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Foreign buyers and housing price dynamics

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ABSTRACT

This paper analyzes the short- and long-run effects of foreign buyers on housing prices in an open economy with the flexible exchange-rate system. In the long run, the changes in housing prices depend on the price elasticity of foreign buyers' housing demand, while the adjustments in the exchange rate depend on the degree of international capital mobility. Nonetheless, in the short run, the changes in housing prices and exchange rates can be over- or under-shot or mis-adjusted, dependent partly on the length of time between the policy announcement and its implementation. The housing prices could fall in the short run if foreign housing demand is price-elastic, while the exchange rates could be over-shot if capital is less mobile.

1. Introduction

“Land or housing is a wealth,” according to a famous Chinese proverb. Since March 2009, rapid surges of housing prices in many emerging and developed economies have attracted great attention in academics and media. As shown in Fig. 1, from 2009 to 2014, housing prices had been doubled in Hong Kong, and more than 50% higher in China, Singapore and Australia, respectively, while the top 10 cities of housing prices growth in Q4 2015 are listed in Table 1. Housing prices, similar to other commodity prices, are mainly determined by housing demand and supply. In the literature, Herring and Wachter (1999), IMF (2000), and Girouard and Blöndal (2001) examined the demand-supply factors that cause fluctuations of housing prices, while Ullah and Zhou (2003) and Grandner and Gstach (2004) analyzed the links between real estate and stock markets. A survey article on related issues can be found in Cho (1996).

It is notable that one of the forces contributed to the surging housing prices in those economies may be increasing demand from foreign buyers. In the environment of low interest rates induced by quantitative easing (QE) policies, overseas funds have continuously flooded into many economies, constantly pushing up their asset prices including housing prices. For example, as shown in Chart 1, real estate investment in 2013–2014 by foreign investors in Australia had a significant increase with 23,428 applications by A\$74.6 billion, compared to 12,025 cases for A\$51.9 billion in 2012–2013. Among it, proposed investment in commercial real estate increased from A\$34.8 billion in 2012–2013 to A\$39.9 billion in 2013–2014, while investment in residential real estate also increased from A\$17.2 billion in 2012–2013 to A\$34.7 billion in 2013–2014. China was the largest source of proposed approvals on real estate in Australia, with the investment of A\$12.4 billion. The other major sources of proposed real estate investment were the United States (A\$6.1 billion), Singapore (A\$4.3 billion), Canada (A\$2.9 billion), and Malaysia (A\$2.0 billion).¹

In Fig. 2, the latest National Australia Bank (NAB) Residential Property Survey 2015 Q1 shows that the foreign buyer participation rate in the new housing markets was 15.6% nationally. Foreign buyers rose to high of 21% in New South Wales, while fell to 20.7% in Victoria. Around 53% of foreign purchases were apartments, 30% houses and 17% for re-development. The 41% foreign buyers

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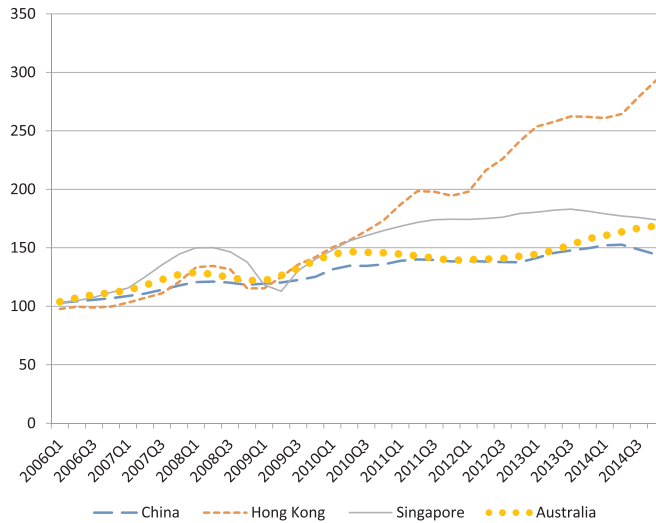


Fig. 1. Housing price index.

Sources: [The Economist \(2015\)](#), [The Global House Prices: Location, Location, Location](#).

bought properties between A\$0.5 and 1 million, 30% for less than A\$0.5 million, and 5% for buying premium properties more than A\$5 million.

Recently, to curb short-term speculations in the heated housing markets, cooling measures and tightening policies, particularly on foreign buyers, have been introduced and implemented in these economies. In Hong Kong, a 15% additional buyer's stamp duty (ABSD) has been imposed on foreign buyers on the top of buyer's stamp duty (BSD) on 27 December 2012. Singapore also introduced a 15% BSD on 12 January 2013. Lately, foreign investors have rushed into the Australian property markets. On May 2, 2015, the Australian government announced that illegal foreign buyers face tough new penalties on housing purchases including three years' jail and huge fines up to A\$637,500. Moreover, on 25 March 2016, Shenzhen and Shanghai, two major cities in China, with annual real estate price jumps by 57 and 20 percent year-to-year respectively, announced new tightening housing measures on non-local buyers by raising the purchase threshold of local employment from 1 year to 3 years in Shenzhen and 2 years to 5 years in Shanghai. In addition, a recent [UBS report \(2016\)](#) indicated that housing in Vancouver, Canada has been overpriced since 2007 and the prices have gone into "overdrive" in the past two years due to strong demand by foreign investors. A typical detached single-family house in August 2016 was C\$1.6 million, according to the Real Estate Board of Greater Vancouver, and the provincial government had to impose a 15 percent property tax on foreign buyers in an attempt to cool housing demand.

For social harmony, stabilization of housing prices is an important consideration for government. Interventions, via verbal announcements and/or actual interventions, in the housing markets have often been used to maintain stability of housing prices as well as achieve efficiency of resource allocation. In particular, verbal announcements on the housing policy, prior to actual interventions, have been a common practice in regulating asset markets. Since the seminal paper of [Dornbusch \(1976\)](#) by introducing expectations on exchange-rate dynamics, substantial studies have examined the effects of "anticipated" policy changes (i.e., policy announcements) on dynamic adjustments of the economy. By extending the regressive formation of expectations in [Dornbusch \(1976\)](#) to perfect foresight, [Wilson \(1979\)](#) and [Gray and Turnovsky \(1979\)](#) investigated the effects of policy announcements on the exchange-rate dynamics of the economy. In addition, the policy announcement effects have been applied to the changes in other financial variables, such as stock prices, commodity prices and housing prices, as in [Poterba \(1984, 1992\)](#) and [Poterba, Weil, and Shiller](#)

Table 1

Top 10 cities of housing price growth.

Source: [Everett-Allen \(2016\)](#), The Knight Frank Global Residential Cities Index-Q4 2015.

Rank	City	12-month % change (Q4 2014-Q4 2015)
1	Shenzhen, CN	47.5%
2	Auckland, NZ	25.4%
3	Istanbul, TR	25.0%
4	Sydney, AU	19.9%
5	Shanghai, CN	18.2%
6	Izmir, TR	16.5%
7	Budapest, HU	16.3%
8	Stockholm, SE	15.6%
9	Gothenburg, SE	14.4%
10	Vancouver, CA	12.9%

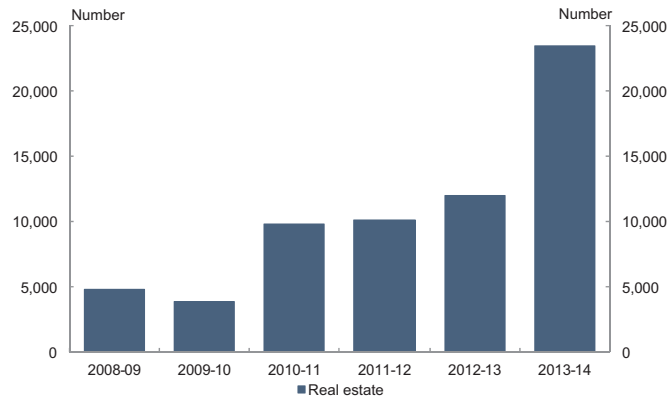


Chart 1. Real estate applications decided (number of proposals) Note: Real estate includes number of proposals decided for commercial and residential real estate. Source: FIRB (2015), Foreign Investment Review Board Annual Report 2013–2014.

(1991).

By incorporating the housing market into the [Dornbusch's \(1976\)](#) model, the purpose of this paper is to examine the housing price movements of the policy announcement, such as a lax regulation on foreign buyers in the domestic housing market, for an economy with international capital mobility. A rise in housing demand by foreign buyers can cause the housing prices to rise and the exchange rate to appreciate in the long run, while yielding various adjustment paths on the housing prices and exchange rates in the short run, depending on the price elasticity of foreign housing demand and the degree of international capital mobility as well as on the time length between policy announcement and its implementation. In particular, the housing prices could fall in the short run if foreign housing demand is price-elastic, while the exchange rates could be over-shot if capital is less mobile. Nonetheless, in the literature, the issue of foreign buyers on price dynamics in the local housing market has been paid less attention, except for the studies by [Miller, Sklarz, and Ordway \(1988\)](#) and [Chao and Yu \(2015\)](#). The former provided evidence on a price premium of \$11.11 per square foot by Japanese buyers relative to local buyers in purchasing Hawaii's houses in 1987–1988, while the latter examined the static impacts of foreign buyers on local housing prices in a general-equilibrium setup.

The remainder of this paper is organized as follows. [Section 2](#) sets up an analytical framework of a small open economy with a housing market, in which we follow [Poterba et al. \(1991\)](#) to specific housing demands based on holding costs for domestic and foreign buyers. In addition, capital is mobile between countries. [Section 3](#) characterizes the dynamic behavior of the economy, in which the associated impacts of foreign buyers on housing prices dynamics are examined and discussed. We will show the dynamics of housing prices depend on the elasticity of foreign housing demand and the degree of capital mobility. The results can be applied to countries such as Australia, China, Malaysia and Singapore. [Section 4](#) provides concluding remarks.

2. The model

We consider an open economy that consists of a goods market, a money market and a housing market. There are domestic and foreign buyers in the home housing market. The market participants form their expectations with perfect foresight, while capital is imperfectly mobile between countries. The economy is small in the sense that it cannot affect the foreign goods price and the world interest rate. The home economy can be described by the following equations:

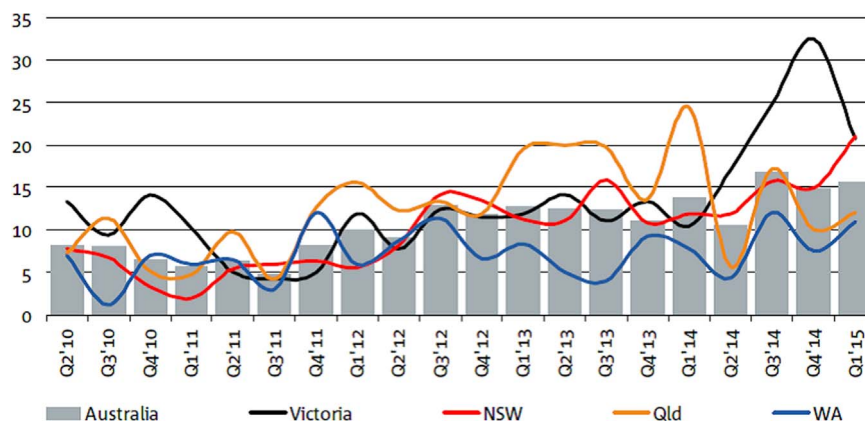


Fig. 2. Share of demand for new properties from overseas buyers (%). Source: NAB (2015), NAB Residential Property Survey: Q1 2015.

$$P^C = EP^{C*} \quad (1)$$

$$\dot{P}^H = \pi \left[D \left(\frac{rP^H}{P^C} \right) + D^* \left(\frac{r^*P^H}{EP^{C*}}, N^* \right) - S \left(\frac{rP^H}{P^C} \right) \right]; D_1 < 0, D_1^* < 0, D_2^* > 0, S_1 > 0 \quad (2)$$

$$\frac{M}{P} = L(r, Y); L_1 < 0, L_2 > 0 \quad (3)$$

$$P^H D^* \left(\frac{r^*P^H}{EP^{C*}}, N^* \right) - P^C C \left(\frac{rP^H}{P^C} \right) + K \left(r - r^* - \frac{\dot{E}}{E} \right) = 0; C_1 > 0, K_\Delta > 0 \quad (4)$$

$$P = \alpha P^C + (1 - \alpha) P^H \quad (5)$$

The variables in Eqs. (1)–(5) are defined as follows: P^C =the price level of the domestic good, E =the exchange rate (defined as the domestic currency price of foreign currency), P^{C*} =the price level of the foreign good, P^H =housing price, π =the adjustment speed of housing price, D =domestic housing demand, r =the domestic interest rate, D^* =foreign housing demand, N^* =foreign housing buyers, r^* =the foreign interest rate, S =domestic housing supply, M =money supply, P =the general price level, L =money demand, Y =output, C =import of the foreign good. Note that $\Delta = r - r^* - \dot{E}/E$, and a dot over a variable denotes the change in the variable with respect to time.

Eq. (1) describes the law of one price as the domestic and foreign traded goods are perfect substitutes. Eq. (2) expresses the domestic housing market: housing demands by domestic and foreign buyers. Following Poterba et al. (1991), domestic demand for housing depends inversely on the holding cost,² while foreign demand is a negative function of the exchange-rate adjusted housing price and is also a positive function related to the number of foreign buyers. Note that the supply of domestic housing is a positive function of the housing price.³ Housing prices rise in Eq. (2) when total demand exceeds supply. Eq. (3) expresses the equilibrium condition of the money market, in which demand for the real money balance is a decreasing function of the domestic interest rate and an increasing function of the output. Eq. (4) specifies that under the floating exchange rate system, the trade and capital accounts must be balanced, where the trade account includes the export of housing minus the import of the good. In addition, the inflow of capital is positively dependent on the interest-rate differential between domestic and foreign countries, adjusted by the exchange rate. Eq. (5) defines the domestic general price level as being made up of a weighted average of the goods price and the housing price.

Based on the above model, we consider the short- and long-run impacts of changes in the number of foreign buyers (N^*) on the housing demand in the home economy. The increase in foreign buyers is considered as an anticipated policy shock. Without loss of generality, we set initially that $P^H = E = P^C = P^{C*} = P = 1$, along with $\dot{P}^H = \dot{E} = 0$. By totally differentiating Eqs. (1)–(5) and combining the terms, we obtain the following two differential equations involving the changes in the housing price P^H and the exchange rate E as:

$$\begin{bmatrix} d\dot{P}^H \\ d\dot{E} \end{bmatrix} = \begin{bmatrix} F_{P^H} & F_E \\ J_{P^H} & J_E \end{bmatrix} \begin{bmatrix} dP^H \\ dE \end{bmatrix} + \begin{bmatrix} F_{N^*} dN^* \\ J_{N^*} dN^* \end{bmatrix} \quad (6)$$

where

$$F_{P^H} = \frac{\partial \dot{P}^H}{\partial P^H} = \pi \left[r \left(1 + \frac{(1 - \alpha)P}{\delta} \right) (D_1 - S_1) + D_1^* r^* \right] < 0$$

$$F_E = \frac{\partial \dot{P}^H}{\partial E} = -\pi \left[r \left(1 - \frac{\alpha P}{\delta} \right) (D_1 - S_1) + D_1^* r^* \right] \begin{matrix} > 0; & \text{if } \frac{r}{r^*} \left(1 - \frac{\alpha P}{\delta} \right) (D_1 - S_1) < -D_1^* \\ < 0; & \text{if } \frac{r}{r^*} \left(1 - \frac{\alpha P}{\delta} \right) (D_1 - S_1) > -D_1^* \end{matrix}$$

$$F_{N^*} = \frac{\partial \dot{P}^H}{\partial N^*} = \pi D_2^* > 0$$

$$J_{P^H} = \frac{\partial \dot{E}}{\partial P^H} = \left[\frac{D^*}{K_\Delta} (1 - \varepsilon^* - \varepsilon) - \frac{(1 - \alpha)M}{L_1} \left(1 - \frac{C_1}{K_\Delta} \right) \right] \begin{matrix} > 0; & \text{if } C_1 + \frac{(1 - \varepsilon^* - \varepsilon)L_1 D^*}{(1 - \alpha)M} < K_\Delta \\ < 0; & \text{if } C_1 + \frac{(1 - \varepsilon^* - \varepsilon)L_1 D^*}{(1 - \alpha)M} > K_\Delta \end{matrix}$$

$$J_E = \frac{\partial \dot{E}}{\partial E} = - \left[\frac{C}{K_\Delta} (1 - \varepsilon^* - \varepsilon) + \frac{\alpha M}{L_1} \left(1 - \frac{C_1}{K_\Delta} \right) \right] > 0; \text{ if } C_1 < K_\Delta$$

$$J_{N^*} = \frac{\partial \dot{E}}{\partial N^*} = \frac{D_2^*}{K_\Delta} > 0$$

Note that $\delta = -\frac{r}{L} \frac{\partial L}{\partial r}$, $\varepsilon^* = -\frac{r^*}{D^*} \frac{\partial D^*}{\partial r^*}$ and $\varepsilon = \frac{r}{C} \frac{\partial C}{\partial r}$.⁴

We now proceed to analyze the dynamic behavior of the economy. By letting λ be the eigenvalue of the dynamic system, the characteristic equation for Eq. (6) is

$$\lambda^2 - (F_{P^H} + J_E)\lambda + (F_{P^H} J_E - J_{P^H} F_E) = 0 \quad (7)$$

² In Sheffrin (1983) and Poterba (1984), the holding cost of housing is the sum of after-tax depreciation and mortgage expenses. This paper focuses on the impacts of foreign buyers on housing prices and exchange rates by ignoring depreciation, income tax and property tax. Here the housing is considered as a consumption good.

³ Following Poterba et al. (1991), the housing supply can be written as $\dot{H} = S(rP^H/P^C)$ in (2), where H denotes the housing stock.

⁴ For the Marshall-Lerner condition, we impose $\varepsilon + \varepsilon^* > 1$.

Let λ_1 and λ_2 be the two characteristic roots of the dynamic system that satisfies Eq. (7). We then have the following relations on trace and determinant of the coefficient matrix in Eq. (6):

$$\lambda_1 + \lambda_2 = F_{p^H} + J_E \tag{7a}$$

$$\lambda_1 \lambda_2 = F_{p^H} J_E - F_E J_{p^H} \equiv \Omega \tag{7b}$$

where $\Omega \equiv -\pi \left[r \left(1 - \frac{\alpha P}{\delta} \right) (D_1 - S_1) + D_1^* r^* \right] \left[\frac{(C - D^*)}{K_\Delta} (1 - \varepsilon^* - \varepsilon) \right] - \pi \left[\frac{r^P}{\delta} (D_1 - S_1) \right] \left[\frac{C}{K_\Delta} (1 - \varepsilon^* - \varepsilon) \right] - \pi \left[r (D_1 - S_1) \right] \left[\frac{M}{L_1} \left(1 - \frac{C_1}{K_\Delta} \right) \right]$. As addressed in the literature of the dynamic rational expectation models (cf., Burmeister, 1980; Turnovsky, 2000), the dynamic system has a unique perfect-foresight equilibrium when the number of unstable roots equals the number of jump variables. Since the model has one predetermined variable on the housing price P^H and one jump variable of the exchange rate E , the restriction $\Omega < 0$ should be imposed to ensure $\lambda_1 \lambda_2 < 0$.⁵ This implies that the system displays a saddle-point stability and, for expository convenience, it is assumed that $\lambda_1 < 0 < \lambda_2$.

We turn next to consider the general solutions for the housing price P^H and the exchange rate E , which can be obtained from Eq. (6) as

$$P^H = \tilde{P}^H + A_1 e^{\lambda_1 t} + A_2 e^{\lambda_2 t} \tag{8}$$

$$E = \tilde{E} + \frac{\lambda_1 - F_{p^H}}{F_E} A_1 e^{\lambda_1 t} + \frac{\lambda_2 - F_{p^H}}{F_E} A_2 e^{\lambda_2 t} \tag{9}$$

where \tilde{P}^H and \tilde{E} denote the stationary values of P^H and E respectively, while A_1 and A_2 are the undetermined coefficients.

Based on the above model, we can examine the long-run properties of the system in Eq. (6). In long-run equilibrium, we have $\dot{E} = \dot{P}^H = 0$ with the values of \tilde{E} and \tilde{P}^H . Nonetheless, these steady-state values can be changed if the economy faces external shocks, such as an increase in foreign housing buyers (N^*). From Eq. (6), by using Cramer's rule, we can obtain the following comparative-static results:

$$\frac{\partial \tilde{E}}{\partial N^*} = -\frac{\pi D_2^*}{\Omega} \left\{ \left[\frac{r(D_1 - S_1)}{K_\Delta} \left(1 + \frac{(1 - \alpha)P}{\delta} \right) \right] + \left[\frac{D_1^* r^*}{K_\Delta} + \frac{(1 - \alpha)M}{L_1} \left(1 - \frac{C_1}{K_\Delta} \right) \right] - \left[\frac{D^*}{K_\Delta} (1 - \varepsilon^* - \varepsilon) \right] \right\} \begin{matrix} > 0 \\ < 0 \end{matrix} \tag{10}$$

$$\frac{\partial \tilde{P}^H}{\partial N^*} = \frac{\pi D_2^*}{\Omega} \left\{ \left[\frac{C}{K_\Delta} (1 - \varepsilon^* - \varepsilon) + \frac{\alpha M}{L_1} \left(1 - \frac{C_1}{K_\Delta} \right) \right] - \frac{1}{K_\Delta} \left[r \left(1 - \frac{\alpha P}{\delta} \right) (D_1 - S_1) + D_1^* r^* \right] \right\} \begin{matrix} > 0 \\ < 0 \end{matrix} \tag{11}$$

Accordingly in Eq. (10), the exchange rate may depreciate (rise) or appreciate (fall), as reflected in the following three effects. Firstly, a rise in foreign buyers yields a current account surplus, and the exchange rate must appreciate in order to maintain the equilibrium of the foreign exchange market by Eq. (4). This effect corresponds to the first term on the right-hand side of Eq. (10). Secondly, the increase in foreign buyers pushes housing prices up by Eq. (2). However, the rise in housing prices raises the domestic general price level by Eq. (5). This leads to a capital account surplus via a higher interest rate. The exchange rate must appreciate in order to maintain the equilibrium of the foreign exchange market, as indicated by the second term of Eq. (10). Lastly, the increase in foreign buyers pushes housing prices up by Eq. (2), thereby raising the domestic general price level by Eq. (5) and consequently yielding a deficit in the current account via the higher interest rate and more import of the good. This causes the exchange rate to depreciate by the third term of Eq. (10) in order to maintain the equilibrium of the foreign exchange market. Nonetheless, if the degree of international capital mobility (K_Δ) is large in the second term of Eq. (10), the home currency can appreciate by the rise in foreign housing demand because of a relative larger surplus in the capital account induced by the higher interest rate. We can summarize this result in the following proposition:

Proposition 1. For the open economy with the housing market, the increase in foreign demand on domestic housing can cause the home currency to appreciate at the long-run equilibrium if the degree of international capital mobility is large.

In addition, Eq. (11) indicates that an increase in foreign buyers gives rise to an ambiguous effect on housing prices. The increase in foreign buyers yields a directly positive effect on housing prices, as captured by the first term in Eq. (11). However, the rise in housing prices raises the domestic general price level by Eq. (5) and consequently increases the holding cost of housing via the higher interest rate by (3). This indirect effect expressed in the second term in Eq. (11) lowers domestic housing demand and hence its prices. In other words, housing prices can go up when the elasticity of housing demand by foreign buyers (D_1^*) in the second term of Eq. (11) is relatively small. In summary, we have the following proposition:

Proposition 2. For the open economy with the housing market, the increase in foreign demand on domestic housing can cause the housing price to rise at the long-run equilibrium if the price elasticity of foreign demand is small.

We then use phase diagrams to examine the adjustment paths of the housing price and exchange rate from one equilibrium to another caused by the rise in foreign housing demand. From Eq. (6), the slopes of the lines of $\dot{P}^H = 0$ and $\dot{E} = 0$ are given by

⁵ There are four situations, depending on the values of F_E and J_{p^H} , for $\Omega < 0$.

$$\left. \frac{\partial P^H}{\partial E} \right|_{\dot{P}^H=0} = -\frac{F_E}{F_{p^H}} > 0; \text{ if } F_E > 0$$

$$< 0; \text{ if } F_E < 0$$
(12)

$$\left. \frac{\partial P^H}{\partial E} \right|_{\dot{E}=0} = -\frac{J_E}{J_{p^H}} > 0; \text{ if } J_{p^H} < 0$$

$$< 0; \text{ if } J_{p^H} > 0$$
(13)

Eq. (12) indicates that the $\dot{P}^H = 0$ line may exhibit upward or downward, and it is positively sloping if the elasticity of housing demand by foreign buyers is relatively large ($F_E > 0$ for a large D_1^*).⁶ Under this case, a rise in the home exchange rate (currency depreciation) increases foreign demand for domestic housing and hence its price.

Similarly, Eq. (13) indicates that the $\dot{E} = 0$ line may exhibit upward or downward, and it is positively sloping when the degree of international capital mobility is small ($J_{p^H} < 0$ for a small K_A). That is, if the degree of international capital mobility (K_A) is small, the home currency depreciates because of a deficit in the capital account. This in turn raises the housing price in the home economy. Note that when both the lines of $\dot{P}^H = 0$ and $\dot{E} = 0$ are positively (negatively) sloping, the $\dot{E} = 0$ line is steeper (flatter) than the $\dot{P}^H = 0$ line.⁷

Since $\lambda_1 < 0 < \lambda_2$, the unstable and stable arms for the solutions, denoted by the UU line and the SS line in Fig. 3, correspond respectively to the case of $A_1 = 0$ and $A_2 = 0$. From Eqs. (8) and (9), the slopes of the UU line and the SS line are given by⁸:

$$\left. \frac{\partial P^H}{\partial E} \right|_{UU} = \frac{F_E}{\lambda_2 - F_{p^H}} = \frac{\lambda_2 - J_E}{J_{p^H}} > 0; \text{ if } F_E > 0$$

$$< 0; \text{ if } F_E < 0$$
(14)

$$\left. \frac{\partial P^H}{\partial E} \right|_{SS} = \frac{F_E}{\lambda_1 - F_{p^H}} = \frac{\lambda_1 - J_E}{J_{p^H}} > 0; \text{ if } J_{p^H} < 0$$

$$< 0; \text{ if } J_{p^H} > 0$$
(15)

Hence, the UU and SS lines may be either upward or downward sloping. Moreover, when both lines are both downward or upward sloping, and the SS line is steeper than the UU line. It is noted that by comparing Eqs. (12)–(15), we can infer that when the lines of $\dot{P}^H = 0$, $\dot{E} = 0$, UU and SS are all upward or downward sloping, the SS line is the steepest one while the UU line is the flattest one under the case of $F_E > 0$ and $J_{p^H} < 0$ or the case of $F_E < 0$ and $J_{p^H} > 0$. When the lines of $\dot{E} = 0$ and SS are downward sloping or the lines of $\dot{P}^H = 0$ and UU are upward sloping, the SS line is flatter than the line of $\dot{E} = 0$, while the line of $\dot{P}^H = 0$ is steeper than the UU line under $F_E > 0$ and $J_{p^H} > 0$. When the lines of $\dot{E} = 0$ and SS are upward sloping or the lines of $\dot{P}^H = 0$ and UU are downward sloping, the SS line is steeper than the line of $\dot{E} = 0$, while the $\dot{P}^H = 0$ line is flatter than the UU line under $F_E < 0$ and $J_{p^H} < 0$.⁹

We will use the phase diagrams in Figs. 3–6 to depict diagrammatically the adjustment paths of the housing price (P^H) and the exchange rate (E), dependent on the elasticity of housing demand by foreign buyers (F_E) and the degree of international capital mobility (J_{p^H}). As indicated by the arrows, all possible trajectories can be sketched and as is evident, the trajectories start from the stable path SS and then asymptotically diverge to the unstable path UU .

3. Dynamic adjustments of an increase in foreign buyers

We are now ready to address the dynamic adjustments of the housing price P^H and the exchange rate E in response to the pre-announcement of increasing foreign buyers (N^*). For expository convenience, in what follows 0^- and 0^+ represent the instants before and after the policy announcement, while T^- and T^+ represent the instants before and after the policy's implementation.

After describing the above steady-state values of P^H and E , we can utilize phase diagrams to depict the dynamic paths towards them. From Eq. (6), the corresponding shifts of the loci of $\dot{P}^H = 0$ and $\dot{E} = 0$ are as follows:

$$\left. \frac{\partial E}{\partial N^*} \right|_{\dot{P}^H=0} = -\frac{F_{N^*}}{F_E} > 0; \text{ if } F_E < 0$$

$$< 0; \text{ if } F_E > 0$$
(16)

⁶ This case applies to the situation that the interest rate elasticity of money demand is large.

⁷ $\left. \frac{\partial P^H}{\partial E} \right|_{\dot{P}^H=0} - \left. \frac{\partial P^H}{\partial E} \right|_{\dot{E}=0} = \frac{-F_E J_{p^H} + J_E F_{p^H}}{F_{p^H} J_{p^H}} > 0; \text{ if } J_{p^H} < 0$
 $< 0; \text{ if } J_{p^H} > 0$.

⁸ The product of the SS line and the UU line is

$$\left[\left. \frac{\partial P^H}{\partial E} \right|_{SS} \right] \left[\left. \frac{\partial P^H}{\partial E} \right|_{UU} \right] = -\frac{F_E}{J_{p^H}} > 0; \text{ if } \text{Sign}(F_E) \neq \text{Sign}(J_{p^H})$$

From the above equation and Eq. (16), the slopes of the SS line and the UU line are identical or opposite signs.

⁹ We have: $\left. \frac{\partial P^H}{\partial E} \right|_{\dot{E}=0} - \left. \frac{\partial P^H}{\partial E} \right|_{SS} = -\frac{J_E}{J_{p^H}} - \frac{\lambda_1 - J_E}{J_{p^H}} > 0; \text{ if } J_{p^H} < 0$
 $< 0; \text{ if } J_{p^H} > 0$.

$$\left. \frac{\partial P^H}{\partial E} \right|_{\dot{E}=0} - \left. \frac{\partial P^H}{\partial E} \right|_{UU} = -\frac{J_E}{J_{p^H}} - \frac{\lambda_2 - J_E}{J_{p^H}} > 0; \text{ if } J_{p^H} < 0$$

$$< 0; \text{ if } J_{p^H} > 0$$

$$\left. \frac{\partial P^H}{\partial E} \right|_{SS} - \left. \frac{\partial P^H}{\partial E} \right|_{\dot{P}^H=0} = \frac{F_E}{\lambda_1 - F_{p^H}} - \left(\frac{F_E}{F_{p^H}} \right) = \frac{\lambda_1}{F_{p^H}} \cdot \frac{F_E}{\lambda_1 - F_{p^H}} > 0; \text{ if } F_E > 0$$

$$< 0; \text{ if } F_E < 0$$

$$\left. \frac{\partial P^H}{\partial E} \right|_{UU} - \left. \frac{\partial P^H}{\partial E} \right|_{\dot{P}^H=0} = \frac{F_E}{\lambda_2 - F_{p^H}} - \left(\frac{F_E}{F_{p^H}} \right) = \frac{\lambda_2}{F_{p^H}} \cdot \frac{F_E}{\lambda_2 - F_{p^H}} > 0; \text{ if } F_E < 0$$

$$< 0; \text{ if } F_E > 0$$

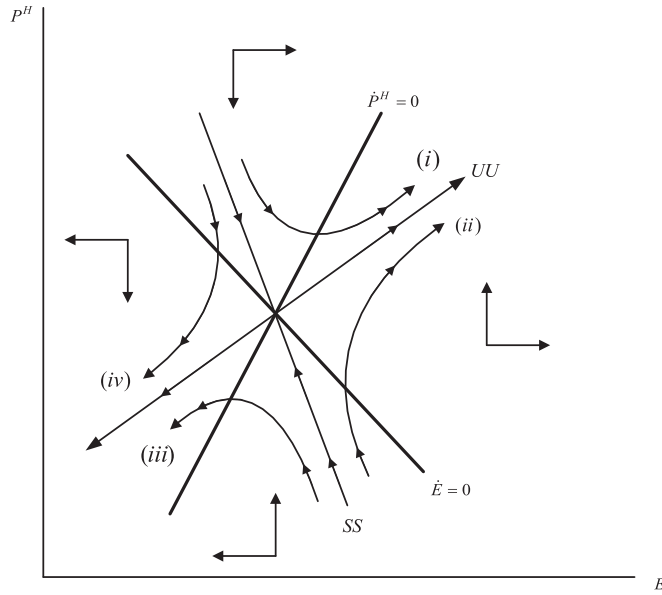


Fig. 3. Phase diagram under $F_E > 0$ and $J_{pH} > 0$.

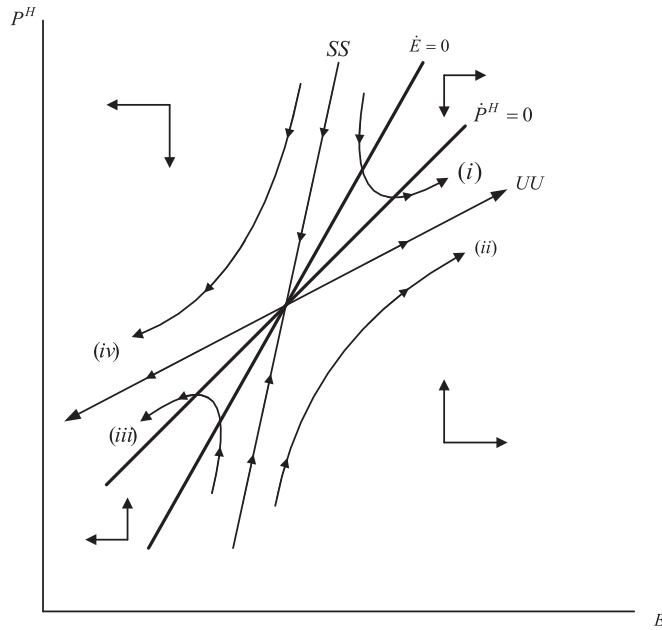


Fig. 4. Phase diagram under $F_E > 0$ and $J_{pH} < 0$.

$$\left. \frac{\partial E}{\partial N^*} \right|_{\dot{E}=0} = -\frac{J_{N^*}}{J_E} < 0 \quad (17)$$

Then, as depicted in the subsequent graphical diagrams, the $\dot{P}^H = 0$ line in Eq. (16) shifts rightward or leftward when F_E is negative or positive, while Eq. (17) shows that the $\dot{E} = 0$ line will shift leftward for a rise in foreign buyers. From Eqs. (16) and (17), we can compare the magnitudes of the shifts between the lines of $\dot{P}^H = 0$ and $\dot{E} = 0$:

$$\left. \frac{\partial E}{\partial N^*} \right|_{\dot{P}^H=0} - \left. \frac{\partial E}{\partial N^*} \right|_{\dot{E}=0} = -\frac{F_{N^*}}{F_E} - \left(-\frac{J_{N^*}}{J_E} \right) = \frac{-F_{N^*} J_E + J_{N^*} F_E}{F_E J_E} > 0 \quad (18)$$

That is, the leftward shift of the $\dot{P}^H = 0$ line can be either smaller or larger than that of the $\dot{E} = 0$ line. Accordingly, in what follows we discuss the dynamic adjustments of housing prices and exchange rates following a pre-announcement of an increase in foreign buyers (N^*) in four cases, which can be applied to Singapore, Malaysia, Australia and China, respectively:

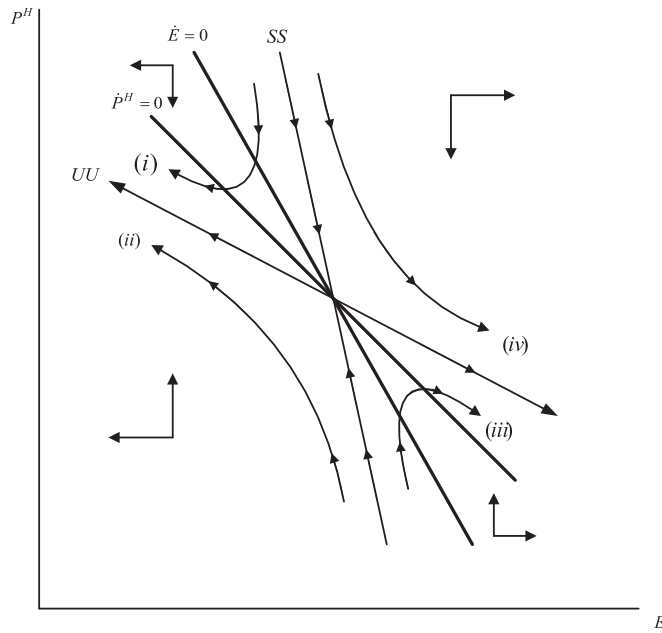


Fig. 5. Phase diagram under $F_E < 0$ and $J_{pH} > 0$.

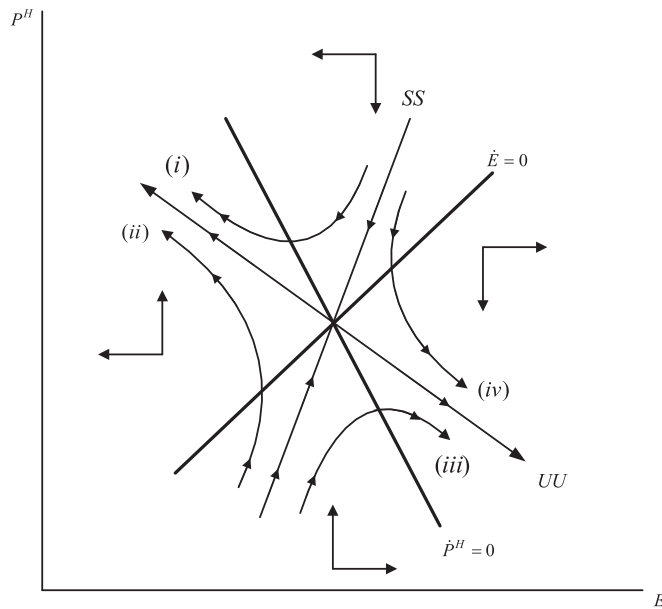


Fig. 6. Phase diagram under $F_E < 0$ and $J_{pH} < 0$.

(A) The case for Singapore: large elasticity of foreign demand and high degree of capital mobility ($F_E > 0$ and $J_{pH} > 0$)

As depicted in Fig. 7, let the initial equilibrium be at point Q_0^- , where the two lines of $\dot{P}^H = 0(N_0^*)$ and $\dot{E} = 0(N_0^*)$ intersect, and the housing price and the exchange rate are respectively denoted by P_0^H and E_0^- . In response to a rise in foreign buyers from N_0^* to N_1^* , two situations can happen, depending on the magnitudes of the leftward shifts between the lines of $\dot{P}^H = 0$ and $\dot{E} = 0$.

If the leftward shift of the $\dot{P}^H = 0$ line is larger than that of the $\dot{E} = 0$ line, then the line of $\dot{P}^H = 0(N_1^*)$ intersects with the line of $\dot{E} = 0(N_1^*)$ at the new equilibrium at point Q_1 . In this situation, the exchange rate will exhibit an undershooting at the moment of the announcement of the rise in foreign buyers. As the arrows indicated, during the period between the announcement (0^+) and the implementation (T^-), the immediate response and the long-run adjustment of the housing prices move in opposite directions. This implies that the housing price exhibits a mis-adjustment at the moment of Q_0^+ to Q_T .

In Fig. 7, it is worth to mention the case that the leftward shift of the $\dot{P}^H = 0$ line is smaller than that of the $\dot{E} = 0$ line. The new

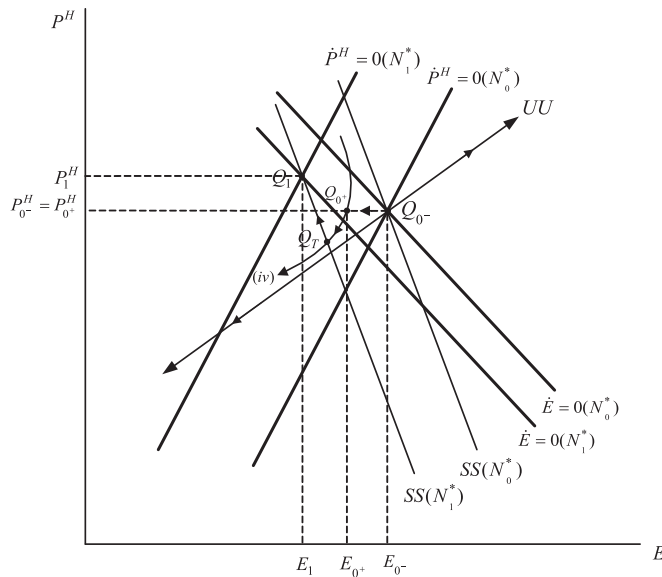


Fig. 7. A rise in foreign demand under $F_E > 0$ and $J_{p^H} > 0$.

equilibrium is at the low housing price and exchange rate in the long run. The exchange rate also exhibits an undershooting at the moment of the announcement of the rise in foreign buyers in the short run. Moreover, during the period between the announcement (0^+) and the implementation (T^-), the housing price exhibits an overshooting.

Note when the elasticity of foreign demand is large ($F_E > 0$), housing prices may exhibit a mis-adjustment. The increase in foreign buyers can lead to an appreciation of home currency, causing a fall in the housing price through a reduction in foreign demand. This results in a mis-adjustment of housing prices between the period of policy announcement and implementation. The fall in housing prices pushes up foreign and domestic demands. This in turn raises housing prices. In other words, the longer the time between policy announcement and implementation is, the higher the chance for a mis-adjustment in housing prices to occur.

(A) *The case for Malaysia: large elasticity of foreign demand and low degree of capital mobility ($F_E > 0$ and $J_{p^H} < 0$).*¹⁰

As depicted in Fig. 8, in conjunction with the initial foreign buyers (N_0^*), the equilibrium of the economy is at point Q_0^- , with the initial housing price and exchange rate at P_0^H and E_0^- . If foreign buyers increases, both the lines of $\dot{P}^H = 0(N_0^*)$ and $\dot{E} = 0(N_0^*)$ shift leftwards to $\dot{P}^H = 0(N_1^*)$ and $\dot{E} = 0(N_1^*)$, respectively. This gives a new equilibrium at point Q_1 , with new housing price P_1^H and exchange rate E_1 .

Upon a shock of the increase in foreign buyers at the instant 0^+ , the exchange rate falls while the housing price remains unchanged. It is noted that the economy will instantaneously jump horizontally from point Q_0^- to Q_0^+ , and the exchange rate exhibits an under-shooting at the time of the policy announcement. From time 0^+ to time T^- , both the housing price P^H and the exchange rate E continue to decrease. At the instant T^+ , when the number of foreign buyers actually increases, the economy will reach a point on the convergent stable arm $SS(N_1^*)$. Thereafter, from time T^+ onward, the economy will move along the line of $SS(N_1^*)$ toward its new equilibrium at point Q_1 . The exchange rate will then exhibit an overshooting at the moment of the announced increase in foreign buyers. As is evident, during the period between the announcement (0^+) and the implementation (T^-), even though the number of foreign buyers have not yet increased, the exchange rate and the housing price will respond in advance.¹¹

From the above discussions in Figs. 7 and 8, we have the following proposition on the short-run adjustment paths on housing prices:

Proposition 3. For the open economy with the housing market, the increase in foreign buyers may cause the housing price to mis-adjust in the short run if the price elasticity of foreign housing demand is large.

(A) *The case for Australia: small elasticity of foreign demand and high degree of capital mobility ($F_E < 0$ and $J_{p^H} > 0$)*

The dynamic adjustments of the economy for this case can be illustrated in Fig. 9, in which the line of $\dot{P}^H = 0(N_0^*)$ will shift rightwards to $\dot{P}^H = 0(N_1^*)$ and the line of $\dot{E} = 0(N_0^*)$ will shift leftwards to $\dot{E} = 0(N_1^*)$ due to an increase in foreign buyers. The new

¹⁰ Foreigners can buy property valued over \$330,000 but it must be approval by the government. (<https://sourceable.net/china-transforms-foreign-property-investment/>)

¹¹ Fig. 8 illustrates the case that the leftward shift of the $\dot{P}^H = 0$ line exceeds the $\dot{E} = 0$ line. For the opposite case, new equilibrium point is along with low housing price and exchange rate in the long run. The exchange rate also exhibits an undershooting at the moment of the announced foreign demand in the short run. Moreover, during the period between the announcement (0^+) and the implementation (T^-), the housing price exhibits monotonically decreasing.

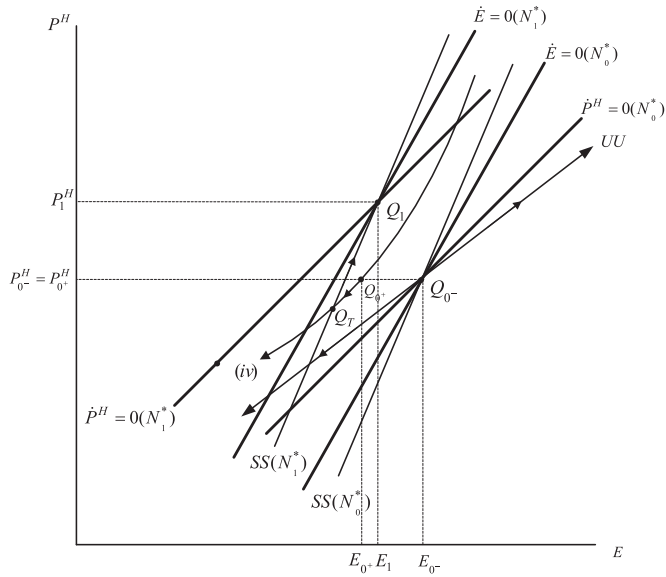


Fig. 8. A rise in foreign demand under $F_E > 0$ and $J_{pH} < 0$.

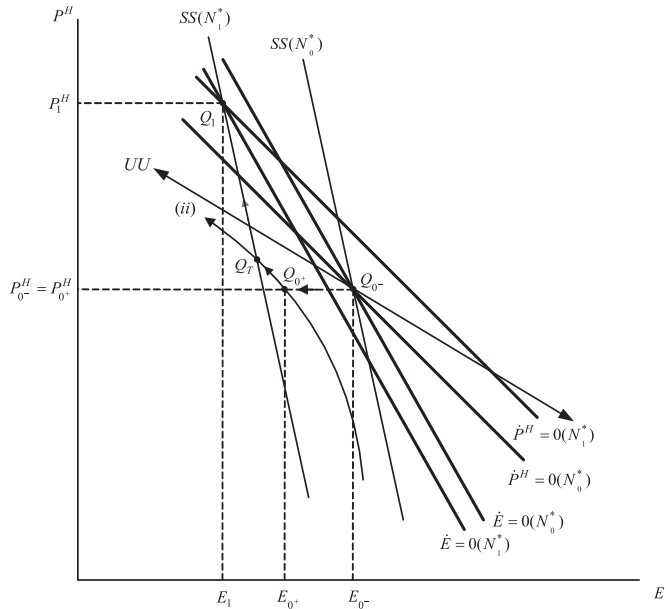


Fig. 9. A rise in foreign demand under $F_E < 0$ and $J_{pH} > 0$.

equilibrium will be at point Q_1 , and the corresponding housing price and the exchange rate will be P_1^H and E_1 , respectively.

At the instant of the policy announcement, the economy will jump leftwards from point Q_{0^-} to point Q_{0^+} , while during the period between time 0^+ and time T^- , the economy will move from point Q_{0^+} to point Q_T along the trajectory (ii). After the time T^+ , the economy will move to the new equilibrium Q_1 along the locus of $SS(N_1^*)$ as the number of foreign buyers rises to N_1^* .

To sum up, the exchange rate will keep on falling from the time of the policy announcement, and the housing price will raise before and after the policy's implementation. In the other words, the exchange rate will be characterized by undershooting (Q_{0^+}) in the short-run. Furthermore, the housing price will exhibit monotonically increasing during the period between the policy announcement at time 0^+ and its implementation at time T^- .

(A) The case for China: small elasticity of foreign demand and low degree of capital mobility ($F_E < 0$ and $J_{pH} < 0$)

In response to a rise in foreign buyers from N_0^* to N_1^* , a new equilibrium at point Q_1 , with the housing price P_1^H and the exchange rate E_1 as depicted in Fig. 10. In this case, the exchange rate will be characterized by overshooting in the short-run, while the housing

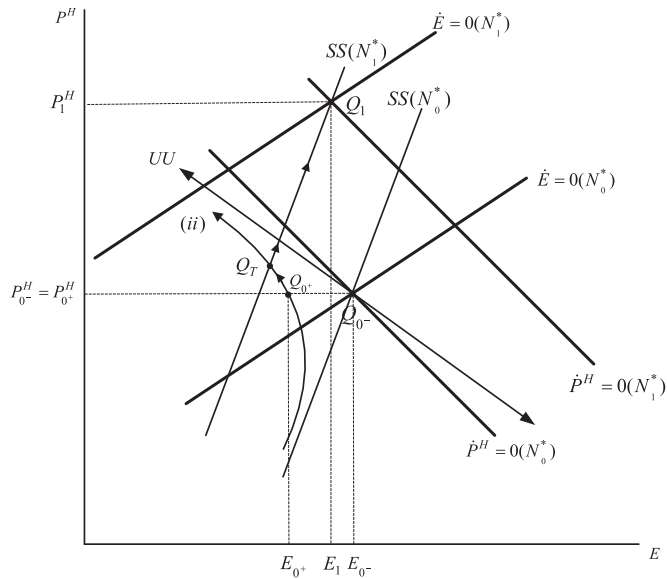


Fig. 10. A rise in foreign demand under $F_E < 0$ and $J_{p^H} < 0$.

price will continue to increase after time 0^+ .

From the discussion in Fig. 10, we have the following proposition on the short-run adjustment in exchange rates:

Proposition 4. For the open economy with the housing market, the increase in foreign buyers may cause the exchange rate to overshoot if both the price elasticity of foreign housing demand and the degree of international capital mobility are small.

4. Conclusions

Property investments from overseas buyers have recently surged in many economies, and consequent debates over the impacts on local housing prices have been also sparked. Utilizing an open macroeconomic model with a housing market, this paper has examined the price responses of a rise in foreign purchases in the short and the long run for the economy. The results show that in the long run the impact of foreign buyers on housing prices depends on the price elasticity of foreign demand, while the exchange rate depends on the degree of international capital mobility. In addition, the short-run fluctuations of the exchange rates in terms of overshooting and undershooting, while the changes in the housing prices and exchange rates can be over- or under-shot or mis-adjusted, dependent partly on the length of time between the policy announcement and its implementation. In particular, the housing prices could fall in the short run if foreign housing demand is price-elastic, while the exchange rates could be over-shot if capital is less mobile.

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