The Impact of FDI in Vertically Integrated Sectors on Domestic Investment: Firm-level Evidence from South Korea

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April 2016

Abstract

In order to analyze the effects of FDI on domestic firms' investment, we use a detailed firm level data-set from South Korea for the 2006-2014 period. We combine it with the input-output tables provided by the Bank of Korea to construct industry level measures of multinational presence in sectors that are horizontally and vertically linked,and estimate dynamic investment equations that are augmented with these foreign presence measures. We find a positive and significant effect of foreign presence in both horizontally and vertically linked industries on domestic firm's investment rate, with larger effects arising from multinational presence in the supplying sectors. Quantitatively, a 2 percentage point increase in the presence of multinational suppliers increases the domestic firms investment rate by 2.29 percentage points. We also find that this effect is larger for small and medium firms, private firms, non-exporters and for firms in external finance dependent industries. A similar 2 percentage point increase in the foreign presence in downstream sectors increases the investment rate of domestic suppliers by 0.71 percentage points. This effect is larger if the domestic firm is part of a chaebol, or is in a less external finance dependent industry. The effect of a 2 percentage point increase in horizontal FDI is also positive, but smaller at 0.42 percentage points.

JEL Classification: E22, F21, F23

Key Words: Foreign direct investment; firm-level investment; South Korea

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1 Introduction

While it is commonly agreed that foreign direct investment (FDI) relaxes credit constrains for firms that receive capital transfers and allows them to invest more, there is no consensus on FDI's overall impact on domestic capital accumulation. The effects of FDI inflows on domestic investment have been investigated by a large number of empirical studies that use aggregate data.[1] However, there are very few studies that focus on how FDI affects domestic firm's investment behavior. We contribute to the literature by analyzing how the presence of multinationals in the downstream and upstream sectors can affect domestic firms' investment decisions using firm level data from South Korea. To the best of our knowledge, our paper is the first to provide firm-level evidence on the effects of foreign presence in vertically integrated industries on firm-level investment decisions.

The presence of multinationals in vertically integrated industries and horizontal industries can affect investment behavior differently. In the horizontal FDI case (multinational presence in the same industry as the domestic firm), FDI inflows might have a positive effect on domestic firms investment, if enhanced competition forces domestic firms to become more efficient, and if firms undertake investment projects in order to copy foreign technologies. On the other hand, foreign multinationals can lead domestic firms to lower investment by acquiring market shares and/or increasing the cost of locally supplied inputs, and thereby lowering the marginal profitability of domestic firms capital. By contrast, the presence of multinationals in vertically integrated industries is generally expected to increase domestic investment. FDI flows into upstream industries, resulting in an increase in the number of foreign suppliers of intermediate inputs, lower the cost of intermediates, which improve the marginal profitability of capital, and therefore allow domestic firms to accumulate more capital. Additionally, FDI flows into downstream industries can lead to higher investment, as multinationals increase the demand for local suppliers products and increase their profitability.

In order to analyze the effects of FDI on domestic firms investment, and to evaluate these

[1] Some examples in this literature that find positive effects of FDI on domestic investment include Bosworth et al. (1999), Tang et al. (2008), and Farla et al. (2014). On the other hand, studies such as Agosin and Machado (2005), Mutenyo et al. (2010), Morrissey and Udomkerdmongkol (2012), and Ashraf and Herzer (2014) use aggregate data and find that FDI inflows crowd-out domestic investment. Using aggregate data for the 1985-1999 period, Deok-Ki Kim and Seo (2003) show find that FDI neither crowded-in nor crowded-out domestic investment in South Korea.

mechanisms, we use a detailed firm level data-set from South Korea's manufacturing sector for the 2006-2014 period. One advantage of this data-set is that it contains information on private firms, whose investment decisions can be affected more by FDI, as they are more financially constrained than the publicly traded firms. We combine the firm level data, which include information on foreign ownership of firms, with input-output tables provided by the Bank of Korea to construct industry level measures of multinational presence in sectors that are horizontally and vertically linked. We then estimate dynamic investment equations that are augmented with these foreign presence measures using the system-GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). The use of firm panel data allows us to control for time invariant firm level unobservables relevant to the domestic firm's investment decision, as well as time-varying unobservable shocks common to all firms in South Korea. In addition, we are also able to analyze other firm-level relevant factors, such as firm size and public status, that influence how FDI might impact investment decisions.

We find a positive and significant effect of foreign presence in both horizontally and vertically linked industries on domestic firms investment rate, with larger effects arising from multinational presence in the vertically linked sectors. In particular, we find that a 2 percentage point (one standard deviation) increase in the presence of foreign multinationals in the upstream sectors, where foreign firms supply intermediate inputs, increases the investment rate of domestic customers by 2.29 percentage points. Since the mean investment rate is 22 percent of the existing capital stock, this increase corresponds to a 10.27 percent increase in the investment rate. When we analyze the heterogeneity of this effect on firms with different characteristics, we find that it is larger for small and medium size firms, private firms, non-exporters and for firms in external finance dependent industries. A similar 2 percentage point increase in the foreign presence in downstream sectors, where foreign firms are the customers, increases the investment rate of domestic suppliers by 0.71 percentage points. This effect is larger if the domestic firm is part of a chaebol, or is in a less external finance dependent industry. Finally, we also show that the effect of a 2 percentage point increase in horizontal FDI is also positive, but smaller at 0.42 percentage points.

Our paper is related to the broader literature on the effects of FDI on firm's productivity. Javorcik (2004) and Blalock and Gertler (2008) find productivity spill-overs from FDI into downstream industries in Lithuania and Indonesia, respectively. Using data from the U.S., Keller and Yeaple (2009) show substantial productivity gains from horizontal FDI. By providing evidence on the positive impact of FDI on firm-level investment, our results complement the findings in these papers. Moreover, different from the productivity literature, our results show that FDI in the upstream industries, increasing the number of multinational

suppliers, can also be important for capital accumulation.

Our work is also related to the literature that estimates dynamic investment equations to analyze how FDI affects firms' credit constraints. Harrison and McMillan (2003) estimate investment Euler equations using data from the Ivory Coast, and show that borrowing by foreign firms exacerbated domestic firm credit constraints, and thereby crowded-out investment. In contrast, using a cross-country firm-level panel data-set Harrison et al. (2004) find that FDI inflows are associated with a reduction in firm financing constraints. While our focus in this paper is not mainly on credit constraints, we also show that both horizontal and vertical FDI also contribute to capital accumulation by relaxing the liquidity constraints faced by domestic firms.

The rest of the paper is organized as follows. In section 2, we describe the theoretical framework and the hypotheses on the effects of FDI in horizontally and vertically linked industries on the domestic firm's investment decisions. Also, within that section, we present the empirical model. In Section 3 we describe the firm-level data and how we construct the FDI measures of interest. Section 4 discusses our findings, and section 5 concludes the paper.

2 Foreign Multinational Presence in Industries and Domestic Firms' Investment

In order to motivate the empirical specification, and to describe how foreign multinational in the vertically and horizontally integrated industries can affect investment decisions of domestic firms, in this section we discuss the investment problem of a firm that is horizontally and/or vertically linked to foreign multinationals. With horizontal linkages, the firm faces the presence of foreign multinationals in the same industry as it operates in. Presence of foreign multinationals in the vertical industries can be in the form of backward or forward linkages. If the domestic firm has backward linkages with the foreign multinationals, then it supplies inputs to the foreign producers. Alternatively, the domestic firm can source inputs from the foreign firms that operate in upstream industries, in which case the domestic firm has forward linkages with the multinationals. We start by describing the theoretical set-up that we use to derive the investment equation, and the hypotheses we test in our empirical application. Then, we describe our empirical set-up, and estimation methodology.

2.1 The model and the Hypotheses

We consider the investment problem of a monopolistically competitive firm that sells its output in the domestic market, where it faces competition from the foreign multinationals. At the beginning of period t, the firm optimally chooses the level of variable inputs, output price, and how much to invest. Firm i enters period t with K_{it-1} units of capital. Due to a one period time-to-build lag, the new capital resulting from total investment becomes productive in the following period, i.e., production in period t depends on K_{it-1}. The firm chooses total investment expenditures I_{it} to maximize the expected present value of current and future profits subject to the standard capital accumulation equation. Denoting the maximum profit of firm i obtained by choosing the optimal level of variable inputs and the output price with Π_{it}, we can write the expected present value of profits as:

$$V_{it}(K_{it-1}) = \max_{I_{it}} \{\Pi_{it} - G(K_{it-1}, I_{it}) - I_{it} + \beta E_t [V_{it+1}(K_{it})]\} \tag{1}$$

subject to

$$K_{it} = (1-\delta)K_{it-1} + I_{it}, \tag{2}$$

where β is the discount factor; δ is the rate of depreciation; and $G(K_{it-1}, I_{it})$ denotes the cost of altering the capital stock, which leads to a loss of a fraction of total investment. The first order conditions of the firm's problem yield the following equation:

$$1 + \frac{\partial G(K_{it-1}, I_{it})}{\partial I_{it}} = \beta E_t \left[\frac{\partial \Pi_{it+1}}{\partial K_{it}} - \frac{\partial G(K_{it}, I_{it+1})}{\partial K_{it}} + (1-\delta)\left(1 + \frac{\partial G(K_{it}, I_{it+1})}{\partial I_{it+1}}\right)\right]. \tag{3}$$

This standard Euler equation implies that along the optimal path, the marginal cost of investing in a new unit of capital equals the present discounted value of the marginal return to capital. The marginal return depends on the marginal profitability of capital (net of adjustment costs) and the value of undepreciated capital.

In order to characterize the marginal profitability of capital, $\frac{\partial \Pi_{it+1}}{\partial K_{it}}$, we assume that the firm sells its product in the imperfectly competitive domestic market. The demand firm faces is given by

$$x_{it} = \left(\frac{p_{it}}{P_t}\right)^{-\theta} X_t, \tag{4}$$

where x_{it} is the demand for firm i's product, p_{it} is the price the firm charges, P_t and X_t are the aggregate price level and aggregate demand, respectively. The parameter $\theta > 1$ denotes the price elasticity of demand, which indicates the substitutability between the varieties.[2]

[2]We assume that individuals consume a continuum of imperfectly substitutable goods ($x(z)$), and the

Given the demand function and the amount of capital at the beginning of the period, the firm optimally chooses the price of its output, in addition to the level of variable inputs. Hence, at the beginning of each period, firm i maximizes profits conditional on all available information:

$$\Pi_{it} = \max_{p_{it}, L_{it},} \left[x_{it} p_{it} - w_t L_{it} \mid \Omega_{t^-} \right] \tag{5}$$

subject to

$$x_{it} = F(K_{it-1}, L_{it})$$

where x_{it} is the product demand given in equation (4); L_{it} denotes inputs with price w_t; and Ω_{t^-} is the information set available at the beginning of period t.

Using the first order conditions from the optimization problem (5), and assuming that the production function, $F(\cdot)$, is homogeneous of degree one, we differentiate the resulting profit function to obtain the expression for the marginal profitability of capital:

$$\frac{\partial \Pi_{it}}{\partial K_{it-1}} = \left[\frac{1}{K_{it-1}} \left(\frac{x_{it} p_{it}}{\psi_i} - w_t L_{it} \right) \mid \Omega_{t^-} \right], \tag{6}$$

where $\psi_i = \frac{\theta}{\theta - 1}$ denotes the mark-up (price-to-cost margin). The presence of foreign multinationals can affect the investment decisions by altering the marginal profitability of capital given in equation (6).

Foreign presence in the vertically integrated industries is expected to have a positive effect on the marginal profitability of capital, and therefore on the investment decisions, as in the case for productivity spill-overs (see e.g., Javorcik (2004)). FDI flows through forward linkages result in an increase in the number of foreign suppliers of intermediate inputs, which would the lower cost of intermediates, $w_t L_{it}$, and also potentially increase the quality of available varieties. Higher quality and/or lower input costs in turn would improve the marginal profitability of capital, and therefore allow domestic firms to increase investment. FDI flows into downstream industries can lead to higher marginal profitability of capital through backward linkages, as an increase in the number of multinationals (as customers) would raise the demand for domestic suppliers' products, and their revenues, $x_{it} p_{it}$. Additionally, the presence of multinationals firms in the downstream industries might lead domestic firms to increase investment by requiring them to upgrade the quality of their

consumption basket is formed by the following CES aggregator:

$$X_t = \left(\int_0^1 x(z)^{\frac{\theta-1}{\theta}} \, dz \right)^{\frac{\theta}{\theta-1}}.$$

products.

In the case of horizontal linkages, the presence of multinationals can have both positive and negative effects on domestic firm's investment decisions. Foreign multinationals can lower marginal profitability of capital and thereby reduce investment by increasing competition, acquiring market shares and lowering the domestic firm's sales (Aitken and Harrison (1999); Markusen and Venables (1999)). Additionally, by increasing the demand for locally supplied inputs, such as labor, foreign multinationals can also lead to lower marginal profitability and investment. On the other hand, domestic firms might increase investment to benefit from the knowledge that spills-over from the more productive foreign firms, and/or to become more efficient in order to compete with the foreign firms. Hence, the net effect of FDI on firm's domestic investment through horizontal linkages is á priori ambiguous, and needs to be determined empirically.

To characterize the investment Euler equation (3), we adopt the standard convex adjustment cost assumption, and adopt the following functional form:

$$G\left(K_{t-1}, I_t\right) = \frac{\gamma}{2}\left(\frac{I_t}{K_{t-1}} - \frac{\bar{I}}{K}\right)^2 K_{t-1}, \tag{7}$$

where γ is the adjustment cost parameter, and $\frac{\bar{I}}{K}$ is the steady-state value of the investment rate. We can obtain the fully-parametrized investment equation by substituting the partial derivatives of the adjustment cost function in equation (7), and the marginal profitability of capital in equation (6) into the Euler equation in (3), which generates a non-linear equation in the variables of interest. In order to simplify the interpretation of the coefficients and to obtain an equation that can be used as the basis for our empirical specification, we linearize the Euler equation using a first-order Taylor approximation around the steady state. After linearizing and rearranging the terms, we obtain the following investment equation:

$$\frac{I_{it}}{K_{it-1}} = E_t\left[\phi_0 + \phi_1\frac{I_{it+1}}{K_{it}} + \phi_2\frac{S_{it+1}}{K_{it}} - \phi_3\frac{Z_{it+1}}{K_{it}}\right] \tag{8}$$

where S_{it+1} is the value of total sales ($x_{it+1}p_{it+1}$), and Z_{it+1} is the cost of variable inputs ($w_{t+1}L_{it+1}$). The ϕ's are positive constants that are functions of the structural parameters of the model.[3] Equation (8), which presents the first-order approximation of the model, shows that the investment process depends on future investment, expected sales, and expected domestic costs, and it provides the basis for our empirical model.

[3] See the Appendix for the details of the Taylor approximation and the expressions for the ϕ's.

2.2 Empirical Investment Equation and Estimation

In order to test for the mechanisms through which presence of multinationals can affect investment decisions, we specify an empirical investment Euler equation, that is augmented with three foreign multinational presence measures. Because the main goal of this study is to estimate the impact of FDI on domestic firms' investment decisions, we estimate a standard reduced form investment equation instead of focusing on the structural relationship described in equation (8).[4] We start by estimating the following baseline specification

$$\frac{I_{ijt}}{K_{ijt-1}} = \alpha_1 \frac{I_{ijt-1}}{K_{ijt-2}} + \alpha_2 \frac{S_{ijt}}{K_{ijt-1}} + \alpha_3 \frac{C_{ijt}}{K_{ijt-1}} + \alpha_4 FDI^H_{jt} + \alpha_5 FDI^B_{jt} + \alpha_5 FDI^F_{jt} + \upsilon_i + \eta_t + \tau_{jt} + \varepsilon_{ijt}, \tag{9}$$

where $\frac{I_{ijt}}{K_{ijt-1}}$ denotes investment rate for firm i, in industry j in year t; and $\frac{S_{ijt}}{K_{ijt-1}}$ and $\frac{C_{ijt}}{K_{ijt-1}}$ are the firm's total sales and cash flow, respectively, normalized by its capital stock. The normalization by capital stock naturally arises in a model with quadratic adjustment costs, and it allows us to control for the size of the firm. The term FDI^H_{jt} is a measure for foreign presence in the same sector as the firm operates in, i.e., sector j, and captures the horizontal linkages; FDI^B is a proxy for foreign presence in sectors that are supplied by sector j, and provides a measure for backward linkages; and FDI^F is a proxy for foreign presence in sectors that provide inputs to sector j, i.e., forward linkages. We describe the construction of each of these measures in the following section.

As firm-level determinants of investment, we include the sales-to-capital ratio in order to control for marginal profitability of capital, and cash flow as a proxy for financing constraints, which arise due to capital market imperfections (Fazzari et al. (1988)). Cash flow can affect investment decisions, since it might be difficult for some firms to smooth investment behavior via external capital markets. Empirically, cash flow is constructed as the difference between sales and total costs, adjusted for taxes and depreciation. We also include the lagged investment rate to control for the autocorrelation that may arise due to adjustment costs in investment. The specification also includes firm specific fixed effects, υ_i, that capture the time-invariant firm-level determinants of investment, as well as year dummies, η_t, that capture aggregate economy-wide fluctuations. Macroeconomic factors common to all firms, such as changes in the exchange rates, will be captured by these year effects. Since firms in different industries might face different productivity trends, which may be correlated with foreign presence in horizontally and vertically linked industries, we include interaction terms

[4] In their review of the empirical literature that uses firm- or plant-level data to estimate an investment equation, Bond and Van Reenen (2008) note that this type of reduced form model can be interpreted as representing an empirical approximation to the underlying investment process.

between two-digit industry dummies and a linear time-trend, τ_{jt} . to allow for industry-specific trends. Finally, we assume that the error term, ε_{ijt}, is i.i.d with $E(\varepsilon_{ijt}) = 0$.

Given the short time dimension of our panel data-set (9 year), we estimate the dynamic investment equation (9) and the augmented specifications using the *system-GMM estimator* of Arellano and Bover (1995) and Blundell and Bond (1998). This estimator addresses the potential biases that arise from the correlation between the firm fixed effects, υ_i, and the lagged dependent variable, $\frac{I_{ijt-1}}{K_{ijt-2}}$, and allows us to treat sales, $\frac{S_{ijt}}{K_{ijt-1}}$, and cash flow, $\frac{C_{ijt}}{K_{ijt-1}}$ as endogenous variables. We use lagged values of firm-specific variables dated $t-2$ and $t-3$ as the GMM-type instruments.[5] We report the second order serial correlation tests and the Sargan-Hansen tests of over-identification to show the validity of our instruments.

3 Data

3.1 Firm level data

To identify the impact of foreign presence in horizontally and vertically linked industries on domestic firms' investment, we use firm-level data for the South Korea's manufacturing sector from the Korean Information Service, Inc. (KIS). The data are obtained from the balance-sheet of both public and private firms.[6] Our sample covers the 2006-2014 period. We choose 2006 as the initial year of our sample in order to maximize the coverage of firms included.[7]

The data-set includes information on sales, costs, as well as various types of assets that allow us to construct the investment rate, which is defined as the ratio of real investment to the lagged replacement value of real capital stock. We follow Kim et al. (2015) closely in constructing real investment and real capital stock. Real investment is measured as nominal investment deflated by the capital goods price index (source: Bank of Korea), where nominal investment is calculated as the change in the book value of capital (tangible assets minus

[5] In some specifications, including lagged value dated $t-2$ of the investment rate as a GMM-type instrument violates the validity of the Sargan-Hansen tests of over-identification. In those cases, we include only the lagged value dated $t-3$ of the investment rate in the instrument set.

[6] KIS compiles data on all firms conforming to one of several criteria, who are required by the Act of External Audit of Joint-Stock Corporations to report audited financial statements to the Financial Supervisory Commission. Based on the 2014 revision of the law the following firms are required to report financial statements: (i) firms assets more than or equal to 12 billion Korean Won; (ii) public firms; (iii) firms with assets more than or equal to 7 billion Won and total liabilities more than or equal to 7 billion Won; (iv) firms with assets more than or equal to 7 billion Won and employees more than or equal to 300.

[7] Before 2006, the total sales of firms recorded in the KIS data is less than 75% of the total sales of all manufacturing firms at least 5 persons are employed in Korea as reported by the Mining and Manufacturing Survey of Statistics Korea.

land and lease assets) plus depreciation costs. We construct the real capital stock using the perpetual inventory method with an 11% depreciation rate, and the real investment described above. We use the real book value of capital in the first year the firm appears in the data-set.

Since our focus is the impact of FDI on domestic firms' investment behavior, we exclude firms with foreign ownership of more than 10% from the sample. However, we provide robustness of our results to also excluding firms with 50% or more foreign ownership. Additionally, we drop the observations in the top and bottom 1% of the sample based on investment rate, sales and cash-flow in order to eliminate outliers. As a result, we end up with 6,430 firms over the 2006-2014 period.[8] We present the descriptive statistics for the variables included in our estimations in Table 1.

3.2 Horizontal and vertical FDI measures

In constructing the foreign presence measures, we follow Javorcik (2004) closely, and construct the same measures in her paper for our sample. The proxies for horizontal and vertical linkages are constructed at the two-digit industry level, as defined by the Bank of Korea. The proxy for horizontal linkages, FDI^H_{jt}, measures the extent of foreign presence in the same sector j as the firm is operating in. It is constructed as the total foreign equity participation in the sector, weighted by each firm's share in total output of the sector:

$$FDI^H_{jt} = \frac{\sum_{\text{for all } i \in j} ForeignShare_{it} * S_{it}}{\sum_{\text{for all } i \in j} S_{it}}, \tag{10}$$

where $ForeignShare_{it}$ is the percentage of firm i owned by foreign firms, and S_{it} is the real sales of firm i (sales deflated by the producer price index).

Foreign presence in the downstream industries, where foreign multinationals are supplied by domestic firms are captured with the FDI^B_{jt} measure constructed as

$$FDI^B_{jt} = \sum_{k, k \neq j} \gamma_{jkt} FDI^H_{jt}. \tag{11}$$

The term γ_{jkt} is the fraction of sector j's output supplied to sector k during year t, and is obtained from the input-output matrix provided by the Bank of Korea at the two-digit level for the corresponding year t. The time-varying input-output coefficients allows for potential

[8] We end up with an unbalanced sample as there are firm entries and exits between 2006 and 2014.

changes in the relationships between the sectors. This measure of backward linkages does not include inputs supplied within sector j ($k \neq j$), since they are already included in the FDI^H_{jt} measure. The proxy for forward linkages is FDI^F_{jt}, and it measures the foreign presence in the upstream industries, where foreign multinationals provide inputs to the domestic firms. It is constructed as the weighted share of output by firms with foreign equity in the supplying sectors, i.e.,

$$FDI^F_{jt} = \sum_{m,m\neq j} \sigma_{jm} \frac{\sum_{\text{for all } i\in m} ForeignShare_{it} * (S_{it} - X_{it})}{\sum_{\text{for all } i\in m} (S_{it} - X_{it})}. \tag{12}$$

Following Javorcik (2004), we exclude exports by (X_{it}) foreign firms since only intermediates sold to domestic firms are relevant for forward linkages under consideration.

Table 1 presents the descriptive statistics for the horizontal, backward, and forward FDI measures for the overall sample, and Table 2 presents the average value of the three measures for each of the two digit industries, ranked by the average horizontal FDI. There is considerable variation across industries for each of the FDI measures. While the overall average for the horizontal FDI measure for all of the industries is 10 percent, it displays a large variation from 0.4 percent in ship building at the low end to 45 percent in glass product manufacturing at the high end. The overall average backward FDI measure is 3.2 percent. It takes on a value zero for Ship building and Tobacco product manufacturing, suggesting that those to industries do not supply inputs to any foreign multinationals. At 13.87 percent, the industry with the highest average backward linkages to foreign multinationals is basic chemical product manufacturing. The forward FDI measure ranges between 0.8 percent in non-ferrous metal manufacturing and 16.95 percent in synthetic resin and rubber manufacturing, which implies that the latter industry had the most linkages with suppliers with at least part foreign ownership.

4 Results

We start by estimating the impact of horizontal, backward, and forward linkages on domestic firm's investment decisions in South Korea, as specified in equation (9). In the first subsection, we discuss the main effects of these three FDI measures on investment, show that the results are robust to including firms with partial foreign investment in the sample, and also show that the impacts become larger when we exclude the financial crisis years. Next, we discuss the heterogeneity in the impact of the FDI measures for exporters, large firms, and firms that belong to a chaebol. In the final subsection, we consider the role of financial

constraints in mediating the impact of FDI on domestic investment.

4.1 Main Effects of FDI on Domestic Firms' Investment Decisions

Table 3 presents the results from our baseline specification (9) for investment, which includes firm and year fixed effects, as well as industry specific time trends. Column (1) of Table 3 shows that all three FDI measures have positive effects on domestic firms' investment decisions, although the proxy for forward linkages is not statistically significant. In column (2), we add a Herfindahl index to the baseline specification to control for the overall industry concentration, which would affect the marginal profitability of the firm and could be correlated with foreign firm presence.[9] Following Javorcik (2004), in column (3), we further include a measure of total demand for industry's output in a given year, calculated using information on input coefficients from the input-output matrix and the value of sales in the using sectors.[10] The results from this augmented specification shows that all three FDI measures are positive and highly significant. The largest impact is obtained for the forward linkage variable with a coefficient of 1.144, which implies that a one standard deviation increase in the presence of foreign suppliers–corresponding roughly to a 2 percentage point increase in FDI_t^F–, the domestic customers increase investment rate by 2.29 percentage points. Given that the average investment rate in the sample is 22.38 percent, this increase corresponds to a 10.27 percent increase in the investment rate. Hence, as expected, the increase in the presence of multinationals in the supplying sectors improves the marginal profitability of capital, and allows domestic firms to increase investment by lowering cost of intermediates and/or improving the quality of available varieties.

The coefficient on the backward linkage measure is smaller at 0.353, which implies that a similar 2 percentage point increase in foreign presence in the downstream sectors, where the customers are multinationals, raises investment by 0.71 percentage points, corresponding to a 3.15 percent increase in the investment rate. This results suggests that backward linkages can increase investment by raising the demand for domestic suppliers' products and increasing their profitability. However, this effect is smaller than the impact Javorcik (2004) obtains for output, which indicates that backward linkages may be more important for growth through productivity increases and knowledge spill-overs, rather than capital accumulation.[11] We find a positive but even smaller effect of horizontal FDI on domestic

[9] The Herfindal index is constructed as the sum of squared sales share of firms in each two digit industry.

[10] More specifically, the demand variable is constructed as $Demand_{jt} = \sum_{k} \alpha_{jkt} S_{kt}$, where α_{jkt} is the fraction of output purchased by industry k from industry j, and S_{kt} is the total sales in industry k, proxying for the value of output in that industry.

[11] More specifically, Javorcik (2004) finds that a 4 percentage point increase in the backward linkages is

firms' investment decisions. At 0.209, the coefficient on FDI_t^H implies an addition of 0.42 percentage points to the investment rate following a similar 2 percentage point increase in the foreign presence in the domestic firm's own industry. Hence, by increasing competition, horizontal FDI leads firms to invest more, but its impact is relatively small.

In terms of the firm-specific determinants of investment, lagged investment rate is positive and statistically significant in all specifications, demonstrating the serial correlation in investment. The coefficient on sales, which proxies for marginal profitability of capital, is positive and significant, as expected. Similarly, the coefficient on cash-flow is also positive and significant, underscoring the importance of liquidity constraints in investment, and suggesting that if firms' liquidity constraints are relaxed (an increase in the cash-flow), firms would raise their investment rates. Turning to the industry-specific determinants of investment, we find a positive and significant effect of the Herfindahl index, suggesting that less concentrated industries (higher values of the Herfindahl index) are associated with higher investment rates, as the firm's profit margin is likely to be higher. Additionally, we obtain a positive and significant coefficient on the industry demand, which means that when the demand for the industry's output increases, the firm becomes more profitable and expands investment. The specifications in Table 3 are supported by the tests of over-identifying restrictions, for which the Hansen test statistic fails to reject the validity of the instrument sets. Moreover, the tests for serial correlation, which are applied to the residuals in the first differenced equations ($\Delta\varepsilon_{ijt}$), show that we can reject the null-hypothesis of no first-order serial correlation, but cannot reject the null-hypothesis of no second order serial correlation.[12] The fact that the errors only have first order autocorrelation confirms the validity of instruments dated $t-2$ and $t-3$.

In column (4) of Table 3, we analyze the sensitivity of our results to limiting the time span of our sample to 2009-2014. By doing so, we are excluding the 2007-2008 global crisis years, which might have adversely affected both the investment decisions of firms and FDI flows. The results show that the impact of each of three FDI measures is larger in the post crisis years compared to the full sample results in column (3), hinting that domestic firms could not benefit from spill-overs from FDI during the financial crisis as much. The last two columns report the estimates obtained from a sample that also includes firms with foreign participation up to 50 percent, and 100 percent, respectively, for the full set of years (2006-2014). In these specifications, we add the percentage of foreign ownership to the previous set of covariates. While the FDI measures for backward linkages and horizontal linkages remain

associated with a 15 percent rise in output of the firms in the supplying industry.

[12]Assuming that the residuals, ε_{ijt}, in equation (9) are i.i.d, we expect $\Delta\varepsilon_{ijt}$ in the first-differenced equations to have first order autocorrelation.

very similar to the estimates in column (3) for fully domestic firms, the coefficient on the forward FDI declines in size as we include firms with greater foreign equity. This suggests that purely domestic firms in the downstream sectors benefit more from forward linkages compared to firms with partial or full foreign ownership, since multinationals likely already have access to cheaper inputs through their international supply networks.

4.2 Firm Characteristics

Next, we analyze the whether firms with different characteristics respond differently to foreign presence in the vertically and horizontally linked sectors. The first characteristic we consider is the size of the firm. We define a large firm dummy variable that takes on a value one if the firm is categorized as a large enterprize by the Korean Small and Medium Business Administration.[13] We then interact the large firm dummy variable with the three FDI measures. The coefficients on the main FDI variables capture the effect of foreign presence in horizontal and vertical industries on the investment decisions of small and medium firms, and the interaction terms provide the marginal effects for the large firms. The results in column (1) of Table 4 show a statistically significant difference for large firms with only the forward linkages measure. The negative and significant interaction between the large firm dummy and FDI_t^F together with the main coefficient on FDI_t^F imply that when foreign presence in the supplying sectors increase by 2 percentage points (one standard deviation), small to medium firms raise investment rate by 2.54 percentage points, where as large enterprizes increase it by 1.39 percentage points. This result conforms the findings in Keller and Yeaple (2009), who show that small firms' productivity increases more as a result of (horizontal) FDI spill-overs, since they have most to learn technologically. In the case for investment, large firms are reap the benefits of an increase in the multinational suppliers less, potentially because they already have access to cheaper inputs through their production networks. Similarly, large firms seem to be affected by less from an increase in horizontal FDI, although the coefficient on the interaction term with FDI_t^H is small and insignificant. By contrast, the interaction term with the backward linkage variable is positive, but also insignificant.

In the second column of Table 4, we analyze whether the presence of multinationals affects firms belonging to a chaebol, i.e., a conglomerate, differently. To that end, we define a chaebol dummy that takes on a value one if the firm is part of a conglomerate, and interact

[13]The Small and Medium Business Administration categorizes firms into two as large enterprizes and small and medium enterprizes. The classification is based on industry-specific sales cut-offs or total asset values. See the Appendix table for the specific criteria.

it with the three FDI measures. We find that the signs of the interaction terms are the same as the interaction terms for the large firm dummy.[14] However, in this specification the interaction term between the chaebol dummy and the backward linkage variable is positive and significant (at the 10 percent level). The coefficient on the interaction term implies an additional increase in the investment rate of 1.69 percentage points following a 2 percentage point increase in the foreign presence of firms in the downstream sectors if the supplier firm is part of a chaebol. Consequently, local suppliers that are part of a business conglomerate find it easier to serve multinational customers, and benefit more from the backward linkages.

In the last column, we consider the exporting status of the firm, which we define as the average exports to total sale ratio for each firm. We interact the average export ratio with the three FDI measures. Consistent with the results in the previous columns, the coefficient on the forward FDI is negative, and the coefficients on backward and horizontal FDI measures are positive, although only the coefficient on the forward FDI is significant. The coefficient of 1.279 on FDI_t^F implies that a 2 percentage point increase in the multinational suppliers will increase the investment rate of domestic firms who do not export by 2.56 percentage points. By contrast, a domestic firm that exports half of its output will increase investment rate by 1.81 percentage points. Despite being small, this difference resembles the findings in Javorcik (2004), and reflects the fact that exporting firms that are part of international production networks likely already have access to international suppliers, and therefore an increase in the presence of foreign suppliers affects them less.

4.3 Financial Constraints

Heterogeneity in the impact of FDI on investment can also depend on the financial constraints that the domestic firm faces. In their paper, Alfaro et al. (n.d.) suggest that external financing is necessary for local entrepreneurs to start supplying multinationals and to benefit from FDI through these backward linkages. Hence, domestic firms that are credit constrained may or may not be able to increase investment given a surge in the number of multinational customers, depending their ability to become suppliers. By contrast, FDI into the upstream industries (forward FDI) can have a larger impact on the financially constrained firms, since the marginal profitability of their capital would improve by more given the lower cost of inputs generated by the increase in the presence of multinational suppliers.

In order to test for these predictions, we first consider an industry-specific measure of external finance dependence provided by Braun (2003), and interact it with the FDI measures.

[14] The correlation between the chaebol dummy and the large firm dummy is 0.34.

The external finance dependence measure is constructed as the median value of the ratio of capital expenditures minus cash flow from operations to capital expenditures of firms in each 3-digit ISIC industry, and is based on the data for publicly listed U.S. companies.[15] Higher values of the external finance dependence measure suggest that the firms in the corresponding industry have less free cash flow, and need to issue debt or equity to finance their investments. Second, we consider publicly traded status of the firm. Since publicly traded firms can issue equity in the capital markets, they would be less financially constrained compared to non-public firms that rely only on debt-financing. Lastly, we interact cash-flow with the FDI measures, and analyze whether an increase in the presence of multinationals contributes to firm's investment by alleviating liquidity constraints.

Column (1) of Table 5 provides the results for the specification that includes the interaction terms between industry's external finance dependence measure and the three FDI measures. While the interaction term with the backward FDI is negative and significant, the interaction terms between the forward FDI and horizontal FDI are positive and significant. The negative coefficient on the interaction term with the backward FDI measure suggests that firms in more external finance dependent industries benefitted less from an increase in the multinational customers. Combined with the main effect backward FDI, the interaction term suggests that a firm in an industry with an external finance dependence measure equal to the mean (0.404), increases investment rate by 0.23 percentage points following a 2 percentage point increase in the presence of multinational customers. On the other hand, a firm in an industry with external finance dependence one standard deviation below the mean (0.404-0.332=0.072; see Table 1 for the descriptive statistics), increases investment by 1.10 percentage points following a similar increase in the presence of multinational customers. This finding conforms with the findings in Javorcik and Spatareanu (2009), who show that less liquidity constrained firms in the Czech Republic self-select into supplying multinationals, and thereby take better advantage of the benefits of FDI inflows. By contrast, the positive interaction term with the forward FDI measure suggests that firms in the more external finance dependent industries benefitted more from the increase in the presence of foreign suppliers. Specifically, the coefficient on the interaction term implies an additional investment rate of 0.93 percentage points for firms that are in industries with an external finance dependence one standard deviation above the mean (0.332), following a 2 percentage point increase in the presence of multinational suppliers. Similarly, we find that the impact of horizontal FDI is larger for firms in more external finance industries, although the marginal effect is small.

[15]The correspondence between the 3-digit ISIC industries and the Korean industry classification is available upon request.

Next, we consider the differential effects of FDI on publicly traded firms, who are less financially constrained, as they can raise equity in the capital markets. The results are reported in column (2) of Table 5. When we include interaction terms between a dummy variable, which takes on a value one for publicly traded firms and zero otherwise, with the three FDI measures, we obtain a statistically significant coefficient only on the interaction term with the forward FDI measure. The negative interaction term together with the coefficient on forward FDI suggest that whereas private firms raise investment by 2.48 percentage points following a 2 percentage point increase in the presence of multinational suppliers, public firms raise it by 1.64. Similar to the results in the previous specification with external finance dependence, this result highlights the importance of forward linkages in promoting investment by the private firms, who likely are more financially constrained than the public firms.

Finally, in the last column of Table 5, we analyze the role FDI in relaxing liquidity constraints and thereby in enhancing investment. To that end, along the same lines as Harrison et al. (2004) and Javorcik and Spatareanu (2009), we interact the FDI measures with the cash-flow variable. If FDI in vertically and horizontally integrated industries relaxes liquidity constraints, then we would expect it to lower the sensitivity of investment to cash-flow. Thus, we would expect the interaction terms to be negative. As expected, all three interaction terms are negative, although only the interaction terms with the forward FDI and horizontal FDI are statistically significant (at the 10 percent). The coefficient on the cash-flow and its interaction with forward FDI together imply that a domestic firm in an industry with no multinational suppliers (zero forward FDI) has an elasticity of investment to cash-flow equal to 0.51 at the mean values of investment and cash-flow. The elasticity goes down to 0.33 for a firm in an industry with forward FDI equal to the mean (0.034). Similarly, at 0.46, the elasticity is of investment with respect to cash-flow is lower for a firm in an industry with horizontal FDI equal to its mean (0.099). These findings suggest that an increase in the presence of multinational suppliers and an increase in the multinationals in the same industry as the domestic firm, lower the sensitivity of investment to cash-flow and therefore lead the firm to invest more by relaxing liquidity constraints.

5 Conclusion

In this paper, we provide evidence on the impact of FDI in vertically and horizontally linked industries on the domestic firms investment decisions. Using firm-level data on South Korea for the 2006-2014 period, we show that FDI increased investment rate of domestic

firms through all types of industry linkages. We also show that the largest gains were acquired as a result of the increase in foreign presence in the supplying sectors, i.e., forward linkages. In particular, we find that a 2 percentage point increase in the presence of multinational suppliers increases the domestic firm's investment rate by 2.29 percentage points, which corresponds to a 10.27 percent increase. We also find that this effect is larger for small and medium firms, private firms, non-exporters and for firms in external finance dependent industries. A similar 2 percentage point increase in the foreign presence in downstream sectors, increases the investment rate of domestic firms by 0.71 percentage points. This effect is larger if the domestic firm is part of a chaebol, or is in a less external finance dependent industry. The effect of a 2 percentage point increase in horizontal FDI is also positive, but smaller at 0.42 percentage points.

Assessing the costs and benefits of FDI for the local economic activity has become more important in an increasingly global economy, where the policies are shaped to attract foreign investors. Our work extends the literature that analyzes the how FDI in the vertically and horizontally linked industries affects the domestic economy. We provide the first set of estimates of the impact of FDI on domestic firms' investment decisions through backward and forward linkages. The evidence strongly suggests that FDI can help countries accumulate capital, especially by increasing the number of multinationals that supply inputs to the domestic firms.

6 Appendix: Taylor Expansion and Structural Parameters

The fully-parameterized non-linear investment equation we obtain when we substitute equation the partial derivatives of the adjustment cost function in equation (7), the marginal profitability of capital in equation (6) into the Euler equation in (3) is:

$$\gamma \frac{I_{it}}{K_{it-1}} = \beta E_t \left[\theta_1 \frac{x_{it+1} p_{it+1}}{\psi_i K_{it}} - \frac{w_{t+1} L_{it+1}}{K_{it}} + (1-\delta)\gamma \frac{I_{it+1}}{K_{it}} + \frac{\gamma}{2} \left(\frac{I_{t+1}}{K_t} \right)^2 \right], \tag{13}$$

where $\theta_1 = 1 - \delta + \left[(1-\delta)\gamma + \frac{\gamma}{2} \right] \frac{I}{K}$.

First we take a first-order Taylor approximation of the non-linear equation above around the steady state values of the variables. Second we define total sales as S_{it}=$x_{it+1} p_{it+1}$, and total costs as $Z_{it+1} = w_{t+1} L_{it+1}$. Rewriting the sales and the cost variables in terms of S_{it}, and Z_{it+1}, we obtain equation (8) in the text:

$$\frac{I_{it}}{K_{it-1}} = E_t \left[\phi_0 + \phi_1 \frac{I_{it+1}}{K_{it}} + \phi_2 \frac{S_{it+1}}{K_{it}} - \phi_3 \frac{Z_{it+1}}{K_{it}} \right]$$

The expressions for the coefficients in terms of the structural parameters and the steady-state values of the variables are:

$\phi_0 = \beta \frac{S}{\psi} - Z + (1-\delta) - \frac{1}{\beta}$

$\phi_1 = \beta \left[\frac{I}{K} + (1-\delta) \right]$

$\phi_2 = \frac{\beta}{\gamma \psi}$

$\phi_3 = \frac{\beta}{\gamma}$.

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Table 1: Descriptive Statistics

Variable	Min	Mean	Standard Dev.	Max
Investment rate $\frac{I_{ijt}}{K_{ijt-1}}$	-0.299	0.224	0.335	3.290
Sales $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.423	7.224	8.583	106.900
Cash-flow $\left(\frac{C_{ijt}}{K_{ijt-1}}\right)$	0.131	1.384	1.791	24.420
Forward FDI $\left(FDI_{jt}^{F}\right)$	0	0.034	0.023	0.219
Backward FDI $\left(FDI_{jt}^{B}\right)$	0	0.032	0.032	0.186
Horizontal FDI $\left(FDI_{jt}^{H}\right)$	0	0.099	0.076	0.548
Herfindahl index	0.010	0.076	0.078	0.871
Industry demand	0.000	12.210	13.250	60.660
Exports to total sales ratio (%)	0	13.430	25.060	100
Chaebol dummy	0	0.035	0.184	1
Large firm dummy	0	0.229	0.420	1
Publicly traded dummy	0	0.174	0.379	1
External finance dependence	-0.451	0.404	0.332	1.140

Table 2: FDI Measure Averages

Industry name	Backward FDI	Forward FDI	Horizontal FDI
Ship building	0.00	3.87	0.40
Telecommunication, video, and audio equipment	0.57	2.78	0.59
Leather product	0.28	2.34	1.11
Wood and wooden product	0.80	1.84	1.56
Chemical fiber	0.22	9.81	1.62
Iron and steel products	4.08	1.49	2.19
Printing and reproduction of recorded media	0.78	3.83	3.20
Fabricated metal products	7.14	3.18	3.89
Textile and apparel	2.32	1.85	4.11
Other non-metallic mineral product	0.51	4.10	4.80
Other manufacturing	3.31	3.59	5.16
Food	1.05	1.05	5.63
Fertilizer and pesticide	0.12	4.72	7.05
Electrical equipment	4.31	3.87	9.02
Motor vehicle	0.63	3.01	9.43
Electronic equipment	3.62	2.85	9.83
Pulp and paper product	3.27	2.16	10.20
Synthetic resin and rubber	8.19	16.95	10.49
Special machinery and equipment	3.15	3.41	11.40
Medicament	0.39	3.58	12.31
Tobacco product manufacturing	0.00	1.11	13.73
Household electrical appliance	0.04	4.88	13.74
General machinery and equipment	2.86	3.17	15.37
Beverage	0.03	3.60	15.63
Plastic product	8.32	6.85	16.72
Other transportation equipment	0.03	3.73	17.67
Non-ferrous metals	3.15	0.80	19.53
Other chemical product	3.21	7.36	19.56
Precision instrument	1.04	4.28	21.84
Rubber product	1.26	4.82	27.62
Computer and peripheral equipment	0.09	2.06	27.68
Basic chemical product	13.87	7.30	28.91
Petroleum and coal product	7.75	0.84	36.16
Glass product	1.80	2.36	45.02

Notes: This table show the average FDI values for each of the 2-digit industries as defined by Bank of Korea. The values are in percentages.

Table 3: Main Effects of FDI on Domestic Firms' Investment

Dependent Variable: $\frac{I_{ijt}}{K_{ijt-1}}$	(1)	(2)	(3)	(4)	(5)	(6)
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.106***	0.107***	0.107***	0.104***	0.111***	0.117***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Sales $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.008**	0.008**	0.008**	0.008**	0.007**	0.009***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Cash-flow $\left(\frac{C_{ijt}}{K_{ijt-1}}\right)$	0.032**	0.037***	0.037***	0.027*	0.037***	0.025**
	(0.013)	(0.013)	(0.013)	(0.016)	(0.011)	(0.011)
Forward FDI $\left(FDI^F_{jt}\right)$	0.563	0.990**	1.144**	1.218*	0.978**	0.801*
	(0.363)	(0.435)	(0.488)	(0.625)	(0.431)	(0.435)
Backward FDI $\left(FDI^B_{jt}\right)$	0.423***	0.664***	0.353**	0.542**	0.382***	0.312**
	(0.164)	(0.209)	(0.166)	(0.237)	(0.146)	(0.127)
Horizontal FDI $\left(FDI^H_{jt}\right)$	0.155**	0.216***	0.209***	0.280***	0.172***	0.164**
	(0.065)	(0.074)	(0.071)	(0.090)	(0.063)	(0.065)
Herfindahl index		0.789***	0.756***	0.708**	0.673***	0.575**
		(0.270)	(0.256)	(0.289)	(0.225)	(0.230)
Industry demand			0.001**	0.001	0.001	0.001
			(0.000)	(0.001)	(0.000)	(0.000)
Foreign equity percentage					-0.001**	-0.001***
					(0.000)	(0.000)
Observations	31,608	31,608	31,608	22,995	34,297	37,041
Number of firms	6,285	6,285	6,285	5,876	6,711	7,061
Hansen-Sargan test (p-value)	0.581	0.698	0.703	0.464	0.785	0.634
1st order serial corr. test (p-value)	0	0	0	0	0	0
2nd order serial corr. test (p-value)	0.473	0.495	0.502	0.0804	0.981	0.748

Notes: The estimates and standard errors are obtained from the two-step system GMM procedure are reported in parentheses. All firm-specific regressors are treated as endogenous. A set of year effects and industry-specific time trends are included in all specifications. The p-values for the Hansen over-identification test and the second order serial correlation tests are reported. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Lags 2 and 3 of the investment rate, sales and cash-flow are included as GMM-type instruments. All industry-level variables are included as IV-type instruments.

Table 4: Firm Characteristics

Dependent Variable: $\frac{I_{ijt}}{K_{ijt-1}}$	(1)	(2)	(3)
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.107***	0.107***	0.107***
	(0.008)	(0.008)	(0.008)
Sales $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.008**	0.008**	0.008**
	(0.003)	(0.003)	(0.003)
Cash-flow $\left(\frac{C_{ijt}}{K_{ijt-1}}\right)$	0.036***	0.036***	0.037***
	(0.013)	(0.013)	(0.013)
Forward FDI $\left(FDI^F_{jt}\right)$	1.268**	1.172**	1.279**
	(0.492)	(0.500)	(0.504)
Forward FDI*Large firm dummy $\left(FDI^F_{jt} * LF_i\right)$	-0.575***		
	(0.194)		
Forward FDI*Chaebol dummy $\left(FDI^F_{jt} * CH_i\right)$		-0.448	
		(0.277)	
Forward FDI*Average Exports $\left(FDI^F_{jt} * EX_i\right)$			-0.753**
			(0.300)
Backward FDI $\left(FDI^B_{jt}\right)$	0.316*	0.309*	0.317*
	(0.183)	(0.169)	(0.177)
Backward FDI*Large firm dummy $\left(FDI^B_{jt} * LF_i\right)$	0.171		
	(0.182)		
Backward FDI*Chaebol dummy $\left(FDI^B_{jt} * CH_i\right)$		0.844*	
		(0.481)	
Backward FDI*Average Exports $\left(FDI^B_{jt} * EX_i\right)$			0.266
			(0.318)
Horizontal FDI $\left(FDI^H_{jt}\right)$	0.213**	0.208***	0.186**
	(0.083)	(0.072)	(0.078)
Horizontal FDI*Large firm dummy $\left(FDI^H_{jt} * LF_i\right)$	-0.038		
	(0.077)		
Horizontal FDI*Chaebol dummy $\left(FDI^H_{jt} * CH_i\right)$		-0.065	
		(0.109)	
Horizontal FDI*Average Exports $\left(FDI^H_{jt} * EX_i\right)$			0.108
			(0.094)
Herfindahl index	0.743***	0.752***	0.755***
	(0.252)	(0.256)	(0.256)
Industry demand	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)
Observations	31,608	31,608	31,608
Number of firm	6,285	6,285	6,285
Hansen-Sargan test (p-value)	0.701	0.705	0.702
1st order serial corr. test (p-value)	0	0	0
2nd order serial corr. test (p-value)	0.507	0.503	0.504

Notes: See Tale 3 for notes.

Table 5: Financial Constraints

Dependent Variable: $\frac{I_{ijt}}{K_{ijt-1}}$	(1)	(2)	(3)
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.107***	0.107***	0.105***
	(0.008)	(0.008)	(0.008)
Sales $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.008**	0.008**	0.010***
	(0.003)	(0.003)	(0.004)
Cash-flow $\left(\frac{C_{ijt}}{K_{ijt-1}}\right)$	0.037***	0.037***	0.083***
	(0.013)	(0.013)	(0.027)
Forward FDI $\left(FDI^F_{jt}\right)$	0.804*	1.240**	1.658**
	(0.416)	(0.490)	(0.675)
Forward FDI*External Finance Dependence $\left(FDI^F_{jt} * EFD_j\right)$	1.397**		
	(0.550)		
Forward FDI*Public dummy $\left(FDI^F_{jt} * P_i\right)$		-0.421**	
		(0.200)	
Forward FDI*Cash flow $\left(FDI^F_{jt} * \frac{C_{ijt}}{K_{ijt-1}}\right)$			-0.860*
			(0.481)
Backward FDI $\left(FDI^B_{jt}\right)$	0.643***	0.364**	0.525**
	(0.217)	(0.174)	(0.254)
Backward FDI*External Finance Dependence $\left(FDI^B_{jt} * EFD_j\right)$	-1.305***		
	(0.469)		
Backward FDI*Public dummy $\left(FDI^B_{jt} * P_i\right)$		-0.142	
		(0.213)	
Backward FDI*Cash flow $\left(FDI^B_{jt} * \frac{C_{ijt}}{K_{ijt-1}}\right)$			-0.372
			(0.258)
Horizontal FDI $\left(FDI^H_{jt}\right)$	0.091	0.200***	0.305***
	(0.067)	(0.076)	(0.097)
Horizontal FDI*External Finance Dependence $\left(FDI^H_{jt} * EFD_j\right)$	0.231**		
	(0.110)		
Horizontal FDI*Public dummy $\left(FDI^H_{jt} * P_i\right)$		0.031	
		(0.077)	
Horizontal FDI*Cash flow $\left(FDI^H_{jt} * \frac{C_{ijt}}{K_{ijt-1}}\right)$			-0.094*
			(0.055)
Herfindahl index	0.739***	0.767***	0.414*
	(0.249)	(0.254)	(0.235)
Industry demand	0.001**	0.001**	0.001*
	(0.001)	(0.000)	(0.000)
Observations	31,608	31,608	31,608
Number of firms	6,285	6,285	6,285
Hansen-Sargan test (p-value)	0.724	0.716	0.248
1st order serial corr. test (p-value)	0	0	0
2nd order serial corr. test (p-value)	0.494	0.499	0.473

Notes: See Tale 3 for notes.