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Housing Market and Current Account Imbalances in the International Economy

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Abstract

This paper presents a two-sector, two-country model showing that inflation in the housing market, a low personal savings rate, and a construction investment boom can contribute to a large current account deficit. In the model, demand by a group of households in the domestic country is constrained by the availability of collateral. This implies more procyclical debt capacity because constrained households can borrow against the increase in the value of their houses during an expansion. A higher degree of financial liberalization and development helps constrained households reach higher loan-to-value ratios, thus relaxing their borrowing constraints. The resulting higher net worth and lower need for savings imply a worsening current account.

JEL Classifications: E2, E32, F32, F41, J22.

1 Introduction

Several economies have experienced substantial appreciation in housing prices over the past decades and a strong appreciation in recent years, with contemporaneous large external deficits (relative to their GDP) and strong decline in household savings.

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Taking into account these stylized facts, this paper seeks to explore whether there is a systematic negative relationship between housing prices and the current account. The paper assess the quantitative impact of this link by using a two-sector, two-country, dynamic, stochastic, general equilibrium model with heterogeneous agents and a financial accelerator mechanism. In the model, changes in housing prices are generated by aggregate technology shocks, housing preference shocks and loan-to-value shock. Houses are durable goods, which provide valuable services and serve as collateral for loans. The wealth effects from housing appreciation boosts household consumption and better access to credit improves investment opportunities. A more flexible financial sector due to the financial liberalization improves liquidity by augmenting funding to the whole economy, and thus contributing to the recent run-up in global asset imbalances. Table 1 shows the importance in the data of the housing market in determining the current account dynamics. **[INSERT Table 1 here]**. Housing variables have negative correlation with the current account.[1] The correlations have strengthened since 1990, which has been a period of financial liberalization and deregulation.

The model is specified with two types of production because the real estate sector requires different efforts and is subject to different risks than other production sectors.[2] In particular, Greenwood and Hercowitz (1991) and Greenwood, Hercowitz and Krusell (2000) built a set of dynamic general equilibrium models to reproduce jointly the business and the residential investment cycles observed in the U.S.[3] Similarly, the model assumes a common shock affecting both productivity sectors, but unlike them, households face credit constraints and housing acts as a collateral in borrowing. Moreover, innovations in the mortgage markets intensify the collateral role of housing and strengthen

[1] Aizenman and Jinjarak (2009) showed that the current account is negatively correlated with appreciations in real estate prices, using cross-country data from 43 countries, including 25 OECD countries. They obtained this result by regressing changes in real estate prices on the ratio of the current account to GDP in various regression forms, controlling for lagged urban population growth, per capita GDP growth, inflation, financial depth, institution, and the real interest rate.

[2] See Greenwood and Hercowitz (1991), Greenwood, Hercowitz and Krusell (2000), Ortalo-Magne and Rady (2006), Jin and Zeng (2004), Davis and Heathcote (2005), Iacoviello and Neri (2010).

[3] They assumed reversibility between residential and business capital, which implies that the relative price of housing will always be unity. Besides that, the present model assumes that demand and supply of houses are the forces determining the equilibrium price. As in Kan, Kwong and Leung (2004) and Leung (2007), this model does not support the "Law of One Price" by introducing housing price dynamics to study their interactions with output growth through substitute production.

the endogenous link.

Davis and Heathcote (2005) use a real business cycle model with housing to replicate business cycle properties, but they fail to account for the observed volatility of housing prices in the U.S. Unlike them, this model is able to capture the consistent volatility of housing prices revealed in the data. Jin and Zeng (2004) develop a three-sector model driven by three different productivity shocks and one monetary shock. Their model is quite successful in accounting for some of the salient business cycle properties of residential investment and housing prices, but it does not study the dynamics of some key macroeconomic variables, such as aggregate consumption and household debt.

Finally the model considers two types of agents, a Saver and a Borrower, motivating the existence of credit flows and the financial accelerator mechanism, where Borrower raises secured credit facilities against residential properties to fuel consumption. As in Iacoviello (2005), they differ in terms of their discount factors, with the borrower being the relatively impatient agent.[4]

There are papers in the literature that show the impact of housing prices on the business cycle, and their propagation effect on consumption and investment; however, none of them link housing prices and current account imbalances. This paper combines Iacoviello and Neri (2010) and Matsuyama (1990). It extends Iacoviello and Neri (2010) by allowing the economic agents to borrow abroad and evaluates the impact on the current account. Matsuyama (1990) was the first to study the link between residential investment and the current account. He states that in a model with residential property, the housing stock accumulation would be affected by a change in government purchasing, since housing is a normal good. Unlike Matsuyama, the paper focuses on the collateral value of houses as incentive to invest in residential investment, consume, and accumulate current account. Gete (2010) documented the correlation between housing dynamics and current account dynamics, showing that increases in the demand for nontradables relative to tradables imply trade deficits which smooth consumption between tradables and nontradables. However, he does not refer to collateral effect or wealth effect; neither he does not consider residential investments.

[4]In Kiyotaki and Moore (1997) patient and impatient agents are interpreted as a farmer and gatherer. Campbell and Cocco (2007) study heterogeneity in wealth effects between old and young households. They estimate the largest effect of house prices on consumption to be for older homeowners, and the smallest effect for younger renters. See also Bernanke and Gertler (1989) and Aoki, Proudman and Vlieghe (2004).

The paper proceeds as follows: Section 2 presents the model; Section 3 discusses the solution methods, calibration, and dynamics of the model; Section 4 concludes.

2 Model

I developed a two-sector DSGE model with flexible prices[5].

The model combines heterogeneity of time preferences with collateral constraints and features a role for housing market imperfections in the propagation of international business cycles. As in Davis and Heathcote (2005), households derive utility from consuming goods and streams of housing services.[6] The service flow is assumed to be proportional to the real value of holdings of housing stock.[7] A sector of the economy produces a consumption good using labor and capital owned by households who rent it to firms. Another sector produces a composite real estate good using residential structures and labor as inputs. As the residential structures used to produce houses come from the first sector, some goods produced in the "good sector" are used as intermediate inputs in the "house sector".

The model allows for constrained agents who collateralize the value of their homes[8]. This financial friction results in the familiar financial accelerator mechanism.

Finally, the model analyzes two large economies[9]. The U.S. and Japan are a good example of this model. The domestic country, the U.S., is characterized by an increasing housing price index and a developed household credit system. It borrows from the foreign country, Japan, which is characterized by a decreasing housing price index and a higher rate of savings. Therefore, Japan is

[5]The flexibility of housing prices seem reasonable since usually economic agents always contract the initial price during the selling process.

[6]See also Matsuyama (1990), Greenwood and Hercowitz (1991), Baxter (1996), Chang (2000).

[7]The stock of houses is highly price inelastic because of its low depreciation rate; therefore, housing services adjust slowly to demand shocks. An increase in demand of housing causes housing prices to rise, rather than causing housing stock to expand. Therefore, houses and housing prices are important variables for household portfolio

[8]Luengo-Prado (2006) and Díaz, A. and M.J. Luengo-Prado (2008, 2010) study the distribution of housing wealth and the volatility of nondurable consumption goods relative to income using a model where households obtain utility from the consumption of nondurables and housing services because they can save either in the form of liquid financial assets or houses, and serve the durable good as collateral for credit purchases.

[9]For simplicity, the model assumes equal size for domestic and foreign economy.

financing the U.S. current account deficit[10].

2.1 Households

There are two types of agents: the Saver and the Borrower.

The Saver has a higher discount factor, so she is more patient. She derives income from renting physical capital to the firms and owns all the assets, which makes her a high-wealth household.[11] Different from Campbell and Hercowitz (2006), here the Saver participates in the labor market.[12] The Saver is viewed as a financial intermediary between the borrower and the rest of the world.[13] Given her large wealth, she is willing to trade assets abroad, after collecting mortgage loans from borrowers.[14] The Borrower is a low-income household, whose main source of funds is the labor income. She faces a borrowing constraint, consistent with the standard lending criteria used in the mortgage and a consumer loan market. The borrowing constraint is introduced through the assumption that households cannot borrow more than a fraction $m \in (0, 1)$ of the value of their houses. The Saver can repossess the borrower's assets only after paying a proportional transaction cost weighted by $(1 - m)$. The coefficient m, the loan to value (LTV) ratio, also represents the degree of credit market development of the economy. High values of m represent a more flexible and developed financial system, while low values of m represent an underdeveloped financial sector.[15]

[10] Japan has been the main Asian country financing the U.S. current account deficit. Also China, Hong Kong and Taiwan have been buying a big portion of long term U.S. securities over time.

[11] Flavin and Yamashita (2002) examines the portfolio choice problem of an agent who invests in both financial assets and real estate.

[12] See Krusell and Smith's (1998).

[13] The Saver can also be interpreted as a financial intermediator between the foreign economy and the Borrower. For example, in the United States private banks lend to households, then the bank sells the loan to Fannie Mae or Freddie Mac, which pool all similar loans together to construct a portfolio in order to diversify risk through mortgage backed securities (MBS). Freddie Mac is a stockholder-owned corporation chartered to keep money flowing to mortgage lenders in support of homeownership and rental housing. Freddie Mac purchases single-family and multifamily residential mortgages and mortgage-related securities, which it finances primarily by issuing mortgage pass-through securities and debt instruments in capital markets.

[14] The loan market is becoming more flexible not only in the U.S. but also abroad: foreign banks have increased their presence in most emerging countries over the past several years. These banks have spearheaded the growth of lending to households attracted by high margins.

[15] Reducing legal limitations regarding true sale treatment of securitization transactions, reducing excessive transfer

This model does not include housing rental market. This is done because if agents can rent their houses, then there would be no wealth effect since the Borrower can rent her houses and save from the rental income. Therefore, the model, allowing for heterogeneous agents, is not including the rental market.

2.2 The Saver's Problem

In this model, the Saver chooses to work in the good production sector, (L_c) and the construction sector, (L_h), she consumes non-durable goods (c) and housing services (h), and owns all the capital used in the production of consumption goods, (k_c) and all the capital used in the production of new houses, (k_h), which is rented to firms. She extends financial credit (b) to the borrower and has access to international asset (b^*). The housing price index, (q), measures how many units of consumption are necessary to buy one unit of housing services.

The saver maximizes the utility function:

$$U_t = E_t \sum_{t=0}^{\infty} \beta^t \left[ln\ c_t + j_t\ ln\ h_t - \eta \frac{(L_{ct}^{1/\nu} + L_{ht}^{1/\nu})^{\alpha\nu}}{\alpha} \right] \tag{1}$$

subject to:

$$c_t + q_t i_t^h + i_{ct} + i_{ht} + b_t + b_t^* \leq w_{ct} L_{ct} + w_{ht} L_{ht} + R_{ct-1} k_{ct-1} + R_{ht-1} k_{ht-1} + R_{t-1} b_{t-1} + R_{t-1}^* b_{t-1}^* + \frac{\psi_b}{2} (b_t^* - \bar{b^*})^2 \tag{2}$$

where

$$h_t = (1 - \delta_h) h_{t-1} + i_t^h - \frac{\psi_h}{2} \left(\frac{h_t - h_{t-1}}{h_{t-1}} \right)^2, \tag{3}$$

$$k_{ct} = (1 - \delta_k) k_{ct-1} + i_{ct} - \frac{\phi_c}{2} \left(\frac{k_{ct} - k_{ct-1}}{k_{ct-1}} \right)^2 k_{ct-1}, \tag{4}$$

$$k_{ht} = (1 - \delta_k) k_{ht-1} + i_{ht} - \frac{\phi_h}{2} \left(\frac{k_{ht} - k_{ht-1}}{k_{ht-1}} \right)^2 k_{ht-1}. \tag{5}$$

taxes and no requirements of borrowers' prior consent to structure securitized deals help to develop the financial system in terms of maximum loan-to-value (LTV) ratios, maximum debt-service-to-income ratios and interest rate conventions.

j_t determines the relative weight in utility on housing services and it represents a proxy for housing demand shocks. It follows an autoregressive process to allow for housing preference shocks. R_t and R_t^* are the domestic and international interest rate, respectively. The model is constructed such that the Saver is indifferent between borrowing abroad at rate R_t^* and lending to the Borrower at rate R_t. ψ_h, ϕ_c, ϕ_h indicate the coefficients for adjustment cost (i.e., the relative prices of installing the existing capital) for housing stocks, capital used in the goods sector and housing sector, respectively. Adjustment costs are incorporated because in their absence, the supply of fixed capital would be infinitely elastic, implying excessive volatility in sectoral investment flows in response to technology shocks. Following Schmitt-Grohe and Uribe (2003),[16] ψ_b and $\bar{b_t^*}$ are constant parameters defining the portfolio adjustment cost function. The benchmark value for ψ_b is 0.008. If the household chooses to borrow an additional unit abroad, then current consumption increases by one unit minus the marginal portfolio adjustment cost $\psi_b(b_t^* - \bar{b^*})$. Next period, the household must repay the additional unit of debt plus interest. At the optimum, the marginal benefit of a unit debt increase must equal its marginal cost. The portfolio adjustment cost solves non-stationarity problems associated to market incompleteness.[17] Introducing the adjustment cost term as a function of debts forces wealth allocations in the long run to return to their initial distribution. δ_k and δ_h represent the depreciation rate for capital and housing stock, respectively. Following Davis and Heathcote (2005), Jin and Zeng (2004) and Iacoviello and Neri (2010), δ_h is assumed to be smaller than δ_k to reflect the fact that houses depreciate slower than non-residential capital.

2.3 The Borrower's Problem

The borrower consumes non-durable goods $\{c^{'}\}$ and housing services $\{h^{'}\}$, she can decide to work in the non-residential $\{L_c{}^{'}\}$ or residential sector $\{L_h{}^{'}\}$.

The borrower maximizes the utility function:

$$U_t = E_t \sum_{t=0}^{\infty} \gamma^t \left[ln\ c_t^{'} + j_t\ ln\ h_t^{'} - \eta \frac{((L_{ct}^{'})^{1/\nu} + (L_{ht}^{'})^{1/\nu})^{\alpha\nu}}{\alpha} \right] \tag{6}$$

[16] Schmitt-Grohe and Uribe (2003) impose a premium on the asset return which is proportional to the outstanding stock of foreign debts.

[17] For alternative ways to induce stationarity, see Devereux (2003) and Cavallo and Ghironi (2002).

subject to:

$$c_t^{'} + q_t i_t^{h^{'}} + R_{t-1} b_{t-1}^{'} \leq w_{ct}^{'} L_{ct}^{'} + w_{ht}^{'} L_{ht}^{'} + b_t^{'} \tag{7}$$

and

$$b_t^{'} \leq m_t q_t h_t^{'} \tag{8}$$

where $\gamma \in (0, \beta)$ captures the borrower's relative impatience. As for the Saver, the parameter ν defines the degree of substitution between the two sectors in terms of hours worked. For a high value of ν, labor hours are perfect substitutes, which means that the worker would devote most of the time to the sector that pays the highest wage. Small values of ν imply that hours worked are not perfect substitutes, thus the worker is willing to diversify labor working for equal numbers of hours in each sector even in the presence of wage differences across sectors.[18] The loan-to-value ratio, m_t, follows an autoregressive process to study the effect of an improving credit conditions in the economy.

The borrower's housing demand differs from the saver's housing demand by the lagrangian multiplier λ on the collateral constraint. Because $\gamma < \beta$, the collateral constraint holds with equality all the time and in steady state its value is always positive, $\lambda = \frac{(1-\gamma R)}{c^{'}} > 0$. This implies that the collateral constraint binds in steady state, and then, the hypothesis of small shocks ensures that it binds outside it as well.

2.4 Firms

Firms produce non-durable goods (y) and new houses (N). Both sectors combine labor effort supplied by both agents and fixed capital in the production function. Firms pay wage to households and repay back rented capital to the Savers.

The firm's problem is to maximize the profit as follows:

$$Max \quad y_t + q_t \, N_t - [w_{ct} L_{ct} + w_{ht} L_{ht} + w_{ct}^{'} L_{ct}^{'} + w_{ht}^{'} L_{ht}^{'} + R_{ct-1} k_{ct-1} + R_{ht-1} k_{ht-1}], \tag{9}$$

where

[18] See Horvath (2000).

$$N_t = (A_{ct}A_{ht})(L_{ht}^{'})^{1-\mu_h-\theta_h}L_{ht}^{\theta_h}k_{ht-1}^{\mu_h}, \tag{10}$$

$$y_t = A_{ct}(L_{ct}^{'})^{1-\mu_c-\theta_c}L_{ct}^{\theta_c}k_{ct-1}^{\mu_c}. \tag{11}$$

Both production functions follow a Cobb-Douglas specification form and they assume complementarity across the labor skills of the two types of workers; this specification helps to obtain closed-form solutions for the steady state of the model. An aggregate shock, A_{ct}, affects both sectors, since y can produce some intermediated goods used in the production of N, while a sector-specific shock, A_{ht}, only affects the real estate market.

2.5 Current Account Equation

The current account is defined as the change in net foreign assets:

$$CA_t = (b_t^* - b_{t-1}^*) =$$

$$= -(R_t - 1)b_{t-1}^* + y_t + (1-\delta_k)(k_{ct-1} + k_{ht-1}) - c_t - c_t^{'} - k_{ct} - k_{ht} =$$

$$= -(R_t - 1)b_{t-1}^* + TB_t \tag{12}$$

The last equation states that the current account is the sum of the service account (interest to repay back) and the trade account, which is the trade balance expressed as the difference between output, consumption and investments[19].

2.6 Foreign Economy

The foreign economy is assumed to be a saver economy and to run a current account surplus. For simplicity, there is only one representative household in the foreign economy, this agent holds all the capital rented to firms, works in both sectors and saves. Firms produce consumption goods and new houses.

[19]Similar definition is found in Obstfelf and Rogoff (1995) and Ghironi (2006). Standard literature includes changes in the exchange rate in the expression for the current account account. See Obstfeld Rogoff (2004).

2.7 Exogenous Factors

Technology process for final goods ($A_{c,t}$) and new houses ($A_{h,t}$), house preference (j_t) and loan-to-value ratio (m_t) are exogenous variables following an autoregressive process of order one, with $(\varepsilon_{ct}, \varepsilon_{ht}, \varepsilon_{jt}, \varepsilon_{mt}) \sim i.i.d(0, \Sigma)$.

3 Quantitative Analysis

3.1 Calibration

The model is calibrated at quarterly frequencies in order to match U.S. and Japan business cycle properties[20]. Saver's discount factor is set equal to 0.99, such that the average annual rate of return is about 4%. The borrower, being impatient, is subject to a smaller discount factor equal to 0.98. Because houses depreciate at slower rate than fixed capital, δ_h assumes a value equal to 1.5%, while δ_k is equal to 3.5%. The share of labor income in sectoral output is chosen equal to 0.45, (θ_c) and equal to 0.55 for house sector, (θ_h), reflecting the higher degree of labor intensity in the housing sector. j_t is set equal to 0.2, together with the house depreciation rate, these parameters match the volatility of house investment relative to GDP presented in the data around 5%. ν is equal to 0.3 to guarantee imperfect labor substitutions across sectors. The parameter representing the degree of credit rationing is in the range of [0,1], and equal to 0.85. Capital adjustment costs are set equal to 10 for both sectors, also here to match the investment volatility of both sectors. On the other hand, adjustment costs for housing stock are set equal to zero because in general the purchase of houses is subject to non-convex adjustment costs (typically, some fixed expenses and an agent fee that is proportional to the value of the house), which cannot be dealt with easily in this specific model.[21] The model assumes the same share for constrained and unconstrained households ($n = 0.5$): in a

[20]Data source: NIPA, Saint Louis Fed Fred2, Central Bank of Japan, Datastream. U.S. housing data are from http://www.freddiemac.com/finance/cmhpi. Japan housing data are from Japan Real Estate Institute. The housing price index is deflated by CPI and the first quarter of 1995 is normalized to 100. Housing prices reflect the retail price at which a house is sold.

[21]Thomas (2002) found that infrequent microeconomic adjustment at the plant level has negligible implications for the behavior of aggregate investment; in addition, a sizable fraction (25 percent) of residential investment in the National Income and Product Accounts consists of home improvements, where transaction costs are less likely to apply.

world with flexible wages and flexible prices, the share size doesn't affect the results. In a more realistic world with nominal rigidities, the size of the two groups matters in determining inflation and the real interest rate, therefore with strong impact on consumption and investment. All the shocks are treated as an autoregressive of order one, AR(1), the persistence for all the shocks is set equal to the estimations as in Iacoviello & Neri (2010): 0.95 for the technology sector, 0.99 for the housing production, 0.96 for the housing demand and 0.994 for the loan-to-value ratio.[22] These estimations are consistent with Jin & Zeng (2004) and David & Heathcote (2005)[23].

The model's dynamic system is linearized around its non-stochastic steady state and it is solved for decision rules of endogenous variables via undetermined coefficients method.[24]

3.2 Business Cycle Property

Volatilities

The model generates a standard deviation of real GDP equal to 1.66, higher than in the data (1.54). [**INSERT Table 2 here**]. The calibration of the model is set such that the relative volatility of housing price (1.44) and current account (0.24) matches the corresponding statistic in the data, including the corresponding correlation.[25] The model does a good job in explaining the U.S. business cycle properties. Unfortunately, this is not the case for Japan. The reason is due to the fact the the model simplifies the foreign country just allowing for saver households. Who is financing the U.S. current account are the Savers, so the model wants to highlight this fact. Furthermore, there exists a deep gender difference in labor supply in Japan and strong occurrence of regional recessions, which makes harder job in explaining this economy[26]. Abstracting from the

[22] Iacoviello & Neri (2010) estimate a DSGE model with collateral constraint using Bayesian methods because they allow incorporating a priori information on the parameters of the model and also because pure maximum likelihood tends to produce fragile results, particularly in situations in which some parameters are weakly identified. They estimate volatility as follows: $\sigma_{Ac} = 0.01011; \sigma_{Ah} = 0.01942; \sigma_j = 0.04094; \sigma_m = 0.0049$.

[23] They measure aggregate productivity shocks by the estimated Solow residuals.

[24] McCallum, (1983), King, Plosser and Rebelo (1987), Uhlig (1995).

[25] Capital investment and private consumption expenditures appear to be less volatile than their empirical counterpart, most probably due to small GDP volatility generated. The result is consistent with business cycle facts that private consumption expenditures are less volatile than output, and capital investment and housing investments are more volatile than real GDP.

[26] See Braun, Esteban-Pretel, Okada and Sudou (2006) and Wall (2007).

housing market, a simple two-country open economy can reach only 0.049 % volatility of the U.S. current account with respect to the data (0.24).

3.3 Impulse Responses

The exogenous shocks analyzed in the simulation experiment are the aggregate technology shock, the specific-sector technology shock, the housing preference shock and the loan-to-value shock. **[INSERT Figure 1 about here]**. Improvement in productivity increases GDP and housing prices,[27] with a spillover effect on residential investment. Agents reallocate the existing capital between different sectors of production, and because output produces capital used in the construction sector, residential investment increases, but less than non-residential fixed investments. Consumption is increasing for both agents, in particular for the Borrower. Through the wealth effect, she uses the value of the house as collateral to get extra credit, and to consume more. The Savers takes advantages of investment opportunity by adjusting capital by borrowing abroad, therefore foreign debt rises. As a result, the current account decreases by 0.4% of steady state. There is also an impact on the labor supply. The Borrower decides to work less in both sectors in the case of better credit conditions, because she can finance her consumption of goods and housing services in part with labor income and in part with borrowing[28]. The model generates similar results in the case of housing demand shock and loan-to-value ratio shock, where the current account respond with a deficit of 0.18% and 0.6% of steady state, respectively. On the other hand, specific sector shock on housing generates decreasing housing price and current account surplus. Anyway, this shock helps to match the higher volatility of residential investment relative to non-residential. Figure 2 highlights the importance of flexible credit market and the degree of market openness. **[INSERT Figure 2 about here]**. Financial liberalization and deregulation amplifies the responses of the

[27] Due to the collateral constraint and flexible prices, house prices increases more for low values of m because higher m shifts even more housing service supply, decreasing housing prices. Log-linearized equation for the borrowing constraint: $\hat{q}_t = \hat{b_t'} - \hat{m}_t - \hat{h_t'}$.

[28] Hryshko, Luengo-Prado and Sorensen (2010) find that homeowners are able to maintain a high level of consumption following job loss (or disability) in periods of rising local house prices while the consumption drop for homeowners who lose their job in times of lower house prices is substantial.

current account.[29]

4 Conclusion

This paper develops a two-sector, two-country DSGE model showing that housing market boom can contribute to a large current account deficit. Housing is an important variable, because as a durable good, it yields a flow of housing services that provide utility to households, and also represents a valuable asset that serves as a collateral for loans. The model predicts that an aggregate technology shock and housing preference shock causes an increase in housing prices and a current account deficit, whereas a sectoral specific shock to the real estate sector induces lower housing prices because of the increased supply and a small current account surplus. The model has some limitations. It does not specify nominal rigidities because it assumes flexible prices in both sectors. Also the model does not study the impact on the exchange rate with different regimes. Those are possible extensions for future research.

The Appendix for the detailed model and for all the optimality conditions is available upon request.

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Table 1: Correlations with the Current Account

U.S.	1965-2009	1965-1989	1990-2009
Housing Prices	-0.103377	-0.0702847	-0.254637
GDP	-0.1065499	-0.1758612	-0.2673452
Consumption	-0.1408088	-0.2695167	-0.3100607
Business Investment	-0.134284	-0.2293511	-0.2982749
Housing Investment	-0.148409	-0.2971196	-0.3448623
Hours good sector	-0.0692695	-0.1139554	-0.1774878
Hours housing sector	-0.104897	-0.1601517	-0.2363513
Mortgage Loans	-0.1187326	-0.0971763	-0.2835509
Japan	1985-2009	1985-1989	1990-2009
Land Prices	-0.3852398	-0.2890864	-0.3750634
GDP	0.0092697	-0.3672764	0.109913
Consumption	-0.232501	-0.2980619	-0.1996599
Business Investment	-0.1480796	-0.588758	-0.0528257
Housing Investment	-0.0839658	-0.2921207	-0.0559324
Hours good sector	0.115535	-0.0097996	0.1442850
Hours housing sector	0.0345493	-0.1103793	0.058656
Mortgage Loans	-	-	-

Table 2: Business Cycle Properties

% St. Dev. (% GDP)	USA: 1965-2009	Full Model	Model without Housing
GDP	1.54	1.66	1.74
CPE	0.81	0.58	0.49
INV_K	3.33	2.72	2.38
INV_H	6.65	6.12	
L_C	0.92	1.003	
L_H	2.73	2.30	
b^*	1.38	0.55	0.22
q	1.44	1.006	
ca	0.24	0.27	0.049
% Correlation			
q, ca	-0.11	-0.09	
b, b^*	0.12	0.58	
% St. Dev. (% GDP)	Japan: 1985-2009	Full Model	Model without Housing
GDP	1.52	0.94	1.06
CPE	0.59	0.43	0.49
q	1.48	0.34	
ca	0.007	0.33	

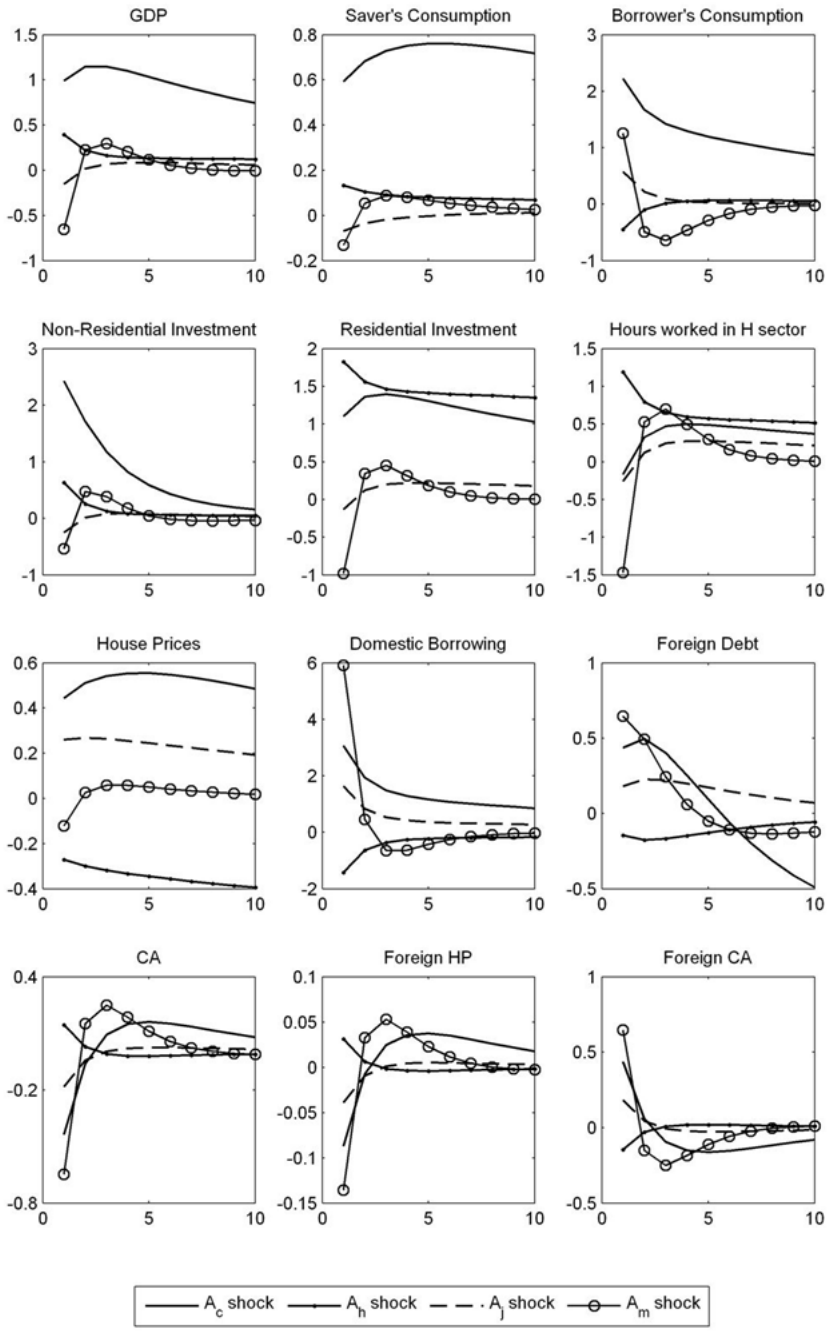

Figure 1: Impulse Responses to Different Shocks.

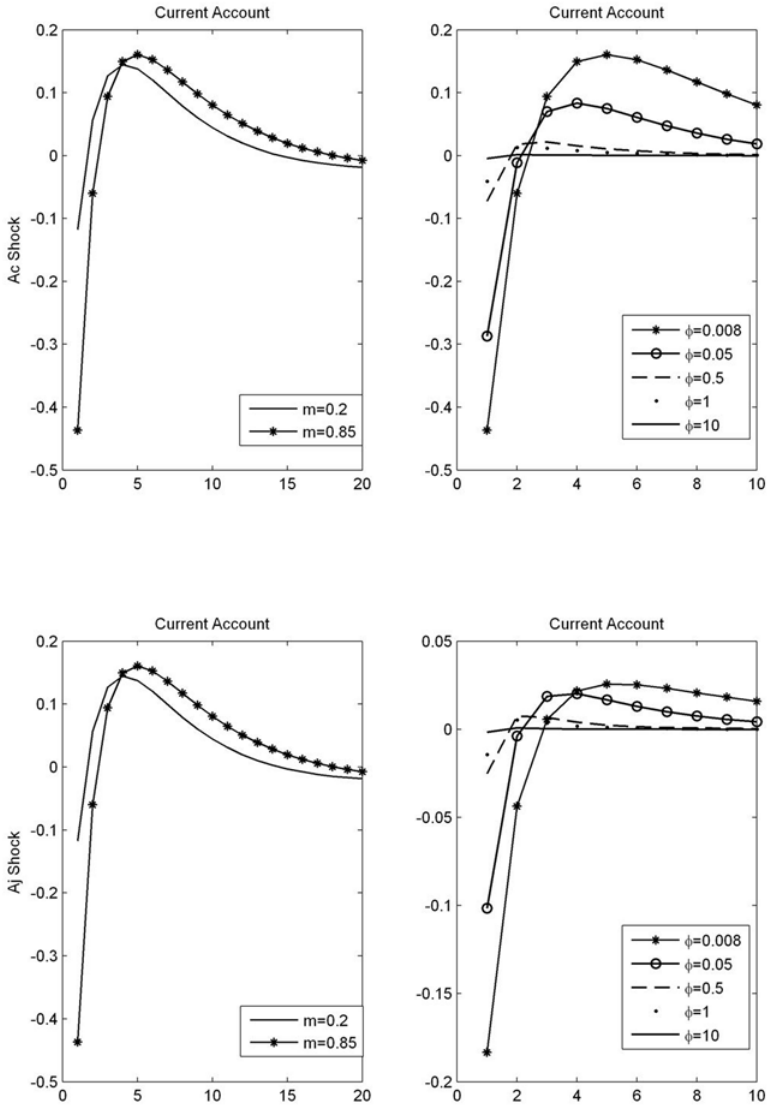

Figure 2: Current Account Responses to Different L-t-V Ratios and Portfolio Adjustment Costs.