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Corporate Investment and Foreign Penetration: Imports and Inward Foreign Direct Investment

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U.S. Corporate Investment and Foreign Penetration: Imports and Inward Foreign Direct Investment

Abstract: This paper examines the *joint* effect of imports and inward foreign direct investment (iFDI), the two primary entry forms of foreign companies to the U.S. product market, on domestic firms' capital investment decisions. We develop novel firm-level measures to gauge the impact of imports and iFDI. We show that increased import competition significantly reduces U.S. firms' investment; in contrast, the effect of iFDI on investment is largely nonsignificant. Further analysis suggests that the negative effect of imports on investment is due to competition-induced decline in cash flows. And the nonsignificant result for iFDI can be partly attributed to technology spillovers generated by foreign multinational's U.S. productions, which promote U.S. local firms' innovation capacity and consequently offset the negative effect of foreign competition on investment. Overall, our results indicate that foreign competition plays a key role in shaping corporate investment policy and highlight the distinct implications of imports and iFDI on firm investment.

Keywords: Foreign direct investment; International trade liberalization; Capital investment
JEL Classification: F14; F23; G31

1. Introduction

The importance of capital investment for a country's economic growth and financial development cannot be overstated. And understanding key determinants of a firm's capital investment decisions is among the most fundamental objectives of corporate finance research. The globalization of product markets continues to shape corporate environments and could have profound impacts on firm investment. In the United States, the market share of foreign firms is more than quadrupled from late the 1970s to the early 2010s.[1] It is also important to note that foreign penetration of U.S. market is a complex and multifaceted construct, and different forms of penetration could have divergent implications on corporate investment policy. However, despite extensive studies on how international trade affects firm survival and profit, the literature so far offers little firm-level evidence about the impact of foreign penetration on capital spending.

In this paper, we set out to fill this important gap by examining how U.S. firms' investment decisions react to the two primary forms of foreign penetration: (1) Foreign firms exporting home country-produced goods to the United States or (2) foreign multinationals directly setting up establishments in the United States or acquiring the ownership of U.S. domestic facilities to produce and sell. Prior studies have mainly focused on how the former, foreign exports, and the removal of related trade barriers (e.g., tariff reduction) affect U.S. corporate policies; however, the impacts of the latter form of foreign penetration have been largely overlooked. Furthermore, given the structural differences between foreign exporters and U.S. subsidiaries owned by foreign multinationals, it is important to distinguish the impact of U.S. imports from goods produced by U.S. affiliates of foreign firms.

[1] As shown in Table 1, the average market share of imports increased from 7.68% in 1978 to 36.78% in 2011, and that of sales of U.S. affiliates with foreign parents increased from 5.62% to 24.48%.

We start with developing an analytical framework to demonstrate the potential divergent impacts of the two foreign entry modes on domestic firm investment decisions. When a firm has imperfect access to external finance, factors that reduce its cash flow also may limit its capital investment. We demonstrate that, when foreign penetration reduces the representative domestic firm's profit, it cuts capital spending in response to increased imports of foreign produced goods. Furthermore, our framework suggests an ambiguous impact of inward FDI (iFDI) on the representative domestic firm's capital investment. On the one hand, iFDI results in conservative investment because it increases competition in the domestic market. On the other hand, foreign multinationals transfer managerial and technological know-how to their affiliates in the host country. Technology and information diffusion associated with such transfer enhances investment efficiency and productivity of the representative domestic firm, and thus allowing it to invest more. Hence, the joint impact of imports and iFDI on U.S. corporate capital investment demands further empirical investigation.

We then propose separate empirical proxies to gauge an individual domestic firm's dynamic exposure to the two entry modes of foreign companies. An U.S. firm's position in product market space is determined by its sales distribution across industries. Then, the firm's exposure to import competition (denoted as $Import$) is calculated as its sales-weighted average of the market share of U.S. imports in each industry in which the firm operates. Similarly, the firm's exposure to iFDI-related activities (denoted as $iFDI$) is defined as its sales-weighted average of the market share of foreign-owned U.S.-based subsidiaries. Compared to proxies constructed based on a firm's static industry membership, our measures capture the dynamic of the firm's exposure to different foreign entry modes.

To identify the causal effect of imports and iFDI on U.S. corporate investment, we must

address the concern that a domestic firm's exposure to foreign penetration and its investment policy are endogenously determined. The endogeneity problem may lead to a correlation between our foreign penetration proxies and multivariate regression residuals, thus resulting in spurious inferences on the effect of imports and iFDI. To address the potential endogeneity, we use an instrumental variables (IV) regression approach. Specifically, three instruments, namely, tariffs, shipping costs, and exchange rates, are employed in the first stage to force the exogenous portion of $Import$ and $iFDI$ to explain domestic firms' capital spending in the second stage. The instrument relevance and exogeneity are also carefully examined. Furthermore, we include an extensive set of both firm and industry characteristics that could affect firm investment decision. And firm and time fixed effects are included to remove unobserved time-invariant firm factors and time trends.

We use a panel of U.S. publicly manufacturing firms to examine the impact of foreign penetration, in the forms of imports and iFDI, on corporate capital investment. We find that U.S. firms exposed to rising imports reduce investment. The estimates suggest that, all else being equal, a one-standard-deviation increase in *Import* lowers the rate of capital investment by 15.7%, a sizable impact compared with the sample average of 31.5%. In contrast, we find no evidence that iFDI influences U.S. firm capital investment.

After establishing the causal impact of two forms of foreign penetration on corporate investment, we turn to explore the financing channel proposed in our analytical framework. Specifically, we examine how imports and iFDI affect the availability of U.S. firms' internal funds. Consistent with our results on capital investment, we find that a one-standard-deviation increase in $Import$ leads to a 3.1% decline in the ratio of cash flow to assets. The results suggest that, by restricting internal financing capacity of U.S, firms, foreign competition impinges on

their investment decisions. Consistent with our results on investment, iFDI has a statistically insignificant impact on the ratio of cash flow to assets.

Our findings highlight that the impact of iFDI on U.S. corporate capital investment is quite distinct from that of imports. As our analytic framework suggests, the nonsignificant impact of iFDI is the trade-off of two countervailing components: intensified competition versus iFDI-induced technology diffusion. Hence, we provide evidence on the positive iFDI spillover effect by showing that the presence of foreign multinationals spurs U.S. corporate innovation. A one-standard-deviation increase in $iFDI$ raises the average R&D-to-assets ratio by 2.4% and firm-level patent count by 2.1. These results provide supportive evidence to our analytic framework that technology transfer and information diffusion encourage U.S. firms to innovate and offset the negative effect of foreign competition on their investment decisions.

Our results are robust to two extensions. First, in our primary measures, an U.S. firm's exposure to foreign penetration is assessed by its position in product market space (i.e., sales distribution). However, single product firms in the same industry can differ in their exposure to foreign penetration if they use different production technology. For instance, a U.S. laptop producer who uses "touch screen" technology for its product's display screen indirectly competes with foreign producers who make touch screen devices. However, U.S. manufacturers of non-touch-screen laptops are not in competition with those foreign producers. Hence, to capture the exposure difference caused by production technology, we use alternative firm exposures to foreign penetration based on a firm's position in technology space as assessed by its patent distribution across technology classes.

Second, to provide further identification for the causal link from import competition to investment, we decompose U.S. total imports into those from China and those from the rest of

the world. While total imports could be driven by U.S. domestic demand, the growth of Chinese goods is largely caused by the country's transition to a more market-oriented economy (Hsieh *et al.* 2016). Therefore, imports from China offer a rare opportunity to identify the effect of foreign supply on firm investment. We find that China's import penetration represents a substantial competitive threat to U.S. manufacturing sectors and negatively affects their capital spending.

Our work makes two contributions to the literature. First, this paper is among the first to analyze the *joint* effect of imports and iFDI, the two primary entry forms of foreign firms to the U.S. markets, on corporate investment decisions. We go beyond industry-level proxies calculated based on a firm's static industry membership and construct firm-level measures that capture a firm's dynamic exposure to imports and iFDI. Second, our results highlight different effects of imports and iFDI on U.S. corporate capital investment. We show that U.S. firms with greater exposure to imports invest more conservatively, whereas their exposure to sales by foreign multinationals' U.S. affiliates appears to have a nonsignificant impact. Furthermore, our results suggest that the negative effect of imports on investment is partly due to competition-induced decline in cash flows. And the nonsignificant impact of iFDI on investment can be attributed to the offsetting effects of foreign competitive threats and efficiency gains from technology spillovers generated by foreign multinational's U.S. presence.

The reminder of this paper is organized as follows. Section 2 gives a brief review of related literature, presents an analytical framework, and delivers the testable hypotheses that guide our subsequent empirical analysis. Section 3 proposes the measures of firm-level exposure to imports and iFDI, presents the empirical method, and discusses data sources and variable construction. Section 4 reports the empirical results. Section 5 reports various robustness checks. And Section 6 concludes the paper.

2. Related literature and analytical framework

2.1 Related literature

The international economics literature suggest different potential channels through which imports and iFDI can affect U.S. corporate capital investment. Recent studies on international trade find import competition drives down domestic firms' profit (Tybout 2003; Baggs & Brander 2006) and reduces their survival rate (Bernard *et al.* 2006). While the presence of foreign multinationals intensifies market competition in the host country and reduces domestic firms' profit (Aitken & Harrison 1999; Coucke & Sleuwaegen 2008), it generates considerable technology spillovers to host-country firms through voluntary transmission, like technological licensing and R&D alliances, and involuntary leakage, such as learning and imitation, upstream and downstream linkages, and mobility of workers (see the survey by Keller 2010).[2] Such beneficial spillovers enhance host-country firms' productivity (Liu *et al.* 2000; Keller & Yeaple 2009), increase their innovative capacity (Jaffe 1986, 1988), and promote economic growth in host countries (Borensztein *et al.* 1998).

Recent developments in corporate finance have used tariff reduction as an exogenous shock to product market competition and identified a causal effect of heightened competition due to import penetration on capital structure (Xu 2012), cost of debt (Valta 2012), cash holdings (Fresard 2010; Hoberg *et al.* 2014), and dividend payout policy (Zhou *et al.* 2013). While we use an instrumental variable approach to identify the effect of foreign competition on U.S. domestic firms' capital investment.

Two papers are closely related to our work. Frésard and Valta (2016) find domestic

[2] Görg and Strobl (2005) and Poole (2013) find productivity spillovers from multinationals through labor turnover. Iacovone *et al.* (2009) find technology spillovers occur through business operations of domestic affiliates of foreign multinationals.

incumbents reduce capital investment in response to lowered import tariffs. Wang (2017) find inward foreign direct investment impinges upon the investment-cash flow sensitivity of U.S. firms. While both papers focus on one facet of globalization, we examine the *joint* effect of trade liberalization and financial integration on corporate investment, and our results compliment the findings of the two papers. Herwartz and Walle (2014) also examine the joint effect of trade and financial openness in an international setting. But they study the joint effect on the growth-promoting role of financial development. Using data from 78 economies for the period of 1981-2006, they find financial openness weakens the role of financial development while trade openness strengthens it.

2.2 Analytical framework

We present a simple analytical framework to illustrate the effects of imports and iFDI on U.S. firms' investment decisions. Motivated by the studies of the interdependence of investment and financing constraints [e.g., Fazzari *et al.* (1988); Kaplan and Zingales (1997)], we focus on the financing channel through which foreign penetration affects corporate investment.

2.2.1 Setup

The model has two dates, 0 and 1. At time 0, the representative domestic firm maximizes the profit of existing projects by choosing the output level q. We assume the demand curve is downward sloping, so the market price P is a decreasing function of the aggregate output Q. Formally, the market price is $P(Q)$, where $P'(.) < 0$. Before foreign rivals enter the domestic market, the representative domestic firm competes with other domestic firms whose output in total is θ_D. And the aggregate demand is the aggregate output of domestic firms, that is, $Q = q + \theta_D$.

There are three ways by which foreign competitors can enter domestic markets: Exporting, setting up establishments to produce directly in the host country (Greenfield FDI), and cross-border merge and acquire firms in the host country (M&A FDI). M&A turns a fraction of domestic firms to foreign multinationals' affiliates, which become more productive following foreign multinationals' transfer of advanced skills and techniques. Hence, we assume the output of the affiliates of foreign multinationals is increased from θ_M (before M&A) to $\lambda\theta_M$ (after M&A), where $\lambda > 1$. After foreign rivals enter the domestic market, the aggregate demand in the economy is the sum of the representative domestic firm output q, imports of foreign-produced goods η, output of plants directly established by foreign θ_G, output of foreign multinationals' affiliates $\lambda\theta_M$, and output of domestic firms that are not targeted by M&A FDI, $\theta_D - \theta_M \geq 0$. Formally,

$$Q = q + \eta + \theta_G + \lambda\theta_M + (\theta_D - \theta_M). \quad (1)$$

The presence of Greenfield and M&A FDI generates positive technology spillovers to the representative domestic firm and boosts its productivity. We thus assume the marginal cost of the firm's production declines with the output due to Green field FDI and foreign cross-border M&A, that is $C(\theta_G + \lambda\theta_M - \theta_M)$, where $C'(.) < 0$. The maximum profit the representative domestic firm can generate at time 0 is

$$\Pi(\eta, \theta_G, \lambda\theta_M) = \max_q [P(Q)q - C[\theta_G + (\lambda - 1)\theta_M]q]. \quad (2)$$

At time 1, new investment opportunities that require an investment, I, are available. We assume this new project generates return $R(I)$, which increases with the investment size at a decreasing rate, that is, $R'(.) > 0$ and $R''(.) < 0$. Moreover, external financing is costly. Thus, whenever the representative domestic firm raises the remaining capital $[I - \Pi(\eta, \theta_G, \lambda\theta_M)]$ from external capital markets to support the project, it must spend an additional $G[I - \Pi(\eta, \theta_G, \lambda\theta_M)]$

to cover the cost of financing, where $G'(.) > 0$ and $G''(.) > 0$. At time 1, the domestic firm chooses the level of investment I to solve the maximization problem:

$$\max_I\{R(I) - I - G[I - \Pi(\eta, \theta_G, \lambda\theta_M)]\}. \quad (3)$$

2.2.2 Analysis

The optimal level of investment I^* at time 1 is determined by

$$R'(I^*) = 1 + G'[I^* - \Pi(\eta, \theta_G, \lambda\theta_M)]. \quad (4)$$

The left-hand side of the equation is the marginal revenue from investing one more dollar in the new project, and the right-hand side of the equation is the marginal cost of doing so.[3] Higher profits from existing projects, $\Pi(\eta, \theta_G, \lambda\theta_M)$, lower the marginal cost of financing (G') and thus relax the firm's financial constraint and allow it to invest more.

Comparative statics analysis yields the impact of imports (η), Greenfield FDI (θ_G), and cross-border M&A ($\lambda\theta_M$) on the firm's optimal investment shown as follows:

$$\frac{\partial I^*}{\partial \eta} = \kappa(\eta, \theta_G, \lambda\theta_M)P'(Q^*)q^* \quad (5)$$

and

$$\frac{\partial I^*}{\partial \theta_G} = \kappa(\eta, \theta_G, \lambda\theta_M)\{P'(Q^*) - C'[\theta_G + (\lambda - 1)\theta_M]\}q^*, \quad (6)$$

and

$$\frac{\partial I^*}{\partial(\lambda\theta_M)} = \frac{\lambda - 1}{\lambda}\kappa(\eta, \theta_G, \lambda\theta_M)\{P'(Q^*) - C'[\theta_G + (\lambda - 1)\theta_M]\}q^*, \quad (7)$$

[3] The optimal level of investment without financial constraint, I^{FB}, satisfies $R'(I^{FB}) = 1$. We assume this investment size of the new project is so large that the firm current profits cannot cover, that is, $I^{FB} > \Pi(\eta, \theta_G, \lambda\theta_M)$.

where q^* ($q^* > 0$) is the optimal level of output at time 0, $Q^* = q^* + \eta + \theta_G + (\lambda - 1)\theta_M + \theta_D$, and $\kappa(\eta, \theta_G, \lambda\theta_M) = \frac{G''[I^* - \Pi(\eta, \theta_G, \lambda\theta_M)]}{G''[I^* - \Pi(\eta, \theta_G, \lambda\theta_M)] - R''(I^*)} > 0$.[4]

Given that $P' < 0$, $\frac{\partial I^*}{\partial \eta}$ is negative in Equation (5). This indicates that increased imports to U.S. product markets lower the market price of the firm's output. The firm's marginal profit and its optimal investment level are reduced consequently.

The effect of Greenfield FDI on firm investment is given by $\frac{\partial I^*}{\partial \theta_G}$ in Equation (6) and that of FDI via cross-border M&A is given by $\frac{\partial I^*}{\partial (\lambda\theta_M)}$ in Equation (7). As shown in both equation, the sign of two derivatives is ambiguous, depending on the trade-off between the efficiency gains from FDI technology spillovers that reduce the marginal production cost $[-C'(\theta)]$ and market price declines due to the output of foreign multinationals $[P'(Q^*)]$. Equations (5)-(7) thus illustrate that imports and iFDI could have distinct impacts on U.S. firms' investment decisions.

2.2.3 Testable proposition

The proposition below states the main implications of our analytical framework.

Proposition: When facing costly external financing, the investment of domestic firms, I, is affected by imports of foreign-produced goods, η, output of domestic subsidiaries that are directly established by foreign multinationals, θ_G, and output of domestic subsidiaries that are merged and acquired by foreign multinationals, $\lambda\theta_M$. And we have that (1) $\frac{\partial I}{\partial \eta}$ is negative, and (2) the sign of $\frac{\partial I}{\partial \theta_G}$ and $\frac{\partial I}{\partial (\lambda\theta_M)}$ is ambiguous.

In sum, the above proposition implies that, in response to import penetration, domestic firms should decrease their investment. In contrast, iFDI—the entry of foreign companies by

[4] The optimal level of output q^* at time 0 solves the equation $P'(Q^*)q^* + P(Q^*) = C[\theta_G + (\lambda - 1)\theta_M]$.

directly setting up establishments or acquiring ownership of local facilities—has an ambiguous impact on corporate investment decision. Our theoretical result is based on the effects of product market competition and FDI spillovers on internal funds. In the subsequent empirical analysis, we first empirically test the proposition and then provide suggestive evidence for the financing channel and FDI spillover effect. While the analytical framework captures a rich texture of foreign penetration, given the same predicted effect on domestic capital investment of Greenfield FDI and cross-board M&A, our empirical analysis focuses on the impact on U.S. firms' capital investment of two primary modes of foreign entry: Exporting and FDI, and we do not specify if the second mode is Greenfield FDI or cross-board M&A.

3. Data and empirical methods

3.1 Firm-level exposure to foreign penetration

We propose two separate measures to gauge individual firms' exposure to the two entry modes of foreign companies. The first one is import penetration (denoted as $Import$), which assesses a firm's exposure to imports of foreign-produced goods. The second (denoted as $iFDI$) appraises the impact of foreign multinationals' iFDI activities.

We first evaluate the extent of foreign penetration at the industry level. Specifically, industry-level import penetration (IP) is defined as the proportion of U.S. domestic demand satisfied by imported goods. Formally, for industry j,

$$IP_j = \frac{\text{Imports}_j}{\text{Shipments}_j - \text{Exports}_j + \text{Imports}_j}, \tag{8}$$

where the denominator proxies for the domestic product market demand.[5] For brevity, the time

[5] Recent empirical work shows that a large fraction of U.S. imports is attributed to intracompany transactions. Thus, import penetration captures both competition from U.S. multinational firms with offshore production and imports from foreign companies.

subscript is omitted for all equations in this section. Similarly, the industry-level iFDI penetration (FP) is calculated as the proportion of U.S. domestic demand fulfilled by foreign-owned subsidiaries' sales. Formally, for industry j,

$$FP_j = \frac{\text{Sales by foreign owened affiliates}_j}{\text{Shipments}_j - \text{Exports}_j + \text{Imports}_j}, \quad (9)$$

where the numerator is sales by foreign multinationals' U.S. affiliates.

We argue that measuring an individual firm's, especially a multisector firm's, exposure to foreign penetration based on its static primary industry membership cannot fully capture the dynamic interaction between a domestic firm and foreign rivals. For instance, though Emerson Radio Corporation mainly engages in the design and marketing of household audio and video equipment, it also sells products in household appliance markets, including microwave ovens and refrigerators. As a result, the firm is likely to be affected by foreign competition in both sectors. An industry-level measure [e.g., IP or FP shown in Equations (8) and (9), respectively], however, would fail to properly capture either the magnitude or within-industry dispersion of the impact of foreign penetration on individual firms.

Firm i's activity in the product market space is determined by the distribution of its sales activities across industries, $S_i = (S_{i,1}, S_{i,2}, \dots, S_{i,j}, \dots)'$, in which, the j^{th} element, $S_{i,j}$, is the share of the firm's sales in industry j. Then the firm's exposure to import penetration is calculated as the dot product between S_i and the vector of industry-level import penetration, $IP = (IP_1, IP_2, \dots, IP_j, \dots)'$, in which, the j^{th} element, IP_j, is defined in Equation (8). Formally,

$$Import_i = \langle S_i \cdot IP \rangle = \sum_j (S_{i,j} \times IP_j). \quad (10)$$

Intuitively, $Import$ reflects the overlaps between a firm's sales and the distribution of U.S.

imports of foreign-produced goods. $Import$ lies in the interval [0,1], and a larger value indicates that the firm's sales overlap more with the supplies of foreign goods, thus reflecting a greater exposure to import penetration.

Similarly, firm i's exposure to iFDI activities is defined as follows:

$$iFDI_i = \langle S_i \cdot FP \rangle = \sum_j \left(S_{i,j} \times FP_j\right), \tag{11}$$

where $FP = \left(FP_1, FP_2, \ldots, FP_j, \ldots\right)'$, in which, the j^{th} element, FP_j, is defined in Equation (9). As shown in Equations (10) and (11), $Import$ and $iFDI$ aim to reflect a firm's exposure to foreign rivalry over the full spectrum of its product market activities.[6]

3.2 Empirical method

To examine how imports and iFDI affect U.S. firms' investment decision, we specify the following regression model. Our specification is based on the q theory and is in line with that in Aivazian *et al.* (2005).

$$I_{i,t} = \alpha + \phi_1 Import_{i,t} + \phi_2 iFDI_{i,t} + \gamma' Z_{i,t-1} + Firm_i + Year_t + \epsilon_{i,t} \tag{12}$$

The subscripts i and t represent a firm and the end of a year, respectively. The dependent variable, I, is the rate of capital investment, calculated as capital expenditure divided by the beginning-of-period net property, plant, and equipment.

The primary interest is in the marginal effect of $Import$ and $iFDI$ on investment (denoted as ϕ_1 and ϕ_2, respectively). We include both firm ($Firm$) and time ($Year$) fixed effects to remove unobserved time-invariant firm factors and time trends.[7] The independent variable

[6] The construction of our firm-level measure is in line with the concept developed by Autor *et al.* (2013). To assess the effects of imports of Chinese goods on U.S. labor markets, they define the local labor markets by region and map import penetration by industry to import penetration by local market based on regional industry specifications.

[7] The three-digit SIC industry dummies are highly correlated with firm dummies in our sample, so the inclusion of firm dummies addresses the concern that unobserved industry-specific shocks could be driving the correlation

vector, Z, includes an extensive set of both firm and industry characteristics that potentially affect a firm's investment decision.[8]

Investment opportunities. We use Tobin's *q* and the price-cost margin to measure investment opportunities and profitability, respectively. As in Kaplan and Zingales (1997), Tobin's *q* is defined as the ratio of the market value of assets to the book value of assets. The market value of assets equals the book value of assets, plus the market value of the common equity minus the sum of the book value of the common equity and balance-sheet-deferred taxes. Price-cost margin is the sales net of variable costs over sales, where variable costs are the sum of costs of goods sold and selling, general, and administrative expenses.

Financial conditions. Almeida et al. (2004) and Whited (1992) show that a firm's stock of liquid assets and debt financing capacity can affect investment. Hence, we use the debt-to-asset ratio and cash-to-asset ratio to measure a firm's financial condition.[9]

Productivity and technology shocks. Domestic productivity or technological shocks may lead the U.S. government to modify the policies and regulations that directly affect international trade and capital flow. If, for instance, the U.S. apparel industry had poor productivity growth or experienced an adverse technology shock, clothing manufacturers might lobby the government to erect either trade barriers or restrict foreign investment to deter foreign competition. Thus, the reduced foreign penetration could allow U.S. firms to investment more. Therefore, we use three variables to account for confounding technology and productivity shocks. The first, the capital intensity defined as in Xu (2012), is measured as a firm's invested capital scaled by the number

between corporate investment and foreign penetration. For robustness check, we repeat the empirical studies with the inclusion of industry dummies in the empirical analysis and find similar quantitative results.

[8] As FDI may come with waves of merger and acquisition, we also include acquisition-to-asset ratio as a control variable in specification (12) and find qualitatively and quantitatively similar results in this paper.

[9] We find in the empirical analysis that foreign penetration changes domestic firms' cash flows. So cash flow is excluded from the independent variables to avoid "bad control" issues.

of employees. The second, the skill intensity as in Bernard et al. (2006), is the ratio of nonproduction workers' salaries to production workers' salaries according to the three-digit Standard Industry Classification (SIC). The third is the five-factor total factor productivity (TFP) for each three-digit SIC industry. The natural logarithm of the three variables is included in Equation (12).

Business cycle. A greater supply by foreign firms can be the result of an increased demand in the U.S. product markets. Hence, foreign penetration can also be correlated with the state of the economy. We include the natural logarithm of gross domestic demand at the three-digit SIC industry level to account for the changes of market size and macroeconomic trends.

Global market opportunities. Globalization expands U.S. firms' market potential, increases resource accessibility, and promotes output growth (Contractor & Lorange 1988; Jones 2002). Moreover, corporate globalization helps firms to procure foreign outsourcing, which is partly facilitated both by trade liberalization and by the development of information technologies and telecommunications. To account for the comparative advantage of U.S. firms in international trade, we use the natural logarithm of U.S. exports at the three-digit SIC industry level.

3.3 Estimation approach

The potential endogeneity issues, namely, the reverse causality and the missing variable bias, present a major empirical challenge to establish the causal effect of imports and iFDI on corporate investment. To address this challenge, we use an instrumental variables (IV) regression approach. We first regress the endogenous variables, $Import$ and $iFDI$, respectively, on a set of instruments, exogenous controls, and firm and year dummies. In the second stage, the predicted value from the first-stage regression is used to estimate Equation (12). Standard errors are corrected for heteroskedasticity and firm-level clustering.

A valid instrument of foreign penetration should satisfy the requirements of both relevance and exogeneity. In other words, the IVs must correlate with imports and iFDI, but not with the regression residuals in the investment equation (12). In line with the prior literature, we employ three IVs for *Import* and *iFDI*: (one-period lags of) tariffs, shipping costs, and exchange rates. Industry-level tariffs and shipping costs are commonly used instruments in the literature of international trade. This is because they directly influence foreign companies' export incentives and are exogenous to an individual firm's characteristics. Moreover, Froot and Stein (1991) find that the currency depreciation promotes foreign acquisitions of the country's assets. Hence, while exchange rates tend to be correlated with iFDI penetration, the rates are unlikely to directly influence an individual firm's capital investment decisions.[10]

In line with firm-level measures of foreign penetration [$Import$ and $iFDI$ shown in Equations (9) and (10), respectively], we map three industry-level variables to construct the firm-level instrumental variables as shown below.

$$\text{Firm level instrument}_{i,t} = \sum_{j} \left[S_{i,j,t=1} \times \text{Industry level variable}_{j,t} \right] \tag{13}$$

The industry-level variable is one of three variables, namely, tariffs, shipping costs, and the natural logarithm of real exchange rates. It tends to closely relate with foreign entry but is unlikely to directly affect a firm's investment policy. Then as in the construction of $Import$ and $iFDI$ [Equations (10) and (11)], the industry-level variable is mapped to a firm using its sales distribution. It is also noteworthy that, rather than the annual sales weight, we use the first-year sales distribution ($t = 1$) to mitigate the potential simultaneity bias. The concern is due to the possibility that contemporaneous sales could be affected by anticipated imports and iFDI

[10] We use the method in Bertrand (2004) to map the country-level exchange rates to the industry-level values. Appendix B provides the detailed definitions and construction of the three instruments.

activities in the United States. We also remove each firm's first-year observation to further alleviate this concern.

3.4 Data

We combine two data sets to obtain the information of multilateral imports and exports by four-digit SIC manufacturing industries. The first data set, compiled by Schott (2008), covers 1989-2012. The second, spanning from 1972 to 2005, is an update of Schott (2008) and uses the concordances from Pierce and Schott (2012) and Bartelsman and Doms (2000).[11] The values of shipments by four-digit SIC codes are from the National Bureau of Economic Research (NBER) and the U.S. Census Bureau's Center for Economic Studies (CES) Manufacturing Industry Database for 1958-2011. The U.S. Bureau of Economic Analysis (BEA) reports the annual sales of U.S. affiliates with foreign parents by a two- or three-digit SIC codes from 1977 to 2011.[12,13] Using these data sets, import penetration for 448 four-digit SIC manufacturing industries and iFDI penetration for 54 BEA industries are computed.[14] Then we use the data on firm segment sales from the Compustat annual segment file to map imports and iFDI by industry-year to those measures by firm-year.

We use a sample of publicly traded manufacturing firms in the United States from the

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[11] Both data sets are available on Peter Schott's Web site at Yale: http://faculty.som.yale.edu/peterschott/sub_international.htm. Our sample covers 1978-2011. For 1978-2005, we use imports and exports from the second data set. Data on international trade for 2006-2011 are from the first data set.

[12] Under the International Investment and Trade in Services Survey Act, FDI in the United States is defined as the direct or indirect ownership or control by a single foreign legal entity of at least 10% of the voting rights of an incorporated U.S. business enterprise, or the equivalent interest in an unincorporated U.S. enterprise. See "A Guide to BEA Statistics on Foreign Direct Investment in the United States" by Alicia M. Quijano for detailed information on these data.

[13] The classification of industries was changed from the SIC system to the North America Industry Classification System (NAICS) in 1997. To keep the industry classifications consistent, we transfer sales of U.S. affiliates with foreign parents by NAICS to those by SIC for 1997-2011. Appendix A provides the details.

[14] For 7 out of 20 two-digit SIC manufacturing industries, multinational firms' sales are available only at the two-digit SIC level. For example, 22-Textile, 23-Apparel. For the other 13 industries, the BEA reports multinationals' sales by three-digit SIC codes, but it combines information on two-, three-, or more than three-digit industries. Hence, we only have 54 industries as classified by mixed-digits SIC codes.

Compustat annual database. To eliminate the possibility that a firm operating in the United States might be affiliated with a foreign multinational, we exclude firms headquartered outside the United States. To ensure a firm in our sample has enough business segment sales in manufacturing sectors, we require its segment sales in manufacturing sector, on average, account for more than 70% of all segment sales. To avoid distorting our results with small or severely financially constrained firms, we include only firms with at least one year of nonnegative cash flows and require that they have an average asset of $5 million or more (in 2010 dollars). The final sample contains 51,964 observations for the period from 1978 to 2011 and encompasses 4,478 unique firms.

3.5 Summary statistics

Table 1 provides an overview of our measures of firm-level exposure to foreign penetration, $Import$, and $iFDI$. Columns 3 to 6 show the annual mean and median values of firm-level exposure to imports and iFDI. The mean values of both ratios have more than quadrupled over the sample period: $Import$ rises from 7.68% to 36.78%, and $iFDI$ rises from 5.62% to 24.48%. It evinces an increasing openness and growing challenge to U.S. manufacturing firms due to intensifying foreign rivalry in both the forms of imports and iFDI.

[Table 1 about here]

The composition of the sample is shown in Table 2, Columns 2 and 3, which displays the numbers of observations and the percentage of multisegment firm-years in each of the 20 two-digit SIC industries, respectively. Table 2 further demonstrates considerable intraindustry variation in firm-level exposure to $Import$ (Panel A) and $iFDI$ (Panel B). Both panels display the average firm-level exposures for each of the 20 two-digit SIC industries in the first column, the average industry-level exposures in the second column [IP and FP as defined in Equations

(8) and (9), respectively], and the difference between the firm- and industry-level measure.[15] As seen in Panel A, in 8 of the 20 total two-digit SIC industries, our firm-level measure of import penetration ($Import$) is significantly different from the measure constructed based on a firm's primary industry membership (IP). Panel B shows that the difference between firm- and industry-level iFDI penetrations is statistically significant in 12 of 20 industries. Overall, a static industry-level proxy fails to take into account of a firm's industrial diversification strategy and tends to bias the measure of its dynamic exposure to foreign penetration.

[Table 2 about here]

The summary statistics of the full sample are presented in Table 3, Panel A. Panel B reports the mean values for the multisegment and those of single-segment firm-years. It is shown that, compared to single-segment firms, multisegment firms, presumably due to industrial diversification, tend to be less affected by imports and iFDI.

[Table 3 about here]

4. Empirical results

In this section, we present the empirical findings of how imports and iFDI affect U.S. corporate investment decisions. We consistently report the second-stage results of the IV regressions. The cluster-robust *t*-statistics are computed based on standard errors consistent to potential heteroskedasticity and correlation within firms (clustered by firms).

4.1 Foreign penetration and corporate capital Investment

Table 4 presents the baseline results, that is, the second-stage results of the IV regression of Equation (12). Column (1) includes our key explanatory variables, that is, $Import$ and $iFDI$, and the set of proxies for investment opportunities. We observe a negative and statistically

[15] The industry-level exposure is a firm's primary industry exposure. A firm primary industry can be four-, three-, or two-digit SIC industry.

significant relationship between $Import$ and the rate of capital investment. This finding supports the first prediction of the Proposition presented in Section 2 and suggests that greater exposure to imports is associated with more conservative capital expenditure by U.S. local firms. Economically, all else being equal, a one-standard-deviation increase in $Import$ (0.199) reduces the rate of capital investment by 12.3%. The impact of $iFDI$ on U.S. firms' capital investment is statistically insignificant.

[Table 4 about here]

Column (2) further includes controls for financial conditions. A large cash reserve and low leverage ratio would allow a relatively aggressive capital spending strategy. Indeed, the estimate suggests the rate of capital investment raises about 0.46% for each additional percentage-point increase in the cash-to-assets ratio; investment falls by about 0.29% for each additional percentage-point increase in the leverage ratio. Column (3) augments the regression model with controls for technological developments at both the firm and industry levels. This specification addresses the concern that foreign penetration might, in part, pick up an overall trend in technology advances. Column (4) further introduces two variables that capture the demand of the U.S. domestic market and the opportunities of global markets. In Column (5), we include the full set of control variables. Overall, our findings are highly consistent across various regression specifications presented in Table 4.[16]

Column (6) reports the results after controlling for the related part trade. International trade can occurs within the boundary of multinational firms. U.S. imports thus include the transactions between U.S. affiliates and their foreign parents as well as between U.S. multinationals and their overseas subsidiaries. Such intrafirm trade can bias our finding that U.S.

[16] In the untabulated OLS estimates of Equation (12), the coefficient on *Import* is significant and negative and that of *iFDI* remains nonsignificant.

firms reduce capital investment when they are more exposed to import competition, while inward FDI has a nonsignificant impact on U.S. capital expenditure. To address this concern, for each industry, we subtract imports due to related party transactions from total imports in the numerator of Equation (8), and then insert the resulting industry-level import penetrations to Equation (10) to compute a firm's exposure to import competition. The related party trade data at the NAICS 4- to 6- digit level over 2002-2012 are available from U.S. Census Bureau.[17],[18] We replicate the estimation of the regression in column (5) of Table 4 using the intrafirm trade-adjusted import penetration. The results are reported in column (6) and consistent with what we find in the first five columns.

The validity of the chosen IVs is closely examined.[19] For a variable to serve as a valid instrument, it must be both relevant (highly correlated with the endogenous explanatory variable) and exogenous (uncorrelated with the regression error term). The *p* values from the under-identification test by Kleibergen and Paap (2006) are less than 0.1%, thereby rejecting the null hypothesis that the three instruments are irrelevant.[20] We also perform the weak-instrument test. The Anderson-Rubin χ^2 test rejects the null of the joint insignificance of endogenous regressors in Equation (12). Then we conduct Hansen's J overidentification test, which has a joint null hypothesis of valid IVs (relevance and exogeneity). The validity of IVs is validated by the fact that we cannot reject the null hypothesis at a conventional significance level across all

[17] For U.S. imports, the U.S. Census Bureau define a related party transaction as a transaction between two parties in which (among many possibilities) "any person directly or indirectly owning, controlling or holding power to vote, 5 percent or more of the outstanding voting stock or shares of any organization. (See 19 U.S.C. 1401a(g)(F)"

[18] Like the way we deal with the data on the sales of U.S. affiliates of foreign multinationals, we map the NAICS-level related party trade data to the SIC-level data according to the method in Appendix A.

[19] The first-stage results of the IV estimation of Equation (12) are presented in Appendix D. The first-stage results further suggest that our choice of instrumental variables is economically sensible.

[20] The two-stage least-squares (2SLS) first-stage regression results are available on request. We find three instruments have strong predictive power because the large R^2 suggests that the three instruments explain a sizable fraction of the variation in both import and FDI penetration.

specifications.[21]

To summarize, our baseline results accentuate the divergent effects of imports and iFDI on firm investment policy. The estimates in Column (5) suggest that, all else being equal, a one-standard-deviation increase in $Import$ lowers the rate of capital investment by 15.7%, a sizable impact compared with the sample average of 31.5%. In contrast, we find no evidence that $iFDI$ influences firm capital expenditure.

4.2 Further analyses

We further examine potential channels through which foreign penetration could affect a firm's investment decision. This allows us to shed light on the distinct effects of imports and iFDI on investment. First, we explore the financing channel by examining the impacts of imports and iFDI on cash flows. Second, as illustrated in our analytical framework in Section 2, the nonsignificant impact of iFDI can be the result of the trade-off between efficiency gains from technology spillovers and intensified competitive threats due to foreign multinationals' host-country productions. Therefore, to better understand the nonsignificant role of iFDI, we consider how iFDI influences U.S. firms' innovation input (i.e., R&D expenditure) and output (e.g., number of patents).

4.2.1 Financing channel

As argued in our analytical framework, import competition leads firms to adopt more conservative investment strategies by diminishing their profits and reducing internal financing capacity. We are thus motivated to examine the effects of imports and iFDI on cash flow.

[21] To further establish the causal effect of foreign penetration on U.S. domestic investment, we conduct a reverse causality test by separately regressing the three instruments, tariffs, shipping costs, and the natural logarithm of exchange rate on the lagged capital investment rate over 1978-2010 for the 133 three-digit SIC manufacturing industries in our sample. We find the rate of capital investment is a poor predictor for next period tariffs, shipping costs, and exchange rates, suggesting our main findings are not plausibly attributable to any industry-specific trends other than increased foreign supply.

[Table 5 about here]

Our estimation approach follows the baseline specification [Table 4, Column (5)], except that the dependent variable is replaced by the ratio of cash flow to beginning-of-period assets. The estimation results are reported in Table 5, Column (1). We find a negative and statistically significant coefficient on $Import$, indicating domestic firms that face increasing import exposure experience a sharp decline in cash flows that limits their investment capacity. The estimate in Column (1) suggests that a one-standard-deviation increase in $Import$ leads to a 3.1% decline in the ratio of cash flow to assets. We also find a statistically insignificant coefficient of *FDI*, which is consistent with our baseline finding of the nonsignificant impact of iFDI on investment.

In sum, our results in this subsection suggest that the financing channel is conductive to the negative impact of imports on corporate investment.

4.3.2 Technology spillovers from iFDI activities

The nonsignificant result for iFDI activities related to both investment and cash flows could be attributed to the countervailing effect of technology spillover, which is generated from foreign multinationals' host-country production and could potentially boost U.S. firms' productivity. To benefit from FDI spillover, local incumbents need to build their absorptive capacity to explore knowledge externalities and adopt advanced technology diffused from foreign multinationals (Blalock & Gertler 2009; Blalock & Simon 2009). We thus posit that the existence of such knowledge spillovers would provide greater incentives to U.S. firms to increase R&D input and, consequently, enhance innovation output.

To examine this conjecture, we use R&D investment and patent counts to measure a firm's innovation input and output, respectively. Specifically, the dependent variable in Table 5, Column (2), is a firm's R&D spending scaled by start-of-period assets and the natural logarithm

of one plus patent counts in Column (3).[22] In both columns, the coefficient on $iFDI$ is positive and statistically significant. Economically, a one-standard-deviation increase in $iFDI$ (0.125) raises the R&D-to-assets ratio by 2.4% and the number of patent counts by 2.1.

Overall, the result suggests that the statistically insignificant impact of iFDI on investment could be a result of technology spillovers originated from foreign multinationals' U.S. production, which improve U.S. firms' innovation productivity and offset the negative effect of foreign competition on corporate investment decisions.

5. Robustness checks

In this section, we present a few robustness checks.

5.1 Technology-based measures of foreign penetration

Our primary measures of firm-level exposure to foreign penetration [$Import$ and $iFDI$ defined in Equations (10) and (11), respectively] aims to capture the degree of overlap between a firm's position in product market (as reflected by its business segment distribution) and sales by foreign firms through either exports or iFDI. Nevertheless, two single-segment firms residing in the same industry potentially could have different exposure to foreign rivalry. Consider two U.S. laptop producers: One uses touch screen technology for displays, and the other does not. Foreign penetration exposure could be different for both because the former also indirectly competes with foreign producers of alternative electronic devices with the same touch screen feature. To capture the impact of such technology-driven foreign penetration, we construct alternative firm-level measures based on the patterns of a firm's technological specialization.

Specifically, firm i's activity in technology space is measured by its patents across 426 United States Patent and Trademark Office (USPTO) technology classes. We assign patents to

[22] The patent data are from NBER Patent Data Project for 1977-2006; Hall *et al.* (2001) describe the data in detail.

corresponding SIC industries.[23] This allows us to determine the distribution of firm i's product technology across industries, $\tilde{S}_i = (\tilde{S}_{i,1}, \tilde{S}_{i,2}, \ldots, \tilde{S}_{i,j}, \ldots)'$, in which, the j^{th} element, $\tilde{S}_{i,j}$, is the share of firm i's patents in industry j. Then, similar to the computation of $Import$ and $iFDI$ in Equations (10) and (11), the technology-based firm-level exposures to foreign penetration are assessed by $Import_i^{Tech} = \langle \tilde{S}_i \cdot IP \rangle$ and $iFDI_i^{Tech} = \langle \tilde{S}_i \cdot FP \rangle$, where IP and FP are defined in Equations (8) and (9), respectively. Concretely, $Import^{Tech}$ ($iFDI_i^{Tech}$) captures how a firm position in technology space is affected by imports of foreign-produced goods (sales by foreign-owned subsidiaries).[24] The construction of instruments [Equation (13)] is modified accordingly. Firms without patents are dropped from this analysis.[25] The sample retains 17,859 observations, encompassing 1,900 firms from 1978 to 2006.[26]

[Table 6 about here]

We re-estimate our baseline IV regressions [corresponding to Columns (1), (2), and (5) in Table 4] using technology-based proxies, $Import^{Tech}$ and $iFDI^{Tech}$, and report the second-stage estimates in Table 6. As shown in all columns, the negative coefficient estimate of $Import^{Tech}$ indicates that our previous finding of a negative impact of import penetration on investment is fully retained.

In contrast to the nonresult finding of *iFDI* using the sales-based measure in Table 4, $iFDI^{Tech}$ has a positive and statistically significant effect on investment. The FDI effect on domestic investment is driven by two countervailing factors: intensified market competition

[23] The concordance obtained from the USPTO Web site is used to map USPTO technology classes to the SIC system.
[24] The untabulated results indicate that the average value of $Import^{Tech}$ increased from 8.4% to 40.6% over 1978-2006. And the average level of $iFDI^{Tech}$ in 2006 was 18.7%, almost quadrupling the level in 1978 (5.4%).
[25] For a non-patenting firm, the patent-weighted $Import$ and $iFDI$ are undefined. Therefore, dropping firms without patents leads a considerable reduction in our sample size.
[26] We require that more than 50% of a firm's patents belong to the manufacturing sector.

vesus technology spillovers. While the former tends to reduce U.S. local firms' capital expenditure, the latter could enhance firm's innovative capability and facilitate investment. As the subsample used in this analysis is limited to patenting firms only, we expect a stronger technology spillover effect. This is because, compared with nonpatent firms, innovative firms, as evinced by their patenting activities, have higher absorptive capacity for proprietary knowledge diffused from foreign multinationals' U.S. production, and spillover transfer is more likely to occur among them (Keller & Yeaple 2009). Hence, patenting firms could benefit more from technology spillovers, which tilt the impact of iFDI on investment toward the positive side.[27] Moreover, $iFDI^{Tech}$ measures the overlap between a firm's production technology and iFDI activities. Therefore, it could better capture the spillover of relevant knowledge externalities that can be adopted by a domestic firm.

Overall, the results in this subsection demonstrate the robustness of our baseline findings and shed further light on the effect of iFDI on investment.

5.2 Decomposing import penetration

Increased domestic demand for foreign-produced goods could simultaneously drive U.S. aggregate imports and firm investment incentives and thus lead to spurious inferences on the effect of imports. In our baseline analysis, we include the natural logarithm of gross domestic demand at the three-digit SIC industry level to account for the change of U.S. market size.

To further alleviate this endogeneity concern, we partition a firm's exposure to total imports ($Import$) into two components: the impact (1) due to imports from China and (2) from other countries. While increased imports could be partly attributed to U.S.-originated demand shocks, the rising imports from China are largely the result of Chinese supply shocks. These

[27] Using the sales-based measures of foreign penetration in the subsample of patenting firms has no material impact on our results.

shocks are the culmination of competitive pricing and the country's transition to a more market-oriented economy (Hsieh *et al.* 2016).[28] Therefore, focusing on firm-level exposure to China's import penetration allows us to further appraise the causal effect of import penetration on firm investment.

Specifically, in parallel with IP, which is defined in Equation (8), China's industry-level import penetration (IP^{CN}) is calculated as the proportion of U.S. domestic demand satisfied by Chinese goods. For industry *j*,

$$IP_j^{CN} = \frac{\text{Imports from China}_j}{\text{Shipments}_j - \text{Exports}_j + \text{Imports}_j}. \quad (12)$$

Then a firm's exposure to China's import penetration assesses the degree of overlap between its sales distribution and that of Chinese goods, formally, $Import_i^{CN} = \langle S_i \cdot IP^{CN} \rangle$. Similarly, we construct $Import_i^{other}$ [$= \langle S_i \cdot IP^{other} \rangle$] to capture the firm's exposure to import penetration that originated from the rest of the world.

[Table 7 about here]

To examine how U.S. firms' react to China's import penetration, we replace *Import* with $Import^{CN}$ and re-estimate Equation (12). Instrumental variables are modified accordingly by using U.S.-China trade data.[29] Table 7, Column (1), reports the second-stage estimates. Consistent with our baseline results, the coefficient estimate of $Import^{CN}$ is negative and statistically significant. It indicates that import penetration compels U.S. firms to adopt more conservative investment policy. Column (2) further includes $Import^{other}$, and the coefficients

[28] China's export growth is the culmination of a sequence of reforms that began in the 1980s. Naughton (1996) marks 1984 as the year that China's tilt toward exports initiated. In 1992, China launched a further wave of reforms that welcomed FDI and promoted Special Economic Zones. In 2000, China's WTO accession solidified its most-favored-nation status in the United States.

[29] For Table 7, Column (1), we use the first year sales-weighted U.S. tariffs on Chinese goods, shipping costs between U.S. and China and the natural logarithm of foreign exchange rate as instruments. We add two more instruments, tariffs and shipping costs, in Column (2).

on $Import^{CN}$ and $Import^{other}$ remain negative and highly significant.

Our analysis substantiates the causal link between import penetration and firm investment. It also highlights that China's import penetration represents a substantial competitive threat to U.S. manufacturing sectors and negatively affects their capital spending.[30]

5.3 Industry heterogeneity in trade barriers

Firms producing only nontradable goods (e.g., service industry) are largely insulated from import competition; therefore, their investment decisions should be less affected by U.S. imports. However, it is difficult to directly test this conjecture because one cannot ascertain the tradeable versus nontradable nature of a firm's final products.

To investigate industry heterogeneity in trade barriers, we classify industries as "pseudo-non-tradable" based on the growth rate of industry tariffs. Intuitively, rapidly rising tariffs would price foreign goods out of an industry and make the industry "pseudo-non-tradable." Specifically, a four-digit SIC manufacturing industry is classified as pseudo-non-tradable if the standardized average annual growth rate of its tariffs exceeds 5%.[31] And firms' investment decisions in pseudo-non-tradable industries are expected to be less adversely affected by import penetration.

[Table 8 about here]

Motivated by this conjecture, we re-estimate our baseline regression (12) with an interaction term between $Nontradable$, an indicator variable for pseudo-non-tradable industries,

[30] Recent empirical work in the international trade literature use imports from China to identify the effect of trade liberation on labor markets and innovation. An incomplete list includes Autor *et al.* (2013), Autor *et al.* (2014), Bloom *et al.* (2016), Acemoglu *et al.* (2016), and Autor *et al.* (2016).

[31] We exclude four-digit SIC industries with their average annual growth rate of tariffs greater than zero and less than 5% in Column (1), 6% in Column (2), and 7% in Column (3) from the analysis.

and $Import$.[32] Table 9, Column (1) reports the second-stage estimates. $Import \times Nontradable$ bears a positive sign, opposite to that of $Import$. It suggests that, among pseudo-non-tradable industries, the detrimental effect of import penetration on firm investment is significantly weakened.

The definition of pseudo-non-tradable industries becomes more stringent in Columns (2) and (3), where $Nontradable$ takes the value of one if the standardized average annual tariff growth rate is greater than 6% and 7%, respectively. While the coefficient of $Import \times Nontradable$ remains positive across the three columns, its magnitude increases monotonically. This indicates that, ceteris paribus, the effect of import penetration on firm investment policy decreases as trade barriers, industry tariffs, elevate.

Overall, our findings suggest that investments by firms producing nontradable goods are less affected by import competition.

6 Concluding Remarks

In this paper, we jointly examine how U.S. manufacturing firms adjust capital investment decisions to rising imports and foreign multinationals' inward investment activities. Our analytical framework illustrates the distinct implications of U.S. imports and iFDI for domestic firms' investment decisions. Specifically, while both imports and iFDI greatly intensify product market competition, iFDI also generates considerable knowledge spillovers that could enhance domestic firms' productivity and innovative capability.

We construct two novel measures to capture firm-level exposure to the two primary

[32] We follow the estimation method in section 5 in Chapter 9 of Wooldridge (2002) to deal with the nonlinear endogenous variable *Import*×*Nontradable*. Specifically, we first run a regression of *Import* on tariffs, shipping costs, exchange rate, exogenous controls, and firm and year dummies to generate the predicted value of *Import*. Then we run the 2SLS regressions to estimate Equation (11), in which we use tariffs, shipping costs, exchange rate, and the interaction between nontradable dummy and the predicted value of *Import* as instruments for *Import*, *FDI*, and *Import*×*Nontradable*.

forms of foreign penetration of the U.S. product market, namely, $Imports$ and $iFDI$. Our empirical results show that increased exposure to imports significantly reduces U.S. domestic firms' investment; in contrast, the effect of iFDI on investment is statistically insignificant. Further analysis suggests that the negative effect of imports on investment is due to trade-induced decreases in internal cash flows. And the nonresult finding of iFDI can be attributed to the trade-off of the efficiency gain from FDI spillovers and iFDI-induced competitive threats. Technology transfer improves U.S. firms' innovation capacity and offsets the negative effect of foreign competition on firm investment.

Overall, our results indicate that trade-induced competitive pressure plays a key role in shaping firm investment and paint a more complex nuanced and complete picture of how U.S. corporate investment policy responses to the market penetration of foreign companies.

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Table 1. Annual means and medians of import and iFDI penetration

This table reports the number of firms and the annual mean and median of the firm-level measures of import and iFDI penetration over the sample period, 1978-2011. Column 2 reports the number of firms each year. Columns labelled "*Import*" show the annual means and medians of sales-weighted import penetration. Columns labelled "*iFDI*" report the annual means and medians of sales-weighted iFDI penetration.

Year	*# of obs*	*Import*		*iFDI*	
		Mean	Median	Mean	Median
1978	789	7.68	6.55	5.62	4.35
1979	1199	7.96	6.81	6.09	4.63
1980	1477	8.35	6.73	6.56	4.24
1981	1481	8.79	7.29	7.65	4.68
1982	1671	9.04	7.54	7.57	4.82
1983	1688	9.71	8.53	7.77	5.50
1984	1700	11.58	9.96	8.04	6.17
1985	1742	12.60	10.96	8.56	6.32
1986	1720	14.43	12.82	9.32	6.27
1987	1695	15.02	13.28	10.36	7.19
1988	1669	16.27	14.22	11.69	7.90
1989	1639	17.95	15.47	14.55	11.54
1990	1623	18.34	15.59	16.45	13.04
1991	1619	19.29	15.50	17.39	17.07
1992	1631	19.61	15.41	17.47	12.21
1993	1701	20.14	16.23	18.41	12.86
1994	1794	21.12	17.81	18.61	13.13
1995	1853	22.13	18.67	18.31	18.49
1996	1962	22.40	19.07	18.32	13.97
1997	2018	23.50	19.48	18.04	14.43
1998	1935	24.35	20.12	21.41	19.92
1999	1753	25.92	21.76	22.51	19.35
2000	1602	28.34	24.62	21.69	19.16
2001	1538	29.63	24.09	20.77	19.51
2002	1498	31.09	27.38	22.95	21.23
2003	1434	32.23	29.39	21.49	20.63
2004	1385	34.98	31.30	19.86	16.13
2005	1328	35.31	30.94	19.71	15.00
2006	1278	36.47	30.41	21.94	16.53
2007	1201	33.36	28.13	21.77	19.74
2008	1162	34.16	27.42	23.20	19.65
2009	1126	33.87	28.39	24.93	21.03
2010	1057	36.24	31.63	24.63	22.16
2011	996	36.78	32.22	24.48	21.29

Table 2. Firm-level and industry-level import and iFDI penetration

This table reports the firm distribution across 20 two-digit SIC industries. Column 2 reports the number of observation in each two-digit SIC industry. Column "*Multi-segment (%)*" shows the percentage of multi-segment firm-years. Panel A (B) reports firm- and industry-level import (iFDI) exposure and their difference. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Two-digit SIC code	*# of obs.*	*Multi-segment (%)*	**Panel A. Import penetration**			**Panel B. iFDI penetration**		
			Firm-level [*Import*, Eq. (10)]	Industry-level [*IP*, Eq. (8)]	Difference	Firm-level [*iFDI*, Eq. (11)]	Industry-level [*FP*, Eq. (9)]	Difference
20	2774	38.18	6.85	6.56	0.29	11.55	11.33	0.22
21	86	83.72	3.35	1.66	1.69***	7.00	7.82	-0.82
22	930	33.87	13.63	13.89	-0.26	4.68	4.41	0.27***
23	965	24.25	35.02	34.62	0.40	3.38	3.17	0.21***
24	851	44.89	7.10	6.72	0.38	2.61	1.97	0.64***
25	921	35.94	10.73	9.68	1.05	4.05	3.59	0.46***
26	1354	65.07	10.32	9.41	0.91**	9.25	9.04	0.21
27	1389	42.19	4.67	4.12	0.55	8.85	8.78	0.07
28	5739	46.91	12.70	12.18	0.52**	35.18	36.32	-1.14***
29	637	73.78	8.20	7.94	0.26*	30.22	30.16	0.06
30	1647	50.76	14.72	13.33	1.39**	12.50	12.21	0.29
31	491	32.79	56.11	59.01	-2.90	9.40	9.33	0.07
32	984	62.09	10.83	9.96	0.87	23.23	24.66	-1.43***
33	1957	55.95	17.80	17.85	-0.05	16.60	17.05	-0.45*
34	2314	60.54	13.19	12.05	1.14***	9.35	8.27	1.08***
35	8013	39.87	31.28	31.47	-0.19	14.01	13.96	0.05
36	9359	34.59	32.47	32.88	-0.41	19.00	19.40	-0.40***
37	2656	62.91	19.44	20.41	-0.97***	13.61	12.90	0.71**
38	7481	32.50	22.45	22.33	0.12	15.30	14.90	0.40***
39	1416	48.02	33.45	35.44	-1.99**	6.68	6.17	0.51***
Total	51964	48.44	21.74	21.70	0.04	16.25	16.27	-0.02

Table 3. Summary statistics

This table reports summary statistics. All variables are defined as in Appendix C. Panel A provides the summary statistics for the full sample. Panel B shows the mean values in the subsample of multi-segment firm-years and that of single-segment firm-years.

	Panel A: Full Sample					Panel B: Subsamples	
	Mean	Median	SD	Min	Max	Multi-segment	Single-segment
Capital	0.315	0.208	0.353	0.010	2.236	0.256	0.360
Import	0.217	0.159	0.199	0.000	1.000	0.200	0.230
iFDI	0.163	0.126	0.125	0.010	0.568	0.161	0.163
Tobin's q	1.730	1.305	1.310	0.552	8.545	1.504	1.901
Price-cost margin	0.067	0.101	0.227	-1.483	0.373	0.094	0.046
Cash-to-assets	0.147	0.075	0.174	0.000	0.760	0.112	0.174
Debt-to-assets	0.214	0.191	0.183	0.000	0.798	0.234	0.200
Ln(Capital intensity)	4.360	4.292	0.977	2.239	6.871	4.344	4.372
Cash flow	0.069	0.092	0.149	-0.593	0.402	0.080	0.061
R&D	0.050	0.020	0.072	0.000	0.377	0.034	0.062
Ln(1+patent)	1.430	0.000	2.230	0.000	10.732	1.778	1.179
Ln(Skill intensity)	-0.109	-0.108	0.671	-1.364	1.225	-0.221	-0.023
Ln(TFP)	0.148	0.036	0.472	-0.235	2.371	0.090	0.193
Ln(Domestic demand)	10.482	10.502	0.987	7.863	12.947	10.432	10.519
Ln(Export)	8.216	8.428	1.816	2.699	11.072	8.088	8.312
Tariffs	0.044	0.040	0.031	0.000	0.198	0.042	0.046
Shipping costs	0.040	0.032	0.028	0.005	0.150	0.042	0.038
Ln(Exchange rates)	3.896	4.154	1.358	0.193	6.708	3.769	3.991

Table 4. The effect of foreign penetration on U.S. firms' capital investment

This table reports the second-stage estimates of the instrumental variable regressions specified in Equation (12). The dependent variable is the rate of capital investment. In the first-stage, $Import$ and $iFDI$ are regressed on three sales-based instruments and all other control variables. All regressions also include firm and year fixed effects. Standard errors are corrected for heteroskedasticity and firm-level clustering. Column (6) repeats the estimation of the regression in column (5) but uses an intrafirm trade-adjusted import penetration. The t values are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Import	-0.616***	-0.819***	-0.827***	-0.797***	-0.789***	-0.736***
	(-3.75)	(-4.56)	(-4.32)	(-4.52)	(-4.30)	(-3.22)
iFDI	0.115	0.263	0.247	0.291	0.279	0.148
	(0.30)	(0.64)	(0.61)	(0.72)	(0.69)	(0.14)
Tobin's q	0.093***	0.080***	0.080***	0.080***	0.080***	0.060***
	(29.35)	(25.67)	(25.32)	(25.71)	(25.39)	(9.40)
Price-cost margin	0.155***	0.169***	0.171***	0.169***	0.171***	0.149***
	(8.97)	(10.18)	(10.20)	(10.20)	(10.24)	(4.29)
Cash-to-assets		0.461***	0.475***	0.460***	0.474***	0.359***
		(18.46)	(18.00)	(18.53)	(18.09)	(8.12)
Debt-to-assets		-0.289***	-0.290***	-0.289***	-0.289***	-0.134***
		(-16.70)	(-16.69)	(-16.82)	(-16.84)	(-3.39)
Ln(Capital intensity)			-0.010*		-0.010*	0.028**
			(-1.68)		(-1.68)	(2.30)
Ln(Skill intensity)			0.004		-0.006	-0.044
			(0.31)		(-0.47)	(-0.69)
Ln(TFP)			0.018		0.017	0.073
			(0.93)		(0.88)	(1.43)
Ln(Domestic demand)				-0.034***	-0.035***	-0.040*
				(-4.03)	(-4.05)	(-1.80)
Ln(Export)				0.029***	0.029***	-0.012
				(3.42)	(3.43)	(-1.14)
Firm FE	Included	Included	Included	Included	Included	Included
Year FE	Included	Included	Included	Included	Included	Included
Sample size	51964	51964	51964	51964	51964	12334
Under-identification test (p-value)	0.000	0.000	0.000	0.000	0.000	0.018
Anderson-Rubin χ^2 test (p-value)	0.001	0.000	0.000	0.000	0.000	0.002
Over-identification test (p-value)	0.568	0.839	0.812	0.981	0.959	0.675

Table 5. The effect of foreign penetration on cash flow and corporate innovation

This table reports the second-stage estimates of the 2SLS regressions of Equation (12), where the dependent variable in column (1) is cash flow over beginning-of-period assets, in column (2) R&D over beginning-of-period assets, and in column (3) the logarithm of one plus patent count. In the first-stage, $Import$ and $iFDI$ are regressed on three sales-based instruments and other control variables. All regressions also include firm and year fixed effects. Standard errors are corrected for heteroskedasticity and firm-level clustering. The t values are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Cash flow	R&D	Patent
	(1)	(2)	(3)
Import	-0.157**	-0.016	-1.035
	(-2.29)	(-0.58)	(-0.93)
iFDI	0.120	0.190***	5.834**
	(0.81)	(3.42)	(2.37)
Tobin's q	0.014***	0.007***	0.023*
	(11.63)	(15.51)	(1.88)
Price-cost margin	0.276***	-0.034***	-0.074
	(31.51)	(-11.64)	(-1.17)
Cash-to-assets	0.029***	0.008**	-0.008
	(3.26)	(2.25)	(-0.07)
Debt-to-assets	-0.099***	-0.023***	-0.330***
	(-14.24)	(-8.98)	(-3.78)
Ln(Capital intensity)	-0.025***	-0.016***	0.064**
	(-9.96)	(-15.15)	(2.52)
Ln(Skill intensity)	0.012**	0.008***	0.086
	(2.53)	(3.59)	(1.13)
Ln(TFP)	-0.014*	0.007*	0.245**
	(-1.73)	(1.88)	(2.31)
Ln(Domestic demand)	0.001	0.001	0.118**
	(0.40)	(1.10)	(2.10)
Ln(Export)	0.003	-0.000	-0.062
	(0.95)	(-0.10)	(-1.30)
Firm FE	Included	Included	Included
Year FE	Included	Included	Included
Sample size	51964	51964	46374
Under-identification test (p-value)	0.000	0.000	0.000
Anderson-Rubin χ^2 test (p-value)	0.067	0.002	0.055
Over-identification test (p-value)	0.806	0.623	0.841

Table 6. The effect of foreign penetration on capital investment: Technology-based measures

The dependent variable is the rate of capital investment. In the first-stage, $Import^{Tech}$ and $iFDI^{Tech}$ are regressed on three technology-based instruments and other control variables. The construction of technology-based instruments is analogue to that of sales-based instruments (defined in Appendix C) with the segment sales replaced by the patent distributions. All regressions include firm and year fixed effects. Standard errors are corrected for heteroskedasticity and firm-level clustering. The t values are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
$Import^{Tech}$	-1.956***	-2.636***	-2.660***
	(-4.44)	(-5.03)	(-4.75)
$iFDI^{Tech}$	1.258**	1.588**	1.595**
	(2.00)	(2.18)	(2.18)
Tobin's q	0.093***	0.080***	0.080***
	(17.17)	(14.67)	(14.54)
Price-cost margin	0.158***	0.167***	0.167***
	(3.79)	(3.88)	(3.88)
Cash-to-assets		0.519***	0.526***
		(12.02)	(11.55)
Debt-to-assets		-0.259***	-0.256***
		(-7.92)	(-7.86)
Ln(Capital intensity)			-0.004
			(-0.28)
Ln(Skill intensity)			0.011
			(0.49)
Ln(TFP)			0.035
			(1.07)
Ln(Domestic demand)			0.012
			(0.91)
Ln(Export)			0.005
			(0.67)
Firm FE	Included	Included	Included
Year FE	Included	Included	Included
Sample size	17859	17859	17859
Under-identification test (p-value)	0.000	0.000	0.000
Anderson-Rubin χ^2 test (p-value)	0.000	0.000	0.000
Over-identification test (p-value)	0.808	0.763	0.710

Table 7. Decomposing import penetration

The dependent variable is the rate of capital investment. In Column (1) and for the first-stage, $Import^{CN}$ and $iFDI$ are regressed on sales-based tariffs on Chinese goods, shipping costs between U.S. and China, $Ln(Exchange\ Rate)$, and other control variables. In Column (2), we include the other two sales-based instruments in the first-stage regressions for $Import^{CN}$, $Import^{Other}$, and $iFDI$. All regressions include firm and year fixed effects. Standard errors are corrected for heteroskedasticity and firm-level clustering. The t values are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
$Import^{CN}$	-1.967**	-1.162***
	(-2.10)	(-3.07)
$Import^{other}$		-0.759***
		(-3.22)
iFDI	0.340	0.068
	(0.31)	(0.10)
Tobin's q	0.075***	0.078***
	(20.66)	(21.65)
Price-cost margin	0.140***	0.145***
	(6.54)	(7.55)
Cash-to-assets	0.452***	0.434***
	(14.49)	(14.41)
Debt-to-assets	-0.236***	-0.236***
	(-10.14)	(-10.81)
Ln(Capital intensity)	0.005	0.009
	(0.58)	(1.20)
Ln(Skill intensity)	0.012	0.017
	(0.61)	(0.85)
Ln(TFP)	0.075**	0.021
	(2.02)	(0.68)
Ln(Domestic demand)	-0.032**	-0.033***
	(-2.04)	(-2.81)
Ln(Export)	-0.004	0.028**
	(-0.54)	(2.56)
Firm FE	Included	Included
Year FE	Included	Included
Sample size	33399	33399
Under-identification test (p-value)	0.005	0.000
Anderson-Rubin χ^2 test (p-value)	0.008	0.000
Over-identification test (p-value)	0.786	0.297
H_0: China = Other (p-value)		0.337

Table 8. Foreign penetration and capital investment: Industry heterogeneity in trade barriers
The dependent variable is the rate of capital investment. *Nontradable* is a dummy variable that equals one if the firm belongs to a pseudo-nontradable industry and zero otherwise. The pseudo-nontradable industries are the four-digit SIC industries with a standardized average annual growth rate of tariffs greater than 5% in Column (1), 6% in Column (2), and 7% in Column (3). All regressions include firm and year fixed effects. Standard errors are corrected for heteroskedasticity and firm-level clustering. The *t* values are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Tariff growth>5% (1)	Tariff growth>6% (2)	Tariff growth>7% (3)
Import	-0.889***	-0.872***	-1.167***
	(-4.61)	(-4.51)	(-3.79)
Import×Nontradable	0.123*	0.179**	0.237**
	(1.67)	(2.34)	(2.48)
iFDI	-0.566	-0.532	1.077
	(-0.54)	(-0.42)	(0.86)
Tobin's q	0.081***	0.080***	0.076***
	(20.27)	(18.52)	(17.19)
Price-cost margin	0.190***	0.193***	0.177***
	(8.94)	(8.92)	(7.37)
Cash-to-assets	0.499***	0.500***	0.500***
	(15.70)	(15.70)	(14.86)
Debt-to-assets	-0.315***	-0.314***	-0.333***
	(-15.08)	(-14.66)	(-13.67)
Ln(Capital intensity)	-0.021***	-0.023***	-0.022**
	(-2.60)	(-2.72)	(-2.47)
Ln(Skill intensity)	-0.011	-0.014	0.017
	(-0.55)	(-0.63)	(0.64)
Ln(TFP)	0.028	0.028	0.072*
	(0.98)	(0.92)	(1.70)
Ln(Domestic demand)	-0.058**	-0.055	-0.039
	(-2.37)	(-1.59)	(-1.55)
Ln(Export)	0.048***	0.048***	0.059***
	(3.01)	(2.66)	(3.09)
Firm FE	Included	Included	Included
Year FE	Included	Included	Included
Sample Size	35336	33887	31877
Under-identification test (p-value)	0.025	0.080	0.062
Anderson-Rubin χ^2 test (p-value)	0.000	0.000	0.000
Over-identification test (p-value)	0.779	0.804	0.841

Appendix A. NAICS vs. SIC

In 1997, U.S. industry classification system, the SIC, was replaced by the NAICS. The BEA financial and operating data on foreign multinationals' U.S. affiliates are recorded under the SIC system before 1997 and the NAICS from 1997 and onward. Using the concordances provided by the NBER-CES Manufacturing Industry Database, we compile sales of foreign multinationals recorded under the NACIS to the SIC system. In addition, the U.S. government also made minor revisions to the SIC classification system in 1987. The NBER-CES Manufacturing Industry Database provides concordances linking the two SIC systems. Again, the concordance for shipments was used to compile foreign multinationals' sales.

Appendix B. Data sources of instrumental variables

Tariffs are duties collected over dutiable value. Shipping costs are calculated as the ratio of cost, insurance, freight (CIF) imports to free on board (FOB) imports minus one. Raw data on duties collected, dutiable value, CIF, and FOB imports are recorded over four-digit SIC codes and obtained from three databases: Feenstra (1996) for 1977-1988, Pierce and Schott (2012) for 1989-2005, and Schott (2008) for 2006-2008.[33]

We follow prior literature (Revenga 1992; Bertrand 2004; Xu 2012) to compute industry-level exchange rate. It is defined as the natural logarithm of the weighted average of the real exchange rates of importing countries. The weights are each foreign country's share of U.S. total imports. As in Xu (2012), we include foreign countries contributing at least 2% of U.S. total imports. Real exchange rates are nominal exchange rates multiplied by the ratio of the U.S. consumer price index (CPI) to the foreign country's CPI. The data on nominal exchange rate and CPI come from World Development Indicators provided by the World Bank.

Appendix C. Variable definitions

Firm-level variables	
Capital investment	The ratio of capital expenditure (*capx*) to the beginning-of-period net property, plant and equipment (*ppent*).
Import	For firm *i* in year *t*, import penetration (*Import*) is calculated as follows. $$Import_{i,t} = \sum_j \left[\frac{Sale_{j,i,t}}{Sale_{i,t}} \times \frac{\text{Imports}_{j,t}}{\text{Shipment}_{j,t} - \text{Exports}_{j,t} + \text{Imports}_{j,t}} \right],$$ where *j* stands for the industry of business segments where firm *i* operates. *Import* is the sales-weighted import share of U.S. product markets.
iFDI	For firm *i* in year *t*, inward FDI (*iFDI*) penetration is calculated as follows. $$iFDI_{i,t} = \sum_j \left[\frac{Sale_{j,i,t}}{Sale_{i,t}} \times \frac{\text{Sales by affiliates}_{j,t}}{\text{Shipment}_{j,t} - \text{Exports}_{j,t} + \text{Imports}_{j,t}} \right],$$ where *j* stands for the industry of business segments where firm *I* operates. *iFDI* is the sales-weighted share in U.S. product markets of the sales of U.S. affiliates with foreign parents.
Tobin's q	The market value of assets divided by book value of total assets (*at*). The market value of assets equals total assets plus the market value of common equity (*csho*×*prcc_f*) minus the sum of the book value of common equity

[33] The database by Feenstra (1996) does not have information on dutiable value. Tariffs thus are defined as the ratio of duties collected to FOB imports over 1977-1988.

(*ceq*) and balance sheet deferred taxes (*txdb*).

Price-cost margin — Sales net of variable costs over sales (*sale*), where variable costs are the sum of costs of goods sold (*cogs*) and selling, general, and administrative expense (*xsga*).

Cash-to-assets — Cash and short-term investments (*che*) divided by beginning-of-period total assets.

Debt-to-assets — The sum of long-term debt (*dltt*) and debt in current liabilities (*dlc*) divided by total assets

Ln(Capital intensity) — The natural logarithm of the ratio of the invested capital (*icapt*) to the number of employees (*emp*).

Cash Flow — The sum of income before extraordinary items (*ib*) and depreciation and amortization (*dp*) divided by total assets (*at*).

R&D — The ratio of R&D expenditure (*xrd*) to beginning-of-period total assets.

Ln(1+Patent) — The natural logarithm of one plus firms' patent counts.

$Import^{Tech}$ — For firm *i* in year *t*, technology-based import penetration ($Import^{Tech}$) is calculated as follows.

$$Import_{i,t}^{Tech} = \sum_{j}\left[\frac{Patent_{j,i,t}}{Patent_{i,t}} \times \frac{\text{Imports}_{j,t}}{\text{Shipment}_{j,t} - \text{Exports}_{j,t} + \text{Imports}_{j,t}}\right],$$

where *j* stands for the industry of firm *i*'s patents. $Import^{Tech}$ is the patent-weighted import share of U.S. product markets.

$iFDI^{Tech}$ — For firm *i* in year *t*, technology-based inward FDI ($iFDI^{Tech}$) penetration is calculated as follows.

$$iFDI_{i,t} = \sum_{j}\left[\frac{Patent_{j,i,t}}{Patent_{i,t}} \times \frac{\text{Sales by affiliates}_{j,t}}{\text{Shipment}_{j,t} - \text{Exports}_{j,t} + \text{Imports}_{j,t}}\right],$$

where *j* stands for the industry of firm *i*'s patents. $iFDI^{Tech}$ is the patent-weighted share in U.S. product markets of the sales of U.S. affiliates with foreign parents.

$Import^{CN}$ — For firm *i* in year *t*, China's import penetration ($Import^{CN}$) is defined as follows.

$$Import_{i,t}^{CN} = \sum_{j}\left[\frac{Sale_{j,i,t}}{Sale_{i,t}} \times \frac{\text{Imports from China}_{j,t}}{\text{Shipment}_{j,t} - \text{Exports}_{j,t} + \text{Imports}_{j,t}}\right],$$

where *j* stands for business segments where firm *i* operates. $Import^{CN}$ is the sales-weighted share of imports from China in U.S. product markets.

$Import^{Other}$ — For firm *i* in year *t*, import penetration of countries other than China ($Import^{Other}$) is calculated as follows.

$$Import_{i,t}^{Other} = \sum_{j}\left[\frac{Sale_{j,i,t}}{Sale_{i,t}} \times \frac{\text{Imports}_{j,t} - \text{Imports from China}_{j,t}}{\text{Shipment}_{j,t} - \text{Exports}_{j,t} + \text{Imports}_{j,t}}\right],$$

where *j* stands for business segments where firm *i* operates. $Import^{Other}$ is the sales-weighted share of imports from countries other than China in U.S. product markets.

Industry-level variables

Ln(Skill intensity) — The natural logarithm of the ratio of the number of skilled workers (non-production) to production workers.

Ln(TFP) — The natural logarithm of the median value of the four-digit SIC industry five-factor total factor productivity index.

Ln(Domestic demand) — The natural logarithm of the gross demand of industry *j*, calculated as $\text{Shipment}_{j,t} - \text{exports}_{j,t} + \text{Imports}_{j,t}$ in year *t*.

Ln(Export) — The natural logarithm of U.S. exports.

Instrumental variables

Tariffs — For firm *i* in year *t*, *Tariffs* is calculated as follows.

$$Tariffs_{i,t} = \sum_j \left[\frac{Sale_{j,i,1}}{Sale_{i,1}} \times \frac{Duties\ collected_{j,t}}{Dutiable\ value_{j,t}} \right],$$

where $Sale_{j,i,1}$ is firm *i*'s first-year segment sales.

Shipping costs — For firm *i* in year *t*, shipping costs is calculated as follows.

$$Shipping\ Costs_{i,t} = \sum_j \left[\frac{Sale_{j,i,1}}{Sale_{i,1}} \times \left(\frac{CIF\ imports_{j,t}}{FOB\ import_{j,t}} - 1 \right) \right],$$

where $Sale_{j,i,1}$ is firm *i*'s segment sales when it first appears in the sample.

Ln*(Exchange rate)* — For firm *i* in year *t*, the natural logarithm of exchange rates is calculated as follows.

$$Ln(Exchange\ Rate)_{i,t} = \sum_j \left[\frac{Sale_{j,i,1}}{Sale_{i,1}} \times Ln(Exchange\ rate_{j,t}) \right],$$

where $Sale_{j,i,1}$ is firm *i*'s segment sales in industry *j* when it first appears in the sample. The exchange rate of industry *j* is defined as

$$Exchange\ Rate_{j,t} = \sum_k \left[\frac{Imports_{k,j,t}}{Imports_{j,t}} \times Exchange\ rate_{k,t} \right],$$

where $imports_{k,j,t}$ is industry *j*'s imports from country *k* in year *t*.

Appendix D. First-stage estimates of the instrumental variable regression of Equation (12)

The dependent variables in the table are sales-weighted import penetration (*Import*; Column 1) and sales-weighted FDI penetration (*iFDI*; Column 2). All independent variables are defined as in Appendix C. Standard errors are corrected for heteroskedasticity and firm-level clustering. The corresponding *t* values are shown in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Import (1)	*iFDI* (2)
Tariffs	-0.787***	0.123*
	(-7.51)	(1.92)
Shipping Costs	-0.065*	0.166***
	(-1.67)	(2.79)
Ln*(Exchange rate)*	0.009***	-0.009***
	(4.40)	(-5.98)
Tobin's q	-0.003***	0.001***
	(-4.31)	(2.81)
Price-cost Margin	-0.009**	0.003
	(-2.08)	(0.91)
Cash-to-Assets	0.019**	-0.007
	(2.37)	(-1.56)
Debt-to-Assets	-0.011	-0.002
	(-1.59)	(-0.46)
Ln(Capital Intensity)	-0.003	0.001
	(-1.46)	(0.41)
Ln(Skill Intensity)	0.028***	-0.007*
	(3.72)	(-1.69)
Ln(TFP)	0.042***	-0.022***
	(3.97)	(-5.52)
Ln(Domestic Demand)	-0.027***	-0.002
	(-5.80)	(-0.65)
Ln(Export)	0.037***	0.006***
	(13.50)	(3.82)
Firm FE	Included	Included
Year FE	Included	Included
Adjusted R-square	0.852	0.808
Sample size	51964	51964

The first-stage results further suggest that our choice of instrumental variables is economically sensible. For instance, the coefficients of *Tariffs* and *Shipping Costs* bears opposite signs in column (1) and (2). This finding is consistent with the prediction of the proximity-concentration hypothesis (Brainard 1997)—as trade barriers rise, foreign rivals tend to shift production to the host country, which therefore increase their affiliates' sales and reduce their exports. Turning to the sign of Ln(*Exchange rate*) in Column (1), given that the offered price of import good in quoted in foreign currencies, a higher exchange rate renders cheaper foreign supplies in terms of U.S. dollars, thus encouraging imports. In line with Froot and Stein (1991), iFDI penetration declines as foreign currency per U.S. dollar increases. Consistently, the sign of Ln(*Exchange rate*) is negative in Column (2).

Appendix E: Robustness check

Table E1. The inclusion of Herfindahl-Hirschman index (*HHI*)

The table reports the second-stage estimates of the 2SLS regressions of Equation (12) with the inclusion of the measure of market concentration: *HHI*. The dependent variable in column (1) is the rate of capital investment, in column (2) cash flow over beginning-of-period assets, in column (3) R&D over beginning-of-period assets, and in column (4) the logarithm of one plus patent count. All variables are defined as in Appendix C. Standard errors are corrected for heteroskedasticity and firm-level clustering. The corresponding *t* values are shown in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Investment	Cash flow	R&D	Patent
	(1)	(2)	(3)	(4)
Import	-0.792***	-0.159**	-0.015	-1.026
	(-4.29)	(-2.30)	(-0.56)	(-0.93)
iFDI	0.285	0.124	0.189***	5.743**
	(0.70)	(0.84)	(3.42)	(2.34)
Tobin's q	0.080***	0.014***	0.007***	0.023*
	(25.38)	(11.63)	(15.52)	(1.88)
Price-cost margin	0.171***	0.276***	-0.034***	-0.076
	(10.24)	(31.54)	(-11.64)	(-1.19)
Cash-to-assets	0.474***	0.029***	0.008**	-0.010
	(18.08)	(3.27)	(2.25)	(-0.10)
Debt-to-assets	-0.289***	-0.099***	-0.023***	-0.334***
	(-16.82)	(-14.21)	(-8.99)	(-3.84)
Ln(Capital intensity)	-0.010*	-0.025***	-0.016***	0.065***
	(-1.69)	(-10.00)	(-15.13)	(2.59)
Ln(Skill intensity)	-0.007	0.011**	0.008***	0.105
	(-0.52)	(2.43)	(3.64)	(1.38)
Ln(TFP)	0.017	-0.014*	0.007*	0.241**
	(0.90)	(-1.69)	(1.86)	(2.27)
Ln(Domestic demand)	-0.036***	0.001	0.002	0.136**
	(-4.07)	(0.18)	(1.20)	(2.36)
Ln(Export)	0.029***	0.003	-0.000	-0.056
	(3.42)	(0.92)	(-0.08)	(-1.19)
HHI	-0.014	-0.011	0.002	0.327***
	(-0.72)	(-1.53)	(0.88)	(2.94)
Firm FE	Included	Included	Included	Included
Year FE	Included	Included	Included	Included
Sample size	51964	51964	51964	46374
Under-identification test (p-value)	0.000	0.000	0.000	0.000
Anderson-Rubin χ^2 test (p-value)	0.000	0.061	0.002	0.061
Over-identification test (p-value)	0.945	0.777	0.606	0.885

Table E2. Using China's export to other high-income countries as instrument in Table 7

This table presents the second-stage estimates of the 2SLS regressions in Table 7 using as instrument in the first-stage regression China's exports to other high-income countries rather than U.S. tariffs on imports from China and shipping costs between China and U.S. Data on China's exports for 1991 to 2012 for 6-digit Harmonized System (HS) are from the United Nation Comtrade Database. We follow Autor *et al.* (2014) to define high-income countries and map the 6-digit HS products of China's exports to 4-digit SIC level. Then, we scale the industry-level China's exports to other high-income countries by 1988 U.S. domestic demand [the denominator in Equation (8)] and map the resulting industry-level numbers to firm-level according to Equation (13). We call this instrument sales-based demand-adjusted China's exports to other high-income countries. The dependent variable is the rate of capital investment. All variables are defined as in Appendix C. Standard errors are corrected for heteroskedasticity and firm-level clustering. The corresponding *t* values are shown in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
$Import^{CN}$	-0.577***	-0.672***
	(-2.94)	(-3.28)
$Import^{other}$	-0.282	-0.343
	(-0.56)	(-0.65)
iFDI		-0.734***
		(-3.22)
Tobin's q	0.078***	0.078***
	(22.52)	(22.10)
Price-cost margin	0.156***	0.152***
	(8.10)	(7.77)
Cash-to-assets	0.426***	0.424***
	(14.59)	(14.15)
Debt-to-assets	-0.230***	-0.230***
	(-10.79)	(-10.36)
Ln(Capital intensity)	0.011	0.013*
	(1.54)	(1.69)
Ln(Skill intensity)	-0.014	0.006
	(-0.96)	(0.33)
Ln(TFP)	0.017	-0.001
	(0.94)	(-0.05)
Ln(Domestic demand)	-0.015	-0.026**
	(-1.55)	(-2.33)
Ln(Export)	0.003	0.033***
	(0.51)	(2.90)
Firm FE	Included	Included
Year FE	Included	Included
Sample size	31158	31158
Under-identification test (p-value)	0.000	0.000
Anderson-Rubin χ^2 test (p-value)	0.000	0.000
Over-identification test (p-value)	0.201	0.188

H_0: *China = Other (p-value)*	0.827

The results in Table E1 are consistent with the results in Table 4 and 5, suggesting our findings are robust to the inclusion of the measure of market concentration-*HHI*. The results in Table E2 are consistent with the results in Table 7, suggesting our findings are robust to use alternative instruments.

Highlights

- We examine the joint effect of imports and inward foreign direct investment (iFDI) on U.S. firms' capital investment.
- We develop firm-level measures to gauge the impact of imports and iFDI and use an instrumental variable regression method.
- Import competition reduces U.S. firm investment, while iFDI have a nonsignificant effect.
- The negative effect of imports on investment is due to competition-induced decline in cash flows.
- The nonsignificant effect of iFDI is partly attributed to technology spillovers associated with FDI.