility would possibly be a contradiction to the recent stance of the IMF, which, although within limited economic circumstances, has admitted the merit of the use of capital controls. See, e.g., Ostry et al. (2011) and Moghadam (2011), papers released by the IMF. The recent economic crisis has shattered the economic orthodoxy behind the fund's previous policies.

[17] For details, see, e.g., Boughton (2003).

[18] For details, see, e.g., Dornbusch and Fisher (1980).

[19] Case, Quigley and Shiller (2005) pointed out that wealth may take many forms and consumption may be variously affected according to the form in which wealth is held. Equation (1) stipulates the form of wealth, which includes liquidized real estate ***LRE***, *i.e.*, securitization products, by merely adding ***LRE*** to the other traditional assets such as ***M***, ***B*** and ***F***. Note that, under the assumption of perfect real estate liquidity, the amount of ***LRE*** equals the total amount of real estate.

Table 1. List of symbols

M	nominal stock of domestic currency
B	nominal stock of domestic-currency-denominated bonds
F	stock of net private sector claims on the rest of the world, denominated in foreign currency
R	stock of official foreign exchange reserves, denominated in foreign currency
q	domestic GDP in GDP units
W	private financial wealth measured in domestic currency
a	private absorption in GDP units
x	net exports in GDP units
T	real taxes
g	public spending in GDP units
i	domestic nominal interest rate
i*	foreign nominal interest rate
p	domestic general price (domestic CPI price)
V	domestic GDP price (GDP deflator)
e	foreign exchange rate (number of units of domestic currency per unit of foreign currency)
LRE	value of liquidized real estate asset under perfect real asset liquidity (private real estate holdings measured in domestic currency)

We will also note that Equation (1), *i.e.*, the formula which expresses the way we include ***LRE*** in the asset menu, affects investors' asset holdings and also affects the transmission paths of the foreign influences across the market, which has been emphasized in the models in previous studies (e.g., Kyle and Xiong, 2001; Kodres and Pritsker, 2002; Yuan, 2005).

As for the relationship between the value of ***LRE*** and the domestic nominal interest rate ***i***, we will suppose that, as ***i*** increases, ***LRE*** may be reduced. Simply put, we will define ***LRE*** as a decreasing function of ***i***:

$$LRE'(i) < 0 \qquad (2)$$

where an increase in ***i*** decreases ***LRE***. Note that Equation (2) is consistent with the cash-flow-based valuation, which, in general, has been used in the process of assessing real estate for asset securitizations.

2.3 Definitions of Equilibriums

Our definitions of equilibriums, *i.e.*, definitions of short-run/instantaneous flow equilibrium and long-run stock equilibrium, are essentially the same as those in Branson and Buiter (1983). We will also use the same setting on the domestic general/CPI price, denoted by ***p***; we will suppose that ***p*** is a decreasing function of the foreign exchange rate ***e*** and express one as $p = p(e)$ and assume that $p(e)' > 0$. In line with the traditional literature, we will assume perfect substitutability and the arbitrage condition with risk-neutral speculation as:

$$i = i^* + \frac{\dot{e}}{e} \qquad (3)$$

where ***i**** denotes the foreign nominal interest rate and ***e*** denotes the foreign exchange rate. Equation (3) may reflect the situation in which the domestic nominal interest rate, *i.e.*, an index of the domestic economic climate, would be directly affected by interest rate movements in foreign

countries or the rest of the world.[20]

2.4 Conditions for Short-run Flow Equilibrium

Short-run flow equilibrium is defined by the ***IS-LM*** equilibrium conditions.[21] If liquidized real estate ***LRE*** was included in the asset menu ***W***, as expressed in Equation (1), the short-run equilibrium conditions determining the values of ***e*** and ***q*** are:

$$\frac{M}{p} = L(i^* + \frac{\dot{e}}{e}, \frac{Vq}{p}, \frac{M+B+eF+LRE}{p}) \tag{4}$$

$$a(i^* + \frac{\dot{e}}{e} - \frac{\dot{p}}{p}, \frac{V}{p}(q-g) + \frac{i^* eF}{p}, \frac{M+B+eF+LRE}{p}) + \frac{V}{p}g + x(i^* + \frac{\dot{e}}{e} - \frac{\dot{p}}{p}, \frac{V}{p}(q-g) + \frac{i^* eF}{p}, \frac{M+B+eF+LRE}{p}, \frac{e}{p}) = \frac{V}{p}q \tag{5}$$

Here, Equation (4) is an ***LM*** curve describing money-market equilibrium, and Equation (5) is an ***IS*** curve describing goods market equilibrium; ***q*** is domestic output, ***a*** is private absorption, ***g*** is government purchases, and ***x*** is net exports. At the same time, the following conditions are Assumed: $L_1 < 0$, $L_2 > 0$ and $L_3 > 0$ for real money demand in Equation (4); $a_1 < 0$, $a_2 > 0$ and $a_3 > 0$ for private absorption in Equation (5), and $x_1 > 0$, $x_2 < 0$ and $x_3 < 0$ for net exports in Equation (5).

In this simultaneous system of Equation (4) and Equation (5), real tax revenue, denoted by ***T***, has been canceled out by use of the open-economy government budget constraint:

$$\frac{\dot{M}}{p} + \frac{\dot{B}}{p} + \frac{ei^* R}{p} + T = \frac{V}{p}g + \frac{iB}{p} + \frac{e\dot{R}}{p} \tag{6}$$

As we follow Branson and Buiter (1983) and examine the case in which the conditions $\dot{B} = 0$, $B > 0$, $\dot{R} = R = 0$ and $\dot{M} = 0$ hold, the open-economy government budget constraint, expressed in Equation (6) above, has also been transformed into:

$$T = \frac{V}{p}g + \frac{iB}{p} \tag{7}$$

Here $\dot{B} = 0$ means that the government does not engage in flow open market operation and does not sterilize balance of payments deficits or surpluses; $B > 0$ shows that there is a pre-existing stock of government debt; $\dot{R} = R = 0$ holds under a floating exchange rate; and $\dot{M} = 0$ means there are no continuous open market operations.

2.5 Conditions for a Long-run Stock Equilibrium

A long-run stock equilibrium is defined by the ***IS-LM*** equilibrium plus current account balance.[22]

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[20] As Branson and Buiter (1983) explained, this setting would also permit us to focus on the importance of exclusion of the exchange rate from the money-market equilibrium condition. Kim (2001) found that the interest rate reaction in other countries was the most important channel of transmission. Also, Hausman and Wongswan (2011) and Canova (2005) showed that U.S. monetary policy also affects foreign short-term interest rates. Ammer, Vega and Wongswan (2010) added that foreign firms tend to be more sensitive to U.S. monetary policy if they are based in countries with exchange rates pegged to the U.S. dollar.

[21] As will be apparent in Equation (5), an ***IS*** curve shown below, the real exchange rate, ***e/p***, adjusts to provide offsetting valuation in ***x*** to movements in ***g***. This implies that in monetary equilibrium the current account balance is, in general, non-zero. This is why an instantaneous short-run equilibrium does not require any current account balance other than the ***IS-LM*** equilibrium conditions. For details, see also Branson and Buiter (1983).

[22] Constraints of long-run portfolio balance would require balance on the current account in the long-run equilibrium. This point contradicts the movements of the Mundell- Dornbusch model [See, Mundell (1961), (1963) and (1968); Dornbusch

As the condition $\dot{e} = \dot{V} = \dot{F} = \dot{p} = 0$ holds in a steady state, the long-run equilibrium conditions determining the steady-state values of ***e***, ***q*** and ***F*** are:

$$\frac{M}{p} = L(i^*, \frac{Vq}{p}, \frac{M + B + eF + LRE}{p}) \tag{8}$$

$$a(i^*, \frac{V}{p}(q-g) + \frac{i^* eF}{p}, \frac{M + B + eF + LRE}{p}) + \frac{V}{p}g + x(i^*, \frac{V}{p}(q-g) + \frac{i^* eF}{p}, \frac{M + B + eF + LRE}{p}, \frac{e}{p}) = \frac{V}{p}q \tag{9}$$

$$-i^* eF = px(i^*, \frac{V}{p}(q-g) + \frac{i^* eF}{p}, \frac{M + B + eF + LRE}{p}, \frac{e}{p}) \tag{10}$$

Here Equation (8) is an ***LM*** curve, Equation (9) is an ***IS*** curve, and Equation (10) is a ***BP*** curve describing current account balance. In the short-run equilibrium, the condition $\dot{F} = 0$ does not hold[23] and so the ***BP*** curve is expressed as Equation (11) below:

$$e\dot{F} - i^* eF = px(i^* + \frac{\dot{e}}{e} - \frac{\dot{p}}{p}, \frac{V}{p}(q-g) + \frac{i^* eF}{p}, \frac{M + B + eF + LRE}{p}, \frac{e}{p}) \tag{11}$$

where the left-hand side expresses net factor income, *i.e.*, primary income account, and the right-hand side expresses the overall trade balance, *i.e.*, goods and services account. In line with the traditional literature, we do not consider transfer payments, *i.e.*, secondary income account, in our basic analytical framework.

3. Effects of the Foreign Interest Rate Hike

In this section we will use the model presented in the previous section and try to identify the crucial implications of the increased liquidity of real estate. Specifically, we will suppose an increase in the foreign interest rate and will examine its effect on the levels of home output both in the short-run and long-run equilibriums. As an increase in the foreign interest rate can be considered as one of the many typical influences from foreign countries, any reactions to that interest rate change would also reflect the role of real estate liquidity. As shown by Ammer et al. (2010) and Devereux and Yetman (2010), for example,[24] this section can also reveal a transmission channel which may affect the patterns of fluctuations of home output along an adjustment path between one equilibrium position and another.

3.1 Short-run Effects

In order to derive the short-run effects of the foreign interest rate hike, we firstly transform the short-run equilibrium condition of Equation (4) and (5).

(1976) and (1980)], and the lack of this point from their traditional settings has been noted earlier by Branson (1972) and Buiter (1978).

[23] The ***IS*** and ***LM*** schedules will not settle to a full equilibrium as long as net foreign investment is above zero; *i.e.*, in the long-run equilibrium, the current account balance must be zero. In contrast, as Branson (1972) and Buiter (1978) noted earlier, the Mundell-Dornbusch model permits current account imbalance indefinitely.

[24] Ammer et al. (2010) specified the four channels of monetary policy transmission, *i.e.*, the demand channel, the credit channel, the portfolio channel, and the foreign interest rate channel; the analysis in this section will be associated with the portfolio channel and the foreign interest rate channel. Devereux and Yetman (2010) compared how macro-influences are transmitted under different financial market structures, focusing on leverage constraints. They developed a two-country model in which investors borrow from savers and invest in fixed assets.

If the demand for money, private absorption, and net exports are homogeneous of degree 1 in real income and wealth, then the short-run equilibrium conditions, *i.e.*, the simultaneous system in ***e*** and ***q***, expressed above by Equation (4) and Equation (5), can be rewritten as:

$$\frac{M}{V} = L(i^* + \frac{\dot{e}}{e}, q, \frac{M + B + eF + LRE}{V}) \tag{12}$$

$$a(i^* + \frac{\dot{e}}{e} - \frac{\dot{p}}{p}, q - g + \frac{i^* eF}{V}, \frac{M + B + eF + LRE}{V}) + g + x(i^* + \frac{\dot{e}}{e} - \frac{\dot{p}}{p}, q - g + \frac{i^* eF}{V}, \frac{M + B + eF + LRE}{V}, \frac{e}{V}) = q \tag{13}$$

Then take the total differential of Equation (12) and Equation (13) to obtain

$$\begin{matrix} & A & & & B \end{matrix}$$

$$\begin{bmatrix} L_2 & L_3\frac{F}{V} & L_3\frac{e}{V} \\ a_2 + x_2 - 1 & a_2\frac{i^*F}{V} + a_3\frac{F}{V} + x_2\frac{i^*F}{V} + x_3\frac{F}{V} + x_4\frac{1}{V} & a_2\frac{i^*e}{V} + a_3\frac{e}{V} + x_2\frac{i^*e}{V} + x_3\frac{e}{V} \end{bmatrix} \begin{bmatrix} dq \\ de \\ dF \end{bmatrix} = - \begin{bmatrix} L_1 + L_3\frac{1}{V}\frac{\partial LRE}{\partial i^*} \\ a_1 + a_2\frac{eF}{V} + a_3\frac{1}{V}\frac{\partial LRE}{\partial i^*} + x_1 + x_2\frac{eF}{V} + x_3\frac{1}{V}\frac{\partial LRE}{\partial i^*} \end{bmatrix} di^* \tag{14}$$

Here the determinant of coefficient matrix $Det(A) < 0$. The solution for a change in ***i**** is given by

$$\frac{dq}{di^*} = \frac{1}{Det(A)}\left[\left\{((a_2 + x_2)i^* + (a_3 + x_3))\frac{F}{V} + \frac{x_4}{V}\right\}L_1 - \left\{(a_1 + x_1) + (a_2 + x_2)\frac{eF}{V} - ((a_2 + x_2)i^* - \frac{x_4}{F})\frac{1}{v}\frac{\partial LRE}{\partial i^*}\right\}\frac{F}{V}L_3\right] \tag{15}$$

where the indicators of $\frac{dq}{di^*}$ determine the short-run effect of a foreign interest rate hike on the domestic GDP. If this indicator in Equation (15) is positive, *i.e.*, $\frac{dq}{di^*} > 0$ holds, an increase in the foreign interest rate improves domestic output; if negative, *i.e.*, $\frac{dq}{di^*} < 0$ holds, the same increase eliminates domestic output.

Firstly, we suppose $\frac{dq}{di^*} > 0$ in Equation (15) above and transform one with respect to $\frac{L_3}{L_1}$ [25] to obtain

$$\frac{L_3}{L_1} < \frac{\left\{(a_2 + x_2)i^* + (a_3 + x_3)\right\}\frac{F}{V} + \frac{x_4}{V}}{\left[\left\{(a_1 + x_1) + (a_2 + x_2)\frac{eF}{V}\right\} - \left\{(a_2 + x_2)i^* - \frac{x_4}{F})\right\}\frac{1}{V}\frac{\partial LRE}{\partial i^*}\right]\frac{F}{v}} \tag{16}$$

Here, the right-hand side of Equation (16) expresses the boundary value, which determines the indicators of the foreign interest rate hike results. As long as $\frac{L_3}{L_1}$ is smaller than this value, an increase in ***i**** raises domestic output ***q***. If we expect a positive short-run effect after the foreign interest rate hike, the wealth effect divided by interest rate effect ratio should take a value below a certain level.

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[25] $\frac{L_3}{L_1}$ is the ratio of the two partial differential coefficients, L_3, which represents the direction of the wealth effect for real money demand, and L_1, which represents the effect of an increase in the foreign interest rate on the demand for real money. Simply put, it expresses the wealth effect, L_3, divided by the interest rate effect, L_1, ratio.

3.2 Long-run Effects

For the long-run effects, similarly, we firstly transform the long-run equilibrium condition of Equation (8) - (10).

If the demand for money, private absorption, and net exports are homogeneous of degree 1 in real income and wealth, then the long-run equilibrium conditions given by Equation (8) - (10) can be rewritten as:

$$a(i^*, q-g+\frac{i^* eF}{V}, \frac{M+B+eF+LRE}{V}) + g + x(i^*, q-g+\frac{i^* eF}{V}, \frac{M+B+eF+LRE}{V}, \frac{e}{V}) = q \tag{17}$$

$$\frac{M}{V} = L(i^*, q, \frac{M+B+eF+LRE}{V}) \tag{18}$$

$$x(i^*, q-g+\frac{i^* eF}{V}, \frac{M+B+eF+LRE}{V}, \frac{e}{V}) + \frac{i^* eF}{V} = 0 \tag{19}$$

Then take the total differential of Equations (17) - (19) to obtain

$$\underset{\alpha}{\begin{bmatrix} L_2 & L_3\frac{F}{V} & L_3\frac{e}{V} \\ a_2+x_2-1 & a_2\frac{i^*F}{V}+a_3\frac{F}{V}+x_2\frac{i^*F}{V}+x_3\frac{F}{V}+x_4\frac{1}{V} & a_2\frac{i^*e}{V}+a_3\frac{e}{V}+x_2\frac{i^*e}{V}+x_3\frac{e}{V} \\ x_2 & x_2\frac{i^*F}{V}+x_3\frac{F}{V}+x_4\frac{1}{V}+\frac{i^*F}{V} & x_2\frac{i^*e}{V}+x_3\frac{e}{V}+\frac{i^*e}{V} \end{bmatrix}} \begin{bmatrix} dq \\ de \\ dF \end{bmatrix} = - \underset{\beta}{\begin{bmatrix} L_1+L_3\frac{1}{V}\frac{\partial LRE}{\partial i^*} \\ a_1+a_2\frac{eF}{V}+a_3\frac{1}{V}\frac{\partial LRE}{\partial i^*}+x_1+x_2\frac{eF}{V}+x_3\frac{1}{V}\frac{\partial LRE}{\partial i^*} \\ x_1+x_2\frac{eF}{V}+x_3\frac{1}{V}\frac{\partial LRE}{\partial i^*}+\frac{eF}{V} \end{bmatrix}} di^* \tag{20}$$

Here the determinant of coefficient matrix $Det(\alpha) < 0$. The solution for a change in i^* is given by

$$\frac{dq}{di^*} = \frac{1}{Det(\alpha)} \frac{X_4 e}{V^2} \left[-\{(x_2-1)i^* + x_3\} L_1 + \left[a_1 + (a_2-1)\frac{eF}{V} - \{(x_2-1)i^* + x_3\} \frac{1}{v} \frac{\partial LRE}{\partial i^*} \right] L_3 \right] \tag{21}$$

where the indicators of $\frac{dq}{di^*}$ determine the long-run effect of a foreign interest rate hike on domestic GDP. If this indicator in Equation (21) is positive, *i.e.*, $\frac{dq}{di^*} > 0$ holds, an increase in the foreign interest rate improves domestic output; if negative, *i.e.*, $\frac{dq}{di_*} < 0$ holds, the same increase eliminates domestic output.

Firstly we suppose $\frac{dq}{di^*} > 0$ in Equation (21) above and transform one with respect to $\frac{L_3}{L_1}$ to obtain

$$\frac{L_3}{L_1} < \frac{(x_2-1)i^* + x_3}{a_1 + (a_2-1)\frac{eF}{V} - \{(x_2-1)i^* + x_3\}\frac{1}{v}\frac{\partial LRE}{\partial i^*}} \tag{22}$$

Here, similarly, the right-hand side of Equation (22) expresses the boundary value, which determines the indicators of the foreign interest rate hike results. As is similar to the case for the short-run effects, as long as $\frac{L_3}{L_1}$ is smaller than this value, an increase in i^* raises domestic output q. If we expect a positive long-run effect after the foreign interest rate hike, the wealth effect divided by the interest rate effect ratio should take a value below a certain level.

4. Link between Short-run and Long-run Effects

In this section, we will examine the link between the short-run and long-run effects, *i.e.*, the effects of the foreign interest rate hike in short-run and long-run equilibriums. Based on the analysis in the preceding section, we attempt to reveal the patterns of fluctuations in home output along an adjustment path between one equilibrium position, *i.e.*, the equilibrium position before the foreign interest rate hike, and another, *i.e.*, the equilibrium position after the foreign interest rate hike. Note that, on the adjustment path to the long-run equilibrium, the home economy will firstly reach the position in short-run equilibrium, where the ***IS-LM*** equilibrium conditions hold.

4.1 Visualized Link

Figure 1 reveals the link between each of these directions, *i.e.*, indicators, of the short-run and long-run effects and $\frac{L_3}{L_1}$, *i.e.*, the wealth effect divided by the interest rate effect ratio, used as a benchmark of the money-market environment. The assumptions underlying this figure will be explained in the APPENDIX 2.

Figure1. Case with Perfect Real Estate Liquidity

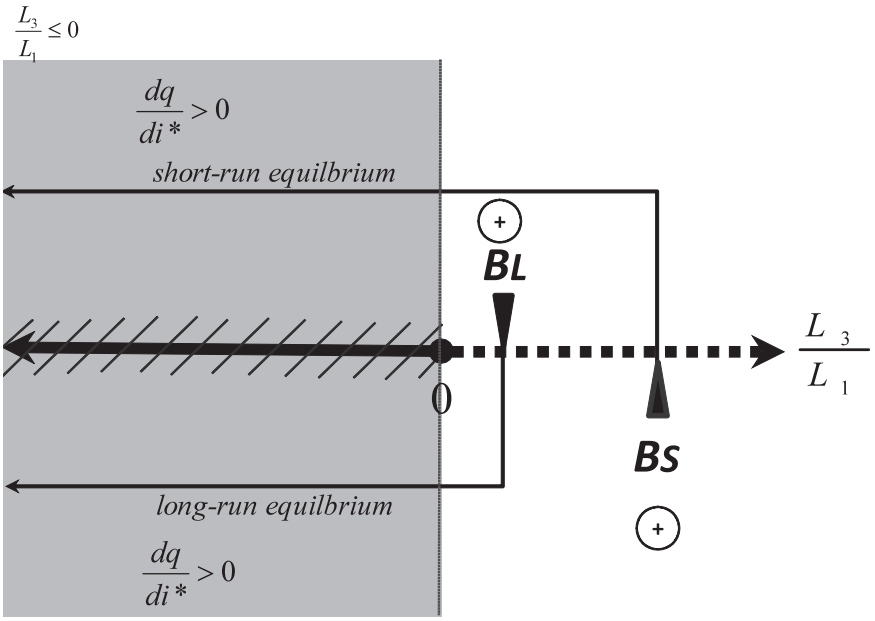

Figure 1 marks each of the boundary values of Equations (16) and (22). The mark on the right, expressed by $\boldsymbol{B_s}$, corresponds to the term on the right-hand side of Equation (16). In the case in which $\frac{L_3}{L_1}$ is smaller than this marked value $\boldsymbol{B_s}$, domestic output $\boldsymbol{q}$ will be increased towards short-run equilibrium after the foreign interest rate hike. In contrast, the mark on the left, expressed by $\boldsymbol{B_L}$, corresponds to the term on the right-hand side of Equation (22). In the case in which $\frac{L_3}{L_1}$ is smaller than this marked value $\boldsymbol{B_L}$, domestic output $\boldsymbol{q}$ will be increased towards the long-run equilibrium after the foreign interest rate hike.

The crucial point is that both $\boldsymbol{B_s}$ and $\boldsymbol{B_L}$ are expected to be larger than zero, *i.e.*, both the boundary values which determine the short-run and long-run effects would lie in the range

$0 < \frac{L_3}{L_1}$; this result contradicts the domain of $\frac{L_3}{L_1}$, *i.e.*, the shaded area in Figure 1 where $\frac{L_3}{L_1} \leq 0$ holds.[26] As Figure 1 shows, if we use the model with perfect real estate liquidity and analyze the directions/indicators of the short-run and long-run effects, both the short-run and long-run effects would be found to be positive. This finding suggests the possibility that, with perfect real estate liquidity, the foreign interest rate hike will bring a smooth adjustment path to a long-run equilibrium, *i.e.*, from the long-run perspective, the pattern of fluctuations of the home output along an adjustment path towards long-run equilibrium is shown to be stable.

4.2 The Role of Liquidized Real Estate

In this subsection, we will proceed to the analysis of the role of liquidized real estate ***LRE***. For this, we simply remove the effects associated with ***LRE*** from the previous framework, presented above, and re-draw the figure as follows:

Figure2. Case without Real Estate Liquidity

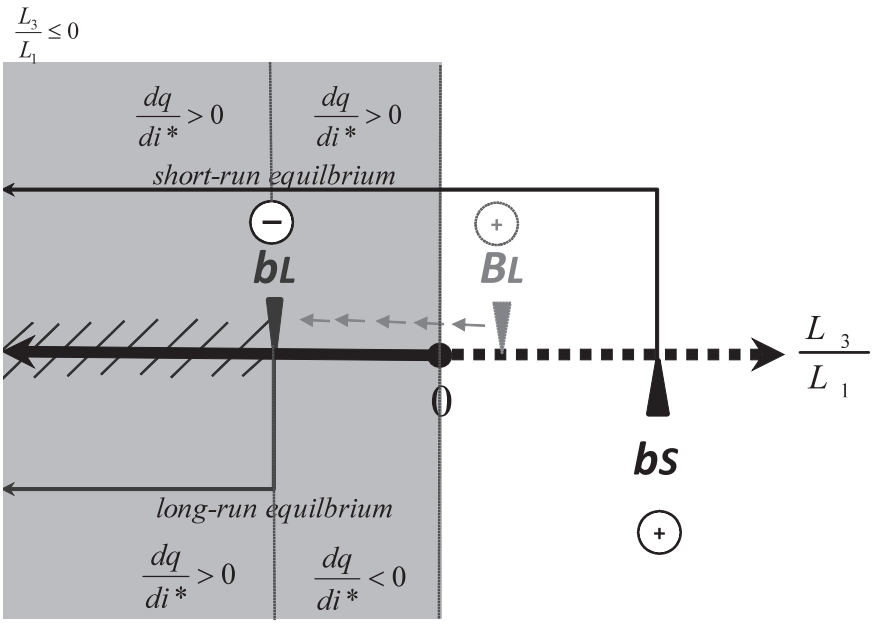

Figure 2 similarly marks each of the boundary values of Equations (16) and (22), but these values in contrast do not include the effects associated with ***LRE***. The assumptions underlying Figure 2 are the same as those for Figure 1, explained in APPENDIX 2. The shaded area in Figure 2 also shows the domain within which $\frac{L_3}{L_1} \leq 0$ holds.

In Figure 2, the mark on the right, expressed by $\boldsymbol{b_s}$, corresponds to the term on the right-hand side of Equation (16) under the assumption of $\frac{\partial LRE}{\partial i^*} = 0$. Similarly, in the case in which $\frac{L_3}{L_1}$ is smaller than the new marked value $\boldsymbol{b_s}$, domestic output $\boldsymbol{q}$ will be increased towards the short-run equilibrium after the foreign interest rate hike. Note that, this new boundary value $\boldsymbol{b_s}$ is also

[26] As we suppose $L_1 < 0$ and $L_3 > 0$, $\frac{L_3}{L_1}$ always takes values smaller than zero, i.e., $0 \leq \frac{L_3}{L_1}$ holds.

expected to be larger than zero, and thus the short-run effect becomes positive. On the other hand, the mark on the left, expressed by b_L, corresponds to the term on the right-hand side of Equation (22) under the assumption of $\frac{\partial LRE}{\partial i^*} = 0$.

The crucial point is that b_s is expected to be larger than zero, but b_L is expected to be smaller than zero, *i.e.*, the boundary values which determine the short-run and long-run effects would lie in the different ranges across zero.[27] This finding suggests that, if $\frac{L_3}{L_1}$ takes values within the shaded area between b_L and zero, *i.e.*, the area within which $b_L < \frac{L_3}{L_1} \leq 0$ holds, domestic output q will be increased in the short-run but decreased in the long-run.[28]

This finding suggests the possibility that, without real estate liquidity, the positive foreign interest rate effect will be reversed in the long-run. It could also be said that the pattern of fluctuations in home output along an adjustment path towards long-run equilibrium would be unstable. As Figure 2 shows, if we use the model without real estate liquidity and analyze the directions/indicators of the short-run and long-run effects, the short-run effect would be found to be positive, but the long-run effects to be negative.

4.3 Adjustment Paths to a Long-run Equilibrium

In the final subsection, we will summarize the derived "adjustment paths" or "patterns of home output fluctuations" towards a long-run equilibrium. Table 2 presents those findings. Note also that they are all based on the assumptions explained in APPENDIX 2.

Table 2. "Adjustment Paths" or "Patterns of Home Output Fluctuations" to Long-run Equilibrium

(ⅰ) Case with Perfect Real Estate Liquidity

	boundary value	indicator of boundary value	effect of foreign interest rate hike on home output	adjustment path to long-run equilibrium
short-run equilibrium	B_S	+	+	**stable**
long-run equilibrium	B_L	+	+	

(ⅱ) Case *without* Perfect Real Estate Liquidity

	boundary value	indicator of boundary value	effect of foreign interest rate hike on home output	adjustment path to long-run equilibrium
short-run equilibrium	b_S	+	+	**stable**
long-run equilibrium	b_L	−	+ (if $L_3/L_1 < b_L$)	
			− (if $b_L < L_3/L_1 \leqq 0$)	**unstable**

[27] The boundary value which determines the long-run effect would lie within the shaded area in Figure 2, where $\frac{L_3}{L_1} \leq 0$ holds. However, that of the short-run effect would not lie within the same area.

[28] More concretely, Figure 2 shows the possibility that domestic output will be pushed up by the positive power in the short-run, but will be pushed down by the negative power in the long-run.

It should be noted that the findings presented in Table 2 are consistent with countries with sufficiently matured markets and industries. As is explained in Appendix 2, the relative degree of the marginal propensity to consume, as opposed to the marginal propensity to import, *i.e.* a national taste which favors local products over imports, and the stock of net private sector claims on the rest of the world have played key roles in our analysis. Thus our findings are, for now, applicable to the sufficiently industrialized countries with a wide range of manufacturing. It should also be noted that all the assumptions or settings are consistent with each other; thus the generality of our findings can be maintained.

5. Conclusions

We have demonstrated that real estate liquidity may serve as a buffer against influences from foreign countries, although within the setting of a theoretical perfect market. In the position of a short-run equilibrium, the foreign interest rate hike has a positive effect on home output under real estate non-liquidity, while, in the position of a long-run equilibrium, the same interest rate hike has a negative effect. On the other hand, under 'perfect' real estate liquidity, both in the positions of short-run and long-run equilibriums, the foreign interest rate hike has a positive effect.

Simply put, without real estate liquidity, the positive foreign interest rate effect in the short-run would be reversed in the long-run. It could also be said that the patterns of fluctuations in home output along an adjustment path towards long-run equilibrium would be stable under perfect real estate liquidity while unstable under real estate non-liquidity.

Note that, our findings contradict previous studies which focused on the fact that those structured products, *i.e.*, securitization products in our context, had been a critical factor in magnifying the effects of the financial crisis. However, if we remove their settings such as informational asymmetry, lack of investors' confidence, leverages, sensitivity to portfolio adjustment, and so on, and formulate an example of a theoretical perfect market, we would expect findings which suggest the essential role of real estate liquidity.

Our findings are consistent with reports by various international institutions. IMF (2009), Blommestein et al. (2011), in the OECD Journal, and Jobst (2008), an IMF economist, have suggested that the revival of securitization markets would be a key to global economic recovery, which reflects their view on the need for securitization markets and also supports our view on changing real estate characteristics.

If my assumption about real estate liquidity were valid in Europe, it would mean that liquidized real estate would serve as a buffer against influences from countries outside the region. After the interest rate hike in the areas outside the EU, *i.e.*, outside the monetary union in more specific terms, the aggregate income of the countries within the EU would firstly be deterred from the current growth path and then switch to an adjustment path towards long-run equilibrium. This adjustment path would be stable under extreme degrees of real estate liquidity while, under the zero degree of real estate liquidity, *i.e.*, real estate non-liquidity, the an adjustment path would turn out to be unstable .

Naturally, the assumption of perfect real estate liquidity, as well as the assumption of perfect capital mobility, is not literally valid. As was pointed out by Mundell (1963), my conclusions are also black and white rather than showing shades of gray. It should also be noted that Mundell put forward the theory of optimum currency areas (Mundell 1961, 1973); such areas, *i.e.*, OCAs, may not only satisfy perfect capital mobility, but can also be extended in a framework with perfect real estate liquidity.

Appendix 1

Appendix 1 will present a further note on the model building. In this paper, we modified the model analyzed in Branson and Buiter (1983), who commented that, when the scale elasticity of money demand was unity, their model was essentially the same as that analyzed in Dornbush and Fisher (1980), except for the inclusion of domestic government bonds in the asset menu and of fiscal variables.

Stating that, with respect to the scale elasticity of money demand, our model can be considered as a Branson-and-Buiter type Keynesian framework, which has the unit scale elasticity of money demand. This produces as simple a model as possible and highlights the role of liquidized real estate, expressed by ***LRE***, in the open-macroeconomic framework.

Note that Fujita (1998) maintained a Branson-and-Buiter type setting of the scale elasticity of money demand; a degree of that elasticity was one of the main focuses of his study. He revisited their conclusions on the link between that elasticity and the effectiveness of fiscal policy under a floating exchange rate and perfect capital mobility and found differences in fiscal policy effectiveness between the short-run and long-run. We followed Fujita (1998) in assuming that real financial wealth affects real money demand, which was the same as the approach adopted in the Mundell-Fleming model, and also affects net exports, which was a modification of that adopted in Branson-Buiter model.

Appendix 2

Appendix 2 will explain the assumptions that underlie Figure 1 and 2, presented in Section 4. Specifically, those assumptions are:

$$a_2 + x_2 > 0 \tag{A1}$$

$$a_3 + x_3 > 0 \tag{A2}$$

$$F \geq 0 \tag{A3}$$

Here, Assumption (A1) corresponds to the relative size of the marginal propensity to consume, *i.e.*, ***MPC***, to the marginal propensity to import, *i.e.*, ***MPM***. Specifically, (A1) can also be expressed as:

$$|a_2| > |x_2| \tag{A1'}$$

Where $|a_2|$ expresses the amounts of marginal increase in domestic absorption due to the increase in disposable income, given the setting of $a_2 > 0$; $|x_2|$, the amounts of marginal increase in net exports due to the increase in disposable income, given the setting of $x_2 < 0$. This relation stipulates a national taste which favors local products over imports. Thus the economy with the assumption of (A1) or (A1') can also be taken as an industrialized economy, which may be well able to satisfy a wide range of domestic demands.

Similarly, Assumption (A2) corresponds to the relative size of the marginal wealth effect on consumption to the marginal wealth effect on imports, which also is expressed as:

$$|a_3| > |x_3| \tag{A2'}$$

Where $|a_3|$ expresses the amounts of marginal increase in domestic absorption due to the increase in real private financial wealth, given the setting of $a_3 > 0$; and $|x_3|$ the amounts of marginal increase in net exports due to the increase in real private financial wealth, given the setting of $x_3 < 0$. This relation also stipulates a national taste which favors local products over imports.

Thereby the assumption of (A2), or (A2'), can be taken to support the economic situation stipulated by (A1), or (A1'), presented above.

Note that assumption (A3) is consistent with these assumptions. If the economy is sufficiently industrialized and has a wide range of manufacturing, which is stipulated by (A1) and (A2), it is natural for the economy to have a stock of net private sector claims on the rest of the world, *i.e.*, $F \geq 0$ holds. We should also note that if the economy has a negative stock of such private sector claims, *i.e.*, $F < 0$ holds, these two assumptions, (A1) and (A2), would possibly be invalid.

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