

Product Market Competition, Heterogeneous Firms, and the World Market for Corporate Assets*

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Abstract

This paper theoretically and empirically explores how firms' heterogeneous characteristics, in particular their competitiveness in the product market and their productivity, affect their domestic and cross-border corporate asset transactions. I find that firms participate in the domestic and overseas corporate asset markets through endogenous self-selection. Specifically, firms with strong competitiveness, measured by high excess price cost margin, are more likely to sell corporate assets in the domestic market, and they are more likely to purchase assets in the overseas markets. This finding indicates that in the increasingly integrated world economy, highly competitive firms tend to use asset purchases as an entry mode when utilizing production synergies to exploit their competitiveness in the product market worldwide. Firms with high productivity are more likely to buy assets in both the domestic and overseas markets, and they are less likely to sell assets in the domestic market.

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1 Introduction

Strengthening competition ability in product markets and participating in the world corporate asset market have become building blocks of corporate strategy. Recent decades have witnessed the global integration of product markets. Firms are facing greater competition from transnational corporations (TNCs) that are serving their local markets via building foreign subsidiaries. International production by TNCs, i.e., value added by foreign affiliates, is growing, with sales, employment, and assets of foreign affiliates all increasing. In 2010 international production accounts for around 40% of TNCs' total value added—up from around 35% in 2005—which represents more than one-tenth of global GDP and one-third of world exports.¹ Corporate asset market has also become increasingly globally integrated. As a result, cross-border asset transactions have been playing an increasingly important role in allocating corporate assets worldwide. One of a variety of channels to serve foreign customers is through foreign subsidiary production that requires corporate asset purchases abroad. Associated with the expansion in international production, cross-border asset transactions have experienced dramatic growth in recent decades, outpacing the expansion of their domestic counterparts.²

These dramatic developments call for a study of how intra-industry firm heterogeneity, especially in terms of firms' competitiveness in the product market and their productivity, affects their corporate asset transactions, both at home and abroad. Based on studies of domestic asset transactions, I introduce the firms' competitiveness in the product market into their decisions and extend the analysis to incorporate the world market for corporate assets. Specifically, I investigate firms' decisions on whether to invest abroad and which mode

¹These data are based on the findings of the United Nations Conference on Trade and Development (UNCTAD). More details are presented in Table A.4, Table A.5, and Fig. A.1.

²During the period 1986-1990, the average annual count and transaction values were 134 deals and \$28.13 billion, respectively. During the period 2006-2010, the average count and transaction values more than doubled, increasing to 289 deals and \$63.46 billion, respectively. In contrast, domestic asset sales did not significantly change during the two periods: 378 deals in counts and \$48.97 billion in transaction values over the first period and 685 deals and \$77.90 billion over the second period. These calculations are based on data from Securities Data Corporation Platinum (SDC). To mitigate the influence of business cycles, I calculate the averages for these two five-year periods. Although only after 1992 does SDC cover deals of any value, the calculations may not be affected by the coverage of SDC because certain restrictions to identify the asset sales are imposed.

to choose, i.e., making new investment (greenfield foreign direct investment) or purchasing existing corporate assets in a foreign country. The theoretical model featuring an open-economy setup produces an endogenous self-selection pattern that links firms' asset purchases and sales to their fundamentals.

I show that when TNCs face their customers' demand and make investment decisions, the competitiveness in the product market, measured by the excess price cost margin, is one of factors affecting their decisions of whether to serve foreign markets and of whether to participate in corporate asset markets worldwide. Other things being equal, firms with high competitiveness in the product market are more likely to buy assets in the overseas markets, and that they are more likely to sell assets in the domestic market. The finding highlights the impact of firms' competitiveness in the product market on their asset transactions worldwide. Specifically, the firms with high realizations of competitiveness find themselves with more assets than optimal in the home country. Therefore, in order to reach the optimal size, these firms sell assets in the home country. More importantly, these highly competitive firms tend to purchase corporate assets abroad and utilize production synergies to exploit their competitiveness in the product market in the foreign country. This finding is supported by firms' investment behaviors: UNCTAD (2000, page 143) states: " [T]he search for new markets and market power is a constant concern for firms. Where domestic markets are saturated, in particular, foreign ones beckon." The numerical analysis further shows that the relationship between the amount of assets sold in the domestic country and the firm's competitiveness in the product market is nonlinear. Specifically, for firms selling assets in the home country, those with stronger competitiveness sell fewer existing assets; and there exists a cutoff level in competitiveness such that the amount of assets sold by firms with competitiveness above this cutoff level starts to increase.

Regarding the impact of productivity, firms with high productivity are more likely to buy assets in both the domestic and overseas markets, and they are less likely to sell assets in the domestic market, which mirrors the established results in the literature.³

³Jovanovic and Rousseau (2002) show that asset sales are driven by cross-sectional differences in productivity and that firms with high productivity buy firms with low productivity (high buys low). Warusawitharana (2008) shows that firms with high profitability (productivity) engage in asset purchases, and that

Based on the theoretical model, I identify testable predictions and map the theoretical results into empirical strategies. I then obtain comprehensive data on the asset transactions of the U.S. firms in the home country and overseas from the SDC. I apply logit models and Heckman selection models and find empirical evidence that supports the theoretical predictions. The findings are also robust when I control for the firms' capital intensity and the valuation effects of the stock market.⁴ The analysis also indicates that large firms are more likely to participate in asset purchases and sales in the domestic country, which is consistent with the findings in Warusawitharana (2008). In addition, I find that large firms also have a higher likelihood of purchasing assets abroad, which adds to the existing research.

This paper is related to two strands of literature. The first is research on firms' competitiveness in the product market. Among a growing body of literature investigating the impact of product market competition on firms' activities and performance, two recent papers analyze how product market competition affects firms' investment. Giroud and Mueller (2011) find that weakly-governed firms make more value-destroying acquisitions only in noncompetitive industries, which indicates that product market competition has impact on the effects of corporate governance on firms' performance. Spearot (2012) shows that within industries in which varieties are close to perfect substitutes—i.e., firms have weak competitiveness and little market power in the product market—firms with high productivity choose to invest. He also finds that regardless of the degree of product substitutability at the industry level, as productivity increases, firms tend to prefer acquisitions to new investment. In this paper, the theoretical model captures asset purchases as well as sales in a unified framework. It analyzes how each individual firm's competitiveness impacts its corporate asset transactions

firms with low profitability (productivity) sell assets. Makaew (2009), using data on cross-border mergers and acquisitions (M&As), compares the productivity of the acquirers with that of the targets and finds that acquirers tend to be more productive and targets tend to be less productive.

⁴Clearly, through the valuation effects, the stock market has important impact on corporate investment decisions or M&As. For example, a large proportion of M&As are financed by stocks, and the valuation of the acquirer or the target can have substantial effects (e.g., Shleifer and Vishny, 2003; Rhodes-Kropf and Viswanathan, 2004; Rhodes-Kropf, Robinson, and Viswanathan, 2005; Baker, Foley, and Wurgler, 2009; and Erel, Liao, and Weisbach, 2011, among others). The findings in this paper indicating that firms' characteristics regarding the fundamentals also affect firms' asset transactions worldwide are complementary to these established results.

both at home and in foreign countries.⁵

The second strand of literature consists of studies on firms' domestic or cross-border asset transactions as well as those on foreign direct investment (FDI). Regarding the studies of domestic asset transactions, this paper is most closely related to Warusawitharana (2008) and Yang (2008). Warusawitharana (2008) shows that profitability and firm size determine asset purchases and sales, and he provides supporting evidence for these predictions using data from SDC. Yang (2008) shows that changes in productivity, rather than productivity levels, affect firms' asset transaction decisions—i.e., firms with rising productivity buy assets and firms with falling productivity downsize (rising buys falling).⁶ In this paper, I extend the studies of domestic asset transactions to an open economy in a general equilibrium setup and derive predictions on the links between firms' investment decisions worldwide and their competitiveness and productivity. This reflects the increasingly important role of cross-border asset transactions and product market competition from foreign affiliates in the global economy,

Regarding the studies on cross-border asset transactions and FDI, this paper is most closely related to Helpman, Melitz, and Yeaple (2004), who investigate the choices between exporting and greenfield FDI when firms serve foreign markets. They show that heterogeneity

⁵Many other papers analyze the impact of product market competition from different perspectives. For example, Gaspar and Massa (2005) find that a firm's monopoly power in the product market reduces the dispersion of earnings forecasts and lowers idiosyncratic return volatility. Hou and Robinson (2006) find that such market power lowers risk-adjusted expected returns, and Irvine and Pontiff (2009) find that it lowers idiosyncratic return volatility. Peress (2010) finds that competition in the product market stimulates trading, including that by insiders; enhances the informativeness of stock prices; and improves the efficiency of capital allocation. Lyandres and Watanabe (2011) show that the expected returns of firms with reliable products can decrease with competition in the product market. Healy, Serafeim, Srinivasan, and Yu (2011) find that corporate profitability mean reverts faster in countries where the product market is more open to foreign competitors and the legislation promotes domestic competition. Brav, Jiang, and Kim (2011) find that improvement in production efficiency associated with hedge fund activism is concentrated in industries where product market competition is more intense.

⁶Other related studies on domestic asset transactions include that of Maksimovic and Phillips (2002), who model asset reallocation as firms' responses to aggregate demand shocks. Lang, Poulsen, and Stulz (1995) argue that management often sells assets to obtain the cheapest funds to pursue its objectives rather than just for operating efficiency. Schlingemann, Stulz, and Walkling (2004) find that firms are more likely to divest segments from industries with a more liquid corporate asset market, unrelated segments, poorly performing segments, and small segments. Levine (2011) shows that low-cost producers seek to acquire projects that have high-revenue-productivity but are not fully implemented due to high costs, rather than acquiring only physical assets. Edmans and Mann (2012) analyzes the conditions under which asset sales are preferable to equity issuance when firms use asset sales as a means of financing.

in firms' productivity can explain the different modes to serve foreign markets: Only the most productive firms engage in FDI. I follow the heterogenous firm setup in Helpman, Melitz, and Yeaple (2004) and extend their framework in two dimensions. First, I exclude the entry mode of exporting but add asset purchases overseas as a new way to set up a foreign subsidiary in addition to greenfield FDI. Second, in addition to the firms' heterogeneity in productivity, I introduce the firms' heterogeneity in two additional dimensions: the competitiveness in the product market and the amount of assets-in-place. Based on these two new elements, I link the firms' competitiveness in the product market to their asset transaction decisions worldwide.

In an international context, a few other studies explore cross-border asset transactions. Froot and Stein (1991) show that when entrepreneurs use external finance from the capital market with informational imperfections to bid for assets, the wealth effects caused by the depreciation of the target country currency enable foreign entrepreneurs to bid a higher price for the target country assets and thereby acquire more assets in the target country. Borisova, John, and Salotti (2011) study the cross-border and domestic divestitures by U.S. firms from 1998 to 2008. They find that asset sales to foreign buyers yield higher abnormal returns to the seller as compared with domestic sales.

The remainder of this paper is organized as follows. Section 2 develops a theoretical model on asset sales featuring firms with heterogeneous competitiveness, productivity, and assets-in-place. Section 3 solves the model numerically and presents comparative statics regarding firms' decisions. The simulation results are also presented in this section. The empirical analysis follows in Section 4, and Section 5 concludes the paper. All of the proofs are collected in the Appendix.

2 Theoretical Model

2.1 General Setup

Suppose that there are N countries in the world. In any industry of a typical country, there is a continuum $[0, 1]$ of firms. A representative firm is characterized by its competitiveness,

productivity, and assets-in-place. Assets-in-place are the capital stock formed by former investments, and they generate revenues for the firm. I assume that firms use only capital to produce goods, which allows us to focus better on the firm's investment decisions in their home country and overseas. Given its competitiveness, productivity, and assets-in-place, each firm makes investment decisions to maximize its profit. To focus on a firm's asset purchases or sales decisions, I further assume that the markets for tangible assets are segmented—i.e., physical goods are immobile across borders, and that there are no exports or imports of goods. However, as is standard in the literature, intangible assets, such as the technology used in production, are mobile. As a result, I focus on multinational production worldwide.

2.2 Firm's Profit Maximization Problem

Let us take a snapshot of the investment decisions of a representative firm at a certain time spot in this open economy. In country i , a representative firm, denoted as firm (i, v) , produces the variety of good v , using only capital. This firm is characterized by a random vector $(\alpha_{i,v}, Z_{i,v}, S_{i,v})$, where $\alpha_{i,v}$ is the competitiveness; $Z_{i,v}$ is the productivity, namely the units of good v produced per unit of capital; and $S_{i,v}$ represents the assets-in-place. $\alpha_{i,v}$, $Z_{i,v}$, and $S_{i,v}$ follow a certain joint distribution. The firm sells goods in a product market characterized by monopolistic competition, and specifically, it faces an inverse demand function of its output, $p_{i,v}(Y_{i,v}) = \beta Y_{i,v}^{-(1-\alpha_{i,v})}$, where $p_{i,v}$ and $Y_{i,v}$ are the price and quantity of good v demanded by the consumers,⁷ $\beta > 0$, and $0 < \alpha_{i,v} < 1$. The price elasticity of demand of good v , $\left| \frac{d \ln Y_{i,v}}{d \ln p_{i,v}} \right|$, equals $\frac{1}{1-\alpha_{i,v}}$ and is increasing in $\alpha_{i,v}$. Therefore, the higher is $\alpha_{i,v}$, the more elastic is the demand for good v and the less market power that firm (i, v) enjoys. In the limit when $\alpha_{i,v} = 1$, the demand for good v is perfectly elastic, and therefore the firm has no market power.

In order to adjust its amount of capital needed, the firm has two options: It can make new investment itself or participate in the asset markets to purchase or sell existing assets.

⁷The corresponding demand function $Y_{i,v}(p_{i,v}) = \beta p_{i,v}^{-\left(\frac{1}{1-\alpha_{i,v}}\right)}$ can be derived from a utility maximization problem with a quasi-linear utility function.

There is fixed costs, f_D , for participating in domestic asset transfers and fixed costs, f_F , for participating in cross-border transactions. These costs account for transaction costs such as legal fees. I assume that $f_F > f_D$; that is, cross-border transactions incur higher costs due to the search for partners overseas. I follow Helpman, Melitz, and Yeaple (2004) in assuming that if the firm produces goods in the foreign country, it needs to pay fixed costs f_I , which are the overhead production costs.

The firm makes two types of decisions: the first is its production and investment decisions in its home country, and the second consists of those in the other $N - 1$ countries. To focus on the impact of the firm's heterogeneous characteristics on its investment, following Helpman, Melitz, and Yeaple (2004), I assume that each firm independently maximizes the profit obtained from the home country and from these foreign countries, instead of maximizing the joint profit. To ease notation, I omit the good index v henceforth. I take the new investment as the numeraire, and as a result the unit price of the new investment is normalized to 1, and the prices of existing capital in country i , denoted by q_i , are endogenously determined in the equilibrium. The following two subsections describe the firm's profit maximization decisions in the home country and abroad, respectively. The equilibrium conditions are described in detail in Appendix A.

2.2.1 Profit Maximization in the Home Country

I first analyze the firm's profit maximization in its *home* country i . Let S_i , I_{ii} , and X_{ii} denote the assets-in-place, the new investment, and the assets transferred, respectively. When firm (i, v) chooses its optimal amount of working capital, it has two options: (1) make new investment, or (2) purchase or sell existing capital in the asset market. If it does sell assets, it cannot sell more than what it has on hand, that is, $X_{ii} \geq -S_i$. Once the assets are installed, they are equally productive, and therefore the total amount of capital available to the firm is

$$K_{ii} = S_i + I_{ii} + X_{ii}.$$

Using K_{ii} units of capital, the firm produces Y_{ii} units of output, where

$$Y_{ii} = Z_i (S_i + I_{ii} + X_{ii}).$$

The cost of producing this amount of output is

$$C(I_{ii}, X_{ii}) = I_{ii} + q_i X_{ii} + f_D 1_{X_{ii} \neq 0},$$

where 1 is an indicator function denoting that the firm participates in asset purchases or sales in the asset market.

The firm chooses $I_{ii} \geq 0$ and $X_{ii} \geq -S_i$ to maximize its profit in the *home* country; that is,

$$\max_{I_{ii} \geq 0, X_{ii} + S_i \geq 0} p_{ii} Y_{ii} - C_{ii} = \beta Z_i^\alpha (S_i + I_{ii} + X_{ii})^\alpha - (I_{ii} + q_i X_{ii} + f_D 1_{X_{ii} \neq 0}).$$

Depending whether the firm chooses to participate in the domestic asset transaction market, it has two options: (1) non-participation ($X_{ii} = 0, I_{ii} \geq 0$), or (2) participation ($X_{ii} \neq 0, I_{ii} = 0$). The firm compares the profits from these two options and makes the decision in its home country. To be specific, let π_{ii}^* , $\pi_{X_{ii}=0}$, and $\pi_{X_{ii} \neq 0}$ denote the equilibrium profit in the home country, the profit under non-participation, and the profit under participation, respectively, where * indicate the equilibrium for the relevant variables. The maximum amount of profit from production in the home country is

$$\pi_{ii}^* = \max \{ \pi_{X_{ii}=0}, \pi_{X_{ii} \neq 0} \},$$

where $\pi_{X_{ii}=0} = p_{ii}^* Y_{ii}^* - I_{ii}^*$ and $\pi_{X_{ii} \neq 0} = p_{ii}^* Y_{ii}^* - (q_i X_{ii}^* + f_D)$.

2.2.2 Profit Maximization Overseas

Let's consider the firm's profit maximization *overseas*. In order to produce in any of the other $N - 1$ countries, for example, country j , firm (i, v) has two options to obtain its capital: (1) make new investment ($X_{ii} = 0, I_{ij} > 0$), which incurs greenfield FDI, that is, the firm does not participate in the asset market in country j ; or (2) purchase existing assets in the asset market in country j ($X_{ij} > 0, I_{ij} = 0$), which leads to cross-border assets purchases. When

the firm produces goods locally in country j ,⁸ the total amount of capital available is

$$K_{ij} = I_{ij} + X_{ij}.$$

And the amount of output produced in country j is

$$Y_{ij} = Z_i (I_{ij} + X_{ij}).$$

The cost of producing output Y_{ij} is

$$C(I_{ij}, X_{ij}) = I_{ij} + q_j X_{ij} + f_F 1_{X_{ij} \neq 0} + f_I.$$

The firm chooses $I_{ij} \geq 0$ and $X_{ij} \geq 0$ to maximize its profit in country j

$$\max_{I_{ij} \geq 0, X_{ij} \geq 0} \beta Z_i^\alpha (I_{ij} + X_{ij})^\alpha - (I_{ij} + q_j X_{ij} + f_F 1_{X_{ij} \neq 0} + f_I).$$

When the profit obtained from country j is positive, the firm enters country j . The firm compares its profits obtained from these two options and determines its entry mode and the amount of investment in country j . Let π_{ij}^* , $\pi_{X_{ij}=0}$, and $\pi_{X_{ij} \neq 0}$ denote the equilibrium profit in country j , the profit under non-participation in country j , and the profit under participation in country j , respectively. The maximum amount of profit from the production in country j is

$$\pi_{ij}^* = \max \{ \pi_{X_{ij}=0}, \pi_{X_{ij} \neq 0} \},$$

where $\pi_{X_{ij}=0} = p_{ij}^* Y_{ij}^* - (I_{ij}^* + f_I)$ and $\pi_{X_{ij} \neq 0} = p_{ij}^* Y_{ij}^* - (q_j X_{ij}^* + f_F + f_I)$.

2.3 Equilibrium

In this open economy, the equilibrium is characterized by the following conditions, which are simultaneously satisfied in each country $i \in \{1, 2, \dots, N\}$: (1) for any firm v , its profit is maximized, and (2) the asset market in each country is cleared. These conditions can be expressed in terms of the excess demand for the existing assets in each country i , which is

⁸Regarding the multinational corporation, assets-in-place in the home country do not enter the firm's production function when it is producing goods locally in a foreign country.

a function of the price of existing assets in country i , q_i . The equilibrium is characterized by the set of conditions under which the excess demand for assets in each of the countries is equal to 0, i.e.,

$$E[X_{ii}(q_i^*)] + \sum_{j=1, j \neq i}^N E[X_{ji}(q_i^*)] = 0, \text{ for } i \in \{1, 2, \dots, N\}, \quad (1)$$

where $E[\cdot]$ denotes the integration over all of the firms given the joint distribution of the firm characteristics α , Z , and S ; $X_{ii}(\cdot)$ is the quantity of assets transferred between firms of country i ; and $X_{ji}(\cdot)$ is the quantity transferred between firms of country i (the seller firms) and firms of country j (the buyer firms) in country i 's asset market.

In order to illustrate the intuition, I focus on the symmetric case in which the N countries in the world are identical. In this scenario, the prices of existing assets in all the countries are equalized, and I denote this price as q ; the set of conditions (1) then boils down to the following equation in terms of the equilibrium price q^* :

$$E[X_{ii}(q^*)] + (N - 1) E[X_{ji}(q^*)] = 0. \quad (2)$$

3 Numerical Analysis and Simulation

The complexity of the model precludes analytical solutions, and therefore I solve the equilibrium using numerical analysis. I then analyze simulated data sets of firms and use the results from the numerical analysis and the simulated data to highlight the empirical predictions of the model.

3.1 Numerical Solution

In order to solve the equilibrium numerically, I make further assumptions on the distribution of the firm characteristics and specify the parameter values. The procedures to obtain the numerical solution are presented in Appendix B.

Let $a = -\ln\left(\frac{1}{\alpha} - 1\right)$,⁹ $s = \log S$, and $z = \log Z$. I assume that a , s , and z follow a joint

⁹I use the logistic transformation $\alpha = \frac{1}{1+e^{-a}}$ to meet the restriction $0 < \alpha < 1$.

normal distribution; that is,

$$\begin{pmatrix} a \\ s \\ z \end{pmatrix} \sim N \left(\begin{pmatrix} \bar{a} \\ \bar{s} \\ \bar{z} \end{pmatrix}, \begin{bmatrix} \sigma_a^2 & \rho_{as}\sigma_a\sigma_s & \rho_{az}\sigma_a\sigma_z \\ \rho_{as}\sigma_a\sigma_s & \sigma_s^2 & \rho_{sz}\sigma_s\sigma_z \\ \rho_{az}\sigma_a\sigma_z & \rho_{sz}\sigma_s\sigma_z & \sigma_z^2 \end{bmatrix} \right). \quad (3)$$

Since there are no well-established values for the parameters in the existing literature, the specific value to attach to the model's parameters is surely debatable. In order to simplify the computation, I analyze the case of two symmetric countries, i.e., $N = 2$. I set the mean of the log of the productivity as $\bar{z} = \log(0.5)$; the mean of the log of the assets-in-place as $\bar{s} = \log(0.5)$; the mean of the competitiveness parameter as $\bar{a} = 1$; the standard deviations as $\sigma_z = \sigma_s = \sigma_a = 0.2$; the correlation between the firm's competitiveness, productivity, and assets-in-place as $\rho_{as} = \rho_{az} = \rho_{sz} = 0$; the demand parameter as $\beta = 1$; and the fixed costs of investment as f_D, f_F , and $f_I = 0.02$. I illustrate the equilibrium in this example below.

3.1.1 Equilibrium Price of Existing Assets

Given the above parameter values, the equilibrium price of existing assets is $q^* = 0.729$. The reason that q^* is less than 1 is intuitive. The magnitude of the equilibrium price of existing assets is affected by the trade-off between the variable cost and the fixed costs in the firm's profit maximization decisions: if it pays the fixed costs, it receives a discount on the variable cost per unit of assets transferred. Given the realization of the productivity and competitiveness, firms with an extremely large amount of assets-in-place would like to sell part of their assets; however, expanding firms, if they would like to participate in the asset market that incurs the transaction cost, do not want to purchase assets if the price of existing assets is greater than or equal to 1, which is the cost of making new investment themselves. Therefore, relative to making new investment, if firms do participate in asset transactions, they only pay the discounted variable cost of q per unit of capital transferred; however, in order to participate in asset transactions, they have to pay the fixed costs f_D or f_F .

3.1.2 Investment Decisions

I first analyze firms' investment decisions in the foreign country. Fig. 1 plots the decisions of the firms characterized by different combinations of competitiveness and productivity, which display an interesting sorting pattern. For a given level of productivity Z , firms with low competitiveness do not engage in overseas investment; firms with medium competitiveness make new investment in the foreign country; and highly competitive firms purchase foreign assets from local firms in the foreign country. For a given level of competitiveness α , firms with low productivity do not make any investment in the foreign country; firms with medium productivity make new investment in the foreign country; and highly productive firms engage in asset purchases in the foreign asset market.

[FIGURE 1 ABOUT HERE]

Next, I investigate firms' investment decisions in the domestic country. In order to compare firms' investment decisions in the home country with those abroad, I make additional assumptions on the amount of assets-in-place and illustrate how firms' decisions vary with the changes in their competitiveness and productivity. I set the amount of assets-in-place at its mean value: $\bar{s} = \log(0.5)$. Fig. 2 displays firms' investment decisions in the domestic country. For a given level of productivity Z , firms with lower competitiveness maintain their levels of investment, neither making new investment nor purchasing existing assets from or selling their assets to other firms, while firms with stronger competitiveness sell their assets, which suggests that firms with stronger competitiveness are more likely to sell assets in the domestic market. For a given level of competitiveness α , firms with lower productivity downsize, while firms with higher productivity maintain their existing levels of investment.

[FIGURE 2 ABOUT HERE]

3.1.3 Impact of Competitiveness

In order to gain insight into how the quantities of the new investment and the assets transferred in equilibrium vary with firms' competitiveness, I plot firms' decisions on these quantities. Specifying all of the other parameter values as above, I now set the standard deviations as $\sigma_z = \sigma_s = 10^{-6}$, and $\sigma_a = 0.2$; in other words, I shut down the impact of productivity and assets-in-place and focus on the impact of competitiveness. I also set the fix cost for participating in the cross-border asset transactions as $f_F = 0.05$.

Fig. 3 shows how changes in competitiveness affect the quantities of new investment and assets purchased in the foreign country, all other variables being fixed. Firms with lower competitiveness make new investment instead of purchasing existing assets, and the amount of new investment increases as their competitiveness increases. There exists a cutoff level in competitiveness, α_{ij}^P , at which the profit from making new investment equals that from purchasing existing assets. Firms with competitiveness above α_{ij}^P make more profit if they make invest by purchasing existing assets in the foreign country. Thus, firms with competitiveness below α_{ij}^P make new investment while those with competitiveness above α_{ij}^P purchase existing assets in country j to produce goods and serve country j 's market. What's more, Fig. 3 shows that there is a nonlinear relationship between the amount of assets purchased and the level of competitiveness. Specifically, firms with stronger competitiveness buy more assets; and there exists a cutoff level in competitiveness, α_{ij}^M , such that the amount of assets bought by firms with competitiveness above α_{ij}^M starts to decrease.

Fig. 4 shows firms' investment decisions in the home country. In this case, all the firms plotted sell their existing assets. Firms' with higher competitiveness sell fewer existing assets; and there exists a cutoff level in competitiveness, α_{ii}^S , such that the amount of assets sold by firms with competitiveness above α_{ii}^S starts to increase.

To summarize, the impact of firms' competitiveness on their investment decisions in the home country and abroad is clear. Other things being equal, firms with high realizations of competitiveness find themselves with more assets than optimal in the home country. In order to reach the optimal size, these firms sell assets in the home country. What's

more, these firms tend to purchase assets abroad and utilize production synergies to exploit their competitiveness in the foreign country. Other things being equal, the impact of firms' competitiveness on the amount of assets purchased overseas may start to decrease as firms become even more competitive.

[FIGURES 3 AND 4 ABOUT HERE]

3.2 Regression Analysis on Simulated Data

In this section, I conduct regression analysis using simulated data. This analysis further sheds light on the relationship between a firm's participation in asset transactions and its characteristics, and it motivates the subsequent analysis using actual data on asset transactions.

I set the mean of the log of the productivity as $\bar{z} = \log(0.4)$; the mean of the log of the assets-in-place as $\bar{s} = \log(0.5)$; the mean of the competitiveness proxy as $\bar{a} = 0$; the standard deviations as $\sigma_z = 0.2$, $\sigma_s = 0.4$, and $\sigma_a = 0.2$; the correlations between the firm's competitiveness, productivity, and assets-in-place as $\rho_{as} = 0$, $\rho_{az} = 0$, and $\rho_{sz} = 0.3$, respectively; the demand parameter as $\beta = 0.9$; and the fixed costs of investment as $f_D = 0.02$, $f_F = 0.05$, and $f_I = 0.02$. I obtain a sample of 10,000 firms.

I first investigate the sample firms' likelihood of participating in asset transactions in the domestic country. I apply the logit model to the asset buyers and sellers separately. I include the firm's competitiveness and productivity as regressors. In order to capture the nonlinear relationship between the likelihood of participating in asset transactions and the firms' competitiveness, I also include the square term of the competitiveness in an alternative specification. Specifically, I run the following two logit regressions to analyze the correlation between the likelihood of participating in asset purchases and the firms' characteristics:

$$y_v = \delta_0 + \delta_1 \alpha_v + \delta_3 Z_v + \xi_v,$$

$$y_v = \delta_0 + \delta_1 \alpha_v + \delta_2 (\alpha_v)^2 + \delta_3 Z_v + \xi_v,$$

where y_v is a dummy variable. y_v equals 1 if the firm producing good v buys assets in

the domestic market; otherwise, y_v equals 0. α_v and Z_v are the competitiveness and the productivity of the firm, and ξ_v denotes the idiosyncratic term. I examine the likelihood of participating in asset sales in a similar way.

In Table 1, columns (1) and (2) report the results for the simulated data on the sample firms' participation in asset purchases in the domestic country. The coefficients on the competitiveness and its square term are statistically insignificant. The coefficients on the productivity in both specifications are positive and statistically significant, which suggests that more productive firms are more likely to buy assets. Columns (3) and (4) display the results for the sample firms' participation in asset sales in the domestic country. The coefficient on the competitiveness is positive and statistically significant, which suggests that more competitive firms are more likely to sell assets. The coefficient on its square term is negative, which indicates that the impact of competitiveness on the likelihood of selling assets in the home country is decreasing. The coefficients on the productivity in both specifications are negative and statistically significant, which suggests that more productive firms are less likely to sell assets.

Regarding the sample firms' asset purchases in the foreign country, depending on the realizations of the competitiveness and productivity, a firm decides whether to engage in asset purchases in a foreign country, and if it does, it then determines the amount of assets purchased. This decision process can be estimated by the two-stage estimator proposed by Heckman (1979). Specifically, I fit the following regression equation regarding the amount of assets purchased

$$y_v^O = \phi_0 + \phi_1\alpha_v + \phi_2(\alpha_v)^2 + \phi_3Z_v + u_{1v},$$

and I assume that y_v^O is observed if

$$\tau_1\alpha_v + \tau_2Z_v + \tau_3S_v + u_{2v} > 0,$$

where y_v^O is the amount of assets purchased in the foreign country. α_v and Z_v are defined the same as before, and S_v is the firm's assets-in-place. Column (5) presents the results. In the selection equation, the coefficients on the competitiveness and productivity are positive

and statistically significant, which indicates that more competitive or more productive firms are more likely to buy assets in the foreign country. In the investment equation, the negative coefficients on the competitiveness suggests that more competitive firms tend to buy fewer assets in the foreign country, while the positive coefficient on the productivity suggests that more productive firms tend to buy more assets in the foreign country. The coefficient on the square term of the competitiveness suggests that the negative correlation between the amount of assets purchased and the competitiveness is decreasing as firms become more competitive. This result is consistent with the nonlinear relationship between the amount of assets purchased and the firm's competitiveness, as shown in Fig. 3.

[TABLE 1 ABOUT HERE]

Based on the above analysis, the model develops a number of empirical predictions on the impact of a firm's characteristics on its decisions regarding asset transactions, both in the domestic country and abroad. To be specific, regarding the asset transactions in the home country, more competitive firms are more likely to sell assets; more productive firms are more likely to buy assets but they are less likely to sell assets. Regarding the asset purchases in the foreign market, more competitive or more productive firms are more likely to buy assets in the foreign country. What is more, for the firms that do purchase assets in the foreign country, other things being equal, more competitive firms tend to buy fewer assets, and more productive firms tend to buy more assets in the foreign country.

4 Empirical Analysis

In this section, I map the theoretical results into empirical strategies and test the model's predictions using the actual data.

4.1 Data and Variables

I first describe the data sources, the screening procedures, and the variables used in the regressions.

4.1.1 Data and Sample

Due to the availability of financial data, I focus on U.S. buyers, or in other words, the buyers are U.S. firms, and the sellers are firms all around the world, including U.S. firms.

Regarding the asset transactions data, I impose certain searching criteria on M&As to identify asset purchases and sales.¹⁰ Based on the “Form of the Deal” recorded by SDC,¹¹ I only include the following forms: “acquisition of assets” and “acquisition of certain assets”. Regarding the domestic asset transactions, they meet the following additional criteria: the deal is announced between January 1, 2001 and December 31, 2009, and it is completed by the end of the sample period; to reduce measurement errors, the deal value is at least \$1 million dollars; and the deal attitude is “friendly.” Following the standard literature, I exclude leveraged buyouts, spin-offs, recapitalizations, self-tender offers, exchange offers, repurchases, and privatizations from the sample. In addition, deals in which the target or the acquirer is a government agency are excluded from the sample.¹² I also exclude asset sales due to bankruptcy because the reasons for asset sales under bankruptcy are different from those of firms in good standing (Ofek, 1993). I further exclude deals involving financial industries (Standard Industrial Classification (SIC) codes 6000-6799). As for cross-border asset purchases and sales, in addition to the above criteria, I identify the deal using the “cross-border deal” flag of SDC, and I further impose the restriction that the deal involve target firms that are not located in the U.S.

Regarding the firms’ financial data, I collect the annual data from Compustat, then I link the firms’ financial data to their asset transaction data using each firm’s CUSIP number

¹⁰Several key features distinguish asset sales from mergers. Hege, Lovo, Slovin, and Sushka (2009) summarize as follows (page 682). First, “an asset sale is governed by contract law and the business judgment rule.” Second, “mergers are generally buyer-initiated, while asset sales are generally seller-initiated.” Third, “sellers of assets foster competitive and coetaneous bidding via an auction-like process, followed by private negotiations between a seller and a selected buyer.”

¹¹Çolak and Whited (2007) use this data set to investigate divestitures. Warusawitharana (2008) uses SDC to collect data on asset purchases and sales when studying domestic deals. Borisova, John, and Salotti (2011) use Thomson ONE Banker’s Deals Analysis module to identify cross-border asset sales, which has the same data coverage as SDC because SDC and Thomson ONE Banker both belong to Thomson Financials Corporation.

¹²Karolyi and Liao (2010) investigate cross-border acquisitions led by government-controlled acquirers from 1990 to 2008, using corporate-led acquisitions as a benchmark.

and the year.

4.1.2 Variables

In this section, I outline the variables used in the empirical analysis. The definitions and data sources of the variables are presented in Table A.1, and the summary statistics and correlation matrices are presented in Tables A.2 and A.3, respectively.

Following Gaspar and Massa (2005), I use a firm's excess price cost margin to measure its competitiveness. First, I calculate each firm's price cost margin, which is defined as its EBITDA (earnings before interest, taxes, and depreciation) scaled by its total sales, then I compute the equally weighted average of the price cost margin for each two-digit SIC sector. The difference between each firm's price cost margin and the average price cost margin of its sector is the firm's excess price cost margin.

Regarding the firm's productivity, I use each firm's return on assets, which equals its EBITDA scaled by its book value of assets. As an alternative to the return on assets, I use the return per employee, which is defined as the EBITDA scaled by the total number of employees.

Following the standard literature, I also include the size of the firm as an explanatory variables. I first take the log of the firm's book value of assets, and then, in order to detrend the assets, I take the difference of the log values between two fiscal years. A firm's asset transactions may also reflect—at least to some degree—variations in its valuation that are not captured by my theoretical model. This problem is partly taken care of by including in the regression each firm's market-to-book ratio, which equals the ratio of the market value of equity to the book value of equity. In addition, to capture the characteristics of a firm's production technology, I control for its capital intensity, which is measured by the ratio of its total assets to its total number of employees.

4.2 Empirical Results

Using the firm level data, I analyze how firms' heterogeneity in their competitiveness and productivity are associated with their asset transactions.

4.2.1 Asset Purchases in the Domestic Country

Regarding firms' asset transactions in the home country, I estimate the following logit regression to analyze the firms' decisions to participate in domestic asset transfers:

$$y_{v,t}^P = \theta_0 + \theta_1\alpha_{v,t} + \theta_2(\alpha_{v,t})^2 + \theta_3Z_{v,t} + \theta_4R_{v,t} + t + e_{v,t},$$

where $y_{v,t}^P$ is a dummy variable. If U.S. firm v buys existing assets from another domestic firm in year t , $y_{v,t}^P = 1$; otherwise, $y_{v,t}^P = 0$. $\alpha_{v,t}$ and $Z_{v,t}$ stand for the competitiveness and the productivity, respectively. $R_{v,t}$ is a vector of control variables, and t is the year dummy.

Table 2 reports the results for the U.S. firms' asset purchase decisions in the domestic country, and it also reports the odds ratios corresponding to the parameter estimates. The odds ratios represent the relative increase in the odds in favor of an asset purchase relative to not purchasing assets for a unit increase in the independent variable. Standard errors are clustered by the acquirer firm to relax the assumption of independence within each cluster. Column (1) presents the results from the baseline regression. The coefficient on the competitiveness is positive but statistically insignificant, while that on the productivity is positive and statistically significant. This result indicates that productive firms are more likely to buy assets in the home market, although firms' competitiveness may not be correlated with their asset purchase decisions in the home market. This result is consistent with those from the simulated data. Regarding the economic magnitude of the coefficient estimates, as indicated by column (1), if the return on assets increases by one standard deviation, the odds of being an asset purchaser are expected to increase by about 33.96%.

In column (2), I control for the market-to-book ratio, and because the data on the market-to-book ratio are only available for recent years, the sample size shrinks. The coefficient on the return on assets is still statistically significant, while the coefficient on the market-to-book ratio is positive and statistically insignificant. In column (3), I include the capital intensity as an explanatory variable. The coefficient on the return on assets remains statistically significant, and the coefficient on the capital intensity is positive and statistically significant, which implies that firms producing relatively capital-intensive goods are more likely to buy

assets in the home country.

In columns (4), (5), and (6), I use the return per employee as an alternative measure for the return on assets, and the results support the theoretical prediction on the link between productivity and firms' asset purchase decisions in the home country. Across all the specifications in Table 2, the coefficients on the firm size are all positive and statistically significant, indicating that large firms are more likely to purchase assets in the home country, which is consistent with the results in Warusawitharana (2008).

[TABLE 2 ABOUT HERE]

In order to investigate whether there is a nonlinear relationship between the likelihood of purchasing assets and the firm's competitiveness, I include in Table 3 the square term of the competitiveness and conduct exercises similar to those in Table 2. Across all the specifications, the coefficient estimates on the competitiveness and its square term are statistically insignificant, and they are tiny in magnitude. The coefficient estimates on the return on assets or return per employee are positive and statistically significant, and their magnitudes are very close to those in the corresponding columns in Table 2. The coefficients on the firm size and the capital intensity remain positive and statistically significant, while those on the market-to-book ratio are still statistically insignificant.

[TABLE 3 ABOUT HERE]

4.2.2 Asset Sales in the Domestic Country

Similarly, I investigate the firms' asset sales decisions in the home country. Specifically, I estimate the following logit regression to analyze the U.S. firms' decisions on whether to sell assets in the domestic market:

$$y_{v,t}^S = \eta_0 + \eta_1 \alpha_{v,t} + \eta_2 (\alpha_{v,t})^2 + \eta_3 Z_{v,t} + \eta_4 R_{v,t} + t + \varepsilon_{v,t},$$

where $y_{v,t}^S$ is a dummy variable. If U.S. firm v sells its assets to another firm in year t , $y_{v,t}^S = 1$; otherwise $y_{v,t}^S = 0$. $\alpha_{v,t}$, $Z_{v,t}$, $R_{v,t}$, and t are defined as in the asset purchases regression.

Table 4 reports the results for the U.S. firms' asset sales decisions in the domestic country. Column (1) presents the results for the baseline regression. The coefficient on the competitiveness is positive and statistically significant, which indicates that other things being equal, firms with high competitiveness are more likely to sell assets. The coefficient on the productivity is negative and statistically significant, which suggests that firms with high productivity are less likely to sell assets in the home market. These results match the findings from the simulated data reported in column (3) of Table 1. Regarding the economic magnitude of the coefficient estimates, if the excess price cost margin increases by one standard deviation, the odds of being an asset seller are expected to increase by about 4.41%. A unit standard deviation increase in return on assets decreases the odds in favor of the asset sales by 27.89%, which is very close to the results in Warusawitharana (2008).¹³

In column (2), I control for the market-to-book ratio. The coefficient on return on assets remains statistically significant, and the coefficient on the market-to-book ratio is negative and statistically significant, which suggests that firms with high valuation are less likely to sell assets. In column (3), I also control for the capital intensity, and the coefficient on the capital intensity is statistically insignificant.

As a robustness test, I use the return per employee as an alternative measure for the return on assets, and the results are presented in columns (4), (5), and (6), which again provide supportive evidence to the theoretical model's prediction. As indicated in columns (4), if the return per employee increases by one standard deviation, the odds of being an asset seller are expected to decrease by about 30.62%. Across all the specifications in Table 4, the coefficients on the firm size are all positive and statistically significant, suggesting that large firms are more likely to sell assets in the home country, which is consistent with the results in Warusawitharana (2008).

[TABLE 4 ABOUT HERE]

¹³Warusawitharana (2008) find that a unit standard deviation increase in profitability decreases the odds in favor of an asset sale by 34% and 23%, respectively, when firm and industry control variables are used (page 486).

In order to investigate whether there is a nonlinear relationship between the decision to sell assets and the firm’s competitiveness, in Table 5 I include the square term of the competitiveness and conduct exercises similar to those in Table 4. Across all the specifications, the coefficients on the competitiveness are positive and statistically significant. The coefficients on its square term are negative and statistically significant, which matches the result from the simulated data. This finding indicates that the impact of competitiveness on the likelihood of selling assets in the home country is decreasing. The coefficient estimates on the return on assets or return per employee remain negative and statistically significant, and the magnitudes are similar to those in the corresponding regressions in Table 4. The coefficients on the size remain positive and statistically significant, and those on the market-to-book ratio are still negative and statistically significant, while those on the capital intensity are again statistically insignificant.

[TABLE 5 ABOUT HERE]

4.2.3 Asset Purchases Overseas

As illustrated in section 3.2, a firm’s decision process regarding asset purchases overseas can be estimated by the two-stage estimator proposed by Heckman (1979). Specifically, I fit the following regression equation regarding the amount of assets purchased

$$y_{v,t}^O = \gamma_0 + \gamma_1 \alpha_{v,t} + \gamma_2 (\alpha_{v,t})^2 + \gamma_3 Z_{v,t} + \gamma_4 R_{v,t} + t + u_{1v,t},$$

and I assume that $y_{v,t}^O$ is observed if

$$\delta_1 \alpha_{v,t} + \delta_2 Z_{v,t} + \delta_3 R_{v,t} + u_{2v,t} > 0,$$

where $y_{v,t}^O$ is the amount of assets purchased by firms in the U.S. from a firm located in a foreign country in year t . $\alpha_{v,t}$, $Z_{v,t}$, $R_{v,t}$, and t are defined the same as before. This two-stage approach first estimates the selection equation and then estimates the investment equation. The amount of asset purchased in the foreign country is measured by the transaction values of each cross-border deal reported by SDC.

Table 6 reports the results for the U.S. firms' asset purchase decisions in the foreign country. Column (1) presents the results from the baseline regression, and Table 1 column (5) provides the simulation counterpart. As shown in Table 6 column (1), in the selection equation, the coefficient on the competitiveness is positive and statistically significant, which indicates that competitive firms are more likely to purchase assets abroad. If the excess price cost margin increases by one standard deviation, the odds of purchasing assets in the foreign country are expected to increase by about 16.78%. Similarly, the positive coefficient estimate for the productivity suggests that, other things being equal, productive firms are more likely to purchase assets abroad. A unit standard deviation increase in the return on assets increases the odds in favor of the asset purchases in the foreign country by 17.57%. In the investment equation, the coefficient on the competitiveness is negative and statistically significant, but the coefficient on the square term of the competitiveness is positive and statistically insignificant. This indicates that, other things being equal, if firms do purchase assets abroad, more competitive firms tend to buy fewer assets in the foreign country. The coefficient on the return on assets is positive and statistically insignificant.

To test the robustness of the result, I control for the market-to-book ratio, the capital intensity, and both of them, and the results are presented in columns (2), (3), and (4), respectively. All the variables of interest remain statistically significant, although the coefficient estimates vary in magnitude because different firms are included in the sample due to the data availability. In columns (3) and (4), the investment equations show that the coefficients on the return on assets are positive and statistically significant, which suggests that if firms do purchase assets abroad, those with high productivity tend to buy more assets in the foreign country. In column (4), in the selection equation, the coefficient on the market-to-book ratio is positive and statistically significant, which indicates that firms with high market-to-book ratios are more likely to purchase assets in the foreign market. In contrast, in the investment equation the coefficient on the market-to-book ratio is positive and statistically insignificant, which suggest that the market-to-book ratio may not be correlated with the amount of assets purchased in the foreign country. As for the capital intensity, column (4) indicates that firms producing relatively capital-intensive goods are less likely to buy

assets in the foreign country; however, if they do buy assets abroad, those with high capital intensity tend to buy more assets in the foreign country.

As an another robustness test, in columns (5) to (8), I use the return per employee as an alternative measure for the return on assets, and the results support the theoretical prediction. In column (5), in the investment equation, the coefficient on the return per employee is positive and statistically significant. If the return per employee increases by one standard deviation, the amount of assets purchased overseas increases by about 0.12 units of standard deviation. As for the market-to-book ratio and capital intensity, the coefficient estimates for them display patterns similar to those when I use the return on assets to measure productivity. Across all the specifications, the coefficients on the firm size are positive and statistically significant, which implies that large firms are more likely to buy assets in the foreign country.

[TABLE 6 ABOUT HERE]

5 Conclusion

In the era of economic globalization, firms face more competition from TNCs that enter their local markets. Cross-border asset transactions have also increased dramatically. Based on these new developments, I introduce a new characteristic of the firm, namely its competitiveness in the product market, which is measured by the excess price cost margin, and I investigate how the competitiveness and productivity affect the firm's asset transactions worldwide. I show that, other things being equal, firms with high competitiveness are more likely to buy assets in the overseas markets, and that they are more likely to sell assets in the domestic market. Firms with high productivity are more likely to buy assets in both the domestic and overseas markets, and they are less likely to sell assets in the domestic market.

Using the comprehensive data on the asset purchases and sales of U.S. firms, I find empirical evidence that supports the model's implications. In particular, the competitiveness and productivity of the firm are associated with the likelihood that a firm purchases assets

overseas. If the excess price cost margin increases by one standard deviation, the odds of purchasing assets in a foreign country are expected to increase by about 16.78%. A unit standard deviation increase in the return on assets increases the likelihood of asset purchases in a foreign country by 17.57%.

The findings in this paper add to the research on the impact of product market competition on firms' activities. It also extends the studies on asset transactions to an open economy setting. Existing literature has shown that financing considerations have impact on firms' domestic asset sales (Lang, Poulsen, and Stulz, 1995; Warusawitharana, 2008), therefore, future research on how financing considerations influence the firms' asset purchase and sales decisions worldwide could prove fruitful. Given the findings on value losses or creation in M&As (e.g., Moeller, Schlingemann, Stulz, 2005; Chari, Ouimet, and Tesar, 2010) and asset sales (Borisova, John, and Salotti, 2011), it could also be interesting to incorporate the product market competition into the analysis and explore the links between a firm's valuation and its asset purchases and sales worldwide.

Appendix

A. Firm's Profit Maximization Problem

In this appendix, I characterize the solutions to the firm's profit maximization problems in the home country and the foreign country.

A1. Profit Maximization in the Home Country

As shown in Section 2.2.1, when the firm chooses whether to participate in corporate asset transactions in the home country, it has two options : (1) non-participation, and (2) participation. The firm's decisions are detailed below.

Case 1. Non-participation ($X_{ii} = 0, I_{ii} \geq 0$)

In this case, there are two scenarios.

Scenario (a). In this scenario, the firm maintains its assets-in-place inherited from the last period, neither making new investment nor purchasing existing assets from or selling its assets to other firms. The firm's decision is characterized by the following expressions:

$$I_{ii}^* = 0, X_{ii}^* = 0, p_{ii}^* = \beta S_i^{-(1-\alpha)} Z_i^{-(1-\alpha)}, Y_{ii}^* = Z_i S_i. \quad (4)$$

The restriction on the parameter values $(\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{\alpha}{1-\alpha}} < S_i$ needs to be satisfied in equilibrium.

Scenario (b). In this scenario, the firm makes new investment using its assets-in-place inherited from the last period, instead of purchasing existing assets from or selling its assets to other firms. The firm's decision is characterized by the following expressions:

$$I_{ii}^* = (\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{\alpha}{1-\alpha}} - S_i, X_{ii}^* = 0, p_{ii}^* = \frac{1}{\alpha Z_i}, Y_{ii}^* = (\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{1}{1-\alpha}}. \quad (5)$$

The restriction on the parameter values $(\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{\alpha}{1-\alpha}} \geq S_i$ needs to be satisfied in equilibrium.

Case 2. Participation ($X_{ii} \neq 0, I_{ii} = 0$)

In this case, the firm purchases or sells corporate assets in the domestic market. The

equilibrium is characterized by the following expressions:

$$I_{ii}^* = 0, \quad X_{ii}^* = (\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{\alpha}{1-\alpha}} q_i^{-\frac{1}{1-\alpha}} - S_i, \quad p_{ii}^* = \frac{q_i}{\alpha Z_i}, \quad Y_{ii}^* = (\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{1}{1-\alpha}} q_i^{-\frac{1}{1-\alpha}}. \quad (6)$$

The firm compares the profits in these two cases and makes its investment decision in the home country. Specifically, let π_{ii}^* , $\pi_{X_{ii}=0}$, and $\pi_{X_{ii}\neq 0}$ denote the equilibrium profit in the home country, the profit under non-participation, and the profit under participation, respectively. The maximum amount of profits from the production in the home country is

$$\pi_{ii}^* = \max \{ \pi_{X_{ii}=0}, \pi_{X_{ii}\neq 0} \}, \quad (7)$$

where $\pi_{X_{ii}=0} = p_{ii}^* Y_{ii}^* - I_{ii}^*$ and $\pi_{X_{ii}\neq 0} = p_{ii}^* Y_{ii}^* - (q_i X_{ii}^* + f_D)$.

A2. Profit Maximization Overseas

As shown in Section 2.2.2, in any of the foreign country j the firm has two options: (1) non-participation, and (2) participation. The firm's decisions are detailed below.

Case 1. Non-participation ($X_{ij} = 0, I_{ij} > 0$)

In this case, the firm makes new investment instead of purchasing existing assets from foreign firms. The equilibrium is characterized by the following expressions:

$$I_{ij}^* = (\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{\alpha}{1-\alpha}}, \quad X_{ij}^* = 0, \quad p_{ij}^* = \frac{1}{\alpha Z_i}, \quad Y_{ij}^* = (\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{1}{1-\alpha}}. \quad (8)$$

The maximum profit obtained in the foreign country is $\pi_{X_{ij}=0} = p_{ij}^* Y_{ij}^* - (I_{ij}^* + f_I)$.

Case 2. Participation ($X_{ij} > 0, I_{ij} = 0$)

In this case, instead of making new investment, the firm purchases existing assets from foreign firms; the equilibrium is characterized by the following expressions:

$$I_{ij}^* = 0, \quad X_{ij}^* = (\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{\alpha}{1-\alpha}} q_j^{-\frac{1}{1-\alpha}}, \quad p_{ij}^* = \frac{q_j}{\alpha Z_i}, \quad Y_{ij}^* = (\beta\alpha)^{\frac{1}{1-\alpha}} Z_i^{\frac{1}{1-\alpha}} q_j^{-\frac{1}{1-\alpha}}. \quad (9)$$

The maximum profit obtained in the foreign country is $\pi_{X_{ij}\neq 0} = p_{ij}^* Y_{ij}^* - (q_j X_{ij}^* + f_F + f_I)$.

When the profit obtained from country j is positive, the firm enters country j . Depending on the amount of profit, the firm either makes new investment or purchases existing assets

in the asset market in country j . The firm compares the profits in these two cases and determines its amount of investment in country j . The maximum amount of profit from the production in country j is

$$\pi_{ij}^* = \max \left\{ \pi_{X_{ij}=0}, \pi_{X_{ij} \neq 0} \right\}. \quad (10)$$

B. Numerical Algorithm

This appendix describes the algorithm of computing the equilibrium. The steps are summarized as follows.

Step 0: Define the finite grid for the equilibrium price q over $(0, 1)$. Define the finite grids for a , s , and z over the interval of 3 standard deviations centering around the corresponding means: \bar{a} , \bar{s} , and \bar{z} , respectively.

Step 1: Solve each firm's profit maximization problem in the domestic country. Use Eqs. (4), (5), and (6) to compute I_{ii} , X_{ii} , p_{ii} , and Y_{ii} . Use Eq. (7) to compute π_{ii} .

Step 2: Solve each firm's profit maximization problem in the foreign country. Use Eqs. (8) and (9) to compute I_{ij} , X_{ij} , p_{ij} , and Y_{ij} . Use Eq. (10) to compute π_{ij} .

Step 3: Given the joint distribution of a , s , and z , as defined in expression (3), compute the aggregate excess demand for the existing assets.

Step 4: Apply the grid search method and use the market clearing condition, Eq. (2), to solve the equilibrium price q^* of the existing assets. First, find the minimum value of the excess demand, exd_1 , and its corresponding value of q , q_1 . Then, determine the value of q that satisfies the following two conditions: (1) it has the closest grid index to q_1 , and (2) it corresponds to the value of excess demand that has the opposite sign to exd_1 . Denote this value of q as q_0 . Define a finite grid for q over $[q_0, q_1]$. Repeat Steps 1 to 3 and find the minimum value of the excess demand, exd , and its corresponding value of q . This value of q is the equilibrium price q^* .

Step 5: Use q^* and Eqs. (4), (5), and (6) to compute I_{ii}^* and X_{ii}^* . Use q^* and Eqs. (8) and (9) to compute I_{ij}^* and X_{ij}^* .

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Table 1

Regressions on the simulated data.

This table reports the regression results of the simulated data. The exogenous parameters are specified as follows. $\bar{z} = \log(0.4)$; $\sigma_z = 0.2$; $\bar{s} = \log(0.5)$; $\sigma_s = 0.4$; $\bar{a} = 0$; $\sigma_a = 0.2$; $\rho_{zs} = 0.3$; $\rho_{sa} = 0$; $\rho_{za} = 0$; $\beta = 0.9$; $f_D = 0.02$; $f_F = 0.05$; $f_I = 0.02$; and $N = 2$. The equilibrium price of existing assets is $q^* = 0.562$. Regressions (1) and (2) report the results of the logit regression where the dependent variable equals 1 if the sample firms purchase assets in the domestic country. Regressions (3) and (4) are the logit regressions where the dependent variable equals 1 if the sample firms sell assets in the domestic country. Regression (5) reports the result of the Heckman selection model for the asset purchases in the foreign country. In the Heckman selection model, the number of uncensored observation is reported. Standard errors are reported in parentheses below regression coefficients, and ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Asset purchases in the domestic country		Asset sales in the domestic country		Asset purchases in the foreign country
	(1)	(2)	(3)	(4)	(5)
<i>Investment equation</i>					
Competitiveness	0.6152 (0.7965)	-17.1446 (12.3604)	1.6270*** (0.4291)	-8.4549 (6.2869)	-0.2687*** (0.0307)
Competitiveness Squared		-17.7710 (12.3404)		-10.1033* (6.2867)	-0.3072*** (0.0312)
Productivity	5.3994*** (0.3611)	5.4005*** (0.3613)	-2.6729*** (0.2166)	-2.6778*** (0.2167)	0.6182*** (0.0013)
Constant	-4.4348*** (0.4511)	-8.8305*** (3.0892)	2.0744*** (0.2461)	-0.4139 (1.5670)	-0.0482*** (0.0075)
<i>Selection equation</i>					
Competitiveness					430.5858*** (57.6309)
Productivity					522.2255*** (72.7802)
Number of Observations	5584	5584	9208	9208	8417
Pseudo R^2	0.0507	0.0512	0.0132	0.0134	-

Table 2

Logit regressions: domestic asset purchases.

This table reports results from logit regressions of domestic asset purchases, competitiveness, productivity, and other control variables. The dependent variable is a dummy variable, which equals 1 if the firm purchases assets on the domestic market, and 0 otherwise. Variable definitions and data sources are as described in Table A.1, and summary statistics are reported in Table A.2. Standard errors robust to heteroskedasticity and clustered by the acquirer firm are reported in parentheses below regression coefficients, and ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Competitiveness	0.0014 (0.0011)	1.0014 (0.0011)	0.0004 (0.0004)	1.0004 (0.0004)	0.0003 (0.0003)	1.0003 (0.0003)	0.0010 (0.0010)	1.0010 (0.0010)	0.00001 (0.0001)	1.00001 (0.0001)	0.00002 (0.00009)	1.00002 (0.00009)
Return on assets	1.4939*** (0.0965)	4.4542*** (0.4298)	1.5066*** (0.1058)	4.5114*** (0.4773)	1.5973*** (0.1136)	4.9398*** (0.5610)						
Return per employee							0.0039*** (0.0002)	1.0039*** (0.0002)	0.0045*** (0.0003)	1.0045*** (0.0003)	0.0041*** (0.0003)	1.0041*** (0.0003)
Size	1.1679*** (0.0431)	3.2151*** (0.1385)	0.4012*** (0.0271)	1.4936*** (0.0405)	0.3660*** (0.0262)	1.4419*** (0.0378)	1.2047*** (0.0419)	3.3359*** (0.1397)	0.9869*** (0.0589)	2.6830*** (0.1579)	0.9697*** (0.0588)	2.6372*** (0.1551)
Market-to-book			0.0002 (0.0001)	1.0002 (0.0001)	0.0002 (0.0001)	1.0002 (0.0001)			0.0002 (0.0001)	1.0002 (0.0001)	0.0002 (0.0001)	1.0002 (0.0001)
Capital intensity					0.0006*** (0.0001)	1.0006*** (0.0001)					0.0003*** (0.0001)	1.0003*** (0.0001)
Observations	93453	93453	42893	42893	42893	42893	93258	93258	39037	39037	39037	39037
Pseudo R ²	0.0446	0.0446	0.0314	0.0314	0.0362	0.0362	0.0420	0.0420	0.0304	0.0304	0.0312	0.0312

Table 3

Logit regressions: domestic asset purchases and the quadratic term of competitiveness.

This table reports results from logit regressions of domestic asset purchases, competitiveness, productivity, and other control variables. The dependent variable is a dummy variable, which equals 1 if the firm purchases assets on the domestic market, and 0 otherwise. Variable definitions and data sources are as described in Table A.1, and summary statistics are reported in Table A.2. Standard errors robust to heteroskedasticity and clustered by the acquirer firm are reported in parentheses below regression coefficients, and ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Competitiveness	0.0015 (0.0011)	1.0015 (0.0011)	-0.0005 (0.0010)	0.9995 (0.0010)	-0.0014 (0.0010)	0.9986 (0.0010)	0.0010 (0.0010)	1.0010 (0.0010)	-0.0014 (0.0012)	0.9986 (0.0012)	-0.0018 (0.0011)	0.9982 (0.0011)
Competitiveness squared	0.0000 (0.0000)	1.0000 (0.0000)	-0.0000 (0.0000)	1.0000 (0.0000)	-0.0000 (0.0000)	1.0000 (0.0000)	0.0000 (0.0000)	1.0000 (0.0000)	0.0000 (0.0000)	1.0000 (0.0000)	-0.0000 (0.0000)	1.0000 (0.0000)
Return on assets	1.4938*** (0.0965)	4.4542*** (0.4298)	1.5071*** (0.1056)	4.5135*** (0.4768)	1.5997*** (0.1135)	4.9514*** (0.5618)						
Return per employee							0.0039*** (0.0002)	1.0039*** (0.0002)	0.0045*** (0.0003)	1.0045*** (0.0003)	0.0041*** (0.0003)	1.0041*** (0.0003)
Size	1.1679*** (0.0431)	3.2151*** (0.1385)	0.4008*** (0.0272)	1.4931*** (0.0406)	0.3651*** (0.0263)	1.4407*** (0.0378)	1.2047*** (0.0419)	3.3358*** (0.1397)	0.9872*** (0.0589)	2.6836*** (0.1581)	0.9698*** (0.0588)	2.6373*** (0.1552)
Market-to-book			0.0002 (0.0001)	1.0002 (0.0001)	0.0002 (0.0001)	1.0002 (0.0001)			0.0002 (0.0001)	1.0002 (0.0001)	0.0002 (0.0001)	1.0002 (0.0001)
Capital intensity					0.0006*** (0.0001)	1.0006*** (0.0001)					0.0003*** (0.0001)	1.0003*** (0.0001)
Observations	93453	93453	42893	42893	42893	42893	93258	93258	39037	39037	39037	39037
Pseudo R ²	0.0446	0.0446	0.0314	0.0314	0.0363	0.0363	0.0420	0.0420	0.0305	0.0305	0.0313	0.0313

Table 4

Logit regressions: domestic asset sales.

This table reports results from logit regressions of domestic asset sales, competitiveness, productivity, and other control variables. The dependent variable is a dummy variable, which equals 1 if the firm sells assets on the domestic market, and 0 otherwise. Variable definitions and data sources are as described in Table A.1, and summary statistics are reported in Table A.2. Standard errors robust to heteroskedasticity and clustered by the acquirer firm are reported in parentheses below regression coefficients, and ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Competitiveness	0.0166** (0.0083)	1.0168** (0.0085)	-0.0030 (0.0131)	0.9970 (0.0131)	0.0008 (0.0133)	1.0008 (0.0133)	0.0172** (0.0083)	1.0174** (0.0085)	0.0048 (0.0136)	1.0048 (0.0137)	0.0057 (0.0136)	1.0057 (0.0137)
Return on assets	-1.6708*** (0.1486)	0.1881*** (0.0280)	-2.2657*** (0.2776)	0.1038*** (0.0288)	-2.1925*** (0.2845)	0.1116*** (0.0318)						
Return per employee							-0.0079*** (0.0007)	0.9921*** (0.0006)	-0.0061*** (0.0011)	0.9939*** (0.0011)	-0.0060*** (0.0011)	0.9941*** (0.0011)
Size	0.2522*** (0.0128)	1.2868*** (0.0165)	0.2981*** (0.0280)	1.3473*** (0.0377)	0.2867*** (0.0286)	1.3321*** (0.0380)	0.2638*** (0.0128)	1.3019*** (0.0167)	0.2532*** (0.0261)	1.2881*** (0.0336)	0.2507*** (0.0263)	1.2850*** (0.0338)
Market-to-book			-0.0319* (0.0173)	0.9686* (0.0168)	-0.0404** (0.0181)	0.9604** (0.0174)			-0.0370** (0.0188)	0.9637** (0.0181)	-0.0405** (0.0190)	0.9603** (0.0183)
Capital intensity					0.00002 (0.00002)	1.0000 (0.0000)					-0.00000 (0.00001)	1.0000 (0.0000)
Observations	100974	100974	40193	40193	38954	38954	99431	99431	38973	38973	38525	38525
Pseudo R ²	0.0404	0.0404	0.0327	0.0327	0.0318	0.0318	0.0425	0.0425	0.0283	0.0283	0.0281	0.0281

Table 5

Logit regressions: domestic asset sales and the quadratic term of competitiveness.

This table reports results from logit regressions of domestic asset sales, competitiveness, productivity, and other control variables. The dependent variable is a dummy variable, which equals 1 if the firm sells assets on the domestic market, and 0 otherwise. Variable definitions and data sources are as described in Table A.1, and summary statistics are reported in Table A.2. Standard errors robust to heteroskedasticity and clustered by the acquirer firm are reported in parentheses below regression coefficients, and ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Competitiveness	0.1307*** (0.0314)	1.1396*** (0.0358)	0.1144** (0.0526)	1.1212** (0.0590)	0.1265** (0.0532)	1.1349** (0.0604)	0.1304*** (0.0314)	1.1393*** (0.0358)	0.1089** (0.0544)	1.1150** (0.0606)	0.1165** (0.0545)	1.1236** (0.0612)
Competitiveness squared	-0.0161*** (0.0042)	0.9841*** (0.0041)	-0.0159** (0.0069)	0.9842** (0.0068)	-0.0171** (0.0070)	0.9831** (0.0068)	-0.0160*** (0.0042)	0.9842*** (0.0042)	-0.0141** (0.0071)	0.9860** (0.0070)	-0.0150** (0.0071)	0.9851** (0.0070)
Return on assets	-1.7368*** (0.1498)	0.1761*** (0.0264)	-2.3243*** (0.2809)	0.0979*** (0.0275)	-2.2550*** (0.2881)	0.1049*** (0.0302)						
Return per employee							-0.0082*** (0.0007)	0.9918*** (0.0007)	-0.0063*** (0.0011)	0.9937*** (0.0011)	-0.0062*** (0.0011)	0.9939*** (0.0011)
Size	0.2579*** (0.0129)	1.2942*** (0.0168)	0.3024*** (0.0282)	1.3531*** (0.0381)	0.2917*** (0.0288)	1.3388*** (0.0386)	0.2692*** (0.0129)	1.3089*** (0.0169)	0.2568*** (0.0263)	1.2928*** (0.0340)	0.2547*** (0.0265)	1.2901*** (0.0342)
Market-to-book			-0.0326* (0.0173)	0.9679* (0.0168)	-0.0410** (0.0181)	0.9598** (0.0173)			-0.0374** (0.0188)	0.9633** (0.0181)	-0.0410** (0.0190)	0.9598** (0.0182)
Capital intensity					0.00002 (0.00002)	1.0000 (0.0000)					-0.00000 (0.00001)	1.0000 (0.0000)
Observations	100974	100974	40193	40193	38954	38954	99431	99431	38973	38973	38525	38525
Pseudo R ²	0.0411	0.0411	0.0335	0.0335	0.0327	0.0327	0.0431	0.0431	0.0289	0.0289	0.0287	0.0287

Table 6

Heckman selection model: cross-border asset purchases and the quadratic term of competitiveness.

This table reports results from Heckman selection model: cross-border asset purchases. The dependent variable is the amount of assets purchased in a foreign country by a firm in a year. Variable definitions and data sources are as described in Table A.1, and summary statistics are reported in Table A.2. The table reports the number of uncensored observations. Standard errors robust to heteroskedasticity and clustered by the acquirer firm are reported in parentheses below regression coefficients, and ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Investment equation</i>								
Competitiveness	-18.9784** (9.3887)	-35.6427** (14.9104)	-13.0905* (6.9313)	-26.7739*** (10.2222)	-15.1517** (6.5353)	-28.0346*** (9.6751)	-14.5044** (6.6835)	-28.3105*** (10.0237)
Competitiveness squared	1.0903 (0.8435)	1.7575 (1.2114)	0.7324 (0.6919)	1.2585 (0.8901)	0.9011 (0.6638)	1.3873* (0.8347)	0.8438 (0.6854)	1.3987 (0.8776)
Return on assets	72.6844 (49.1422)	41.8668 (66.9040)	211.3409*** (42.7678)	176.8486*** (57.0374)				
Return per employee					0.6241*** (0.1187)	0.6725*** (0.1836)	0.2965** (0.1363)	0.1868 (0.2359)
Market-to-book		2.3913 (5.2656)		4.4737 (4.6324)		-1.1871 (4.4455)		4.3717 (4.8075)
Capital intensity			0.1338*** (0.0391)	0.1848*** (0.0671)			0.1049*** (0.0410)	0.1637** (0.0707)
<i>Selection equation</i>								
Competitiveness	0.0693*** (0.0038)	0.0476*** (0.0042)	0.0664*** (0.0039)	0.0380*** (0.0045)	0.0636*** (0.0038)	0.0450*** (0.0041)	0.0598*** (0.0039)	0.0340*** (0.0043)
Return on assets	1.2827*** (0.1094)	1.2700*** (0.1305)	1.1968*** (0.1062)	1.0366*** (0.1203)				
Return per employee					0.0008*** (0.0001)	0.0005*** (0.0002)	0.0016*** (0.0002)	0.0015*** (0.0002)
Size	0.4395*** (0.0334)	0.3437*** (0.0479)	0.4724*** (0.0344)	0.4290*** (0.0498)	0.4978*** (0.0305)	0.4162*** (0.0451)	0.4957*** (0.0314)	0.4537*** (0.0457)
Market-to-book		0.0682*** (0.0065)		0.0599*** (0.0068)		0.0654*** (0.0061)		0.0517*** (0.0062)
Capital intensity			-0.00005*** (0.00002)	-0.00014*** (0.00002)			-0.00016*** (0.00002)	-0.00023*** (0.00002)
Observations	3037	1944	2784	1786	3080	1922	2936	1841

Figure 1

Firms' investment decisions overseas.

This figure plots how firms' investment decisions overseas vary with changes in the productivity and the degree of competitiveness. The exogenous parameters are specified as follows. $\bar{z} = \log(0.5)$; $\sigma_z = 0.2$; $\bar{s} = \log(0.5)$; $\sigma_s = 0.2$; $\bar{a} = 0$; $\sigma_a = 0.2$; $\rho_{zs} = 0$; $\rho_{sa} = 0$; $\rho_{za} = 0$; $\beta = 1$; $f_D = 0.02$; $f_F = 0.02$; $f_I = 0.02$; and $N = 2$. The equilibrium price of existing assets is $q^* = 0.729$.

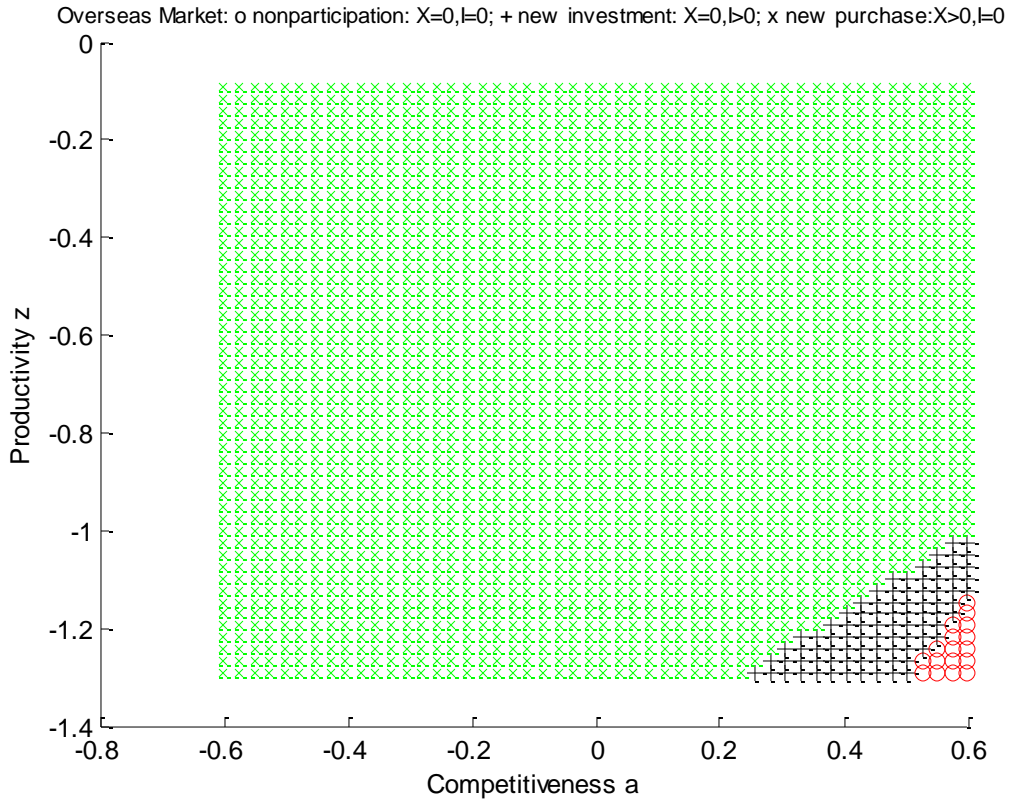


Figure 2

Firms' investment decisions in the domestic country: $s = \bar{s}$.

This figure plots how firms' investment decisions in the domestic country vary with changes in the productivity and the degree of competitiveness when the assets-in-place is fixed at the mean value \bar{s} . The exogenous parameters are specified as follows. $\bar{z} = \log(0.5)$; $\sigma_z = 0.2$; $\bar{s} = \log(0.5)$; $\sigma_s = 0.2$; $\bar{a} = 0$; $\sigma_a = 0.2$; $\rho_{zs} = 0$; $\rho_{sa} = 0$; $\rho_{za} = 0$; $\beta = 1$; $f_D = 0.02$; $f_F = 0.02$; $f_I = 0.02$; and $N = 2$. The equilibrium price of existing assets is $q^* = 0.729$.

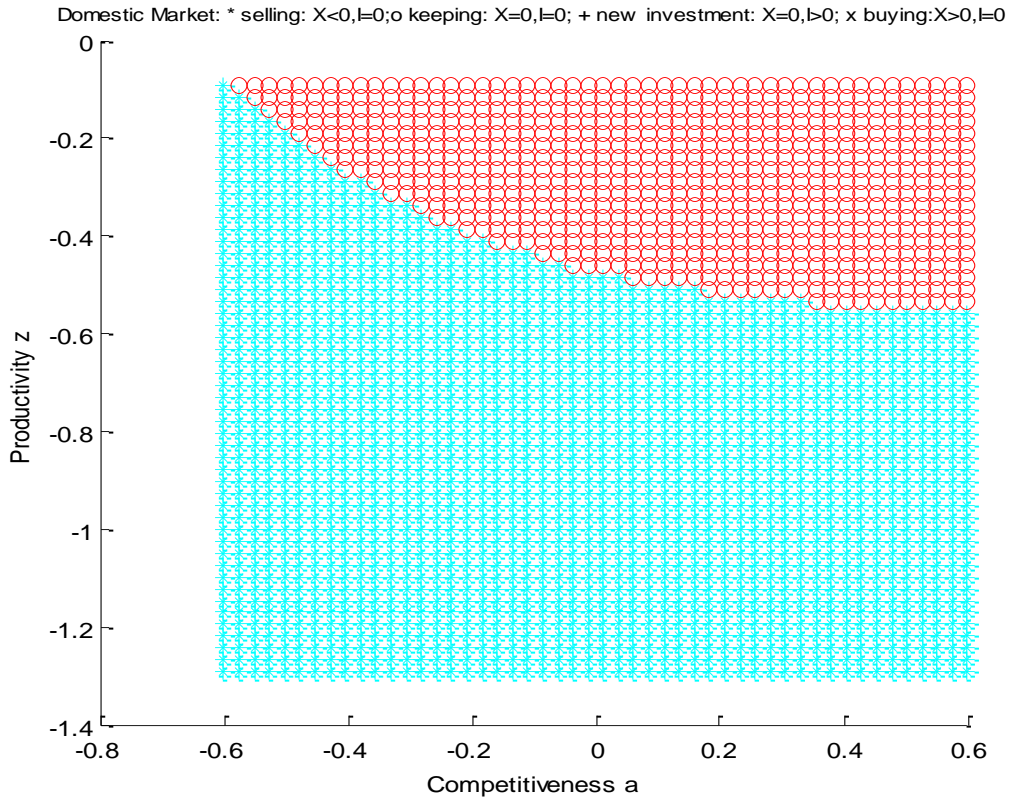


Figure 3

Equilibrium quantity of investment: in the foreign country.

This figure plots how firms' investment varies with changes in their competitiveness when they invest in the foreign country. The exogenous parameters are specified as follows. $\bar{z} = \log(0.5)$; $\sigma_z = 10^{-6}$; $\bar{s} = \log(0.5)$; $\sigma_s = 10^{-6}$; $\bar{a} = 0$; $\sigma_a = 0.2$; $\rho_{zs} = 0$; $\rho_{sa} = 0$; $\rho_{za} = 0$; $\beta = 1$; $f_D = 0.02$; $f_F = 0.05$; $f_I = 0.02$; and $N = 2$. The equilibrium price of existing assets is $q^* = 0.694$. "X-foreign" is the quantity of assets purchased in the foreign country, and "I-foreign" is the quantity of new investment in the foreign country.

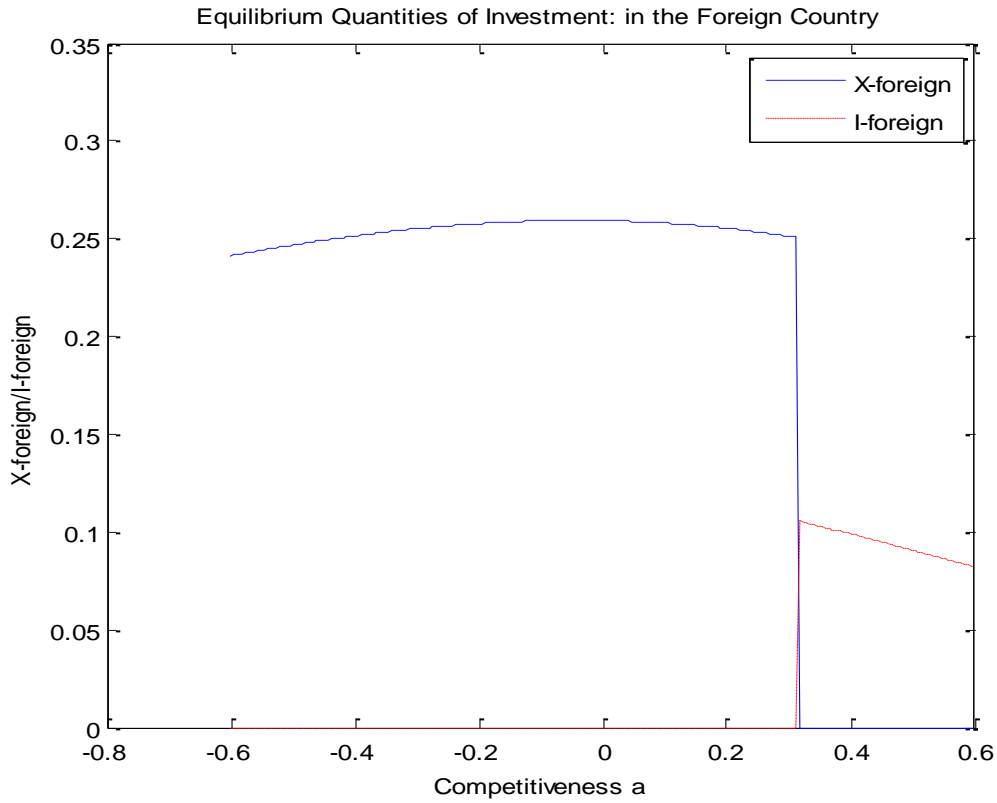


Figure 4

Equilibrium quantity of investment: in the home country.

This figure plots how firms' investment in the domestic country varies with changes in their competitiveness. The exogenous parameters are specified as follows. $\bar{z} = \log(0.5)$; $\sigma_z = 10^{-6}$; $\bar{s} = \log(0.5)$; $\sigma_s = 10^{-6}$; $\bar{a} = 0$; $\sigma_a = 0.2$; $\rho_{zs} = 0$; $\rho_{sa} = 0$; $\rho_{za} = 0$; $\beta = 1$; $f_D = 0.02$; $f_F = 0.05$; $f_I = 0.02$; and $N = 2$. The equilibrium price of existing assets is $q^* = 0.694$. "X-domestic" is the quantity of assets transferred in the domestic country, and "I-domestic" is the quantity of new investment in the domestic country.

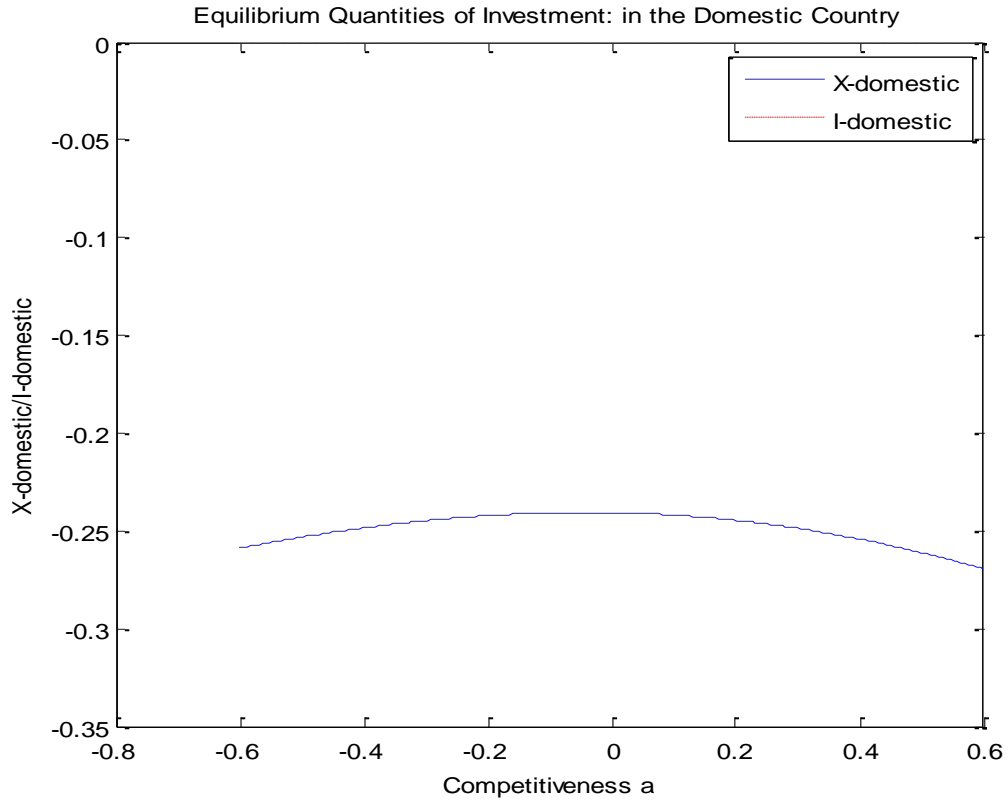


Table A.1

Variable definitions and data sources.

This table describes the definitions and data sources of the variables used in the regressions.

Variable	Definition
Asset Purchases in the Domestic Country	Dummy variable which equals 1 if a firm purchases assets in the domestic country and 0 otherwise. (Source: SDC)
Asset Sales in the Domestic Country	Dummy variable which equals 1 if a firm sells assets in the domestic country and 0 otherwise. (Source: SDC)
Amount of Assets Purchased in the Foreign Country	Transaction values of a cross-border deal with a U.S. firm as the acquirer and a non-U.S. firm as the target (Source: SDC)
Excess Price Cost Margin	The difference between the price cost margin of a firm and that of the two-digit SIC sector which this firm belongs to. A firm's price cost margin is defined as its EBITDA scaled by its total sales. The price cost margin of a two-digit SIC sector is the equally weighted average of the price cost margin of each firm in this two-digit SIC sector. (Source: Compustat)
Return on Assets	A firm's EBITDA scaled by its book value of assets. (Source: Compustat)
Return per Employee	A firm's EBITDA scaled by its total number of employees. (Source: Compustat)
Market-to-book	The ratio of the market value of equity to the book value of equity. (Source: Compustat)
Capital Intensity	A firm's total assets scaled by its total number of employees. (Source: Compustat)
Size	The difference of the log values of a firm's book value of assets between fiscal year t and fiscal year t-1. (Source: Compustat)

Table A.2

Summary statistics.

This table reports summary statistics for the variables used in the regressions. Variable definitions are described in Table A.1.

Variable	Mean	Standard Deviation	Min	Max	Observations
Panel A: Domestic Country					
Asset Purchases in the Domestic Country	0.0913	0.2881	0	1	153354
Asset Sales in the Domestic Country	0.0237	0.1523	0	1	142740
Excess Price Cost Margin	2.0274	2.5956	-0.0475	7.6683	151144
Return on Assets	0.0256	0.1957	-0.4166	0.2266	156237
Return per Employee	8.2353	46.0436	-88.3333	82.3240	142020
Market-to-book	2.3805	2.2866	-0.4358	7.2329	62577
Capital Intensity	262.6086	284.0985	27.5035	1547.2870	114896
Size	0.0897	0.2520	-0.2875	0.5901	140131
Panel B: Overseas					
Amount of Assets Purchased in the Foreign Country	148.0981	607.0350	1.0000	17639.9700	3788
Excess Price Cost Margin	2.2411	7.3837	-27.8620	49.0483	182478
Return on Assets	-0.0649	0.6210	-4.5292	0.4552	187925
Return per Employee	16.6121	49.2810	-77.2000	103.2086	164736
Market-to-book	2.2412	2.0108	-0.1309	6.5854	77033
Capital Intensity	478.3585	715.7485	29.1494	3769.9170	148260
Size	0.0889	0.2326	-0.2650	0.5461	168101

Table A.3

Correlation matrices.

This table reports the pairwise correlations of the variables used in the regressions. * indicates significance at the 1% level.

Panel A: Asset Purchases in the Domestic Country							
	Asset Purchases	Excess Price Cost Margin	Return on Assets	Return per Employee	Market-to-book	Capital Intensity	Size
Asset Purchases	1.0000						
Excess Price Cost Margin	0.0058	1.0000					
Return on Assets	0.0811*	0.0422*	1.0000				
Return per Employee	0.0846*	0.0642*	0.6512*	1.0000			
Market-to-book	0.0047	0.0017	-0.0080	0.0079	1.0000		
Capital Intensity	0.0384*	-0.0052	-0.0089*	0.1596*	-0.0021	1.0000	
Size	0.1074*	0.0002	0.1210*	0.0859*	0.0021	0.0139*	1.0000
Panel B: Asset Sales in the Domestic Country							
	Asset Sales	Excess Price Cost Margin	Return on Assets	Return per Employee	Market-to-book	Capital Intensity	Size
Asset Sales	1.0000						
Excess Price Cost Margin	0.0013	1.0000					
Return on Assets	0.0027	0.0367*	1.0000				
Return per Employee	-0.0125	0.0399*	0.0725*	1.0000			
Market-to-book	-0.0062	0.0034	0.0182*	-0.0099	1.0000		
Capital Intensity	0.0132	-0.0182*	-0.0070	-0.0337*	0.0868*	1.0000	
Size	0.0385*	0.0131	0.0472*	0.1666*	0.0615*	0.1757*	1.0000
Panel C: Amount of Assets Purchased in the Foreign Country							
	Amount of Assets Purchased	Excess Price Cost Margin	Return on Assets	Return per Employee	Market-to-book	Capital Intensity	Size
Amount of Assets Purchased	1.0000						
Excess Price Cost Margin	-0.0821*	1.0000					
Return on Assets	0.0384	-0.1267*	1.0000				
Return per Employee	0.1243*	-0.1399*	0.5464*	1.0000			
Market-to-book	0.0267	0.1504*	0.0604*	0.0315*	1.0000		
Capital Intensity	0.1556*	-0.2374*	-0.0805*	0.3788*	-0.0826*	1.0000	
Size	0.0440	0.0039	0.2345*	0.1642*	0.2246*	0.0771*	1.0000

Table A.4

Selected indicators of FDI and international production, 1990–2010.

Item	Value at current prices (Billions of dollars)					Annual growth rate or change on return (Per cent)				
	1990	2005–2007 average	2008	2009	2010	1991– 1995	1996– 2000	2001– 2005	2009	2010
FDI inflows	207	1 472	1 744	1 185	1 244	22.5	40.1	5.3	-32.1	4.9
FDI outflows	241	1 487	1 911	1 171	1 323	16.9	36.3	9.1	-38.7	13.1
FDI inward stock	2 081	14 407	15 295	17 950	19 141	9.4	18.8	13.4	17.4	6.6
FDI outward stock	2 094	15 705	15 988	19 197	20 408	11.9	18.3	14.7	20.1	6.3
Income on inward FDI	75	990	1 066	945	1 137	35.1	13.1	32.0	-11.3	20.3
<i>Rate of return on inward FDI^a</i>	<i>6.6</i>	<i>5.9</i>	<i>7.3</i>	<i>7.0</i>	<i>7.3</i>	<i>-0.5</i>	<i>-</i>	<i>0.1</i>	<i>-0.3</i>	<i>0.3</i>
Income on outward FDI ^a	122	1 083	1 113	1 037	1 251	19.9	10.1	31.3	-6.8	20.6
<i>Rate of return on outward FDI^a</i>	<i>7.3</i>	<i>6.2</i>	<i>7.0</i>	<i>6.9</i>	<i>7.2</i>	<i>-0.4</i>	<i>-</i>	<i>-</i>	<i>-0.2</i>	<i>0.3</i>
Cross-border M&As	99	703	707	250	339	49.1	64.0	0.6	-64.7	35.7
Sales of foreign affiliates	5 105	21 293	33 300	30 213 ^b	32 960 ^b	8.2	7.1	14.9	-9.3	9.1
Value-added (product) of foreign affiliates	1 019	3 570	6 216	6 129 ^b	6 636 ^b	3.6	7.9	10.9	-1.4	8.3
Total assets of foreign affiliates	4 602	43 324	64 423	53 601 ^b	56 998 ^b	13.1	19.6	15.5	-16.8	6.3
Exports of foreign affiliates	1 498	5 003	6 599	5 262 ^c	6 239 ^c	8.6	3.6	14.7	-20.3	18.6
Employment by foreign affiliates (thousands)	21 470	55 001	64 484	66 688 ^b	68 218 ^b	2.9	11.8	4.1	3.4	2.3
GDP	22 206	50 338	61 147	57 920 ^d	62 909 ^d	6.0	1.4	9.9	-5.3	8.6
Gross fixed capital formation	5 109	11 208	13 999	12 735	13 940	5.1	1.3	10.7	-9.0	9.5
Royalties and licence fee receipts	29	155	191	187	191	14.6	10.0	13.6	-1.9	1.7
Exports of goods and non-factor services	4 382	15 008	19 794	15 783 ^d	18 713 ^d	8.1	3.7	14.7	-20.3	18.6

Source: UNCTAD, World Investment Report 2011, Table I.5, page 24.

Table A.5

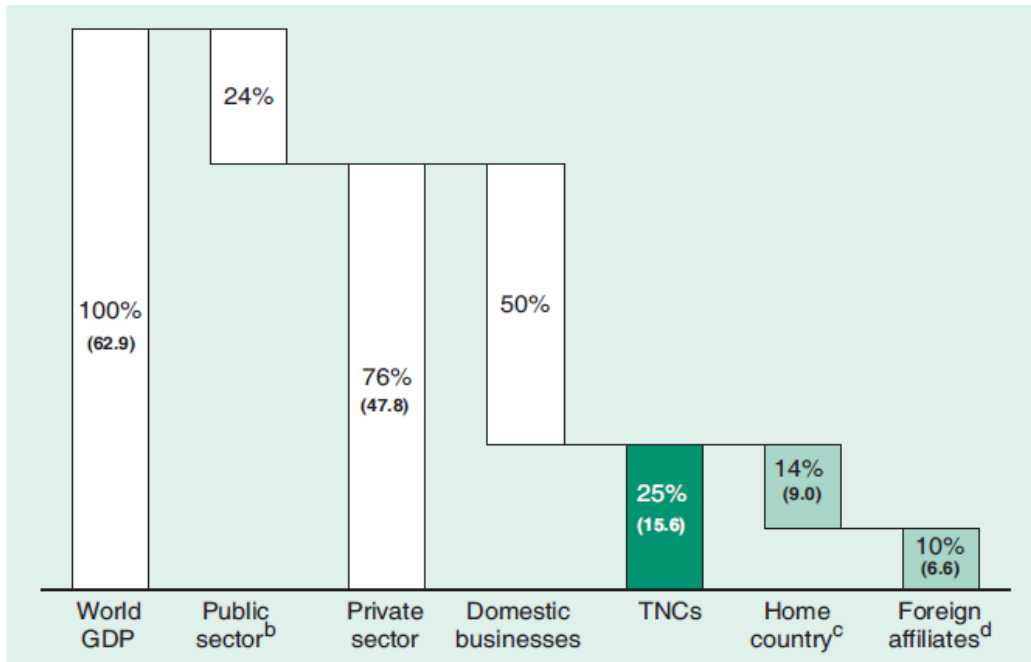
Internationalization statistics of the 100 largest non-financial TNCs worldwide and from developing and transition economies (Billions of dollars, thousands of employees and per cent).

Variable	100 largest TNCs worldwide					100 largest TNCs from developing and transition economies		
	2008	2009	2008–2009 % change	2010 ^b	2009–2010 % change	2008	2009	% change
Assets								
Foreign	6 161	7 147	16.0	7 512	5.1	899	997	10.9
Total	10 790	11 543	7.0	12 075	4.6	2 673	3 152	17.9
Foreign as % of total	57	62	4.8 ^a	62	0.3 ^a	34	32	-2.0 ^a
Sales								
Foreign	5 168	4 602	-10.9	5 005	8.8	989	911	-7.9
Total	8 406	6 979	-17.0	7 847	12.4	2 234	1 914	-14.3
Foreign as % of total	61	66	4.5 ^a	64	-2.2 ^a	44	48	3.3 ^a
Employment								
Foreign	9 008	8 568	-4.9	8 726	1.8	2 651	3 399	28.2
Total	15 729	15 144	-3.7	15 489	2.3	6 778	8 259	21.9
Foreign as % of total	57	57	-0.7 ^a	56	-0.2 ^a	39	41	2.0

Source: UNCTAD, World Investment Report 2011, Table I.6, page 27.

Figure A.1

TNCs account for one-quarter of world GDP, 2010 (Per cent and trillions of dollars)



Source: UNCTAD, World Investment Report 2011, Figure I.22, page 25.