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IDE DISCUSSION PAPER No. 431

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Keywords: FDI, firm heterogeneity, investment liberalization, developing country
JEL classification: C68, F21, F23, O2

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* This paper was written as part of the project entitled "Multinational Firms and the Globalization of Developing Economies" funded by the Institute of Developing Economies. We gratefully acknowledge the financial support of JSPS Grant-in-Aid for Young Scientists (B). For their useful comments and discussions, we would like to thank Kazu Takechi and seminar participants at the Institute of Developing Economies and the International Economics Conference at Yokohama National University. The opinions expressed and arguments employed in this paper are the sole responsibility of the authors and do not necessarily reflect those of any institution with which the authors are affiliated. All remaining errors are our own.

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1. Introduction

The past few decades have seen that a number of developing countries attempt to increase foreign direct investment (FDI) by removing foreign ownership restrictions and offering preferential investment incentives for foreign firms. Indeed, prior evidence shows that a better investment climate encourages FDI activity (Markusen, 2002; Kinda, 2010). However, regulatory barriers to foreign investment in developing economies remain greater than in developed economies. The average length of the investment process for foreign investors was 20 days for high-income economies and 47 days for middle- and low-income economies (World Bank Group, 2010).

Regulatory reforms and discriminatory tax practices for foreign investors are a crucial policy issue for governments in developing economies. Although the impact of eliminating policy-related obstacles to inward foreign investment is of great interest for policy makers, we know little about how policy-driven reductions in investment costs will affect FDI decisions differently across *individual* firms. Reductions in barriers lead not only to reallocations of resources across countries but also across individual firms. Their different responses carry important implications for both aggregate productivity gains and the concentration of production across firms. This paper investigates this issue one step further by examining how heterogeneous foreign firms will respond to a reduction of policy-specific investment barriers in developing countries.

Our task in this paper is to quantify firm-level responses to investment liberalization in developing economies. Linking positive aggregate shocks and individual firm responses in a standard econometric framework is difficult because of the lack of observable natural experiments and difficulty in quantifying barriers to FDI. Thus, we employ a structural approach for counterfactual policy experiments by drawing on our prior work in Arita and Tanaka (2013a), where a firm-heterogeneity model of Eaton, Kortum, and Kramarz (2011; EKK hereafter) is calibrated to match data on Japanese multinational firms.

We consider a hypothetical scenario in which only developing countries reduce investment barriers, but investment costs in developed countries remain constant. Specifically, we explore two policy experiments: (1) FDI barriers fall to the level of investment barriers faced by their domestic firms and (2) FDI barriers decline to the level of investment barriers in developed countries. Because the quantitative impact of policy changes on FDI barriers is not normally observable, the literature has applied ad-hoc reductions to assess the impact of liberalization. For our policy experiments, we apply two policy-specific measures of FDI barriers: the length of investment procedures for foreign investors and the effective corporate tax rate faced by foreign firms. To link

these theoretical measures with actual policy barriers, we relate the fixed cost to the length of investment procedures and the variable cost to the corporate tax rates. Drawing on the estimated elasticity between FDI costs and actual measures of policy barriers, we translate the actual absolute reduction in these policy measures into a percentage point change in FDI costs, which will serve as counterfactual scenarios.

Comparing the baseline and counterfactual simulations for each policy experiment, we can summarize our main findings as follow. First, economies where there is a larger reduction in investment barriers tend to experience a welfare gain as measured by a change in real wages; the larger inflow of foreign firms contributes to increase nominal wages and market competition in local markets. By contrast, economies where there is a negligible elimination of investment obstacles could yield a welfare loss because their markets may become more unattractive than those of other economies that reduced FDI barriers significantly. Second, an improvement of investment processes encourages new entry of foreign investors relatively more than a reduction of local tax burdens on foreign firms.

Finally, this paper examines how different types of FDI barriers and policy instruments affect heterogeneous firm activity. di Giovanni and Levchenko (2013) show a significant distinction between fixed and variable costs on welfare gains from trade in the presence of heterogeneous firms. Chor (2009) demonstrates that subsidies for FDI yield different welfare implications between fixed and variables costs of foreign production through selection effects of individual firms. Consistent with these studies, we find that individual firms respond differently to falling investment costs in developing economies. Specifically, an improvement in investment procedures induces low productive firms to shrink their foreign production in developing economies for intensified competition but induces middle productive firms to increase their entry and production there substantially. The most productive firms expand their foreign production modestly. The reason is that marginally productive producers below the entry threshold of productivity are the primary beneficiaries from lower entry barriers. Comparing the type of policy reforms, we find that multinationals expand their entry and production in developing economies more substantially following a decline in entry barriers than following a decline in corporate tax rates.

This paper is related to the empirical studies on the determinants of FDI activity in developing economies. Asiedu (2002) examines whether FDI determinants in Africa differ from those in other regions. The findings show that return on capital, infrastructure development, and FDI openness may affect African countries differently than other countries. Kinda (2010) uses a firm-level data set to investigate the impact of

investment climate on FDI in developing countries. The results indicate that an improvement in physical infrastructure, financial constraints, and institutional barriers would encourage FDI activity. Additionally, Harding and Javorcik (2011) provide evidence that sector-specific investment promotion increases FDI inflows in developing countries, suggesting that the sector-targeting investment incentives are an effective policy option. Consistent with these empirical works, our findings imply that investment barriers deter foreign firms. By contrast, we extend the evidence by showing a strikingly different response of individual firms to a decline in investment costs.

Another branch of related studies includes a structural approach to examining the impact of investment liberalization. Markusen (1997) and Egger et al. (2007) employ the knowledge capital model and analyze the impact of trade and investment liberalization on multinational activity and welfare in developing economies. Policy experiments are designed to examine a set of different liberalization scenarios at the arbitrary level of liberalization in trade and investment. Konan and Maskus (2006) study the impact of services liberalization on the Tunisian economy using a computable general equilibrium (CGE) model. Barriers to foreign investment in service sectors are modeled as a combination of price wedges in cost inefficiency and market power of local firms in the absence of foreign firms. While a removal of these price wedges is defined as services liberalization, they rely on crude approximations gathered from Tunisian industry studies to set the level for eliminating barriers. Additionally, Burstein and Monge-Naranjo (2009) develop a quantitative model to estimate the impact of eliminating policy barriers on foreign controls of domestic factors of production in developing economies.

Other works have sought to predict the gains of increased FDI through free trade agreements and regional economic integration. Petri et al. (2011) estimate the gains from the ASEAN Economic Community with a CGE model. Along with reductions of tariffs and non-tariff measures, they simulate improvements in FDI climate and find potentially large joint gains from the integration. Using the framework employed in this paper, Arita and Tanaka (2013b) simulate the impact of regional economic integration on multinational firms in developed and developing countries. However, both of these works employ ad-hoc changes in FDI barriers, making it difficult to assess policy-specific instruments of investment liberalization.

While our paper is similar to these previous studies in its structural approach, it extends the prior approach by directly linking actual measures of policy barriers with theoretical measures of investment costs in the model. To conduct counterfactual analysis, it is necessary to identify a change in the underlying costs of FDI activity

under certain policy experiments. In the prior work, the magnitude of the cost changes is not necessarily determined on the basis of the actual change in policy barriers but is set at an arbitrary level. In this respect, we employ actual survey measures for FDI barriers and design policy experiments in which a change in underlying FDI costs is based on a change in the survey measures.

The rest of this paper is organized as follows. Section 2 presents the methodological framework to conduct the counterfactual analysis. Section 3 discusses policy-related barriers on foreign investment, followed by the estimation of a relationship between theoretical and survey measures of FDI barriers. Section 4 presents the counterfactual results under distinct policy experiments. Section 5 concludes.

2. **Theoretical Framework**

This section presents the theoretical framework for counterfactual experiments. While we discuss the key elements of the framework that closely follow EKK (2011), we provide a summary of the methodological framework in Appendix A.[1]

Based on the EKK model of heterogeneous firms in international trade, we allow firms to serve foreign markets solely via local production, i.e., horizontal FDI. By excluding the role of trade, we preclude a variety of alternative choices for firms in serving abroad.[2] However, this simplification enables us to avoid complex firm-level decisions and to focus on the choice between home and foreign production.

The EKK model is based on the monopolistic competition framework. Goods are differentiated and a single firm produces a unique good *j* with efficiency $z_i(j)$. There are *N* countries that have a continuum of potential producers. A firm in home country *i* that invests and produces in host country *n* will incur unit costs:

$$c_{ni}(j) = \frac{w_n d_{ni}}{z_i(j)} \tag{1}$$

where w_n is the factor cost in country *n* and d_{ni} is an iceberg form of efficiency loss such as management costs of local plants to implement production technology abroad. A firm incurs no additional cost to implement its production technology at home. Since each firm receives a random productivity draw from a Pareto distribution, a measure of potential producers with efficiency of at least z is as follows:

$$\mu_i^Z(\mathrm{Z} \geq \mathrm{z}) = \mathrm{T_i z}^{-\theta}, \ \ \mathrm{z} > 0 \tag{2}$$

where T_i is the average level of efficiency in country *i*. The parameter θ is a

[1] See further details of the methodology in Arita and Tanaka (2013a).

[2] As multinational firms may engage in exporting, Irarrazabal et al. (2013) consider intra-firm trade between parents and their foreign affiliates, whereas Tintelnot (2012) examines exports of foreign affiliates.

distribution parameter of firm productivities for $\theta > 0$.

Each country has the standard CES preferences over differentiated goods with the elasticity of substitution between any two goods $\sigma > 1$. We obtain a demand function:

$$X_n(j) = \alpha_n(j)\left(\frac{p_n(j)}{P_n}\right)^{-(\sigma-1)} X_n \tag{3}$$

where $X_n(j)$ is the sales by firm *j* in country *n*, X_n is an aggregate demand for manufacturing varieties, and P_n is the CES price index. We assume $\theta - 1 > \sigma$. $\alpha_n(j)$ is an unobservable demand shock for firm *j* selling in country *n.* A firm *j* enters market *n* by paying a fixed cost to establish a production plant:

$$E_{ni}(j) = E_{ni}\varepsilon_n(j) \tag{4}$$

where E_{ni} is the general fixed cost that is constant for all firms such as administrative setup costs. $\varepsilon_n(j)$ is an idiosyncratic fixed cost specific to firm *j* entering market *n*. In this setting, firm *j* from country *i* will generate net profits in market *n*:

$$\pi_{ni}(j) = \left(1 - \frac{c_{ni}(j)}{p_n(j)}\right)\alpha_n(j)\left(\frac{p_n(j)}{P_n}\right)^{-(\sigma-1)} X_n - E_{ni}\varepsilon_n(j). \tag{5}$$

With monopolistic competition and Dixit-Stiglitz preferences, each firm maximizes its profit by charging a constant markup $\bar{m} = \sigma/(\sigma-1)$ over its unit cost $c_{ni}(j)$ such that $p_n(j) = \bar{m}c_{ni}(j)$. Its total gross profit is proportional to demand with a factor of $1/\sigma$, yielding $X_n(j)/\sigma$. Firm *j* will enter market *n* if and only if its operating profit is sufficient to overcome the fixed entry cost:

$$\eta_n(j)\left(\frac{p_n(j)}{P_n}\right)^{-(\sigma-1)}\frac{X_n}{\sigma} \geq E_{ni} \tag{6}$$

where $\eta_n(j) = \alpha_n(j)/\varepsilon_n(j)$ is an entry shock to firm *j* that invests in market *n*.

From equation (6), the entry hurdle condition shows that firm *j* in country *i* enters the market if and only if its unit cost is less than the threshold entry cost:

$$c_{ni}(j) \leq \bar{c}_{ni}(j) \tag{7}$$

where:

$$\bar{c}_{ni}(j) = \left(\eta_n(j)\frac{X_n}{\sigma E_{ni}}\right)^{1/(\sigma-1)}\frac{P_n}{\bar{m}}. \tag{8}$$

A lower value of $\bar{c}_{ni}(j)$ indicates a less attractive market for multinational production. Substituting the constant markup price and equation (8) into equation (3), we express the latent sales conditional on entry:

$$X_{ni}(j) = \frac{\alpha_n(j)}{\eta_n(j)}\,\sigma E_{ni}\left(\frac{\bar{c}_{ni}(j)}{c_n(j)}\right)^{\sigma-1}. \tag{9}$$

Conditional on entry, equation (9) dictates the volume of sales by firms in that market. Equations (7), (8), and (9) provide the main predictions about the structure of

heterogeneous multinational firms. That is, more productive firms are more likely than less productive firms to: (i) invest in a larger number of markets, (ii) penetrate the less attractive markets, and (iii) yield larger sales per market.

To conduct counterfactuals, we modify the general equilibrium in EKK (2011) to set up a model in which producers serve their home country by domestic production and foreign countries through FDI. The general equilibrium is set up such that manufacturing production and consumption across countries are connected through FDI activity. Equilibrium in the world market for manufacturers leads to a system of equations, which allows us to solve for changes in wages and prices from an exogenous change in variable and fixed FDI costs. We calculate welfare changes as measured by real wages because of adjustments in aggregate prices and wages.

3. Discussions on Investment Barriers

Drawing on the methodological framework in section 2, we conduct a series of counterfactual experiments. While simple extreme scenarios are global prohibition and no friction of multinational production, a comparison of these cases does not yield practical policy implications. To make an analysis relevant for policy discussions, we discuss investment barriers and identify policy-related frictions for FDI activity.

3.1. Policy-Related Investment Costs

To design counterfactual scenarios relevant for policy issues, we first need to identify crucial barriers to foreign investment. As is well known, foreign firms take into account a wide range of factors in making direct investment, including not only investment costs related to institutional and regulatory barriers but the market size, factor endowments, transport costs, infrastructure quality, macroeconomic stability, and so on. Empirical evidence for these FDI determinants has been shown in a large number of previous studies (Blonigen, 2005; Barba Navaretti and Venables, 2004). Among alternative determinants, market-seeking and efficiency-seeking motives constitute a fundamental incentive for multinational firms in manufacturing to make direct investment in a foreign market (Markusen, 2002). This suggests that the first-order determinants of FDI would be the potential market size and production costs in a host country. However, these market characteristics improve only in the long term and do not change in the short term. The analysis of these determinants helps us to see policy implications from the long-run perspective but sheds little light on the plausible policy reforms that can be implemented in the short term.

In contrast to the previous literature, this paper focuses exclusively on institutional

and policy-oriented barriers that are specific to foreign investors but less relevant for domestic investors in the economy. Thus, this approach places less emphasis on the overall investment climate in the market that influences investment and production decisions both by domestic firms and by foreign firms. For example, Dollar et al. (2005) define the investment climate as the institutional, policy, and regulatory environment in which firms operate, and they investigate the impact of investment climate on firm performance in developing economies. Specifically, they use the World Bank surveys to highlight the public services provided by the governments for firms: export/import clearance times, the reliability of power supply, and telecommunications set-up times. As investigated by Kinda (2010), these factors are apparently crucial for multinational activity, and a broad measure of investment barriers is useful for understanding aggregate impacts on multinational production. However, the broad measure of investment impediments is likely to affect both domestic and foreign firms, making it difficult to address what specific factors deter FDI inflows.

In this paper, we analyze a removal of policy-related restrictions on foreign investors in order to clearly understand what policy reforms are necessary to reduce investment distortions. In this respect, our approach is similar to the prior study by Waglé (2011) on the institutional determinants of FDI, but it differs in that we adopt a structural method to investigate the impact of institutional barriers on individual firms. Similar to Petri et al. (2011), we employ estimates of FDI retrieved outside the model, but we base our measures off of actual policy information rather than frontier investment reference. Additionally, Gormsen (2011) estimates the unobservable barriers to FDI from the observed data on FDI stocks. Conceptually, his measure of FDI barriers represents the relative attractiveness of holding foreign capital as perceived by a domestic firm in comparison with domestic capital. Compared to his measure, we focus on more specific FDI barriers.

3.2. Fixed FDI Costs and Investment Procedures

As discussed in the preceding section, we focus on policy-related investment costs among alternative investment barriers for multinationals. To design a hypothetical scenario consistent with our theoretical model, we further need to connect specific investment barriers to the fixed and variable costs of FDI activity. To this end, we first discuss fixed FDI costs in this section.

Equation (4) of the model shows that individual firms pay fixed costs to start foreign production and incur additional fixed costs as compared with local firms in a host market. For counterfactual analysis, we need to measure such entry barriers

specific to foreign investors. In this respect, the World Bank's Investing Across Borders (IAB) project provides useful quantitative measures of FDI barriers. The IAB survey provides comparable indicators across countries for (1) foreign ownership restrictions across sectors, (2) starting a foreign business, (3) accessing industrial land, and (4) arbitrating commercial disputes. The survey data were obtained from over 2,350 local experts and practitioners in 87 economies between April and December 2009.

Because we focus exclusively on manufacturing multinational firms, an indicator of ownership restrictions in manufacturing seems to be a good candidate for analysis. However, the index exhibits little variation across economies, suggesting that manufacturing foreign firms are generally allowed to establish their own foreign subsidiary and acquire domestically-owned firms. Thus, we conclude that ownership restrictions are not likely to be a significant barrier for manufacturing multinationals. Alternatively, an obvious entry barrier pertains to the process for establishing a foreign subsidiary by multinational firms. Among others, it is useful to employ indicators on starting a foreign business.[3] According to the IAB report, foreign companies need, on average, 14 more days and require 2 more procedures than domestic companies. Specifically, we use the number of procedure days required by foreign firms to quantitatively assess the impact on multinational activities that results from more equal treatment of domestic and foreign investors, simplification of establishment procedures for foreign firms, and streamlining of foreign investment approvals.

To link a specific measure of FDI regulation with fixed FDI costs, E_{ni}, we use the following equation from the modified version of the EKK model:

$$\sigma E_{ni} = \kappa_2 {\kappa_1}^{-1} \bar{X}_{ni}. \tag{10}$$

Taking logs and rearranging the above equation, we have the log of average affiliate sales by multinationals from home country *i* in host country *n* as a function of $\ln E_{ni}$ and other parameters. We then assume that $\ln E_{ni}$ depends on the number of procedure days for foreign investors, *Day*, with an error term:

$$\ln E_{ni} = \mu_0 + \mu_1 Day_n + \varepsilon_{ni}. \tag{11}$$

Using the equations (10) and (11), we specify the log of $\bar{X}_{ni}$ as a function of days:

$$\ln \bar{X}_{ni} = \mu_0 + \mu_1 Day_n + \gamma Z' + \varepsilon_{ni}. \tag{12}$$

where Z is a set of control variables, including GDP, GDP per capita, distance, geographic contiguity, common language, regional trade agreements, and home-country

[3] According to the IAB report, procedural steps include pre- and post-incorporation procedures that are officially required for a foreign investor to formally establish a wholly-owned subsidiary. For instance, the ease of establishing a company depends on restrictions on the composition of the board of directors, an official channel to expedite establishment procedures, restrictions on holding a foreign currency commercial bank account, and availability of electronic services.

fixed effects. By estimating the above specification, we can infer a relationship between the procedure days and fixed costs of FDI.

For estimation, we construct data on average affiliate sales using the number of foreign affiliates and their sales across home and host countries as reported in the OECD Globalisation Database. To supplement the data on average affiliate sales, we also use data from the U.S. BEA and Japanese RIETI. Data on the control variables come from the CEPII Gravity Dataset complied by Head et al. (2010). After constructing the dataset, our sample consists of 212 observations. The variable of procedure days in the sample has a mean of 39.2 and a standard deviation of 37.1, ranging from 6 days to 179 days.

Based on the sample, we estimate specification (12) by OLS. We find that the coefficient of *Day* is 0.0031 with a robust standard error of 0.0018, implying that the length of investment procedures in a host market has a significantly positive association with the average sales of foreign affiliates. Using the estimated coefficient, we compute the elasticity of E_{ni} with respect to a change in the procedure days. For example, a fall in the procedure length by 10 days should lead to a decline in fixed FDI costs by 3.15% ($=100 \times [(\exp(0.0031 \times 10) - 1]$). In the following counterfactual scenarios, we compute the corresponding percentage change for each country.

3.3. Variable FDI Costs and Corporate Tax Rates

We turn to examine variable FDI costs. According to the model, individual firms incur variable costs in the iceberg form of efficiency loss from operating their plant in a foreign market. Among alternative factors to determine the efficiency loss, taxation on FDI is apparently a policy-related impediment to the efficient management of local production by multinationals. As governments in developing economies impose a variety of taxes, a reduction of foreign tax rates is a useful policy experiment.

For this task, we first construct effective corporate taxes imposed on foreign firms. Following Burnstein and Monge-Naranjo (2009), we use the data on U.S. multinational companies from the U.S. BEA to compute an effective tax rate applied to foreign affiliates by U.S. multinationals. As is explained in Desai et al. (2004), the taxes levied on multinationals include not only corporate income taxes but also indirect foreign taxes including sales taxes, value-added taxes, and property taxes. To capture the overall effective tax rates in each host country, the effective tax rate is calculated as:

$$Tax = \frac{\text{foreign income taxes} + \text{indirect foreign tax}}{\text{net foreign income} + \text{foreign income taxes} + \text{indirect foreign tax}}. \quad (13)$$

In the following analysis, we assume that the effective tax rates of U.S. multinationals

also apply to the multinationals originating from other home countries.[4]

To relate effective corporate tax rates with variable FDI barriers, d_{ni}, we use the following equation from the model:

$$\frac{X_{ni}}{X_n} = \frac{T_i(w_n d_{ni})^{-\theta}(c)^{\theta}}{\Phi_n} \tag{14}$$

where c and Φ_n are parameters. Taking logs and rearranging the equation, we specify the log of X_{ni} as a function of variable costs and other variables. We assume that the log of variable costs of production in host country *n* by multinationals from home country *i* is a function of the effective corporate tax rates with an error term:

$$\ln d_{ni} = \lambda_0 + \lambda_1 Tax_n + u_{ni}. \tag{15}$$

The coefficient of *Tax*, λ_1, is needed to quantify a percentage change in variable cost from decreasing effective the tax rates. However, the above equation is not estimable for the lack of observed data on variable costs. Thus, we re-specify the relationship between X_{ni} and d_{ni} as:

$$\ln X_{ni} = \lambda_0 - \theta\lambda_1 Tax_{ni} + \psi Z' + u_{ni} \tag{16}$$

where Z is a set of control variables, including GDP, GDP per capita, distance, geographic contiguity, common language, colonial relationships, legal origins, GATT/WTO membership, regional trade agreements, and home-country fixed effects.[5]

For estimation, we construct the sample with 2,402 observations using data on affiliate sales in 2006 from the Japanese RIETI and UNCTAD.[6] The effective corporate tax rates have a mean of 0.40 and a standard deviation of 0.17, ranging from 0.02 to 0.70. Based on the sample, we estimate the coefficient of *Tax* by OLS. The OLS estimate is -1.02 with a robust standard error of 0.30, which is statistically significant at the 1% level. Consistent with our intuition, foreign affiliate sales are systematically lower in the countries with higher effective tax rates.

To obtain an estimate for λ_1, we need to calculate $\lambda_1 = 1.02/\theta$. Using the estimate for an elasticity of substitution from Kang (2008) and the estimated size dispersion of Japanese multinationals, we obtain 2.37 for θ.[7] This implies that the elasticity of variable costs with respect to the foreign tax rate is 0.43 (=$1.02/2.37$). For instance, a 10% increase in the tax rate is associated with an increase in the variable costs by 4.39% (= $100 \times [(\exp(0.43 \times 0.10) - 1]$). In the following, we calculate the

[4] Since some developing countries are not included in the BEA data, we replace missing figures with either regional effective foreign taxes or nearest neighbor tax rates from the same data. These countries include Indonesia, Laos, Myanmar, Pakistan, Turkey, and Vietnam.

[5] Additional control variables from the CEPII Gravity Dataset are included for the larger sample size when bilateral affiliate sales are used as the dependent variable.

[6] See Appendix B.

[7] We compute $\theta = \tilde{\theta}(\sigma - 1) = 1.99(2.19 - 1)$. See Appendix A1 for estimation of $\tilde{\theta}$.

corresponding percentage drop in variable costs for each country.

3.4. Counterfactual Scenarios

We consider the four scenarios of counterfactual policy experiments as summarized in Table 1. We set up the policy experiment (1) to reduce barriers for foreign firms in developing economies to the level of their domestic firms and (2) to eliminate impediments for the foreign firms to the level of developed economies. We consider that these experiments are applied to either fixed or variable costs of foreign production by multinational firms. A specific change in these costs is computed using the elasticity of fixed and variable FDI costs with respect to investment procedure days and effective corporate tax rates, respectively. Throughout counterfactual experiments, we keep domestic production barriers within a country fixed.

=== Table 1 ===

We consider the policy experiment in which governments in developing economies reduce the length of investment procedures for foreign investors. We assume that the governments reduce the approval days for foreign firms to the level that applies to domestic firms in their economies, which can be called a “level-playing-field” policy. As is explained previously, we use the actual approval days for foreign firms from the Investing-Across-Borders (IAB) of the World Bank. For a comparable measure of business restrictions on domestic firms, we employ the days for starting a business from the Doing Business Indicator (DBI) of the World Bank.[8] We subtract the IAB figures from the DBI figures to measure the magnitude of reductions in FDI-specific barriers in developing countries. As the DBI measure exceeds the IAB measure for Bangladesh, Malaysia, and Peru, we assume that these countries have not redued the FDI-specific barriers. Thus, we compute the length of eliminating procedure days for multinationals, which the governments in developing economies must target to implement the “level-playing-field” policy. Drawing on the estimated elasticity in section 3.2., we compute the corresponding percentage change in fixed FDI costs for each country in column (1) of Table 2.

=== Table 2 ===

For the second policy experiment, we presume that governments in developing economies aim for a higher level of investment liberalization by reducing the FDI procedure days to the level of developed economies; we call this a “catching-up” policy. In this experiment, we assume that the developing economies eliminate procedure days

[8] We estimate the FDI procedure days for Laos from a simple regression of the IAB measures on the DBI measures.

for foreign investors to correspond to those of developed economies. According to the IAB report, foreign firms require, on average, 20 days for their investment approval in the developed countries, which we take as the catch-up target for developing economies. Thus, we subtract the IAB figures from 20 days to calculate the length of procedure reduction necessary to eliminate FDI-specific barriers. As is the case in the first scenario, we make no change for the economies in which the IAB measures are smaller than 20. Finally, the corresponding percentage change in fixed FDI costs is also shown in column (2) of Table 2.

We turn to examine variable FDI costs in the third scenario, where governments in developing economies reduce effective tax rates for foreign firms to the level of their domestic firms. For the effective tax rate applied to domestic firms, we follow Burstein and Monge-Naranjo (2009) and set the rate at 29%, which is the average effective tax rate relevant to investment decisions. We subtract the effective tax rate of U.S. multinationals from the average effective tax rate to compute the amount of tax reductions necessary for the level-playing-field policy. Since the tax rate for foreign firms is lower in China and Malaysia, we keep these countries' tax rates fixed. We calculate the corresponding percentage change in variable FDI costs as shown in column (3) of Table 2.

Finally, the fourth policy experiment is to reduce the effective tax rate of foreign firms to the level of developed economies. From our data on tax rates, the average effective tax applied to U.S. multinationals in developed economies is 32.5%. Thus, the effective tax rate for foreign firms is reduced to the tax rate of 32.5%, which is a slightly more moderate policy target relative to the third experiment. We replace zeros for the countries in which the tax rate on FDI is lower than 32.5%, including China, India, and Malaysia. The corresponding percentage change in variable costs is shown in column (4) of Table 2.

4. Counterfactual Results

We proceed to quantify the aggregate and firm-level consequences of eliminating barriers to multinational production in developing economies. Conducting a series of counterfactual simulations, we discuss the quantitative implications of counterfactual changes from the benchmark simulation.

4.1. Welfare and Aggregate Multinational Production

Table 3 presents the general equilibrium changes in real wages across developing economies resulting from their investment liberalization. For each experiment, we

compute a proportion of nominal price changes relative to nominal wage changes in order to estimate the aggregate welfare impacts. We find that the real wages increase for some developing economies and decline for others. For instance, the economies such as the Philippines, South Africa, and Vietnam experience a welfare gain across different policy experiments. These economies are commonly distinctive in that their policy-related barriers are relatively high, translating into a relatively large reduction of fixed and variable FDI costs. Because there is a large inflow of foreign multinational firms to these markets, foreign firms increase demand for local labor, which in turn pushes up nominal wages. At the same time, more efficient multinational firms increase production at lower marginal costs, leading to a steep decline in price levels. These two forces combine to generate a relatively large increase in real wages for these countries.

=== Table 3 ===

By contrast, economies such as Chile, Malaysia, and Mexico are already open to foreign investors, and their reduction of policy-related investment barriers is relatively negligible in the policy experiments. This implies that these markets become less attractive for multinational firms compared with the other developing economies that substantially eliminate FDI barriers. As a result, the counterfactual real wages relative to the baseline ones do not increase sufficiently as compared with the counterfactual prices relative to baseline prices. This would lead to a modest loss of welfare for these countries, as shown in Table 3.

Additionally, the average reduction of fixed FDI costs is larger in scenario (2) than in scenario (1). We find that the former experiment shows relatively larger welfare gains across economies. Also, the average decline of variable FDI costs is greater in scenario (3) than in scenario (4), with the former having the slightly larger welfare gains on average. These results suggest that welfare gains from investment liberalization in developing economies are likely to increase following more significant policy reforms in investment barriers.

Following the general equilibrium changes in wages and prices, we compute aggregate changes in entry and sales by artificial multinational firms. By focusing on foreign affiliates in developing economies, we present the baseline and counterfactual changes in Table 4. In the baseline, the total firm entry into developing countries is 5,397, with 257 entries per market on average. Total affiliate sales in these markets amount to 38.4 trillion yen, with average sales per market of 1.83 trillion yen. Across the policy experiments, the increase in firm entry is the largest for scenario (2); when governments in developing economies reduce investment procedure days to the level of developed economies, there will be 1,181 additional firm entries from Japan. By

contrast, the increase in firm entry is 168 in scenario (3) and 120 in scenario (4), which involve a reduction of effective tax rates on foreign firms in developing economies. These changes are significantly smaller as compared to scenarios (1) and (2), which involve an elimination of investment procedures.

=== Table 4 ===

We find that total affiliate sales increase substantially following the large reduction in investment procedure length in the policy experiment (2). Developing economies would experience an increase of 0.31 trillion yen in average sales of foreign affiliates per market. In contrast, the aggregate affiliate sales increase much less in policy scenario (1) mainly because of less significant reforms in the investment procedures. In contrast, the average affiliate sales in developing countries increase by 0.10 trillion yen in scenarios (3) and (4). These resulting increases are smaller than the impacts found from the fixed costs reductions in scenarios (1) and (2). Taken together, these results suggest that policy reforms in investment procedures could be more effective than the provision of fiscal incentives to foreign firms to attract foreign investment and promote their local production.

4.2. Firm-level Impacts at the Extensive Margin

Having analyzed the aggregate impacts, we proceed to shed light on firm heterogeneity in the counterfactual results. Specifically, we decompose the aggregate changes in multinational activity into firm-level changes at the extensive and intensive margin. First, we aggregate all the entries to developing countries across initial productivity groups in the baseline.

Table 5 shows the extensive margin of the baseline and counterfactual percentage changes from the baseline. The baseline shows that more productive firms are more likely than less productive firms to establish foreign production in developing economies, as is consistent with the findings in Yeaple (2009); more productive U.S. multinationals tend to penetrate less attractive foreign markets. In particular, the top 30% of firms account for 86.7% of the total entries, whereas the bottom 30% account for only 2.6%. The highest productivity firms are crucial for developing economies.

=== Table 5 ===

Decomposing the aggregate counterfactual changes at the extensive margin, we find strikingly distinctive patterns across productivity groups. Throughout scenarios (1)-(4), firms in the lowest productivity group tend to close down their foreign affiliates. Despite the decline in investment costs, more intensive competition in developing economies drives out foreign production by these low productive firms.

In scenarios (1) and (2), middle productive firms increase their entry into developing economies more substantially than high productive firms. Moreover, lower-middle productive firms are more likely than upper-middle productive firms to establish new foreign affiliates more prominently in developing economies in the wake of policy reforms in investment procedures. The reason is that, among potential producers below the cutoff productivity, the relatively high productive firms tend to overcome entry barriers in a wide range of markets in the wake of declining entry costs. Additionally, the top 1% of firms also increase their entry into developing economies, but their growth is relatively modest. An explanation is that they have already served multiple markets and experience more intensified market competition in foreign markets resulting from the new entry of multinationals.

Finally, scenarios (3) and (4) indicate that a decrease in variable costs tends to discourage the entry of less productive firms but encourages that of more productive firms. These results indicate that a decline in corporate tax rates mainly affects the operational costs of foreign production, making the extensive-margin impact less clear-cut.

4.3. Firm-level Impacts at the Intensive Margin

Table 6 presents the results for the intensive margin of foreign affiliates in developing economies. It is evident from the baseline that more productive firms exhibit larger foreign production per market. The average volume of local production is remarkably large for the top 1% of firms. Their average foreign production is approximately 24 billion yen, more than 100 times larger than the bottom 10% of firms. These patterns suggest that the most productive firms account for the majority of local production by foreign firms in developing economies.

=== Table 6 ===

Columns (1) to (4) in Table 6 show the counterfactual changes at the intensive margin from the baseline. In policy experiments (1) and (2), the intensive margin increases for all the firms, with a relatively large percentage increase for low and middle productive firms. This implies that these firms are likely to benefit from improvement in the inefficient processes of investment approval. On the other hand, the most productive firms face increased competition from the new entry of multinational firms, and the competition effects mitigate an increase in their foreign production. Another reason for their modest growth is that they had already penetrated many foreign markets prior to investment liberalization, which attenuates the impact of falling entry barriers.

In scenarios (3) and (4), the majority of the firms across productivity groups

experience a decline in the average volume of their foreign production. By contrast, firms in the top 1% experience a relatively large increase in the average level of their offshore production. Given their large share of total production, these small percentage changes – 5% to 7% intensive-margin growth – lead to very large aggregate changes in foreign production. Since a reduction in effective tax rates primarily affects the intensive margin, the largest, most efficient firms, which have already paid the initial fixed entry costs, expand disproportionately relative to smaller, less efficient firms.

5. Conclusion

Governments in developing economies have recently made substantial efforts to attract foreign investment. Prior empirical studies have investigated the impact of eliminating investment barriers against FDI activity but have paid little attention to how individual firms would respond to an aggregate reduction of investment costs. In this paper, we employ a structural approach to simulate the firm-level responses of multinational production to a series of counterfactual policy changes. To design a practical policy experiment, we link the theoretical measures of variable and fixed costs of multinational production with actual survey measures of investment procedures and effective tax rates faced by multinationals. Thus, we employ the more practical level of policy reforms toward foreign investors in counterfactual analysis.

Counterfactual reductions in investment barriers produce a set of interesting changes in welfare and multinational production. Developing economies tend to experience a large welfare gain for a substantial elimination of investment costs because entries of foreign multinationals increase demand for local labor and intensify market competition in host markets. These forces combine to magnify an increase in real wages. However, other developing countries that implement small policy reforms may experience a welfare loss because their markets are likely to become less attractive for foreign multinationals. As these simulations are based on various assumptions that abstract away from the real world, we must carefully interpret these results. Nevertheless, our result is consistent with the study in Baldwin et al. (1996) on the investment creation and diversion effects of the European Single Market Programme.

Our work demonstrates that firm heterogeneity is a crucial point of policy consideration for investment-promotion strategy because individual firms respond differently to reduction in investment barriers. While the level of elimination of investment barriers is uniform for all firms, more productive firms are more likely than less productive firms to conduct direct investment and expand local production in developing economies in terms of the absolute volume. Policy reform of investment

procedure requirements appears to be more effective than tax reductions for attracting new direct investment. By contrast, tax reductions tend to magnify the intensive margin of the larger multinationals that have already penetrated multiple markets. These results suggest implications for the potential importance of targeting in the provision of investment incentives because foreign multinationals will respond differently to new investment opportunities.

Finally, we must recognize that our application of requirements for investment procedures as fixed costs and tax reductions as variable costs are hypothetical in nature. Certain procedures required for foreign investment may also inflict variable costs, while taxes also contain different vehicles (such as entry subsidies) that can affect fixed costs and entry. Additionally, our finding of the differences across policy-specific barriers points to the need for further econometric work to examine these impacts across firms.

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Table 1. Summary of Counterfactual Policy Experiments

	Counterfactual Policy Scenario			
Variable	(1)	(2)	(3)	(4)
Fixed Cost	Reduce the average number of approval days for foreign firms in developing economies to the average level faced by domestic firms.	Reduce the average number of approval days for foreign firms in developing economies to the average level faced in developed economies.	Constant	Constant
Variable Cost	Constant	Constant	Reduce the average effective tax rate for foreign firms in developing economies to the average level faced by domestic firms.	Reduce the average effective tax rate for foreign firms in developing economies to the average level of developed economies.

Table 2. Hypothetical Reductions in FDI Barriers

Economy	Income Group	(1)	(2)	(3)	(4)
		Fixed Cost		Variable Cost	
Argentina	Upper middle	6.07	9.75	15.60	13.87
Brazil	Upper middle	4.44	57.24	11.21	9.55
Chile	Upper middle	0.62	2.83	2.45	0.91
Malaysia	Upper middle	0.00	0.00	0.00	0.00
Mexico	Upper middle	0.93	3.47	3.37	1.83
Peru	Upper middle	0.00	7.39	4.46	2.90
Russian Federation	Upper middle	0.31	3.47	6.39	4.80
South Africa	Upper middle	14.26	14.97	14.41	12.70
Turkey	Upper middle	0.62	0.00	13.78	12.08
China	Lower middle	19.70	27.75	0.00	0.00
Egypt	Lower middle	0.31	0.00	7.36	5.76
India	Lower middle	5.09	8.39	1.43	0.00
Indonesia	Lower middle	3.15	22.70	1.56	0.04
Pakistan	Lower middle	0.00	0.31	1.56	0.04
Philippines	Lower middle	8.73	20.44	7.91	6.29
Thailand	Lower middle	0.31	4.44	10.61	8.96
Vietnam	Lower middle	14.61	25.78	11.36	9.69
Bangladesh	Low	0.00	11.46	1.56	0.04
Cambodia	Low	0.31	22.70	11.36	9.69
Laos	Low	6.76	36.81	11.36	9.69
Myanmar	Low	0.00	0.00	0.00	0.00
Average		4.11	13.33	6.56	5.18

Notes: Figures indicate a percentage point change in fixed costs for (1) and (2) and in variable costs for (3) and (4); income group is based on the World Bank list of economies as of September 2010; income levels are $995 or less for low income, $996–$3,945 for lower middle income, and $3,946–$12,195 for upper middle income.

Table 3. Real Wage Changes in Developing Economies

Economy	(1)	(2)	(3)	(4)
Argentina	0.995	1.001	1.054	1.046
Brazil	0.998	1.048	1.021	1.017
Chile	0.959	0.966	0.976	0.965
Malaysia	0.953	0.953	0.953	0.953
Mexico	0.987	0.991	0.996	0.992
Peru	0.984	0.993	0.997	0.993
Russian Federation	0.987	0.988	0.990	0.989
South Africa	1.009	1.010	1.040	1.034
Turkey	0.994	0.993	1.034	1.029
China	1.011	1.036	0.954	0.952
Egypt	0.984	0.984	1.001	0.997
India	0.996	0.997	0.995	0.994
Indonesia	0.972	0.989	0.973	0.969
Pakistan	0.995	0.995	0.998	0.995
Philippines	1.006	1.026	1.025	1.018
Thailand	0.960	0.974	1.055	1.039
Vietnam	1.011	1.047	1.058	1.044
Bangladesh	0.995	1.000	0.996	0.995
Cambodia	0.991	1.059	1.080	1.066
Laos	0.999	1.022	1.016	1.013
Myanmar	0.994	0.994	0.994	0.994
Average	0.990	1.003	1.010	1.004

Table 4. Total Entries and Sales of Foreign Affiliates in Developing Economies

	Baseline	(1)	(2)	(3)	(4)
		Counterfactual Change from Baseline			
Total entries	5,397	568	1,181	168	120
		(10.5)	(21.9)	(3.1)	(2.2)
Mean of entries per market	257	27	56	8	6
		(10.5)	(21.8)	(3.1)	(2.3)
Total sales	38.4	2.86	6.56	2.00	2.03
		(7.4)	(17.1)	(5.2)	(5.3)
Mean of sales per market	1.83	0.14	0.31	0.10	0.10
		(7.4)	(17.1)	(5.2)	(5.3)

Notes: Figures in parentheses represent the percentage changes; affiliate sales are in trillions of yen.

Table 5. Extensive Margin of Foreign Affiliates in Developing Economies

Initial Productivity Group (percentile)	Baseline	(1)	(2)	(3)	(4)
		Counterfactual Percentage Change from Baseline			
0-10	36	-61.1	-58.3	-25.0	-38.9
10-20	45	-17.8	-2.2	-8.9	-11.1
20-30	58	41.4	50.0	-6.9	-8.6
30-40	77	44.2	76.6	-9.1	-7.8
40-50	107	42.1	72.0	0.9	-5.6
50-60	153	34.0	64.7	2.0	-2.0
60-70	240	28.3	48.8	0.4	3.8
70-80	403	22.8	39.7	1.7	-0.7
80-90	814	15.4	25.7	2.1	2.6
90-99	2,446	4.9	14.3	4.9	3.0
99-100	1,018	0.6	7.2	1.2	2.7

Note: The baseline figures indicate the cumulative number of markets penetrated by all the firms in the corresponding productivity group.

Table 6. Intensive Margin of Foreign Affiliates in Developing Economies

Initial Productivity Group (percentile)	Baseline	(1)	(2)	(3)	(4)
		Counterfactual Percentage Change from Baseline			
0-10	189.8	39.3	71.1	-8.4	15.4
10-20	215.1	25.5	108.5	-1.5	-1.8
20-30	234.9	19.5	42.0	-5.9	3.4
30-40	276.1	33.0	38.7	-9.6	-21.7
40-50	344.0	24.2	39.9	-11.6	-8.1
50-60	422.9	30.2	37.1	-4.2	-14.1
60-70	582.5	27.0	40.4	-15.1	-20.7
70-80	852.0	19.7	23.7	-10.4	-14.2
80-90	1478.7	15.2	23.3	-7.9	-6.2
90-99	4820.2	11.0	7.2	-2.9	-1.1
99-100	24348.7	0.1	3.3	6.5	5.1

Notes: The baseline figures indicate the average sales of foreign affiliates in developing economies across the corresponding productivity group; intensive margin is in millions of yen.

Appendix A

A1. Calibration

To calibrate the model, the entry and sales conditions are re-specified. To isolate the heterogeneous component of unit costs, we define standardized unit costs as follow:

$$u(j) = T_i z_i(j)^{-\theta}. \tag{A1}$$

By connecting the country-level parameters in equation (8) with the total number of firm entries N_{ni}, we express the entry hurdle as follows:

$$u(j) \leq \bar{u}_{ni}\big(\eta_n(j)\big) = N_{ni}{\kappa_2}^{-1}\eta_n(j)^{\tilde{\theta}}, \tag{A2}$$

where $\tilde{\theta} = \theta/(\sigma-1) > 1$ and $\kappa_2 = \int \eta^{\tilde{\theta}}\, g_2(\eta)d\eta$. $\bar{u}_{ni}(\cdot)$ is a standardized entry hurdle in market *n* for potential producer *j* in country *i*. $\tilde{\theta}$ is the heterogeneity in observed sales, with a lower value indicating a larger dispersion in sales across firms. Conditional on entry, the sales condition for firm *j* in market *n* is rewritten as

$$X_{ni}(j) = \frac{\alpha_n(j)}{\eta_n(j)}\overline{\mathrm{X}}_{ni}\frac{\kappa_2}{\kappa_1}\big(\upsilon_{ni}(j)\big)^{-1/\tilde{\theta}}, \tag{A3}$$

where $\overline{\mathrm{X}}_{ni}$ is the average sales in market *n* of foreign affiliates by multinationals from country *i*, $\kappa_0 = \tilde{\theta}/\big(\tilde{\theta}-1\big)$, and $\kappa_1 = \kappa_0 \iint \alpha_n(j)\eta_n(j)^{(\tilde{\theta}-1)}\, g(\alpha,\eta)d\alpha d$. We assume that the parameter $\upsilon_{ni}(j) = u(j)/\bar{u}_{ni}\big(\eta_n(j)\big)$ follows a uniform distribution on $[0,1]$.

To parameterize κ_1 and κ_2, $g(\alpha,\eta)$ is assumed to be joint lognormal with zero means, variances (σ_α and σ_η), and correlation ρ. Thus, we can express κ_1 and κ_2 as follow:

$$\kappa_1 = \left[\frac{\tilde{\theta}}{\tilde{\theta}-1}\right] exp\left[\frac{\sigma_\alpha + 2\rho\sigma_\alpha\sigma_\eta(\tilde{\theta}-1)+\sigma_\eta(\tilde{\theta}-1)^2}{2}\right], \tag{A4}$$

$$\kappa_2 = exp\left[\frac{(\tilde{\theta}\sigma_\eta)^2}{2}\right]. \tag{A5}$$

Taken together, the entry and sales conditions are governed by four structural parameters: heterogeneity in observed sales $\tilde{\theta}$, variance in sales σ_α, variance in entry shocks σ_η, and their correlation ρ. We denote the set of these structural parameters as

$$\Theta = (\tilde{\theta}, \sigma_\alpha, \sigma_\eta, \rho)$$

We estimate a set of optimal structural parameters by calibrating the model to match firm-level data in Japan. Specifically, we use microdata pertaining to the Basic Survey of Japanese Business Structure and Activities conducted by the Japanese Ministry of Economy, Trade, and Industry (METI), which covers all business firms with 50 employees or more and capital of 30 million yen or more. To link foreign affiliate sales with Japanese parent firms, we use microdata pertaining to the Survey of Overseas Business Activities conducted by METI, which covers the multinational parent firms that are headquartered in Japan and own at least one foreign business enterprise. For

calibration, we primarily use the sample on multinational manufacturing firms in 2006, which consists of 2,032 parent firms with 7,626 foreign affiliates. However, the figures for domestic sales are missing for some parent firms, making it difficult to measure a linkage between domestic and foreign sales for them. After excluding these firms, we have 1,656 parent firms in the sample.

We employ the simulated method of moments for estimation. In the first step, we use the entry and sales conditions in equations (A2) and (A3) to simulate an artificial producer *s* by generating its efficiency draw $u(s)$, sales shock $\alpha_n(s)$, and entry shock $\eta_n(s)$. With an initial guess for the structural parameters and aggregate data on Japanese multinationals, we produce a dataset of hypothetical firms, including the market entry and affiliate sales across markets. Second, we construct a set of moment conditions from simulated multinationals and actual Japanese multinationals. We define a vector of deviations between actual and hypothetical moments for outcome *k*:

$$y(\Theta) = m^k - \hat{m}^k(\Theta). \tag{A6}$$

Following the theoretical implications, we choose four moment conditions: pecking order strings, affiliate sales distributions across markets, parent sales distribution in Japan, and multinational production intensity. Stacking a vector of moment conditions, we minimize the objective function with respect to the structural parameters as follows:

$$\widehat{\Theta} = \arg\min_{\Theta}\{[m^k - \hat{m}^k(\Theta)]' \ [m^k - \hat{m}^k(\Theta)]\}. \tag{A7}$$

To mitigate the influence of noisier segments of the data, we exclude markets with less than 10 foreign affiliates from the estimation. The best fit is obtained for the following structural parameters with bootstrapped standard errors in parenthesis:

$\tilde{\theta}$	σ_a	σ_η	ρ
1.99	1.64	0.39	-0.62
(0.43)	(0.07)	(0.31)	(0.34)

The parameters are quite similar in magnitude to the corresponding estimates for French exporters in EKK (2011). Additionally, we check the robustness of the benchmark estimates by estimating the parameters alternatively for all the markets, without the pecking order of entry from the moment conditions, and the data in 1996. These checks demonstrate the robustness of the benchmark estimates to the sample and moments.

A2. Validation

To examine whether the calibrated model can be used to replicate real multinational activity reasonably well, we conduct internal and external validation of the model. Given the estimated parameters, we first simulate a new dataset of multinational activity and compare the simulated moments with the moments from the estimation sample. We

find a fairly good fit of the data between simulated and actual moments, suggesting that the model is able to closely replicate the in-sample moments of the actual data.

However, the internal validation may not support the predictive power of the model about multinational activity in an environment with significantly different FDI barriers. For external validation, we reproduce out-of-sample predictions of Japanese multinational activities in 2006 with our parameters estimated on the 1996 data. Using the 2006 data to parameterize N_{nJ} and $\overline{\mathrm{X}}_{nJ}$ with the 1996 parameter estimates, we simulate an artificial set of multinationals from the entry and sales conditions for simulated firm *s* as follow:

$$u(s) \leq \bar{u}_n\big(\eta_n(s)\big) = N_{nJ}^{2006}{\kappa_2}^{-1}\eta_n(s)^{\tilde{\theta}}, \tag{A8}$$

$$X_{nJ}(s) = \overline{\mathrm{X}}_{nJ}^{2006}\frac{\alpha_n(s)}{\eta_n(s)}\frac{\kappa_2}{\kappa_1}\left(\frac{u(s)}{\bar{u}_n(s)}\right)^{-1/\tilde{\theta}}. \tag{A9}$$

Comparing the number of simulated and actual firms according to the moment conditions, we find that the model fit is fairly good along various dimensions of multinational activities, such as the sales distribution across markets.

A3. General Equilibrium

Each country is endowed with labor, which is mobile within countries, but immobile across countries. Intermediates are a Cobb-Douglas combination of labor and intermediates. Final output is non-traded and a Cobb-Douglas combination of manufactured goods and labor. Fixed cost for FDI is paid by labor. Profits accrue to the countries where producers' headquarters are located. As consumers own equal shares of each firm headquartered in their country, the profits are redistributed equally among the consumers. A country's GDP is equal to its total wages from production in its own country and its total profit from abroad. Lastly, some countries are net receivers of FDI, implying that they incur FDI deficits.

Solving for prices and wages jointly, we calculate counterfactual changes in the entry and affiliate sales of Japanese firms across markets $\hat{X}_{nJ}^{C}$ and $\hat{N}_{nJ}^{C}$. Given these counterfactual changes, we use the entry and sales conditions in equations (A2) and (A3) to specify the corresponding counterfactual conditions for firm-level behaviors as follow:

$$u(s) \leq \bar{u}_{nJ}^{C}\big(\eta_n(s)\big) = N_{nJ}^{C}{\kappa_2}^{-1}\eta_n(s)^{\tilde{\theta}}, \tag{A10}$$

$$X_{nJ}^{C}(s) = \overline{\mathrm{X}}_{nJ}^{C}(s)\frac{\alpha_n(j)}{\eta_n(j)}\frac{\kappa_2}{\kappa_1}\left(\frac{u(s)}{\bar{u}_n^{C}(s)}\right)^{-1/\tilde{\theta}}. \tag{A11}$$

Holding the structural parameters fixed, we next simulate a set of artificial firms on the basis of equations (A10) and (A11). Throughout the counterfactuals, we fix productivity

draws and entry/sales shocks specific to each firm. Thus, all changes in firm-level activity relative to the baseline stem solely from a change in aggregate FDI barriers.

Appendix B

B1. Data Description

We use the UNCTAD data on FDI stocks and flows for the period 1990-2006 to estimate foreign affiliate sales in 2006. First, we construct bilateral FDI stocks in 2006 for each country pair, and we approximate missing figures by the cumulative stocks of FDI flows over 1990-2006. Negative figures of the estimated FDI stocks are replaced with zero. Second, we estimate total FDI stocks in manufacturing sectors by multiplying the figures by 21%; this is the average share of manufacturing FDI as reported in the World Investment Report (2010). Finally, we multiply the FDI stocks by 2.02 to convert into sales by foreign affiliates; this is the estimated relationship between FDI stocks and affiliate sales in the World Investment Report (2010).