

IMES DISCUSSION PAPER SERIES

Capital Flow, Foreign Direct Investment and Home Market Effect

Naohisa Hirakata and Mitsuru Katagiri

Discussion Paper No. 2013-E-5

IMES

INSTITUTE FOR MONETARY AND ECONOMIC STUDIES

BANK OF JAPAN

2-1-1 NIHONBASHI-HONGOKUCHO

CHUO-KU, TOKYO 103-8660

JAPAN

You can download this and other papers at the IMES Web site:

<http://www.imes.boj.or.jp>

Do not reprint or reproduce without permission.

NOTE: IMES Discussion Paper Series is circulated in order to stimulate discussion and comments. Views expressed in Discussion Paper Series are those of authors and do not necessarily reflect those of the Bank of Japan or the Institute for Monetary and Economic Studies.

Capital Flow, Foreign Direct Investment and Home Market Effect

Naohisa Hirakata* and Mitsuru Katagiri**

Abstract

In this paper, we investigate the dynamics of foreign direct investment (FDI) and examine the effects of FDI on the macroeconomic dynamics following a decline in labor endowment. In so doing, we introduce capital accumulation into Helpman, Melitz and Yeaple (2004)'s model and extend their model to a dynamic setting following Ghironi and Melitz (2005). Our main findings are as follows. First, we find that FDI stocks do not monotonically decrease toward the new steady state but rather initially increase and move away from the new steady state before reversing course and converging to it, reflecting the fact that a part of foreign assets is accumulated in the form of FDI. Second, we find that foreign portfolio investment (FPI) helps the funding of foreign multinational firms and encourages inward FDI by them. While the increase in inward FDI decreases the number of domestic firms by discouraging their entry, it increases the equilibrium relative wages, thus making the relationship between relative wages and the number of firms different from the conventional "home market effect."

Keywords: Foreign Direct Investment (FDI); Capital Flows; Home Market Effect

JEL classification: F12, F23, F32

*Director and Senior Economist, Institute for Monetary and Economic Studies (currently, Financial System and Bank Examination Department), Bank of Japan (E-mail: naohisa.hirakata@boj.or.jp)

**Associate Director and Economist, Institute for Monetary and Economic Studies (currently, Monetary Affairs Department), Bank of Japan (E-mail: mitsuru.katagiri@boj.or.jp)

We would like to thank Kosuke Aoki, Gianluca Benigno, Hirokazu Ishise, Takashi Kano, Kiminori Matsuyama, and staff of the Bank of Japan for helpful suggestions and comments. The views expressed in this paper are those of the authors and do not necessarily reflect the official views of the Bank of Japan.

1 Introduction

Foreign direct investment (FDI) has played an important role as a capital flow channel. Figure 1 shows that FDI accounts for about 20% of total international capital flows for G7 countries. In addition, emerging economies such as China receive large amounts of FDI.¹ To take advantage of economic growth in emerging economies, the international capital flows through FDI have been a promising channel particularly for developed countries such as European countries and Japan, because they are faced with shrinkage of domestic markets because of, for example, population aging or low productivity growth.

In this paper, we investigate the dynamics of international capital flows following the shrinkage of domestic markets because of a labor endowment decline. Based on the observation above, we particularly focus on the role of FDI as one of several capital flow channels. We compare the dynamics of international capital flows and other economic variables in an economy with and without FDI, and examine the effect of FDI on these dynamics. We also examine the role played by the interaction between FDI and foreign portfolio investment (FPI) based on internationally traded riskless bonds.

To investigate these issues, we extend Helpman et al. (2004)'s model in the following two directions. First, we introduce capital accumulation into the model. As in a standard open macroeconomic model, the household and the firm can accumulate foreign assets in addition to domestic assets. In contrast to previous open macroeconomic models, however, there are two forms of foreign assets: riskless bonds and FDI. We assume that the firm accumulates foreign assets as a form of FDI under the proximity–concentration trade-off as in Helpman et al. (2004). Second, we extend their model to a dynamic setting following Ghironi and Melitz (2005), who extend Melitz (2003)'s trade model to a dynamic setting. By doing so, we can simulate the transition path in the face of shrinkage of domestic markets, and analyze the dynamics of international capital flows and other economic variables on the transition path.

Our findings are summarized as follows. First, we find that FDI stocks do not converge monotonically to the new steady state but rather initially move away from the new steady state, or overshoot, before reversing course and converging to it, reflecting dynamic optimiza-

¹Regarding inflows, FDI is largely liberalized and even encouraged in some cases through tax incentives, whereas other inflows are constrained. Inward FDI in manufacturing is almost completely liberalized.

tion by households. This result implies that the empirical observation of an increase in FDI stocks at some point does not necessarily mean that the economy heads to a steady state with a higher level of FDI. Therefore, when we analyze developments in FDI, we should examine the transition dynamics as well as comparative statics because focusing only on comparative statics as in previous studies may mislead our understanding of developments in FDI.

Few previous studies have analyzed the dynamics of FDI from the standpoint of capital flows. The open macroeconomy literature, on the one hand, has not considered FDI separately from other capital flow channels, but has discussed the dynamics of international capital flows by assuming that only one kind of capital is available (e.g., Backus et al. (1992)).² The international trade literature, on the other hand, has not referred to FDI as a capital flow channel but has intensively investigated the determinants of FDI from the standpoint of trade theory using comparative statics.³

Second, we find that when FDI and FPI are available together, the economic transition is different from the case where only one of them is available. For example, the response of the number of domestic firms is different: on the one hand, when only FDI is available, a decline in the number of domestic firms following the shrinkage of domestic markets is mitigated relative to the economy without FDI. This is simply because FDI gives domestic firms a chance to do business in foreign countries, and as a result encourages investment in the domestic firms. On the other hand, in the case that FDI and FPI are opened up together, the decline in the number of domestic firms would be larger relative to the economy without FDI. This is because of the interaction between FDI and FPI. That is, the domestic household's FPI encourages the entry of foreign firms and international activity of foreign multinational firms, namely inward FDI, in the household's country, and as a result discourages the entry of domestic firms. This interaction between FDI and FPI can be interpreted as capital outflows to the foreign country through FPI flow back to the home country through inward FDI by productive foreign firms.

This interaction between FDI and FPI changes the relationship between the number

²Recently, the literature on international capital controls emphasizes that FDI should be discussed separately from other capital flows because FDI does not seem systematically dangerous to financial stability. See Korinek (2010) and Jeanne (2012).

³For example, see Brainard (1997), Markusen and Venables (2000) and Helpman et al. (2004). Antras and Yeaple (2013) provide an extensive survey of this literature.

of domestic firms and relative real wages obtained in the previous studies. For example, Krugman (1980) and Corsetti et al. (2007) demonstrate that a decrease in the number of firms in a particular country leads to *lower* real wages in the country.⁴ Our results are in contrast to these previous studies. While the decrease in the number of domestic firms is larger with both FDI and FPI than with only one of them, relative real wages are *higher* in the former case than in the latter case. This result suggests that once we take into account FDI together with FPI and focus on the transition dynamics, the relationship between the number of firms and real wages is not as simple as that found in previous studies.

The most closely related paper in terms of motivation is Ju and Wei (2010). They considered FDI as a capital flow channel as in this paper and pointed out the possibility that FPI reinforced the inward FDI. They, however, focus on financial frictions and property rights rather than proximity-concentration trade-off in FDI, productivity heterogeneity and market size. Albuquerque (2003) also considers FDI as a capital flow channel, but focuses on the difference in volatility between FDI and other capital flow channels. Some recent studies also investigate the effects of relative changes or differences in a market size between countries. For example, Hsieh and Ossa (2011) investigates the effect of Chinese economic growth on other countries' economic welfare. Ramondo and Rodriguez-Clare (2010) analyze the fact that some European small countries realize a high level of income even though their market size is small, and emphasize the role of multinational firms. Those papers, however, do not consider a transition between steady states. Chor (2009) emphasizes the effect of inward FDI on economic welfare like ours, but focuses on the possibility that the subsidy on inward FDI improves the welfare.

The rest of the paper is organized as follows. In Section 2, we formulate an economic model based on the work of Helpman et al. (2004). Section 3 explains the simulation procedure and calibrates the model. In Section 4, we provide the main results. Section 5 provides some policy implications and concluding remarks.

2 Model

The economy consists of two countries, home and foreign. Foreign variables are denoted by an asterisk. In what follows, we first describe optimization in both a final goods firm and

⁴Corsetti et al. (2007) refer to the changes in real wages as a “home market effect.”

an intermediate goods firm, and then characterize the household's behavior and aggregate dynamics.

2.1 Firms

2.1.1 Final Goods Firm

The representative final goods firm in the home country produces the final good, Y_t , by aggregating the intermediate goods, $y_t(\omega)$, using the following CES aggregator:

$$Y_t = \left(\int_{\omega \in \Omega_t} y_t(\omega)^{\frac{\theta-1}{\theta}} d\omega \right)^{\frac{\theta}{\theta-1}},$$

where θ is the elasticity of substitution and Ω_t is the set of available intermediate goods in the home country in period t . Let $p_t(\omega)$ be the price of each intermediate good. The price index in the home country, P_t , is defined as:

$$P_t = \left(\int_{\omega \in \Omega_t} p_t(\omega)^{1-\theta} d\omega \right)^{\frac{1}{1-\theta}},$$

and the demand for each intermediate good is derived as a result of profit maximization of the representative final goods firm:

$$y_t(\omega) = \left(\frac{p_t(\omega)}{P_t} \right)^{-\theta} Y_t. \quad (1)$$

The price index and the demand for each intermediate good in the foreign country, P_t^* and $y_t^*(\omega)$, are defined in the same manner. Note, however, that the set of available intermediate goods in the home and foreign country are not necessarily the same, i.e., $\Omega_t \neq \Omega_t^*$.

2.1.2 Intermediate Goods Firm in the Domestic Market

There is a continuum of intermediate goods firms in each country. They are different with respect to the intermediate goods they produce, $\omega \in \Omega$, and their productivity, z . In the home country, the intermediate goods firms produce using labor, l , and capital, k , according to the following Cobb–Douglas technology:

$$y(\omega) = Z_t z k_t^\alpha l_t^{1-\alpha}, \quad (2)$$

where Z_t is the aggregate productivity in the home country at period t . We assume that the firms' idiosyncratic productivity, z , is constant over time as in Melitz (2003). The maximization problem for the intermediate goods firms is:

$$\max \frac{p_t(\omega)}{P_t} y(\omega) - w_t l_t - r_{k,t} k_t, \quad (3)$$

subject to (1) and (2). w_t and $r_{k,t}$ are the real wage rate and the real rental rate of capital in the home country at period t .

As a consequence of the above optimization problem, the intermediate goods firms charge a price that includes a proportional markup, $\theta/(\theta - 1)$, over their effective marginal cost. Let $p_t(z)$ be the price charged by the intermediate goods firms with productivity z . Then, the intermediate goods price relative to the price index is given by:

$$\rho_t(z) \equiv \frac{p_t(z)}{P_t} = \frac{\theta}{\theta - 1} \frac{\lambda_t}{Z_t z},$$

where λ_t is the marginal cost of production, which is defined by:

$$\lambda_t \equiv \frac{r_{k,t}^\alpha w_t^{1-\alpha}}{\alpha^\alpha (1-\alpha)^{1-\alpha}}.$$

Furthermore, the demand for capital and labor is given by:

$$k_t(z) = \frac{\alpha}{r_{k,t}} \left(1 - \frac{1}{\theta}\right) \rho_t(z)^{1-\theta} Y_t$$

and

$$l_t(z) = \frac{1-\alpha}{w_t} \left(1 - \frac{1}{\theta}\right) \rho_t(z)^{1-\theta} Y_t.$$

Finally, the profit of the intermediate goods firms becomes:

$$d_t(z) = \frac{1}{\theta} \rho_t(z)^{1-\theta} Y_t.$$

The profit of the intermediate goods firms is distributed to the stockholders.

In the foreign country, we can describe the behavior of intermediate goods firms in the same manner. We can similarly derive their price, $\rho_t^*(z)$, demand for capital and labor, $k_t^*(z)$ and $l_t^*(z)$, and profit, $d_t^*(z)$.

2.1.3 Export and Foreign Direct Investment

The intermediate goods firms can do business in the other country in addition to their own country. In so doing, there are two ways: export or FDI. The intermediate goods firms would

be involved in exporting (or FDI) if and only if the expected profit from export (or FDI) is positive. In what follows, we will describe the entry decision for the exporting and FDI market. While we mainly focus on the decision by intermediate goods firms in the home country, the decision by those in the foreign country is described in a similar manner.

Export and FDI are different in terms of the cost structure. When the intermediate goods firms enter the exporting market, they need to pay a fixed cost, f_X , for setup. As the fixed cost is measured by effective labor in their own country, it is $w_t f_X / Z_t$ in real terms. In addition, exporting their products to the other country requires an iceberg-type trade cost, τ . When the intermediate goods firms enter the FDI market, on the other hand, they only need to pay a fixed cost f_I . While they do not need to pay any variable costs to carry out FDI, the fixed cost for FDI is assumed to be higher than that for exporting (i.e., $f_X < f_I$) as in Helpman et al. (2004). In addition to the difference in the cost structure, export and FDI are fundamentally different in terms of labor and aggregate technology. The exporting firms in the home country hire their labor in the home country and utilize the home country's aggregate technology (Z_t). The FDI firms in the home country, on the other hand, hire their labor in the other country and utilize the foreign country's aggregate technology (Z_t^*). Therefore, the FDI firms' production function is characterized by $y(\omega) = Z_t^* z k_t^\alpha l_t^{1-\alpha}$, and their labor cost as well as the fixed setup cost are measured by the wage rate in the foreign country, w_t^* .

Under these assumptions, we can derive prices, labor demand, capital demand and profits for the exporting and FDI firms. Hereafter, variables for the exporting and FDI firms are denoted by the subscripts X and I , respectively. Let $p_{X,t}(z)$ and $p_{I,t}(z)$ be the prices charged by the exporting and FDI firms with productivity z . Then, the prices charged by the exporting and FDI firms relative to the price index in the other country, P_t^* , are given by:

$$\rho_{X,t}(z) \equiv \frac{p_{X,t}(z)}{P_t^*} = \frac{\tau}{Q_t} \frac{\theta}{\theta - 1} \frac{\lambda_{X,t}}{Z_t z} \quad \text{and} \quad \rho_{I,t}(z) \equiv \frac{p_{I,t}(z)}{P_t^*} = \frac{\theta}{\theta - 1} \frac{\lambda_{I,t}}{Z_t^* z},$$

where Q is the real exchange rate based on the price indices. Note that the effective marginal cost for the FDI firms is based on the foreign country's aggregate technology, Z_t^* , reflecting the fact that they produce in the foreign country. While the marginal cost for exporting firms is the same as that of the domestic firms (i.e., $\lambda_{X,t} = \lambda_t$), the marginal cost of FDI firms is different from that for domestic and exporting firms because they have to hire their

labor in the foreign country. That is, the marginal cost for the FDI firm is defined by:

$$\lambda_{I,t} \equiv \frac{r_{k,t}^\alpha w_t^{*1-\alpha}}{\alpha^\alpha (1-\alpha)^{1-\alpha}}.$$

The capital demand of exporting and FDI firms is:

$$k_{X,t}(z) = \frac{Q_t \alpha}{r_{k,t}} \left(1 - \frac{1}{\theta}\right) \rho_{X,t}(z)^{1-\theta} Y_t^* \quad \text{and} \quad k_{I,t}(z) = \frac{\alpha}{r_{k,t}} \left(1 - \frac{1}{\theta}\right) \rho_{I,t}(z)^{1-\theta} Y_t^*.$$

Note that the capital demand is driven by the aggregate demand in the foreign country, Y_t^* , rather than that in the home country. As for the labor demand of exporting and FDI firms, they must hire labor for production as well as for setup. Thus, the labor demand for exporting and FDI firms is given by:

$$l_{X,t}(z) = \frac{Q_t(1-\alpha)}{w_t} \left(1 - \frac{1}{\theta}\right) \rho_{X,t}(z)^{1-\theta} Y_t^* + \frac{f_X}{Z_t}$$

and

$$l_{I,t}(z) = \frac{1-\alpha}{w_t^*} \left(1 - \frac{1}{\theta}\right) \rho_{I,t}(z)^{1-\theta} Y_t^* + \frac{f_I}{Z_t^*}.$$

Note that the FDI firms pay a labor cost based on the foreign country's wage rate, w_t^* . Finally, the profit of the exporting and FDI firm becomes:

$$d_{X,t}(z) = \frac{Q_t}{\theta} \rho_{X,t}(z)^{1-\theta} Y_t^* - \frac{w_t f_X}{Z_t} \quad \text{and} \quad d_{I,t}(z) = \frac{1}{\theta} \rho_{I,t}(z)^{1-\theta} Y_t^* - \frac{w_t^* f_I}{Z_t^*}.$$

As mentioned before, the intermediate goods firms would enter the exporting market or the FDI market if and only if their profit was positive. That is, the intermediate goods firms would enter the exporting market if $d_{X,t} > 0 \wedge d_{X,t} > d_{I,t}$, they would enter the FDI market if $d_{I,t} > 0 \wedge d_{I,t} > d_{X,t}$, and they would enter neither the exporting nor FDI market otherwise.

Because of the scale economy caused by the fixed costs, f_X and f_I , only productive firms do business in the other country through export or FDI. Moreover, because of the assumption of $f_I > f_X$, the FDI firms are more productive than the exporting firms, as in Helpman et al. (2004). Let $z_{X,t}$ and $z_{I,t}$ be the thresholds for exporting and FDI. That is, $d_X(z_{X,t}) = 0$ and $d_I(z_{I,t}) = 0$. Then, the intermediate firms' decision is summarized as follows.

$$\left\{ \begin{array}{ll} \text{Only domestic market} & \text{if } z \leq z_X \\ \text{Domestic and exporting market} & \text{if } z_X < z \leq z_I \\ \text{Domestic and FDI market} & \text{if } z > z_I \end{array} \right.$$

2.1.4 Aggregation

The productivity distribution of the intermediate goods firms is assumed to be Pareto distributed with lower bound z_{min} and shape parameter $\kappa > \theta - 1$: $G(z) = 1 - (z_{min}/z)^\kappa$. Let the total mass of intermediate goods firms be N_t . Then, the fraction of intermediate firms that enter the exporting market and FDI market is:

$$\frac{N_{X,t}}{N_t} = \left(\frac{z_{min}}{z_X} \right)^\kappa - \left(\frac{z_{min}}{z_{I,t}} \right)^\kappa \quad \text{and} \quad \frac{N_{I,t}}{N_t} = \left(\frac{z_{min}}{z_{I,t}} \right)^\kappa,$$

where N_X and N_I are the mass of exporting and FDI firms, respectively. As in Melitz (2003), we define a kind of average productivity, \tilde{z} as follows:

$$\tilde{z} \equiv \left[\int_{z_{min}}^{\infty} z^{\theta-1} dG(z) \right]^{1/(\theta-1)} = \nu z_{min},$$

where $\nu \equiv [\kappa/(\kappa - \theta + 1)]^{1/(\theta-1)}$. Similarly, we define the average productivity for the exporting and FDI firms in period t as follows:

$$\tilde{z}_{X,t} \equiv \nu \left[z_{I,t}^{\theta-1} \left(1 - \left(\frac{z_{I,t}}{z_{X,t}} \right)^\kappa \right)^{-1} + z_{X,t}^{\theta-1} \left(1 - \left(\frac{z_{X,t}}{z_{I,t}} \right)^\kappa \right)^{-1} \right]^{\frac{1}{\theta-1}} \quad \text{and} \quad \tilde{z}_{I,t} \equiv \nu z_{I,t}.$$

As shown by Melitz (2003), these average productivities summarize all information regarding the productivity distribution. The economy can be treated as that where N_t intermediate goods firms with productivity \tilde{z} exist. Furthermore, as for the exporting and FDI markets, the economy can be considered as that where N_X firms with productivity \tilde{z}_X enter the exporting market while N_I firms with productivity \tilde{z}_I enter the FDI market. Hereafter, we define the average for any variables, x , as follows:

$$\tilde{x}_t \equiv x_t(\tilde{z}), \quad \tilde{x}_{X,t} \equiv x_{X,t}(\tilde{z}_{X,t}) \quad \text{and} \quad \tilde{x}_{I,t} \equiv x_{I,t}(\tilde{z}_{I,t}).$$

For example, the average prices are defined by: $\tilde{p}_t \equiv p_t(\tilde{z})$, $\tilde{p}_{X,t} \equiv p_X(\tilde{z}_{X,t})$ and $\tilde{p}_{I,t} \equiv p_I(\tilde{z}_{I,t})$.

Given these average productivities, the price index is redefined. It is easily shown that $P_t = [N_t(\tilde{p}_t)^{1-\theta} + N_{X,t}^*(\tilde{p}_{X,t}^*)^{1-\theta} + N_{I,t}^*(\tilde{p}_{I,t}^*)^{1-\theta}]^{1/(1-\theta)}$, which is equivalent to:

$$N_t(\tilde{p}_t)^{1-\theta} + N_{X,t}^*(\tilde{p}_{X,t}^*)^{1-\theta} + N_{I,t}^*(\tilde{p}_{I,t}^*)^{1-\theta} = 1. \quad (4)$$

Note that the price index in the foreign country, P_t^* , can be redefined in the same manner, and the equation corresponding to (4) holds.

Finally, the average dividend, D_t , is defined using these average productivities as:

$$D_t = \tilde{d}_t + \frac{N_{X,t}}{N_t} \tilde{d}_{X,t} + \frac{N_{I,t}}{N_t} \tilde{d}_{I,t}. \quad (5)$$

In the following subsection, the average dividend will be used for computing the firm value and for deciding whether new entrants enter the economy or not.

2.1.5 Entry and Exit

The intermediate goods firms actively enter and exit in every period. For their exits, we assume that the intermediate goods firms are hit by an exogenous “exit shock” with probability δ in every period. When they are hit by the exit shock, they let all employees go and sell all capital. For their entry, on the other hand, we assume that the potential entrants endogenously choose to enter the economy if and only if their value is larger than the entry cost. They are assumed to be identical prior to entry, and their initial productivities follow the cumulative distribution function, $G(z)$, which is the same distribution as the productivity distribution of incumbent firms. Thus, the value of new entrants, V_t , is:

$$V_t = \sum_{s=t+1}^{\infty} [\beta(1 - \delta)]^{s-t} \frac{\Lambda_s}{\Lambda_t} D_s,$$

where D_s is the average dividend in period s , which is defined in (5), and Λ_t is the aggregate marginal utility of consumption. Note that the value of these entrants is equal to the average value of the incumbent firms because we assume that the productivity of each incumbent firm is constant after the entry. We assume that the new entrants must pay a fixed entry cost, f_E , to enter the economy. As the entry cost is also measured by an effective labor unit, the entrant must pay $w_t f_E / Z_t$ in real terms to enter the economy. Thus, the new entrants enter the economy if:

$$V_t \geq \frac{w_t f_E}{Z_t}.$$

We assume that new entry continues until this condition is satisfied with equality.

Let $N_{E,t}$ be the mass of entrants. Then, the law of motion for the mass of intermediate goods firms is:

$$N_t = (1 - \delta)(N_{t-1} + N_{E,t-1}),$$

where $(1 - \delta)$ is the survival rate. As the law of motion indicates, we assume that the intermediate goods firms are hit by the exit shock after the new entrants enter the economy.

2.2 Household

We assume a representative household in each of the home and foreign countries. While we will mainly describe the household decision in the home country, the same applies for that in the foreign country.

The representative household inelastically supplies L_t labor units and obtains labor income, $w_t L_t$. The household can invest in intermediate goods firms in the following two ways. First, the household holds the capital of incumbent firms, K_t , whose return is equal to $(1 + r_{k,t} - \delta_K)$, where δ_K is the depreciation rate of capital. Second, the household invests in intermediate goods firms by financing the setup of the firm and obtaining its share, X_t , whose value is denoted by V_t . As this share of the firm gives an average dividend, D_t , in every period, the representative household obtains $X_t D_t$ dividends in every period. The household also saves money as riskless bonds denominated in the home and foreign currency, B_t and $B_{*,t}$. Then the representative household's budget constraint is:

$$\begin{aligned} C_t + K_{t+1} + \frac{X_{t+1}}{1-\delta} V_t + B_{t+1} + Q_t B_{*,t+1} + \frac{\eta}{2} (B_{t+1})^2 + \frac{\eta}{2} Q_t (B_{*,t+1})^2 \\ = W_t L_t + (1 + r_{k,t} - \delta_k) K_t + X_t (D_t + V_t) + (1 + r_t) B_t + (1 + r_t^*) Q_t B_{*,t} \end{aligned} \quad (6)$$

where r_t and r_t^* are the risk-free rate in the home and foreign countries, respectively. We assume that the household needs to pay a tiny cost, η , for holding the riskless bonds to avoid indeterminacy for bond holdings in the steady state as in Ghironi and Melitz (2005).

The household maximizes the discounted sum of utility from consumption subject to the budget constraint. That is, the household's optimization problem is:

$$\max \sum_{t=0}^{\infty} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma}, \quad (7)$$

subject to (6). As a result of this optimization problem, we obtain four Euler equations, each of which is with respect to B_{t+1} , $B_{*,t+1}$, K_{t+1} and X_{t+1} :

$$B_{t+1} : 1 + \eta B_{t+1} = \beta (1 + r_t) \frac{\Lambda_{t+1}}{\Lambda_t} \quad (8)$$

$$B_{*,t+1} : 1 + \eta B_{*,t+1} = \beta (1 + r_{t+1}^*) \frac{\Lambda_{t+1}}{\Lambda_t} \frac{Q_{t+1}}{Q_t} \quad (9)$$

$$K_{t+1} : 1 = \beta \frac{\Lambda_{t+1}}{\Lambda_t} (1 + r_{k,t+1} - \delta_K) \quad (10)$$

$$X_{t+1} : V_t = \beta (1 - \delta) \left[\frac{\Lambda_{t+1}}{\Lambda_t} (V_{t+1} + D_{t+1}) \right], \quad (11)$$

where $\Lambda_t \equiv C_t^{-\gamma}$ is the marginal utility of consumption in period t .

2.3 Market Clearing and Current Account

In each country, there are three domestic markets to be cleared in the equilibrium: labor, capital and share. The market clearing conditions for these markets are:

$$\text{Labor} : L_t = N_t \tilde{l}_t + N_{X,t} \tilde{l}_{X,t} + N_{I,t}^* \tilde{l}_{I,t}^* + N_{E,t} \frac{f_E}{Z_t} \quad (12)$$

$$\text{Capital} : K_t = N_t \tilde{k}_t + N_{X,t} \tilde{k}_{X,t} + Q_t N_{I,t} \tilde{k}_{I,t} \quad (13)$$

$$\text{Share} : X_t = N_t \quad (14)$$

The left-hand side and the right-hand side of these equations are the supply and demand for labor, capital and share, respectively. Note that the labor demand for FDI firms is that of foreign firms. Note also that the value of the capital of FDI firms is determined by the exchange rate, Q , because the capital of FDI firms is denominated in the foreign country's currency.

The net supply of the riskless bonds in the international bond market must be zero in the equilibrium for both currencies:

$$B_t + B_t^* = 0 \quad \text{and} \quad B_{*,t} + B_{*,t}^* = 0, \quad (15)$$

where B_t and B_t^* are the home bonds held by the home and foreign households, while $B_{*,t}$ and $B_{*,t}^*$ are the foreign bonds held by the home and foreign households.

The definition of the current account in this model is straightforward. The trade balance, TB_t , is equal to exports minus imports:

$$TB_t \equiv Q_t N_{X,t} (\tilde{\rho}_{X,t})^{1-\theta} Y_t^* - N_{X,t}^* (\tilde{\rho}_{X,t}^*)^{1-\theta} Y_t. \quad (16)$$

The income balance, IB_t , consists of the net FDI return (= return from the outward FDI minus return from the inward FDI) and the net bond return:

$$\begin{aligned} IB_t \equiv & Q_t \left[N_{I,t} (\tilde{d}_{I,t} + (r_{k,t} - \delta_K) \tilde{k}_{I,t} + r_t^* B_{*,t}) \right] \\ & - \left[N_{I,t}^* (\tilde{d}_{I,t}^* + (r_{k,t}^* - \delta_K) \tilde{k}_{I,t}^* + r_t B_t^*) \right]. \end{aligned} \quad (17)$$

The current account is equal to the sum of TB_t and IB_t by definition. In equilibrium, the changes in net foreign assets must be equal to the current account. Let FDI_t and FDI_t^* be the outward and inward FDI stock for the home country. As they are defined in the model

by:

$$\Delta FDI_t \equiv \underbrace{Q_{t+1} N_{I,t+1} \tilde{k}_{I,t+1}}_{FDI_{t+1}} - \underbrace{Q_t N_{I,t} \tilde{k}_{I,t}}_{FDI_t} \quad \text{and} \quad \Delta FDI_t^* \equiv \underbrace{N_{I,t+1}^* \tilde{k}_{I,t+1}^*}_{FDI_{t+1}^*} - \underbrace{N_{I,t}^* \tilde{k}_{I,t}^*}_{FDI_t^*},$$

the fact that the change in net foreign assets is equal to the current account, CA_t , is formulated by:

$$CA_t \equiv (\Delta FDI_t - \Delta FDI_t^*) + [Q_t(B_{*,t+1} - B_{*,t}) - (B_{t+1}^* - B_t^*)] = TB_t + IB_t,$$

where the left-hand side represents the change in net foreign assets and the right-hand side is the current account for the home country.

3 Simulation

In this section, we investigate how economic changes in one country affect the other country through capital flows, and how the availability of FDI affects the shock propagation. In particular, we focus on the economic consequences of gradual declines in the home country's (HC) labor endowment. In what follows, we first parameterize the model and then explain the simulation procedure in detail.

3.1 Parameterization

Each period in the model equals one year, and we set $\beta = 0.96$ and $\gamma = 2$, which are standard in the literature. We also set the capital share and the depreciation rate for capital to a standard value, $\alpha = 0.36$ and $\delta_k = 0.05$. We assume that the exogenous job destruction rate is 10%, which is roughly equal to that in the US. According to Ghironi and Melitz (2005), we set $\theta = 3.8$ and $\kappa = 3.4$. In order to ensure the existence of the steady state, we assume a tiny cost for holding the riskless bonds, $\eta = 0.001$.

As for the trade costs, we set the iceberg cost for exports to 30%, i.e., $\tau = 1.3$. As described in Ghironi and Melitz (2005), we would have the same result as long as the ratios between the entry cost and the other fixed costs (i.e., those for export and FDI) are the same. Thus, we normalize the entry cost, f_E , to 4, and set the fixed cost for export, f_X , to 20% of $(1 - \beta(1 - \delta))/(\beta(1 - \delta))f_E$ as in Ghironi and Melitz (2005). Finally we assume that the fixed cost for FDI is four times larger than that for export.⁵

⁵We do not have any empirical evidence to calibrate the fixed cost of FDI, but the value of the fixed cost

3.2 Decline in Labor Endowment

In the simulation, we assume that the HC's labor endowment, L_t , exogenously declines as follows (Figure 2): from periods 1 to 19, the labor endowment in the HC and foreign country (FC) remains constant and at the same level. In period 20, the labor endowment in the HC starts to decline. It continues to decline for 20 periods (from periods 20 to 39) at the same pace, and converges to a 5% lower level than in the FC. After period 40, the labor endowment in the HC remains at a 5% lower level than in the FC forever.⁶

The households and the firms make all decisions under perfect foresight.⁷ That is, in period 1, all agents in the model notice the future decline of the HC's labor endowment, and decide the future path of endogenous variables such as consumption, capital and stockholdings. Therefore, even though labor endowment does not decline until period 20, the economic transition to the new steady state starts at period 1.

4 Results

In this section, we describe the economic transition in the face of the gradual decline in the HC's labor endowment. We compute the economic transition in the following four economies, which are different in terms of availability of capital flow channels. First, we briefly describe a financial autarky case, where no capital flow channels are available. Second, we consider the economy where only FPI is available as a channel for capital flows. By comparing the first and the second cases, we analyze how the economic transition changes once capital flows become available. Third, we consider the economy where FDI is the only channel for capital flows. By comparing the third case with the first and second cases, we investigate the role of FDI in the economic transition. Fourth and finally, we consider the economy where both FPI and FDI are available. In this case, we emphasize the interaction between FPI and FDI. That is, we demonstrate that once both of them are opened up together, the economic transition shows very different patterns from the economy where only one of them is opened

of FDI does not qualitatively affect the results in this paper.

⁶We only focus on the shock to labor endowment, but we can conduct the same computational simulation for the shock to, for example, aggregate productivity, Z_t or Z_t^* .

⁷We use Dynare to solve the model and compute the deterministic transition path following a permanent shock to labor endowment.

up.

We analyze the economic transition from the following several aspects. First, we document the responses of the current account and its composition, i.e., the trade and income balance. Second, we document the response of the number of firms in both countries. Given the “taste for variety,” the number of firms in a particular country has nontrivial effects on real wages and welfare in the country because it is closely tied to the number of varieties available in the country.⁸ Third, we describe the responses of the real interest rate and wages. As for wages, we also show the responses of “terms of labor (TOL)” for the HC, $Q_t w_t / w_t^*$, as in Ghironi and Melitz (2005). The TOL indicate the relative real wage adjusted by the real exchange rate between two countries.

In all figures mentioned in this section, the steady state values before the decline in labor endowment are normalized to one in both countries, and the responses in each economy indicate the percentage changes from the old steady states. Note, however, that the steady state values could be changed depending on the availability of FDI. We will also discuss the effects on steady state values in a later section.

4.1 Financial Autarky

Before we move on to the analysis of capital flows, we briefly describe the economy without any capital flows. In this financial autarky case, the trade balance as well as the income balance in both countries are always balanced, implying that the current account is always balanced too. That is, $TB_t = IB_t = 0$ and $TB_t^* = IB_t^* = 0$ for all periods t (Figure 3).

The number of firms N_t follows the decline in labor endowment L_t : the number of firms in the HC decreases about 5% along with the labor endowment decline, while it is almost flat in the FC (Figure 4).

In the HC, the real wages w_t increase first and then drop sharply while the real interest rate r_t shows opposite patterns (Figures 5 and 6). These dynamics of factor prices in the HC reflect the fact that the labor endowment L_t is scarce relative to capital during the decline in labor endowment. The figures also show that, in the FC, the real interest rates and real

⁸We define the “home country firms (HC firms)” as those having their headquarters in the HC. Thus, the number of HC firms does not match the number of varieties available to the HC consumer. The number of varieties available to the HC consumer is equal to the sum of the number of FDI firms that carry out inward FDI to the HC and the number of HC firms.

wages move very little compared with the HC, implying that arbitrage between the HC and the FC does not take place in the labor and capital markets completely.

The TOL increase first and then drop, as do the real wages in the HC (Figure 5). Note, however, that the TOL converge to a lower level than the initial level, meaning that relative real wages in the HC are lower at the new steady state. The phenomenon that real wages in a small country are lower than those in a large country is known as the “home market effect,” which was proposed by Krugman (1980). The response of TOL shows that, although the home market effect appears in the very long run, the TOL can be driven by the changes in labor endowment on the transition path, meaning that the effect of increases in the capital–labor ratio on the TOL dominates the home market effect in the short run.

4.2 Economy with FPI Only

Next we consider the economy where only the FPI is available as a capital flow channel. The FPI in this model is represented by the trade of riskless bonds, B_t and $B_{*,t}$.

Now that the accumulation of foreign assets is allowed, the current account is not necessarily balanced in every period. The response of the current account and its composition (the trade balance TB_t and the income balance IB_t) is basically driven by the consumption and saving behavior in response to the decline in labor endowment (Figure 3). When the households recognize the future decline in the HC’s labor endowment, they also recognize the drop in permanent income in the HC. Therefore, before the decline in labor endowment, the HC household decreases their consumption (increases their savings) and increases their exports to the FC, making the trade balance positive. Furthermore, because a part of their savings consists of FPI, the income balance surplus continues to increase. Once the labor endowment converges to a low level, the HC household imports more varieties from the FC while it keeps obtaining capital income from the FPI stocks, leading to the negative trade balance and the positive income balance. Taken all together, the current account in the HC is positive and hump shaped until the labor endowment converges, and then it remains at a slightly negative level. The responses of the real wages and interest rates are also changed from the financial autarky case (Figures 5 and 6): while the fluctuations in the HC become much smaller, the real interest rates and wages in the FC fluctuate almost by the same magnitude as in the HC. Obviously, this result is induced by the arbitrage that takes place

in the international capital market across the two countries.

The TOL are flat and lower than the initial level even in the transition path (Figure 5). This response of the TOL is in contrast to the financial autarky case, where the TOL go up first and gradually converge to the lower level. When capital flows through FPI are allowed, the capital moves from a small country to a larger country along with (the expectation of) the changes in labor endowment. As this capital flow across the two countries dampens the fluctuations in the relative value of labor across the two countries, the TOL are immediately adjusted to the new steady state level, and as a result the home market effect appears immediately after the recognition of the future changes in labor endowment.

4.3 Economy with FDI Only

In this subsection, we turn to the economy where FDI is the only channel for capital flows. The question to be addressed in this subsection is: Are the effects of FDI on the macroeconomy similar to those of FPI? The answer is no. To demonstrate this, we assume that the cost for holding riskless bonds, η , is so high that the household cannot be involved in the FPI. Note, however, that the capital can move across the two countries through the FDI conducted by the intermediate goods firms.

4.3.1 Comparative Statics

In contrast to FPI, opening up FDI has effects on steady state values because FDI stocks are not necessarily zero in steady states. We therefore conduct comparative statics before the analysis of the transition and investigate how opening up FDI changes steady state values.

Table 1 shows that when FDI is opened up, the steady state values of consumption and real wages increase while those of the number of firms decreases. When FDI is available, some large and productive firms that can cover the high fixed costs of FDI are free from transportation costs associated with exports by switching to FDI. Thus, some resources are saved and the large and productive firms produce more than the case in which FDI is not available, leading to high real wages and consumption. On the other hand, the increase in the number of subsidiaries of foreign firms coming through FDI discourages the entry of domestic firms, causing a fall in the total number of domestic firms.

Table 2 shows the percentage changes in steady state values in response to the decline

in labor endowment. It shows the percentage changes in consumption, real wages and the number of firms between the old and the new steady states. The table indicates that when FDI is opened up, the declines in consumption and real wages in the HC are mitigated, whereas the decline in the number of the HC firms is exacerbated. These results imply that opening up FDI supports consumption and real wages in a relatively small country.⁹

4.3.2 FDI Stock

Figure 7 shows the outward and inward FDI stocks in the HC. In both figures, the steady state values before the decline in labor endowment are normalized to one. The circles at the right edge of the figure indicate the new steady states. The figure shows that: (1) outward FDI increases along with the decline in labor endowment, and then it decreases and converges, and (2) inward FDI decreases and overshoots somewhat, and then it gradually increases after the convergence of labor endowment. As FDI is the only way to accumulate foreign assets, these responses of outward and inward FDI can be understood from the standpoint of capital accumulation in response to the decline in labor endowment as follows.

Before and during the decline in labor endowment, the HC household decreases its consumption and increases its savings because its permanent income decreases. Without FPI, it cannot invest abroad directly but can invest abroad indirectly by putting its savings into the HC firms. Since HC firms with productivity $z > z_I$ allocate their assets to both outward FDI $k_I(z)$ and domestic investment $k(z)$, the outward FDI stocks FDI_t in the HC increase in this phase. The inward FDI stocks FDI_t^* , on the other hand, decrease before and during the decline in labor endowment because all the savings go to the HC firms and lower their funding costs, thus encouraging entry of HC firms. This increase in the entry of the HC firms discourages the FC firms' subsidiaries from entering the HC through inward FDI. Once the labor endowment converges to a lower level, the HC household gradually reduces its savings. As the HC household reduces its savings (i.e., reduces its investment in the HC firms), the HC firms reduce their outward FDI stocks.[OLE6] Furthermore, as the HC household reduces its investment in the HC firms, the FC firms are encouraged to do business in the HC, leading to the increase in inward FDI.

These responses of FDI to labor endowment suggest that we should examine the transition

⁹These results are consistent with the argument that multinational firms play a key role in enhancing income in relatively small European countries.

dynamics in addition to comparative statics when we analyze the determinants of FDI. If we focus only on the results of the comparative statics as in previous studies, what we learn from the analysis is only that the decline in labor endowment induces a low level of outward and inward FDI stocks in the long run. However, as the responses of FDI in this model suggest, the outward FDI stocks increase and remain at higher levels for a substantially long period during the transition dynamics, reflecting the dynamic optimization of the households. It implies that the empirical observation of an increase in FDI at some point does not necessarily imply that the economy heads to a steady state with a higher level of FDI. Therefore, when we analyze developments in FDI, we should examine the transition dynamics as well as comparative statics because focusing only on the comparative statics as in previous studies may mislead our understanding of developments in FDI.

4.3.3 The Number of Firms, Current Account, and Terms of Labor

The Number of Firms The decline in the number of HC firms in response to the decline in labor endowment is mitigated when FDI is opened up (Figure 4). When FDI is opened up, the HC firms with productivity $z > z_I$ have a chance to do business in the FC by allocating their assets there, which raises the profits of these HC firms. Therefore, these HC firms tend to raise more funds from the HC household, encouraging the investment in the HC firms and mitigating the decline in the number of HC firms.

Current Account The current account surplus shrinks compared with the economy only with FPI, meaning that a smaller amount of foreign assets is accumulated through FDI (Figure 3). The response of the current account implies that FDI is a more limited channel for international capital flows than the FPI. As FDI involves a fixed cost, f_I , foreign asset accumulation through FDI is available only to large and productive firms, leading to the small amount of foreign asset accumulation.

Terms of Labor The TOL are higher than in the economy with FPI only (Figure 5). There are two reasons. First, the decrease in the number of firms is mitigated in the HC. Second, the ratio of capital to labor increases because FDI is a more limited channel for international capital flows. Thus, the labor demand in the HC remains at a high level. Although the higher TOL lead to welfare gains for the HC, the overall welfare gains obtained by opening

up FDI instead of FPI are ambiguous because FDI is a more limited channel for international capital flows, and as a result the consumption in the HC is less smooth than in the economy with FPI only.

4.4 Economy with FDI *and* FPI

Finally, we investigate the economy where both FDI and FPI are available as a channel for international capital flows. Would the economy where both channels are available be at the midpoint of economies where either of them is available? Or, would it exhibit different patterns because of the interaction of the two channels? We will examine these questions.

4.4.1 FDI Stock

When FDI is opened up together with FPI, the responses of FDI stocks are completely different from the economy with FDI only. First, the level of outward FDI becomes much lower, particularly after the start of the decline in labor endowment (Figure 7). This is because FDI is a more limited tool for capital accumulation as mentioned in the previous subsection. That is, because FDI involves larger costs than FPI, the HC household tends to choose FPI rather than FDI to accumulate foreign assets when both of them are available.

Second, inward FDI increases after the start of the decline in labor endowment. This behavior of inward FDI is also in contrast to the economy with FDI only, where the inward FDI continues to decrease and remains at a low level. This result stems from the fact that the HC firms cannot exclusively attract sufficient capital in the HC anymore because of the capital outflows through FPI. While the HC firms do not have an easy way to raise funds anymore, productive FC firms raise funds more easily through FPI, leading to the increase in inward FDI by the productive FC firms. This suggests that the capital outflows to the FC through FPI flow back to the HC through the inward FDI by the productive FC firms. In sum, the interaction between FPI and FDI stated above is crucial for understanding the international capital flows.

4.4.2 The Number of Firms, Current Account, and Terms of Labor

The Number of Firms The number of HC firms decreases more than in all other previous cases (Figure 4). This result looks counterintuitive at first glance because it means that

while the decline in the number of HC firms is mitigated when only FDI is opened up, it is exacerbated when FDI is opened up together with FPI. A key to understanding this result is the response of inward FDI, which we described in the previous subsection. When FDI is opened up together with FPI, the productive FC firms expand their business in the HC through inward FDI. The increase in inward FDI increases the wage rates in the HC, which discourage HC firms from entering. This result suggests that the HC household's FPI encourages international activity of foreign multinational firms, namely inward FDI, in the HC, and as a result discourages unprofitable HC firms from entering.

Current Account While the path of the current account is not substantially different from the economy with FPI only, its composition (trade and income balance) exhibits different patterns (Figure 3). In both countries, when FDI is opened up in addition to FPI, some productive and large firms choose FDI rather than exports. Before the decline in labor endowment, the shift from exports to FDI *in the HC* reduces the trade surplus in the HC. After the decline in labor endowment, on the other hand, the shift from exports to FDI *in the FC* reduces the trade deficit in the HC. As the shift from exports to FDI has an opposite effect on the income balance, there are only small changes in the current account path because the effects on the trade balance and the income balance offset each other.

Terms of Labor While the real interest rates are almost equalized across the two countries, the TOL for the HC remain at a higher level than the initial level. This is because the increase in the number of FC firms that hire the HC labor and produce in the HC through inward FDI pushes up the labor demand in the HC.

4.4.3 Relationship Between Market Size and Wages

The results in this section indicate that the relationship between the number of firms and real wages is different from previous studies because of the interaction between FDI and FPI. Previous studies such as those of Krugman (1980) and Corsetti et al. (2007) demonstrate that a decrease in the number of firms in a particular country leads to *lower* real wages in the country; those authors call such a relationship the “home market effect.” Our results are in contrast to those of previous studies. While the number of HC firms relative to the number of FC firms (the third graph of Figure 4) becomes *lower* in the case with both FDI and

FPI available than the case in which only one of them is available, relative real wages (i.e., TOL) are *higher* in the former case than in the latter case. This result suggests that once we take into account FDI together with FPI *and* focus on the transition path, the relationship between the number of firms and real wages is not as simple as in previous studies.

4.5 Welfare Implication

Finally, we briefly discuss the welfare implications. Table 3 shows the consumption equivalent welfare in each economy, in which the welfare in the financial autarky case is normalized to one. We can draw the following implications from the table. First, as shown in the second column of Table 3, opening up FPI decreases the welfare of a shrinking country. This is a little bit surprising because the households in both countries benefit from smoothing their consumption by using the FPI. This result implies that the welfare loss associated with the negative effect of the home market effect on the HC caused by capital outflow through FPI dominates the welfare gain from smoothing consumption. Second, as shown in the third column of Table 3, opening up FDI is more beneficial to the country that faces shrinkage of domestic markets. As we discussed above, this is because a shrinking country benefits from higher real wages stemming from inward FDI. One obvious caveat to these welfare implications is that the abovementioned differences in welfare between economies or countries are quantitatively very small. In particular, because the welfare gains and losses from opening up FPI are almost negligible, we should be careful when utilizing these welfare implications.¹⁰

5 Concluding Remarks and Policy Implications

In this paper, we investigated the dynamics of international capital flows following the shrinkage of domestic markets caused by a decline in labor endowment. In particular, we examined the effect of FDI on the dynamics. Our main findings are as follows. First, we find that FDI stocks do not converge monotonically to the new steady state but rather initially move away from the new steady state, or overshoot, before reversing course and converging to

¹⁰These small welfare gains are not new in the literature, but are consistent with the conventional argument that the benefit from smoothing consumption is very small.

it, reflecting dynamic optimization by households. This result implies that the empirical observation of an increase in FDI at some point does not necessarily mean that the economy heads to a steady state with a higher level of FDI. Second, we find that if FDI and FPI are opened up together, FPI encourages international activity of multinational firms through FDI, and reduces entry of domestic firms into the domestic market. This result might be interpreted as suggesting that the capital outflows to the FC through FPI flow back to the HC through the inward FDI by the productive FC firms. Our model shows, however, that while the interaction between FDI and FPI reduces the number of firms, it increases relative wages and welfare, contrary to the conventional “home market effect.”

Taken literally, the results suggest that, in the face of shrinkage of domestic markets, policy makers should encourage inward FDI and support the level of real wages rather than discourage it and protect domestic firms. Even though such policies may force domestic firms to exit from the domestic market, domestic households are better off in terms of welfare. One caveat to this policy suggestion is that the welfare implications in this paper depend on the assumption that a labor force can smoothly move across firms including foreign firms arriving through inward FDI. If such a smooth reallocation of the labor force across firms is impaired by some labor market frictions, the welfare gains from FDI might be limited. Therefore, policy makers should keep in mind that a policy for removing such labor market frictions may also be necessary for generating welfare gains from FDI.

References

- Albuquerque, R. (2003). The composition of international capital flows: Risk sharing through foreign direct investment. *Journal of International Economics*, 61:353–383.
- Antras, P. and Yeaple, S. R. (2013). Multinational firms and the structure of international trade. In *Handbook of International Economics*, 4th ed. North Holland.
- Backus, D. K., Kehoe, P. J., and Kydland, F. E. (1992). International real business cycles. *Journal of Political Economy*, 100(4):745–775.
- Brainard, S. L. (1997). An empirical assessment of the proximity-concentration trade-off between multinational sales and trade. *American Economic Review*, 87(4):520–544.

- Chor, D. (2009). Subsidies for fdi: Implications from a model with heterogeneous firms. *Journal of International Economics*, 78:113–125.
- Corsetti, G., Martin, P., and Pesenti, P. (2007). Productivity, terms of trade and the 'home market effect'. *Journal of International Economics*, 73:99–127.
- Ghironi, F. and Melitz, M. J. (2005). International trade and macroeconomic dynamics with heterogeneous firms. *Quarterly Journal of Economics*, 120:865–915.
- Helpman, E., Melitz, M. J., and Yeaple, S. R. (2004). Export versus fdi with heterogeneous firms. *American Economic Review*, 94(1):300–316.
- Hsieh, C.-T. and Ossa, R. (2011). A global view of productivity growth in china. Unpublished.
- Jeanne, O. (2012). Capital flow management. *American Economic Review: Papers and Proceedings*, 102(3):203–206.
- Ju, J. and Wei, S.-J. (2010). Domestic institutions and the bypass effect of financial globalization. *American Economic Journal: Economic Policy*, 2:173–204.
- Korinek, A. (2010). Regulating capital flows to emerging markets: An externality view. Unpublished.
- Krugman, P. R. (1980). Scale economies, product differentiation, and the pattern of trade. *American Economic Review*, 70(5):950–959.
- Markusen, J. and Venables, A. (2000). The theory of endowment, intra-industry and multi-national trade. *Journal of International Economics*, 52(2):209–234.
- Melitz, M. J. (2003). The impact of trade on intra-industry reallocation and aggregate industry productivity. *Econometrica*, 71:1695–1725.
- Ramondo, N. and Rodriguez-Clare, A. (2010). Growth, size, and openness: A quantitative approach. *American Economic Review: Papers and Proceedings*, 100:62–67.

Table 1: Changes in Steady State Values (%)

Consumption	# of firms	Real wage
1.100	0.973	1.103

Note: Table 1 shows how the steady state values for consumption, the number of firms and real wages change when FDI is opened up.

Table 2: Changes Between Steady States (%)

	Consumption		# of firms		Real wage	
	Autarky	with FDI	Autarky	with FDI	Autarky	with FDI
Home	-7.17	-6.95	-5.16	-5.92	-2.27	-1.88
Foreign	-0.53	-0.77	0.17	0.92	-0.55	-0.93

Note: Table 2 shows the percent changes of consumption, the number of firms and real wages between the old and the new steady state.

Table 3: Welfare Gain

	Autarky	Only with FPI	Only with FDI	with FDI and FPI
Home	1.0000	0.9994	1.1008	1.1006
Foreign	1.0000	1.0008	1.0997	1.1000

Note: Table 3 shows the consumption equivalent welfare in each economy, in which the welfare in the financial autarky case is normalized to one.

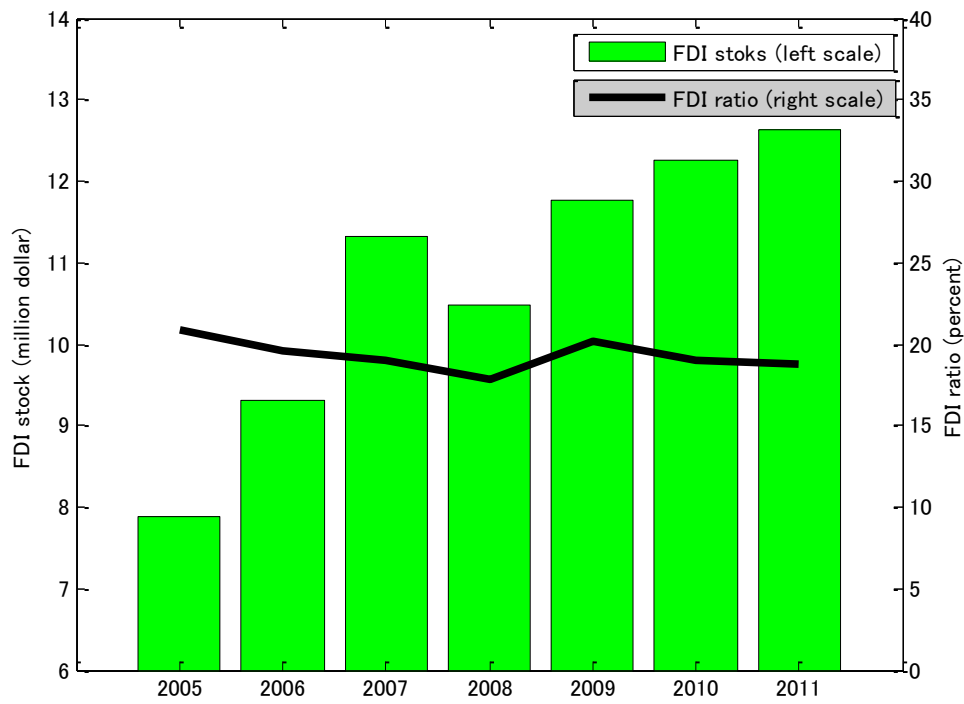


Fig. 1: FDI stocks and FDI ratio for G7 countries

Note: The values for FDI stocks are sum of FDI stocks of G7 countries. The FDI ratio is defined as the ratio of FDI stocks to total foreign asset.

Source: IMF

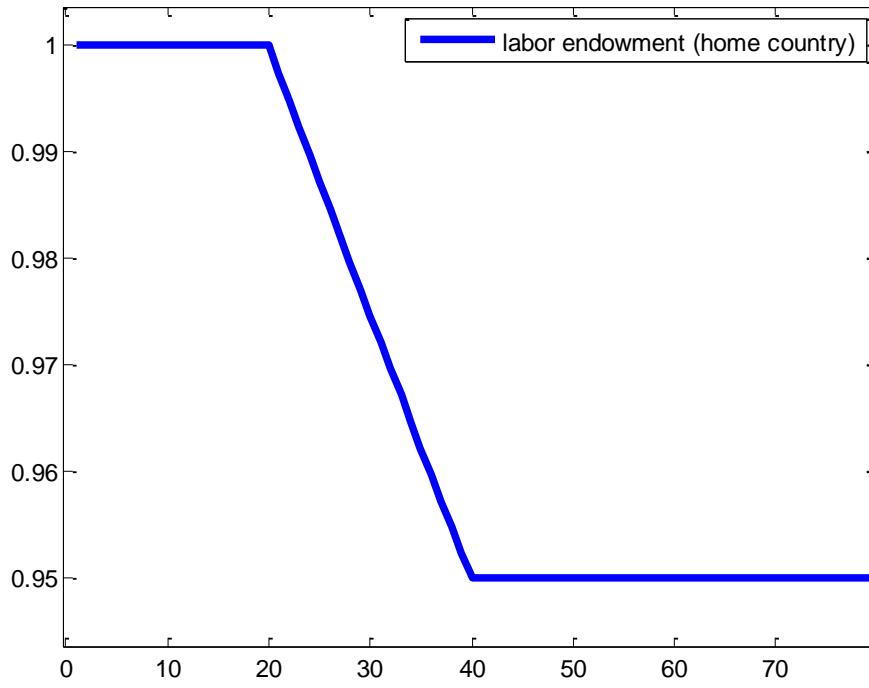


Fig. 2: Labor endowment

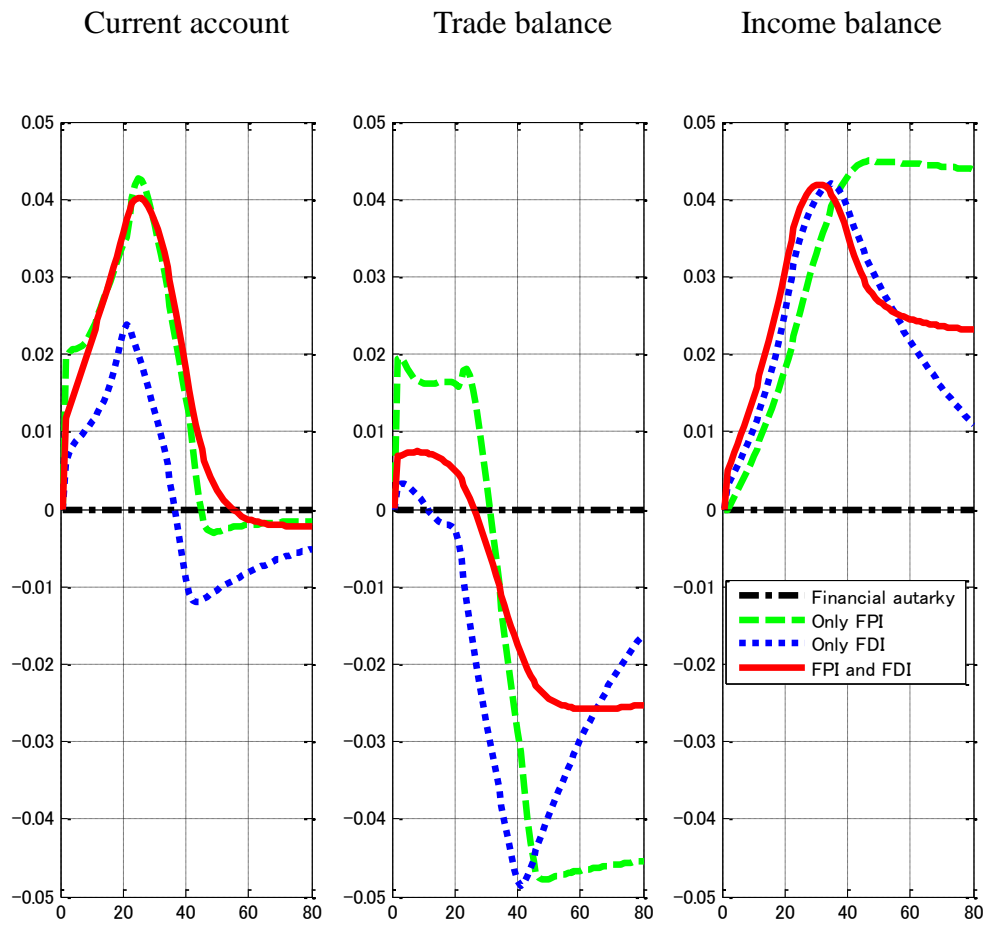


Fig. 3: Current account, trade balance and income balance (home country)

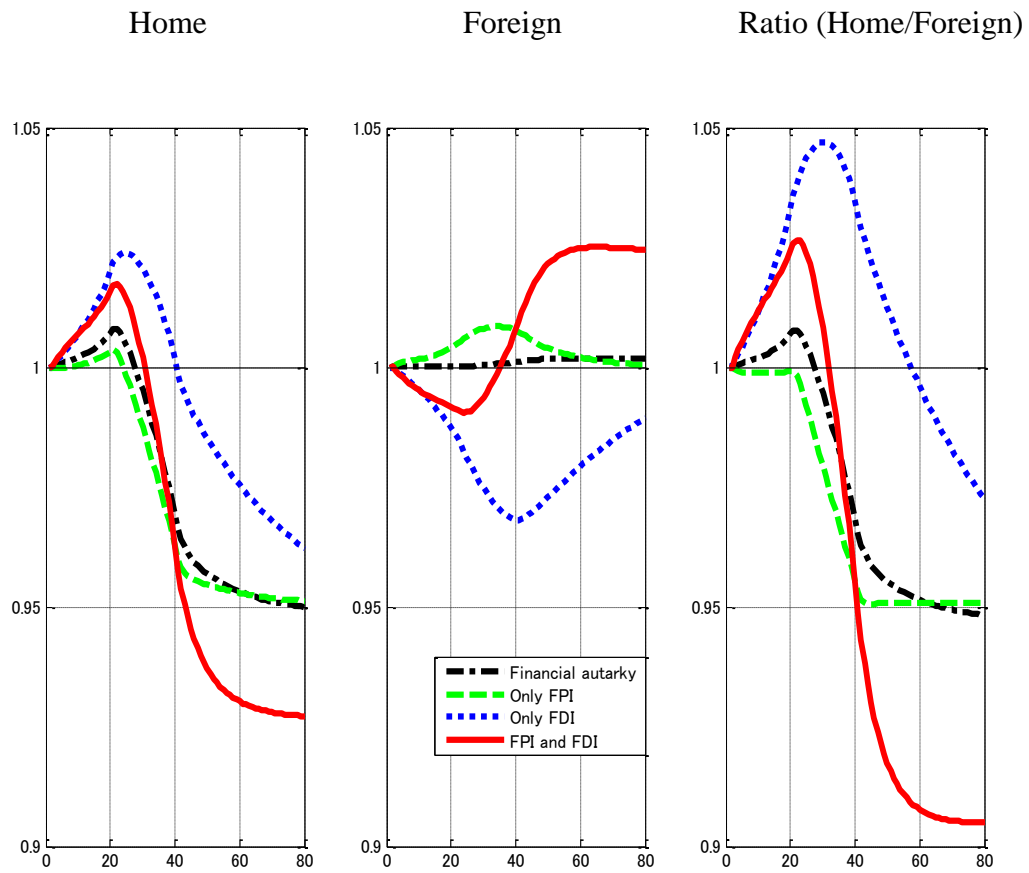


Fig. 4: The number of firms (home and foreign country) and its ratio (home/foreign)

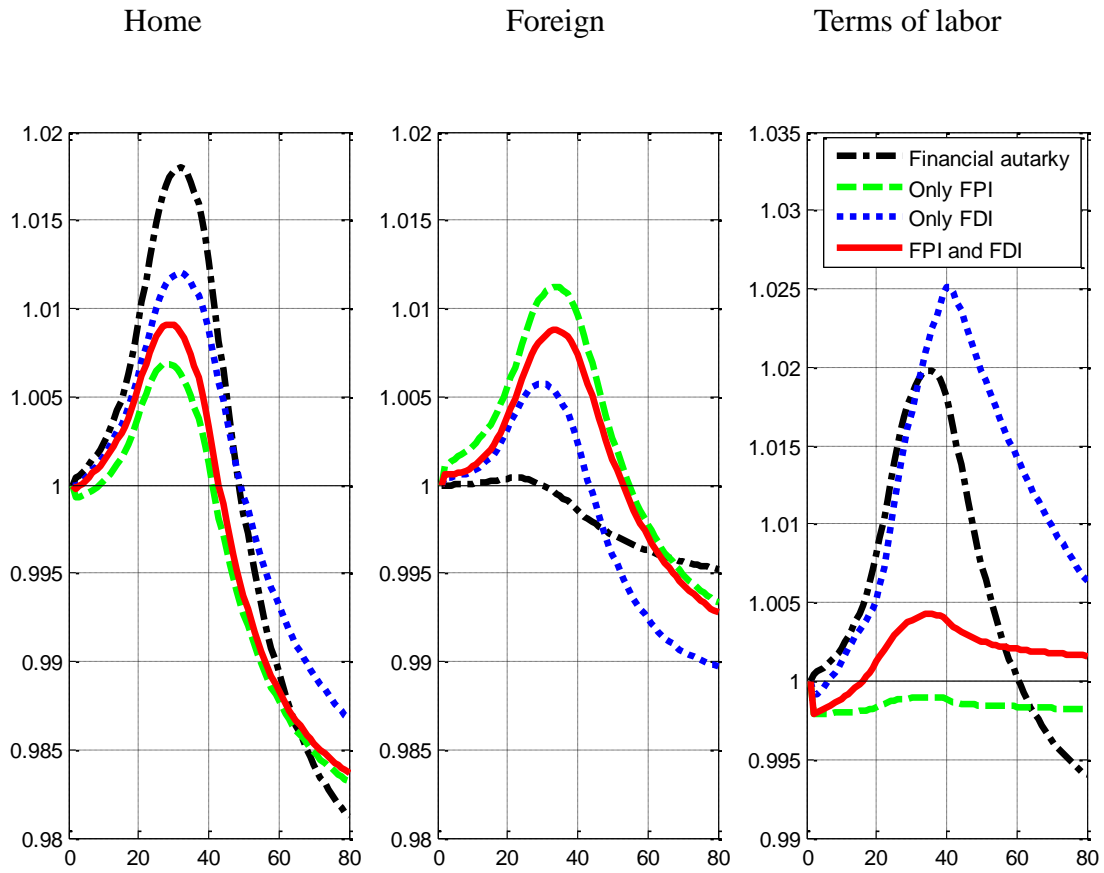


Fig. 5: Real wages (home and foreign country) and terms of labor (home country)

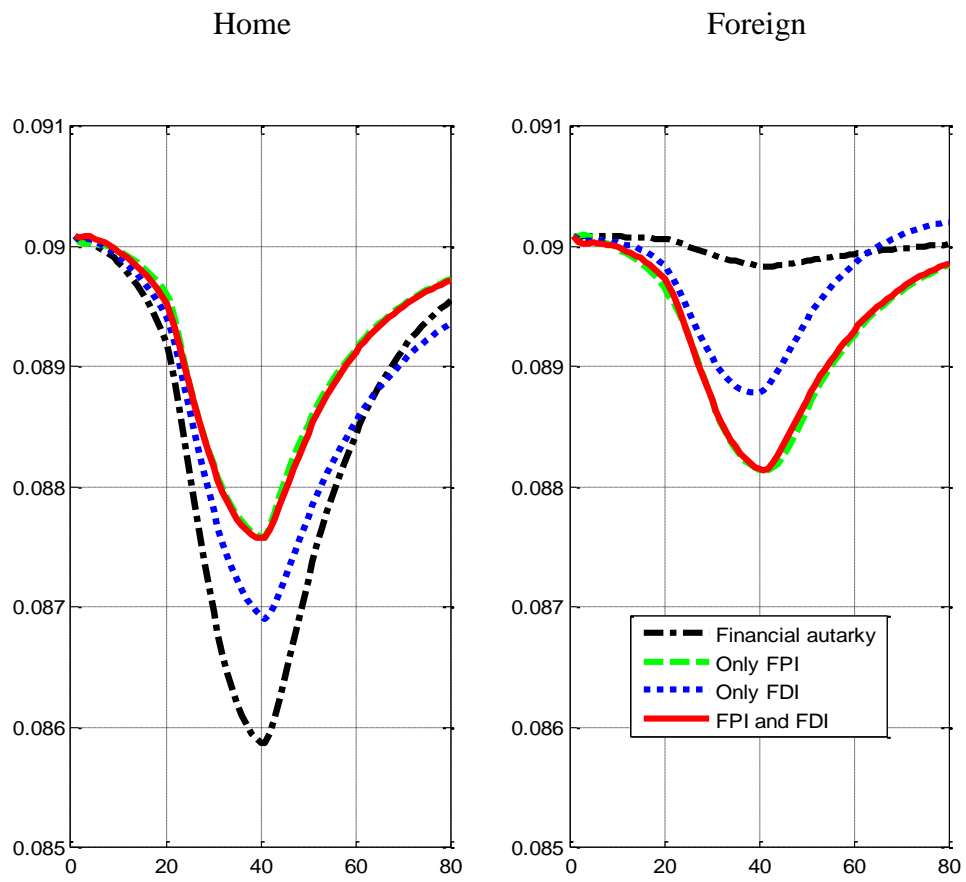


Fig. 6: Real interest rates (home and foreign country)

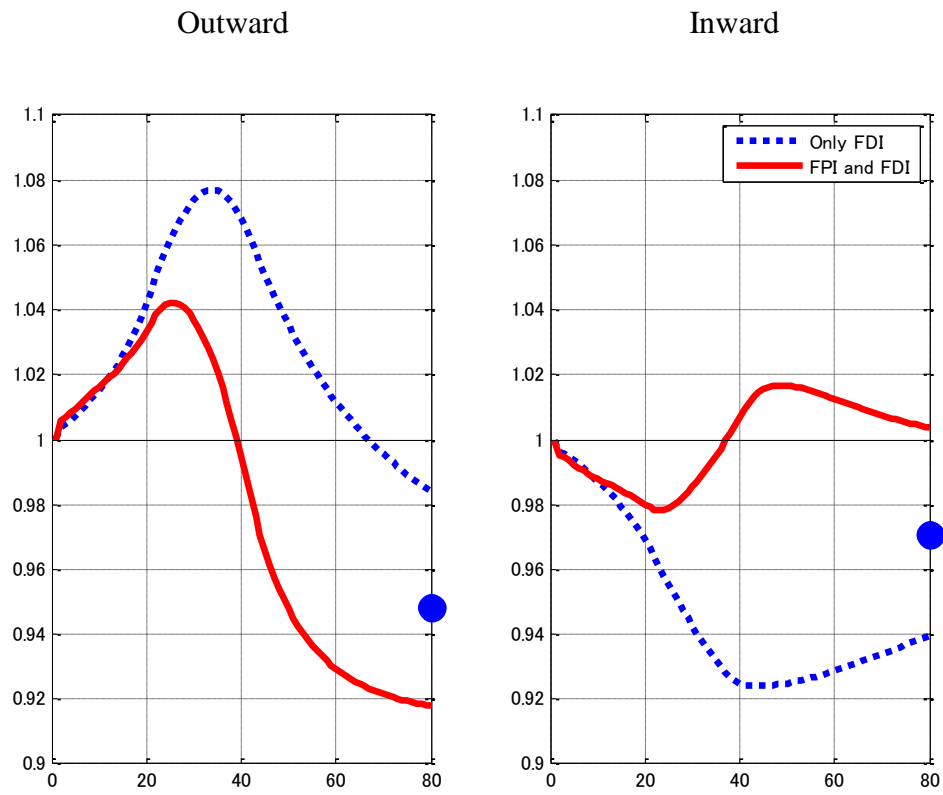


Fig. 7: Outward and inward FDI (Stocks)