

ESSAYS ON INVESTMENT AND EXPORTS OF MULTINATIONAL FIRMS IN
SOUTH KOREA

by

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To my family

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SOUTH KOREA

by

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This dissertation consists of three essays on investment and exports of multinational firms in South Korea. The first chapter examines firm-level evidence that banking crises in source countries affect investment decisions of foreign multinationals. Using firm-level data on annual financial statements with information on banking crises and foreign-owned companies in South Korea from 1994 to 2013, I find that an increase in foreign shareholding decreases the investment rate of foreign multinationals during banking crises in source countries. Firm characteristics and financial vulnerabilities alter the impact of the banking crisis on investment decision of foreign multinationals. In the case of non-chaebol, non-exporter firms, or less financially sensitive industries, there exists an inverse relationship between foreign shareholding and the investment rate of foreign-owned firms during banking crises, but the rest of the firms suffer no effects from banking crises in source countries, concerning the investment behavior of foreign multinationals.

The second chapter shows the effect of foreign direct investment (FDI) on exports of foreign multinationals during banking crises in source countries. Using a firm-level dataset on firms' annual amount of exports with the banking crises database in South Korea during the 1994-2013 period, I present that banking crises in source countries hinder FDI from increasing exports of foreign affiliates in more financially vulnerable industries. More than 50 percent

of foreign shareholding promotes the amount of foreign affiliates' exports in more financially vulnerable industries, but during banking crises in source countries, it is hard for foreign multinationals with even more than 50 percent of foreign shareholding to increase exports in more financially dependent industries. I also find that firm characteristics affect foreign multinationals' exports during banking crises in source countries. FDI increases the amount of chaebol exporters' exports relatively more than non-chaebol foreign multinationals in more financially vulnerable industries. Chaebol exporters with more than 10 percent of foreign shareholding export more than non-chaebol exporters in more financially dependent industries. During banking crises in source countries, chaebol exporters with more than 10 percent of foreign shareholding export less than non-chaebol exporters in more financially dependent industries. By contrast, publicly listed foreign multinational exporters export more than non-public foreign multinational exporters in less financially dependent industries, but during banking crises in source countries, publicly-listed foreign multinational exporters export more than non-public foreign multinational exporters in more financially dependent industries.

The last chapter with Dr. Asli Leblebicioğlu analyzes the effects of foreign multinationals' presence on domestic firms' investment. For this analysis, we combine a South Korean firm-level dataset for the 2006–2014 period 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 the 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 firm's investment rate by 3.24 percentage points. We also find that this effect is larger for small and medium firms, private firms, non-exporters, firms that are

not part of a chaebol, 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 0.55 percentage points. This effect is larger if the domestic firm is part of a chaebol, or is in a less external finance dependent industry. Investment increases by 0.53 percentage points following a 2 percentage point increase in horizontal linkages.

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CHAPTER 1

CRISIS, FDI, AND INVESTMENT: THE IMPACT OF FDI ON THE INVESTMENT OF FOREIGN-OWNED COMPANIES DURING BANKING CRISES IN SOURCE COUNTRIES

1.1 Introduction

Generally, foreign-owned companies face less credit constraints because they can be provided equity from a foreign parent company (Harrison and McMillan (2003)). During a global crisis, local companies with no foreign direct investment (FDI) face severe credit constraints during the global crisis, whereas, in the case of multinational subsidiaries with FDI, the liquidity constraint is reduced (Tong and Wei (2011)). Desai et al. (2007) find that the companies which are acquired by foreign companies increase sales, assets, and investment caused by currency depreciations, but domestic companies increase little, or they decrease sales, assets, and investment during the currency crisis. They argue that, in the case of multinational subsidiaries, foreign equity is supplied from a foreign parent company during the crisis, and this is the main role of foreign direct investment in the developing countries. On the other hand, local companies do not have additional sources to mitigate financial constraints, so they cannot expand economic activity at severe currency depreciation. Blalock et al. (2005) analyze the impact of financial crisis on investment for domestic and foreign owned firms in Indonesia, and find that not domestic exporters, but foreign-owned exporters only, increase investment during the Asian crisis between 1997 and 1998. Moreover, in Alfaro and Chen (2012), the authors examine the effect of the global financial crisis between 2007 and 2009 on the annual percentage point increase in sales of foreign-owned establishments.

Almost all previous literature focuses on the role of global crises or the crises in host countries that receive FDI from other countries. However, just a few papers investigate the role of the source country's financial crises. That is, there barely exists any examine how the

financial crisis in the source country involves in the performance of foreign-owned company. This chapter uses information about source country's banking crisis to distinguish between the specific external shock from the source country and the common external shock from the global financial crisis, and analyzes the effects of banking crisis in the source country on investment of foreign multinationals. These are the main contributions of this chapter.

For this analysis, I use firm level dataset on financial statements of companies in South Korea from 1994 to 2013. This dataset includes information not only on all companies publicly listed but also on some private companies that external audit of financial statements is required by the Law.¹ In order to construct a dummy variable for source country's banking crisis, I use the banking crises database from Valencia et al. (2012). For information about foreign-owned companies, I use the data on the list of foreign multinationals from Ministry of Trade, Industry and Energy in South Korea. For empirical analysis, I use the system-GMM estimator suggested by Arellano and Bover (1995) and Blundell and Bond (1998) in order to estimate the dynamic investment equations with foreign ownership and the crises in source countries. In addition, an increase in foreign shareholding decreases the investment rate of foreign multinationals during the banking crises in source countries. During the banking crises in source countries, a ten percent point increase in foreign shareholding decreases foreign multinationals investment rate by about 1.56 percentage points, and in the case of full foreign ownership, the banking crisis in source country reduce the investment rate by 4.7 percent. That is, companies in which foreign shareholding exceeds by about 70 percent have negative effects of the banking crisis in source countries on the investment decision of the foreign multinationals.

¹According to the Act of External Audit of Joint-Stock Corporations revised on September 3rd 2014, the following firms are required to publish audited financial statements to the Financial Supervisory Commission: (a) public firms; (b) private firms with assets more than or equal to 12 billion Korean Won; (c) private firms with assets and total liabilities more than or equal to 7 billion Korean Won, respectively; or (d) private firms with assets are more than or equal to 7 billion Korean Won and employees more than or equal to 300.

Next, to find whether firm characteristics or financial vulnerabilities alter the impact of the banking crisis on investment decision of foreign multinationals, I split the sample into two groups with various criteria and estimate the baseline specification for each subsample, respectively. In the case of non-chaebol, non-exporter firms, or less financially sensitive industries (more asset tangibility and/or more trade credits), there exists an inverse relationship between foreign shareholding and investment rate of foreign-owned firms during banking crises. On the contrary, firms that belong to chaebols, export firms, or more financially sensitive industries (less asset tangibility and/or less trade credits) suffer no effects from banking crises in source countries, concerning the investment behavior of foreign multinationals.

I organize the rest of this chapter as follows. In the next section, the empirical model is presented. In section 1.3, I describe the firm-level data. In section 1.4, I present the empirical results. The last section concludes.

1.2 Empirical Model and Hypotheses

According to the previous literature, domestic companies without any foreign capital face liquidity constraint during the financial crisis (Tong and Wei (2011)), but companies with foreign ownership reduce the liquidity constraint and increase investment during crisis periods (Blalock et al. (2005), Desai et al. (2007) and Tong and Wei (2011)) because they are provided liquidity from foreign parent companies which can have greater access to outside funding (Aguilar and Gopinath (2005) and Harrison and McMillan (2003)). These mean that the financial crises can affect firms' liquidity constraints negatively, but FDI can affect them positively. Then, if the financial crisis occurred in foreign country where foreign companies which invest capital in local companies with foreign ownership are located, then these foreign companies would face liquidity constraint, so it is expected to have a negative effect on the investment behavior of foreign affiliates. However, if a foreign company has a low stake, then the negative impact could be smaller or ignored.

In order to identify whether the banking crisis in the source country affects investment behavior of foreign multinationals, I estimate the following dynamic investment equation:

$$\frac{I_{ijt}}{K_{ijt-1}} = \beta_1 \frac{I_{ijt-1}}{K_{ijt-2}} + \beta_2 \frac{S_{ijt}}{K_{ijt-1}} + \beta_3 \frac{CF_{ijt}}{K_{ijt-1}} + \beta_4 BC_{jt} + \beta_5 FDI_{ijt} + \beta_6 BC_{jt} \times FDI_{ijt} \quad (1.1)$$

$$+ v_i + \nu_t + \tau_{jt} + \varepsilon_{ijt},$$

where $\frac{I_{ijt}}{K_{ijt-1}}$ is investment rate for firm i , the source country j from which foreign direct investments are made, in year t , to control for the autocorrelation that may arise because of adjustment costs in investment; $\frac{S_{ijt}}{K_{ijt-1}}$ is the firm's sales revenue to control for marginal profitability of capital; and $\frac{CF_{ijt}}{K_{ijt-1}}$ is the firm's cash flows from operating activities as a proxy for financial constraints.² These variables are normalized by their real capital stock to control for the firm's size. BC_{jt} is a dummy variable, equal to one, if the source country j is in the banking crisis in year t , and FDI_{ijt} is company i 's percentage of foreign shareholding invested by the parent company in the source country j in year t . In addition, firm fixed effects and common time effects are included in the model to capture the firm-specific time-invariant effects on firm's investment and macroeconomic fluctuations which affect each firm. Country specific time trends (τ_{jt}), interaction terms between a linear time trend and source country dummies, are included in the model because firms with foreign direct investments from the same source country could be affected by the same productivity trends each year.

The coefficient on FDI_{ijt} , β_5 , means the effect of FDI on the investment behavior of foreign multinationals. Thus this coefficient is expected to be positive. The coefficients on BC_{jt} and the interaction term between BC_{jt} and FDI_{ijt} , β_4 and β_6 , present the impact of the FDI on investment behavior during the banking crises in source countries. The banking crises in source countries affect parent companies' liquidity constraints and the investment

²The firm's sales revenue and the cash flows from the operating activities are used by Fazzari et al. (1988).

of foreign multinationals negatively. However, the negative impact of the banking crises in source countries can be minimized or ignored if the percentage of foreign shareholding of domestic company is low. Hence, β_4 is expected to be positive and β_6 is expected to be negative.

In order to estimate the above baseline specification, the system-GMM estimator by Arellano and Bover (1995) and Blundell and Bond (1998) is used. The biases from the correlation between the lagged dependent variable and the firm fixed effects, v_t , can be removed by the estimator. To do so, the lagged values of dependent and explanatory variables dated $t - 2$ and $t - 3$ are used as the GMM-type instruments.

1.3 Data

The main data used in this chapter is a South Korean firm-level panel data set for the years 1994 to 2013 provided by Korea Information Service, Inc.(KIS).³ This data set contains detailed financial data based on annual financial statements of both all publicly-listed and some private firms.⁴

This data set includes all information to construct variables included in the estimating equation such as investment rate ($\frac{I_{ijt}}{K_{ijt-1}}$), sales revenue ($\frac{S_{ijk}}{K_{ijk-1}}$), and cash flows from operating activities ($\frac{CF_{ijk}}{K_{ijt-1}}$). In order to construct real capital stock (K_{ijt-1}) and real investment (I_{ijt}), I follow the measure from Kim et al. (2015).⁵ The real capital stock is constructed $K_t = (1 - \delta)K_{t-1} + I_t$, where I_t is real investment and δ is depreciation rate, assumed to be 6.11 percent, an average depreciation rate of building, machinery, structure, and vehicle in

³This data set includes information from balance sheet, statement of income, and statement of cash flows. Among them, statement of cash flow has been required to be published by Generally Accepted Accounting Principles in South Korea since 1994. Thus, this data set covers the 1994-2013 periods.

⁴See footnote 1. KIS compiles those data.

⁵In order to construct the real investment, Kim et al. (2015) followed Bayraktar et al. (2005).

South Korea. The real investment is the nominal investment deflated by the capital goods price index provided by the Bank of Korea. The nominal investment is constructed by the sum of change in the book value of capital, calculated by subtracting land and lease assets from tangible assets, and depreciation for tangible assets which is included in statement of cash flows. In addition, this data set also includes other information such as amounts of exports, proportion of export, the Korean Standard Industrial Classification (KSIC) Code, and names of largest stockholders and percentage of shareholding of each firm.

Next, to construct the dummy variable for source country's banking crisis, I combine the banking crises database from Valencia et al. (2012) with the main panel data set. This data set includes the period of a banking crisis in each country from 1970 to 2011. In addition, I use the data on the list of foreign multinationals from the Ministry of Trade, Industry and Energy in South Korea. From this data set, I get the name of source country where the parent firm is located and the registration date when a firm first becomes foreign-owned. According to the law, firms with foreign ownership less than 10 percent can be considered foreign-owned firms.⁶

In addition, if investment rate, sales revenue, or cash flows from operating activities in the combined data set are distributed to the top or lower 1 percent, I exclude these observations from the data set to remove outliers. Finally, the data set includes 13,115 firms for the years 1994 to 2013. The summary statistics is presented in Table 1.1. In addition, Table ?? and Table 1.3 show the periods of source countries' banking crises and the list of source countries.

⁶According to the Enforcement Decree of the Foreign Investment Promotion Act revised on July 28th, 2016, a foreign-capital invested company shall file for registration as a foreign-capital invested company. A foreign-capital invested company needs to meet the following requirements: (a) the amount of investment shall be at least 100 million Korean Won; and (b) a foreigner shall own at least 10/100 of either the total number of voting stocks or the total equity investment. In the case of a business which fails to meet the requirements of the main sentence of this paragraph due to partial transfer of stocks or shares or capital reduction, etc. after it has been registered as a foreign capital invested company, it shall be also deemed a foreign investment.

Table 1.1. Summary Statistics

Variable	Min	Mean	Std. Dev.	Max
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	-0.454	0.286	0.509	6.142
Sales revenue $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.172	22.167	68.040	1221.392
Cash-flow $\left(\frac{CF_{ijt}}{K_{ijt-1}}\right)$	-49.718	0.674	4.869	80.648
Banking crisis dummy (BC_{jt})	0	0.031	0.174	1
Foreign shareholding (FDI_{ijt})	0	0.074	0.238	1
Chaebol dummy	0	0.058	0.235	1
Export firm dummy	0	0.186	0.389	1
Asset tangibility	0.036	0.293	0.306	4.556
Trade credit	-0.154	0.115	0.088	1.461

Note: The above table presents the summary statistics for the 106,740 observations from 13,115 firms used in the estimations.

Table 1.2. Periods of Source Countries' Banking Crises

Country	Period	Country	Period
Japan	1997-2001	Denmark	2008-2011
U.S.A.	2007-2011	Spain	2008-2011
Netherlands	2008-2011	Finland	1993-1995
Germany	2008-2011	Hungary	1993-1995, 2008-2011
U.K.	2007-2011	Ireland	2008-2011
France	2008-2011	Italy	2008-2011
Switzerland	2008-2011	Luxemburg	2008-2011
Malaysia	1997-1999	Portugal	2008-2011
Austria	2008-2011	Slovenia	2008-2011
Belgium	2008-2011	Sweden	1993-1995, 2008-2011

Source: Valencia et al. (2012)

Table 1.3. List of Source Countries

Country	All firms	Chaebol	Export firms	Banking crisis
Japan	5,840 (40.69%)	426 (44.89%)	1,031 (47.25%)	808 (24.46%)
U.S.A.	2,498 (17.40%)	115 (12.12%)	300 (13.75%)	1,039 (31.45%)
Netherlands	1,023 (7.13%)	101 (10.64%)	71 (3.25%)	344 (10.41%)
Germany	984 (6.86%)	21 (2.21%)	51 (2.34%)	325 (9.84%)
U.K.	532 (3.71%)	32 (3.37%)	87 (3.99%)	193 (5.84%)
France	518 (3.61%)	29 (3.06%)	61 (2.80%)	178 (5.39%)
Switzerland	428 (2.98%)	40 (4.22%)	38 (1.74%)	132 (4.00%)
Singapore	407 (2.84%)	5 (0.52%)	47 (2.15%)	0 (0%)
Cayman Islands	214 (1.49%)	15 (1.58%)	88 (4.03%)	0 (0%)
Malaysia	204 (1.42%)	12 (1.26%)	56 (2.57%)	9 (0.27%)
Hong Kong	197 (1.37%)	5 (0.52%)	41 (1.88%)	0 (0%)
Sweden	137 (0.95%)	12 (1.26%)	25 (1.15%)	52 (1.57%)
China	106 (0.74%)	5 (0.52%)	16 (0.73%)	0 (0%)
Belgium	98 (0.68%)	16 (1.69%)	9 (0.41%)	27 (0.82%)
Luxemburg	94 (0.65%)	10 (1.05%)	7 (0.32%)	34 (1.03%)
Italy	82 (0.57%)	0 (0%)	20 (0.92%)	38 (1.15%)
Denmark	77 (0.54%)	6 (0.63%)	5 (0.23%)	23 (0.70%)
Ireland	60 (0.42%)	10 (1.05%)	28 (1.28%)	37 (1.12%)
Austria	46 (0.32%)	0 (0%)	0 (0%)	18 (0.54%)
Spain	35 (0.24%)	0 (0%)	2 (0.09%)	24 (0.73%)
Finland	25 (0.17%)	2 (0.21%)	1 (0.05%)	1 (0.03%)
Hungary	22 (0.15%)	15 (1.58%)	7 (0.32%)	7 (0.21%)
Portugal	18 (0.13%)	6 (0.63%)	9 (0.41%)	11 (0.33%)
Slovenia	12 (0.08%)	0 (0%)	0 (0%)	4 (0.12%)
Etc.	696 (4.85%)	66 (6.95%)	182 (8.34%)	0 (0%)
Total	14,353 (100%)	949 (100%)	2,182 (100%)	3,304 (100%)

Sources: Korea Information Service, Inc., Valencia et al. (2012), and the Ministry of Trade, Industry and Energy in South Korea

1.4 Results

1.4.1 The Main Effect of Banking Crises in Source Countries on the Investment of Foreign Multinationals

Table 1.4 shows the results from the baseline specification (equation (1.1)) for investment decisions of foreign multinationals. In column (1) of Table 1.4, the coefficient on the lagged dependent variable is positive (0.110) and statistically significant at the 1 percent level. That is, the previous investment rate of firms has a positive effect on the current investment decisions of firms. The coefficient on sales revenue is also positive (0.001) and statistically significant. It implies that the increase in the marginal profitability of capital increases the investment rate of firms. Moreover, the coefficient on cash flows from operating activities is positive (0.011) and statistically significant at the 10 percent level. The coefficient on banking crises in source countries is positive (0.024) statistically significant as expected. In addition, the coefficient on foreign shareholding of foreign multinationals is positive (0.026) as expected because firms with foreign ownership are less credit constrained. However, this is not statistically significant.

In column (2), the interaction term between the banking crisis and foreign shareholding is included. The coefficient on foreign shareholding (0.009) is still statistically insignificant, but the coefficients on the banking crisis and the interaction term between the banking crisis and foreign shareholding are 0.109 and -0.156, respectively, and statistically significant at the 10 percent level. According to the two coefficients, foreign multinationals with 10 percent foreign shareholding increase their investment rate by 9.3 percent during the banking crisis in source country, and in the case of full foreign ownership, the banking crises in source countries reduce the investment rate by 4.7 percent. In addition, companies in which foreign shareholding exceeds by about 70 percent have negative effects of the banking crises in source countries on the investment decision of the foreign multinationals. That is, in the case of

Table 1.4. Baseline Results

Dep. Var.: Investment rate $\left(\frac{I_{ijt}}{K_{ijt-1}}\right)$	(1)	(2)	(3)	(4)
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.110*** (0.007)	0.109*** (0.007)	0.107*** (0.008)	0.107*** (0.007)
Sales revenue $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.001** (0.000)	0.001** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Cash-flow $\left(\frac{CF_{ijt}}{K_{ijt-1}}\right)$	0.011* (0.006)	0.011** (0.007)	0.015** (0.007)	0.011* (0.006)
Banking crisis dummy (BC_{jt})	0.024** (0.012)	0.109* (0.056)	0.034*** (0.012)	0.106* (0.060)
Foreign shareholding (FDI_{ijt})	0.026 (0.142)	0.009 (0.084)	0.009 (0.070)	0.006 (0.065)
Banking crisis dummy \times Foreign shareholding ($BC_{jt} \times FDI_{ijt}$)		-0.156* (0.091)		-0.145 (0.099)
Lagged investment rate \times Asian crisis dummy $\left(\frac{I_{ijt-1}}{K_{ijt-2}} \times AC_{jt}\right)$			0.004 (0.023)	0.007 (0.024)
Sales revenue \times Asian crisis dummy $\left(\frac{S_{ijt}}{K_{ijt-1}} \times AC_{jt}\right)$			0.000 (0.000)	0.000 (0.000)
Cash-flow \times Asian crisis dummy $\left(\frac{CF_{ijt}}{K_{ijt-1}} \times AC_{jt}\right)$			-0.028** (0.013)	-0.026*** (0.010)
Banking crisis dummy \times Asian crisis dummy ($BC_{jt} \times AC_{jt}$)			-0.071*** (0.027)	-0.138** (0.070)
Foreign shareholding \times Asian crisis dummy ($FDI_{ijt} \times AC_{jt}$)			0.018 (0.073)	0.041 (0.063)
Banking crisis \times Foreign shareholding \times Asian crisis ($BC_{jt} \times FDI_{ijt} \times AC_{jt}$)				0.130 (0.153)
Observations	106,740	106,740	106,740	106,740
Number of firms	13,115	13,115	13,115	13,115
Hansen-Sargan test (p-value)	0.518	0.264	0.540	0.601
1st-order serial correlation test (p-value)	0	0	0	0
2nd-order serial correlation test (p-value)	0.321	0.322	0.461	0.521

Note: The empirical model is based on equation 1.1. The estimation is by the two-step system GMM procedure with firm fixed effects, common time effects, and country specific time trends. GMM-type instruments are the second and the third lags of investment rate, sales revenue, cash flows from operating activities, foreign shareholding, and the interaction term between foreign shareholding and banking crisis. The rest variables are IV-type instruments. Clustered standard errors at the source country-year level in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

companies with low inward FDI, FDI can alleviate negative impact of banking crisis in source countries because FDI relaxes credit constraints of firms, but in the case of companies with high inward FDI, financial dependence on parent firms in source countries aggravates those companies' investment behavior during banking crises in source countries.

Columns (3) and (4) show the results in order to consider the 1997-1998 Asian crisis. According to the dataset from Valencia et al. (2012), the banking crisis occurred in South Korea between 1997 and 1998. This crisis was caused by Asian crisis and might have affected investment decision of both foreign multinationals and domestic firms in South Korea negatively. Thus, to see this influence, I define the Asian crisis dummy, equal to one, if the year is 1997 or 1998, and add the interaction terms between all explanatory variables in the previous columns and the Asian crisis dummy variable to the baseline specification.

In these Columns, the coefficient on the interaction term between the cash flows from operating activities and the Asian crisis dummy is negative and statistically significant. That is, during the Asian crisis the coefficient on the cash flows from operating activities becomes negative. It means that firms faced harsh shortfall of cash flows, but they could not decrease essential investments. Thus, investment-cash flows sensitivity might be negative during the Asian crisis, and this can be explained by the results.⁷ In addition, the coefficient on the interaction term between the banking crisis dummy and the Asian crisis dummy is also negative and statistically significant. It means that during the Asian crisis the coefficient on the banking crisis dummy also becomes negative. In other words, in the case of companies with not only high inward FDI, but also low inward FDI, FDI cannot reduce negative effects of banking crises in source countries during the Asian crisis.

⁷refer to the following previous literature: Allayannis and Mozumdar (2004), Kaplan and Zingales (1997), and Cleary et al. (2007)

1.4.2 Firm Characteristics

Table 1.5 presents the effects of banking crises in source countries on the investment decision of foreign multinationals with different firm characteristics. First, I define a chaebol dummy, which takes the value one, if the firm is an affiliate of a conglomerate.⁸ According to previous literature, the advantage of affiliates that belong to chaebols is that it is easier for them to access sources of financing than non-chaebol firms (Lee et al. (2000), Borensztein and Lee (2002), and Min (2007)). Thus, the external shock such as banking crisis from the source country may have a less influence on affiliates of chaebols. In order to confirm it, I split the sample into firms that belong to chaebols and firms that does not belong to chaebols, and estimate the baseline specification for these subsamples, respectively. From 1994 to 2013, for affiliates of chaebols, column (1) shows that the coefficients on the banking crisis and the interaction term between banking crisis and foreign shareholding is 0.067 and -0.119, respectively, but statistically insignificant. They imply that becoming foreign multinationals and/or change in foreign shareholding do not affect the investment behavior of subsidiaries of chaebols when the banking crisis occurred in the source country. That is, there is a rare advantage of foreign multinationals during a banking crisis if those companies belong to a chaebol. Thus, these results support that financial dependence on parent company in source countries rarely affects the investment decision of chaebols' subsidiaries due to chaebols' better access to financing.

In comparison, column (2) presents the results of non-chaebol companies. Both coefficients, statistically significant, mean that foreign multinationals with 10 percent foreign shareholding that do not belong to chaebols increase their investment rate by 9.2 percent

⁸According to Law for limit of assurance, chaebol is the conglomerate whose summation of total assets is more than 5 trillion Korean Won. Each affiliate that belongs to a chaebol cannot acquire or hold any stock of another affiliate which belongs to the same chaebol. The list of chaebol is announced by the Korea Fair Trade Commission on April 1st annually. In 2016, there exist 65 chaebols and 1,741 affiliates belong to 65 chaebols.

Table 1.5. Firm Characteristics

Dependent Variable:	(1)	(2)	(3)	(4)
Investment rate $\left(\frac{I_{ijt}}{K_{ijt-1}}\right)$	Chaebol	Non-chaebol	Exporter	Non-exporter
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.149** (0.070)	0.105*** (0.007)	0.115*** (0.013)	0.092*** (0.008)
Sales revenue $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.000 (0.000)	0.001** (0.000)	0.001** (0.000)	0.001*** (0.000)
Cash-flow $\left(\frac{CF_{ijt}}{K_{ijt-1}}\right)$	0.008 (0.005)	0.002 (0.006)	-0.003 (0.011)	0.004 (0.005)
Banking crisis dummy (BC_{jt})	0.067 (0.095)	0.108* (0.058)	0.031 (0.042)	0.152* (0.082)
Foreign shareholding (FDI_{ijt})	0.026 (0.184)	0.002 (0.085)	0.097 (0.100)	0.018 (0.085)
Banking crisis dummy \times Foreigng shareholding ($BC_{jt} \times FDI_{ijt}$)	-0.119 (0.268)	-0.162* (0.089)	-0.100 (0.138)	-0.220* (0.124)
Observations	6,872	104,189	19,271	84,186
Number of firms	668	12,987	2,801	12,530
Hansen-Sargan test (p-value)	0.719	0.226	0.535	0.514
1st-order serial correlation test (p-value)	5.33e-09	0	0	0
2nd-order serial correlation test (p-value)	0.848	0.403	0.924	0.831

Note: See note below the Table 1.4

during the banking crises in source countries. They also mean that additional ten percent point increase in foreign shareholding decreases investment rate of foreign-owned companies not belong to chaebols by about 1.62 percentage points during source country's banking crisis, and non-chaebol companies in which foreign shareholding exceeds by about 67 percent have negative effects of the banking crisis in source countries on the investment decision of the foreign multinationals.

Next, I define an exporter dummy, which takes the value one, if the amount of export of the firm is more than zero. Export firms can have easy access to financing markets for

international transactions because they need more upfront expenses and more periods for cross-border shipping and delivery than domestic firms. Thus, export firms seem to be less affected by the external shock such as banking crisis from the source country. In order to confirm it, the sample is split into exporters and non-exporters, and the baseline specification is estimated for these subsamples from 1994 to 2013, respectively.

Column (3) shows the result of exporters. The coefficients on banking crisis and the interaction term between banking crisis and foreign shareholding is 0.031 and -0.100, respectively, but statistically insignificant. The empirical results suggest that banking crisis in source countries does not affect foreign-owned exporters' investment behavior, and change in foreign shareholding of exporters have no effect on their investment behavior when banking crisis occurred in source country.

The results of non-exporters are in column (4). The coefficient on banking crisis and the interaction term of non-exporters are 0.152 and -0.220, respectively, and statistically significant at the 10 percent level. These means that non-exporters in which foreign shareholding exceeds by about 69 percent have negative effects of the banking crisis in source countries on investment decision. Thus, the results support that financial dependence on parent company in source countries affects less the exporters' investment decision because of their better access to financing markets for international transactions.

1.4.3 Financial Constraints

According to Desai et al. (2004) and Harrison and McMillan (2003), foreign multinationals can rely on domestic finance in their operations less than domestic firms. Thus, financial crisis affects firms' behavior differently depending on the needs of domestic finance. To investigate it, I use the measures about the industry-level financial vulnerability, close to the methods calculated by Rajan and Zingales (1998), Claessens and Laeven (2003) and Fisman and Love (2003). The first one is external finance dependence, defined as the fraction of

total capital expenditure not financed by internal cash flows from operations. This measure reflects each firm's requirements for outside capital. If firms or industries depend on external capital for long-term investment projects, then it means that they have a high level of external finance dependence, and therefore they are more financially vulnerable than companies or industries with less level of external finance dependence.

The next one is asset tangibility, proxy for collateral to raise finance, defined as net property, plant and equipment divided by book value of assets. This measure indicates that the asset structure optimized for production is different from sector to sector. For industries with a large portion of tangible assets, each company which belongs to these industries can utilize a large amount of collateral and has better ability to gain capital than other companies which does not belong to these industries.

The last measure is trade credit intensity, proxy for access to alternative financial market, computed as the ratio of the change in accounts payable over the change in total assets. This measure distinguishes between the external capital from the formal financial market and from the alternative financial market. If a company can have more trade credit, then it can reduce reliance on the formal financial market. Thus, industries with more trade credit intensity are less financially vulnerable than industries with less trade credit intensity. These measures are based on a South Korean firm-level panel data set for the years 2001 to 2005 provided by KIS. Table 1.6 lists the measures of financial vulnerability in each industry.

In addition, I split the sample into firms that belong to the industry with relatively greater external finance dependence, asset tangibility, or trade credit intensity than the median value of industry level external finance dependence, asset tangibility, or trade credit intensity and firms that belong to industry with relatively less external finance dependence, asset tangibility, or trade credit intensity than the median value of industry level external finance dependence, asset tangibility, or trade credit intensity, respectively. Table 1.7 shows the empirical results about financial constraints.

Table 1.6. Industry Level Financial Vulnerability

KSIC9	Industry	External Finance Dependence	Asset Tangibility	Trade Credit Intensity
01	Agriculture	2.019	0.989	0.086
03	Fishing	0.557	0.310	-0.063
06	Mining of metal ores	0.189	0.266	0.055
07	Mining of non-metallic minerals; except fuel	0.079	0.537	-0.019
10	Food products	-0.202	0.278	0.062
11	Beverages	0.209	0.234	0.030
12	Tobacco products	-3.651	0.216	0.007
13	Textiles, except apparel	0.203	0.297	0.091
14	Wearing apparel, clothing accessories and fur articles	-0.116	0.188	0.082
15	Luggage and footwear	1.021	0.308	0.081
16	Wood and cork; except furniture	0.736	0.624	-0.030
17	Pulp, paper and paper products	-0.174	0.330	0.031
18	Printing and reproduction of recorded media	0.393	0.113	0.016
19	Coke, hard-coal, briquettes and refined petroleum products	-0.208	0.260	-0.122
20	Chemicals and chemical products; except pharmaceuticals and medicinal chemicals	-0.256	0.165	0.080
21	Pharmaceuticals, medicinal chemicals and botanical products	-0.796	0.155	0.011
22	Rubber and plastic products	-0.001	0.274	0.147
23	Other non-metallic mineral products	-0.127	0.310	0.051
24	Basic metal products	0.339	0.385	0.086
25	Fabricated metal products; except machinery and furniture	0.211	0.204	0.072
26	Electronic components, computer, radio, television and communication equipment	-0.263	0.140	0.110

Table 1.6 continued

KSIC9	Industry	External Finance Dependence	Asset Tangibility	Trade Credit Intensity
27	Medical, precision and optical instruments, Watches and Clocks	0.736	0.181	0.056
28	Electrical equipment	0.597	0.160	0.150
29	Other machinery and equipment	0.296	0.260	0.153
30	Motor vehicles, trailers and semitrailers	-0.068	0.302	0.201
31	Other Transport Equipment	-0.356	0.803	0.097
32	Furniture	-0.351	0.361	0.231
33	Other manufacturing	0.431	0.095	0.084
35	Electricity, gas, steam and air conditioning supply	-0.580	0.5952	0.234
38	Waste collection, disposal and materials Recovery	-2.385	0.203	0.048
39	Remediation activities and other waste management services	-0.975	0.106	0.084
41	General construction	0.147	0.071	0.162
45	Sale of motor vehicles and parts	0.965	0.595	0.045
46	Wholesale and commission trade; except of motor vehicles and motorcycles	0.478	0.097	0.239
47	Retail trade; except motor vehicles and motorcycles	0.261	1.031	0.145
49	Land transport; transport via pipelines	0.111	0.848	0.037
50	Water transport	0.837	0.573	0.089
51	Air transport	-0.336	2.412	-0.069
52	Storage and support activities for transportation	-1.958	0.395	0.025
55	Accommodation	0.441	1.283	-0.004
56	Food and beverage service activities	-0.316	0.036	0.077
58	Publishing activities	1.314	0.045	0.089

Table 1.6 continued

KSIC9	Industry	External Finance Dependence	Asset Tangibility	Trade Credit Intensity
59	Motion picture, video and television program production, sound recording and music publishing activities	-0.245	0.112	-0.005
60	Broadcasting	0.184	0.112	-0.029
68	Real estate activities	0.076	0.381	0.054
71	Professional services	-0.810	0.307	0.024
73	Professional, scientific and technical services	0.957	0.071	0.511
74	Business facilities anagement and landscape services	-3.329	0.144	-0.103
75	Business support services	-1.235	0.123	0.013
85	Education	-2.745	0.244	0.007
90	Creative, arts and recreation related services	-0.084	0.158	-0.154
91	Sports activities and amusement activities	0.257	1.071	0.001
95	Maintenance and repair services	1.858	0.152	1.461
96	Other personal sServices activities	-0.507	4.556	0.092

Note: External finance dependence is calculated as the difference between capital expenditure and cash flows from operations divided by capital expenditure. Asset tangibility is computed as net tangible assets divided by book value of assets. Trade credit intensity is defined as the ratio of the change in accounts payable over the change in total assets. The measures are closed to the mdthods calculated by Rajan and Zingales (1998), Claessens and Laeven (2003), Fisman and Love (2003).

First, in the case of affiliates which belong to industry with greater asset tangibility, column (1) presents that the coefficients on banking crisis and the interaction term between banking crisis and foreign shareholding are 0.134 and -0.256, respectively, and statistically significant at the 5 percent level. It means that when the banking crisis occurs in source country, foreign-owned companies with 10 percent foreign shareholding which belong to a less financially vulnerable industry increase their investment rate by 10.8 percent. In addition, it implies that additional ten percent point increase in foreign shareholding decreases investment rate of foreign-owned companies not belong to chaebols by about 2.56 percentage points during source country's banking crisis, and non-chaebol companies in which foreign shareholding exceeds by about 52 percent have negative effects of the banking crisis in source countries on the investment decision of the foreign multinationals. This is the same result from the baseline specification that in the case of companies with high inward FDI, financial dependence on parent firms in source countries aggravates those companies' investment behavior. However, in column (2), the coefficients on banking crisis and the interaction term are statistically insignificant. It shows that FDI has a statistically insignificant effect on the performance of foreign multinationals included in a more financially vulnerable industry.

Next, in the case of affiliates which belong to industry with greater trade credit intensity, column (3) shows similar results in column (1). Both coefficients have the same signals as those in column (1) and statistically significant at the 10 percent level, too. It means that foreign multinationals in a less financially vulnerable industry increase their investment during the banking crisis in source countries, but in the case of companies with high inward FDI, financial dependence on parent firms due to the banking crisis in source countries aggravates investment behavior. The result from column (4) is also similar to the result from column (2).

Last, the results of external finance dependence are in columns (5) and (6). The coefficients on banking crisis and the interaction term in both columns have the same signals as

Table 1.7. Financial Constraints

Dependent Variable:	(1)	(2)	(3)	(4)
Investment rate $\left(\frac{I_{ijt}}{K_{ijt-1}}\right)$	Asset Tangibility above Median	Asset Tangibility below Median	Trade Credit above Median	Trade Credit below Median
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.097*** (0.009)	0.097*** (0.008)	0.100*** (0.008)	0.094*** (0.012)
Sales revenue $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.004*** (0.001)	0.001*** (0.000)	0.001*** (0.000)	0.003*** (0.001)
Cash-flow $\left(\frac{CF_{ijt}}{K_{ijt-1}}\right)$	0.002 (0.007)	0.002 (0.005)	0.001 (0.005)	-0.001 (0.007)
Banking crisis dummy (BC_{jt})	0.134** (0.060)	0.055 (0.088)	0.117* (0.061)	0.024 (0.074)
Foreign shareholding (FDI_{ijt})	0.038 (0.124)	0.011 (0.101)	0.023 (0.094)	0.005 (0.185)
Banking crisis dummy \times Foreign shareholding ($BC_{jt} \times FDI_{ijt}$)	-0.256** (0.115)	-0.066 (0.137)	-0.180* (0.096)	-0.061 (0.156)
Observations	59,925	51,136	79,079	31,982
Number of firms	7,309	6,346	9,744	3,911
Hansen-Sargan test (p-value)	0.166	0.203	0.185	0.347
1st-order serial correlation test (p-value)	0	0	0	0
2nd-order serial correlation test (p-value)	0.126	0.479	0.374	0.144

Note: See note below the Table 1.4

those in columns (1) to (4), but are statistically insignificant. It means that financial crisis does not affect firms behavior regardless of industry-level external finance dependence.

1.5 Conclusion

I investigate in this paper the role of the banking crisis in source countries in investment behavior of foreign multinationals. To do so, I estimate the dynamic investment equation with foreign ownership and the crises in source countries based on the standard investment problem of a firm using the system-GMM estimator. I use firm-level panel dataset on annual financial statements with the banking crises database in South Korea during 1994-2013. First, I find an effect of banking crisis in source countries on the investment of foreign multinationals depends on the percentage of foreign shareholding. In the case of foreign-owned firms with 10 percent foreign shareholding, the investment rate rises by 9.3 percent when the banking crisis occurred in source countries. Moreover, a ten percent point increase in the percentage of foreign shareholding decreases foreign-owned firms investment rate by about 1.56 percentage points during the banking crisis in source countries, and foreign multinational with more than 70 percent of foreign shareholding have negative impacts of the banking crisis in source countries on the investment behavior. Next, I find that firm characteristics and financial vulnerability of industries also affect investment behavior of foreign multinationals during the banking crisis in source countries. If firms do not belong to a chaebol, are not exporters, or if firms' industry is less financially sensitive, foreign shareholding affects investment rate of foreign-owned firms during banking crises, but in the case of the rest firms, foreign shareholding does not affect investment rate of foreign multinationals.

CHAPTER 2
THE EFFECT OF FDI ON THE EXPORT OF FOREIGN
MULTINATIONALS DURING BANKING CRISES IN SOURCE
COUNTRIES

2.1 Introduction

Financial constraints reduce international trade. During the global financial crisis between 2008 and 2009, exporters faced financial constraints which played an important role in the decrease in international trade (Amiti and Weinstein (2011)). According to Chor and Manova (2012), the reason for the substantial decrease in international trade is because of the global financial crisis which resulted in a decrease in firms' exports and production due to credit constraints, and a reduction in imports because of the pessimistic economic outlook. Because of the financial constraints, exporters needed more finance and this affected their trade patterns (Matsuyama (2005)). In this situation, foreign direct investment (FDI) may alleviate the firms' financial constraints (Harrison et al. (2004)). Tong and Wei (2011) examine that during the global crisis, firms without any FDI face severe credit constraints, whereas the liquidity constraint of multinational subsidiaries with FDI is reduced. In addition, Harrison and McMillan (2003) show that foreign-owned companies face less credit constraints because foreign parent companies can provide them equity. Other previous papers also show that foreign multinationals reduce credit constraints during financial crisis periods (Blalock et al. (2005) and Desai et al. (2007)).

Previous literature shows that financial constraints such as the global financial crisis reduce international trade, and FDI alleviates financial constraints and decreases in international trade during the global financial crisis. Then, what about the international trade of foreign multinationals during the financial crisis in source countries? On the one hand, foreign affiliates may suffer from credit constraints less than domestic companies because

FDI from a parent company can reduce these constraints. On the other hand, due to the financial crisis in source countries, the parent company may face credit constraints, and this may affect foreign affiliates negatively because they partly depend on the decisions of their parent companies. Medium and small-sized enterprises can be especially affected by external economic shocks, not only the global financial crisis, but also small crises, such as a regional or national banking or currency crisis. This paper help to set and to run on economic policy related to the international trade of these companies. This is the main contribution of this paper.

For this analysis, I use South Korean firm-level panel data for the years 1994 to 2013 provided by Korea Information Service, Inc. (KIS), to get the amount of each firm's exports (dependent variable), sales revenue for firm size, information on each firm's Korean Standard Industrial Classification (KSIC) Code, and firm characteristics. In addition, I use data on the banking crises database from Valencia et al. (2012), data on the list of foreign multinationals from Ministry of Trade, Industry and Energy in South Korea, and industry-level financial vulnerability measure calculated by Rajan and Zingales (1998), Claessens and Laeven (2003), and Fisman and Love (2003).

I find that banking crises in source countries hinder FDI from increase in exports of foreign affiliates in more financially vulnerable industries. For non-banking crisis periods, more than 50 percent of foreign shareholding promotes the amount of foreign affiliates' exports in more financially vulnerable industries, but during banking crises in source countries, it is challenging for foreign multinationals with even more than 50 percent of foreign shareholding to increase exports in more financially dependent industries.

I also find that firm characteristics affect foreign multinationals' exports during banking crises in source countries. In the case of South Korean chaebols, FDI increases the amount of their exports relatively more than non-chaebol foreign multinationals in more financially vulnerable industries. Chaebol exporters with more than 10 percent of foreign shareholding

export more than non-chaebol exporters with more than 10 percent of foreign shareholding in more financially dependent industries. On the contrary, during the banking crisis in source countries, chaebol exporters with 10 percent or greater of foreign shareholding export less than non-chaebol exporters with 10 percent or greater of foreign shareholding in more financially dependent industries. Next, publicly-listed foreign multinational exporters export more than non-public foreign multinational exporters in less financially dependent industries, but during banking crises in source countries, publicly-listed foreign multinational exporters export more than non-public foreign multinational exporters in more financially dependent industries. Lastly, large exporters with more than 50 percent of foreign shareholding export more than non-large firms in more financially dependent industries. During banking crises in source countries, these exporters still export relatively more than non-large firms in more financially vulnerable industries, but the amount of the increase in exports is relatively smaller than the amount of the increase in exports during non-crisis period in source countries.

The rest of this paper is organized as follows. In the next two sections, the theoretical background, hypotheses, and empirical model are presented. In section 2.4, the firm-level data is described. Section 2.5 contains the empirical results, and section 2.6 concludes.

2.2 Theoretical Background

Generally, exporters depend more on external finance than domestic companies. This is related to additional fixed upfront costs, such as more transaction costs, because of longer period of international shipping and delivery than domestic transactions, and variable upfront costs to invest in foreign business partners to keep exports.¹ These upfront costs usually exceed internal cash flows from operating activities or retained earnings of exporters, so they

¹Amiti and Weinstein (2011), Feenstra et al. (2014), and Manova et al. (2015)

sometimes rely on external capital. In addition, exporters are also sensitive to exogenous financial shocks, which affect them more substantially than domestic firms, so they also need external finance.²

The theoretical background for credit constraints and international trade is the static, partial equilibrium model that incorporates financial frictions and firm heterogeneity with domestic producers and credit-constrained exporters based on Melitz (2003) and developed by Manova (2012). In Manova (2012), more companies participate in export in less financially vulnerable industries and in more financially developed countries because only companies with high productivity can obtain sufficient external capital to participate in export, and companies in less financially vulnerable industries and in more financially developed countries have relatively lower productivity cut-off. In addition, financial development raises this participation relatively more in more financially vulnerable industries. Of course, the amount of companies' exports is greater in more financially developed countries and in less financially vulnerable industries. Moreover, financial development raises the amount of companies' exports relatively more in more financially vulnerable industries.

In the case of foreign multinationals, credit constraints affect foreign multinationals relatively less than domestic firms because domestic firms have more limited access to capital than foreign subsidiaries. They are better equipped to raise external finance in foreign capital market (Aguiar and Gopinath (2005) and Harrison and McMillan (2003)). Thus, foreign multinationals participate in export relatively more than non-multinational exporters and the amount of their exports is greater than non-multinational exporters'.

2.3 Empirical Model and Hypotheses

To identify whether the banking crisis in source countries affects exports of foreign multinationals, the following baseline specification is estimated:

²Ahn et al. (2011) find that export prices and prices of goods shipped by sea became more expensive than domestic goods and those shipped by air, respectively during the global financial crisis in 2008.

$$\begin{aligned}
Export_{ijkt}^* &= \beta_1 BC_{kt} + \beta_2 FDI10_{ikt} \times FinVul_j + \beta_3 FDI50_{ikt} \times FinVul_j \\
&+ \beta_4 FDI100_{ikt} \times FinVul_j + \beta_5 Size_{it} \times FinVul_j \\
&+ \beta_6 BC_{kt} \times FDI10_{ikt} \times FinVul_j + \beta_7 BC_{kt} \times FDI50_{ikt} \times FinVul_j \\
&+ \beta_8 BC_{kt} \times FDI100_{ikt} \times FinVul_j + \beta_9 BC_{kt} \times Size_{it} \times FinVul_j \\
&+ \beta_{10} Establish_i + v_j + \tau_t + \nu_{kt} + \varepsilon_{ijkt},
\end{aligned}$$

$$Export_{ijkt} = 0 \quad \text{if } Export_{ijkt}^* \leq 0,$$

$$Export_{ijkt} = Export_{ijkt}^* \quad \text{if } Export_{ijkt}^* > 0,$$

In this specification, $Exports_{ijkt}^*$ is an unobserved latent variable, and $Exports_{ijkt}$ is the observed outcome. $Exports_{ijkt}$ is the amount of exports of firm i , belonging to industry j , that received FDI from source country k in year t . BC_{kt} is a dummy variable, equal to one, if the source country k is experiencing the banking crisis in year t . $FDI10_{ikt}$ is a dummy variable, equal to one, if company i 's percentage of foreign shareholding invested by parent company in source countries k in year t is greater than 0 percent and less than 10 percent. $FDI50_{ikt}$ is a dummy variable, equal to one, if company i 's percentage of foreign shareholding invested by parent company in source countries k in year t is greater than or equal to 10 percent and less than 50 percent. $FDI100_{ikt}$ is a dummy variable, equal to one, if company i 's percentage of foreign shareholding invested by parent company in source countries k in year t is greater than or equal to 50 percent. $FinVul_j$ is industry-level financial

vulnerability. External finance dependence³, asset tangibility⁴, and trade credit intensity⁵ are used as measures of financial vulnerabilities calculated by Rajan and Zingales (1998), Claessens and Laeven (2003), and Fisman and Love (2003). $Size_{it}$ is the amount of sales revenue of firm i in year t . According to Manova et al. (2015), a firm's size reflects access to external finance, so they use it as another kind of proxy for financial development. In previous literature⁶, bigger firms are likely to face less financial constraints than small firms, so in this paper, I also use this variable as a proxy for financial development of the firm. In this specification, industry fixed effects, common time effects, country-specific time fixed effects and the error term are included. In most cases (about 74 percent), the amount of firms' exports is zero, so I use a Tobit regression.

Foreign multinationals are partly affected by financial constraints of their parent company in other countries, so banking crises in source countries affect parent companies negatively, and they also affect the exports of foreign multinationals. Thus, the coefficient on the banking crisis dummy variable is expected to be negative. Next, more financially developed companies more participate in export and their amount of exports is greater than less financially

³Rajan and Zingales (1998) defines this as the fraction of total capital expenditure not financed by internal cash flows from operations. This measure reflects each industry's requirements for outside capital. Actually, production and exporting in some industries are related to bigger capital expenditures that cannot be obtained internally, and such industries require more external finance. If industries depend on external finance for long-term investment projects, then it means that they have high level of external finance dependence, and therefore they are more financially vulnerable than industries with less level of external finance dependence.

⁴According to Claessens and Laeven (2003), this is a proxy for collateral to raise finance, defined as net property, plant and equipment divided by book value of assets. This measure indicates that the asset structure optimized for production is different from industry to industry. For industries with a large portion of tangible assets, each company which belongs to these industries can utilize a large amount of collateral and has better ability to gain capital than other companies which does not belong to these industries.

⁵In Fisman and Love (2003), this is a proxy for access to alternative financial market, computed as the ratio of the change in accounts payable over the change in total assets. This measure distinguishes between the external capital from the formal financial market and from the alternative financial market. If a company can have more trade credit, then it can reduce reliance on the formal banking financing. Thus, industries with more trade credit intensity are less financially vulnerable than industries with less trade credit intensity.

⁶Gertler and Gilchrist (1994), Beck et al. (2008), and Guiso et al. (2004).

developed companies. In addition, companies in less financially vulnerable industries enter into export markets more easily and export more than those in more financially vulnerable industries. Thus, these coefficients on the interaction term between a foreign shareholding dummy and a financial vulnerability measure is expected to be positive if the financial vulnerability measure is asset tangibility or trade credit intensity, and negative if the financial vulnerability measure is external finance dependence. In this case, if FDI from the parent company is sufficient for foreign multinationals in more financially vulnerable industries to promote exports more, then these coefficients can be negative if the financial vulnerability measure is asset tangibility or trade credit intensity, and positive if the financial vulnerability measure is external finance dependence. Lastly, banking crises in source countries mean the parent company faces financial constraints, and this can also affect foreign affiliates' exports negatively. Hence, the coefficients on the triple interaction terms among a banking crisis dummy, a foreign shareholding dummy, and a financial vulnerability measure are expected to be positive if the financial vulnerability measure is asset tangibility or trade credit intensity, and negative if the financial vulnerability measure is external finance dependence. However, if FDI from the parent company is sufficient for foreign multinationals in financially more vulnerable industries to overcome financial constraints during banking crisis in source countries, then these coefficients can be negative if the financial vulnerability measure is asset tangibility or trade credit intensity, and positive if the financial vulnerability measure is external finance dependence.

2.4 Data Sets

I use the South Korean firm-level panel data set for the years 1994 to 2013 provided by the Korea Information Service, Inc. (KIS). From this dataset, I use the amount of each firm's exports for the dependent variable, sales revenue for firm size, information on each firm's Korean Standard Industrial Classification (KSIC) Code, and firms' characteristics, such as

chaebol, publicly-listed, and/or large firms. In addition, I use data on the banking crises database which includes the period of banking crisis in each country from 1970 to 2011 from Valencia et al. (2012), and data on the list of foreign multinationals from the Ministry of Trade, Industry and Energy in South Korea to obtain the name of the source country where the parent company is placed, and the registration date when a firm first becomes foreign-owned. According to the law, firms with foreign ownership of less than 10 percent can be also considered foreign-owned firms under specific conditions.⁷ Moreover, for industry-level financial vulnerability measure, I introduce the measures calculated by Rajan and Zingales (1998), Claessens and Laeven (2003), and Fisman and Love (2003). The descriptive statistics for the 82,286 observations used in the estimations are presented in Table 2.1. In addition, Tables 2.2 and 2.3 show the periods of source countries' banking crises and industry-level financial vulnerability measure, respectively.

2.5 Results

2.5.1 The Main Effect of FDI on Export of Foreign Multinationals during Banking Crises in Source Countries

Table 2.4 presents the results from baseline specification discussed the above. Columns (1), (3), (5) show the results from the Tobit regression, and Columns (2), (4), and (6) present the marginal effects of the specific explanatory variable in the average of the other explanatory variables after Tobit regression. In Columns (1) and (2), the coefficient on the banking crisis in a source country is negative (-0.63 and -0.08, respectively). This means if other variables

⁷According to the Enforcement Decree of the Foreign Investment Promotion Act revised on July 28th, 2016, a foreign-capital invested company shall file for registration as a foreign-capital invested company. A foreign-capital invested company needs to meet the following requirements: (a) the amount of investment shall be at least 100 million Korean Won; and (b) a foreigner shall own at least 10/100 of either the total number of voting stocks or the total equity investment. In the case of a business which fails to meet the requirements of the main sentence of this paragraph due to partial transfer of stocks or shares or capital reduction, etc. after it has been registered as a foreign capital invested company, it shall be also deemed a foreign investment.

Table 2.1. Descriptive Statistics

Variable	Min	Mean	Std. Dev.	Max
Amount of Exports ($Export_{ijkt}$) (Unit: a hundred billion Korean Won)	0	0.495	8.106	776.486
Sales revenue ($Size_{it}$) (Unit: a hundred billion Korean Won)	0.0002	1.600	15.381	1497.892
Banking crisis dummy (BC_{kt})	0	0.031	0.172	1
Foreign shareholding (less than 10%) ($FDI10_{ikt}$)	0	0.007	0.084	1
Foreign shareholding (10-50%) ($FDI50_{ikt}$)	0	0.037	0.189	1
Foreign shareholding (more than 50%) ($FDI100_{ikt}$)	0	0.066	0.248	1
Finance dependence	-1.140	0.094	0.537	2.430
Asset tangibility	0.120	0.272	0.103	0.620
Trade credit intensity	0.020	0.073	0.022	0.220
Chaebol dummy	0	0.040	0.195	1
Public firm dummy	0	0.144	0.351	1
Large firm dummy	0	0.262	0.440	1
Exporter dummy	0	0.221	0.415	1

Note: The above table presents the descriptive statistics for the 82,286 observations from 9,292 manufacturing companies of South Korea used in the estimations.

Table 2.2. Periods of Source Countries' Banking Crises

Country	Period	Country	Period
Japan	1997-2001	Denmark	2008-2011
U.S.A.	2007-2011	Spain	2008-2011
Netherlands	2008-2011	Finland	1993-1995
Germany	2008-2011	Hungary	1993-1995, 2008-2011
U.K.	2007-2011	Ireland	2008-2011
France	2008-2011	Italy	2008-2011
Switzerland	2008-2011	Luxemburg	2008-2011
Malaysia	1997-1999	Portugal	2008-2011
Austria	2008-2011	Slovenia	2008-2011
Belgium	2008-2011	Sweden	1993-1995, 2008-2011

Source: Valencia et al. (2012)

Table 2.3. Industry-Level Financial Vulnerability Measure (Manufacturing Industries)

KSIC9	Industry	External Finance Dependence	Asset Tangibility	Trade Credit Intensity
10	Food products	-0.15	0.37	0.06
11	Beverages	0.03	0.40	0.05
12	Tobacco products	-1.14	0.19	0.04
13	Textiles, except spinning of textiles	0.01	0.31	0.08
131	Spinning of textiles	-0.05	0.38	0.18
14	Wearing apparel, clothing accessories and fur articles	-0.21	0.15	0.08
151	Luggage, footwear and similar products	-0.95	0.12	0.02
152	Footwear and parts of footwear	-0.74	0.13	0.04
16	Wood and cork; except furniture	0.05	0.32	0.08
17	Pulp, paper and paper products	-0.35	0.42	0.06
18	Printing and reproduction of recorded media	-0.42	0.21	0.05
191	Coke and briquettes	0.13	0.46	0.07
192	Refined petroleum products	-0.02	0.62	0.22
201, 202	Basic chemicals, fertilizers and nitrogen compounds	-0.19	0.43	0.06
203	Synthetic rubber and plastics in primary forms	0.03	0.40	0.07
204, 205	Other chemical products, and man-made fibers	-0.30	0.27	0.07
21	Pharmaceuticals, medicinal chemicals and botanical products	2.43	0.16	0.03
221	Rubber products	-0.02	0.36	0.13
222	Plastic products	-0.02	0.38	0.10
231	Glass and glass products	0.03	0.42	0.04
232	Ceramic ware	-0.41	0.28	0.03
233	Cement, lime, and plaster and Other non-metallic mineral products	-0.29	0.48	0.07

Table 2.3 continued

KSIC9	Industry	External Finance Dependence	Asset Tangibility	Trade Credit Intensity
241	Basic iron and steel	0.05	0.44	0.09
242, 243	Basic precious and non-ferrous metal and cast of metal	-0.12	0.32	0.08
25	Fabricated metal products; except machinery and furniture	-0.25	0.28	0.08
261, 262, 264 and 265	Electronic components, computer, radio, television and communication equipment except for computers and peripheral equipment	0.70	0.14	0.07
263	computers and peripheral equipment	0.54	0.14	0.06
27	Medical, precision and optical instruments, Watches and Clocks	0.72	0.16	0.05
28	Electrical equipment	0.24	0.21	0.08
29	Other machinery and equipment	-0.04	0.22	0.09
30, 31	Motor vehicles, trailers, semitrailers, and other Transport Equipment	-0.08	0.23	0.06
32	Furniture	-0.38	0.28	0.05
33	Other manufacturing	0.28	0.18	0.08

Note: External finance dependence is calculated as the difference between capital expenditure and cash flows from operations divided by capital expenditure. Asset tangibility is computed as net tangible assets divided by book value of assets. Trade credit intensity is defined as the ratio of the change in accounts payable over the change in total assets. The measures are calculated by Rajan and Zingales (1998), Claessens and Laeven (2003), Fisman and Love (2003).

are fixed on average, then the banking crisis in source countries reduces the amount of exports of foreign multinational exporters by about 8 billion Korean Won, and the banking crisis affects firm's exports negatively.

The coefficients on the interaction terms between a foreign shareholding dummy variable and an asset tangibility measure, and their marginal effects after the Tobit regression are positive if the foreign shareholding is less than 50 percent, and negative if that is greater than or equal to 50 percent. All of them are statistically significant at the 1 percent level. Since financial frictions decrease firm's selection into exporting and their amount of exports, and FDI alleviates these financial frictions, foreign shareholding affects firm's exports positively. In addition, since firms in less financially vulnerable industries can enter into export markets and export their commodities more easily, asset tangibility also affects firm's exports positively. Thus, the first two coefficients on interaction terms between foreign shareholding and asset tangibility are positive. If FDI from the parent company is sufficient for foreign multinationals in more financially vulnerable industries to further promote exporting, then the entrance into export markets and the amount of exports of foreign multinationals in financially more vulnerable industries would increase. As a result, the interaction term between foreign shareholding and asset tangibility can be negative. Actually, in the case of foreign multinational exports with 50 percent of foreign shareholding or more, the coefficient on the interaction term and its marginal effect after the Tobit regression are negative (-15.81 and -1.95, respectively).

The coefficients on the triple interaction terms among the banking crisis dummy, a foreign shareholding dummy, and an asset tangibility measure, and their marginal effects after the Tobit regression are positive and statistically significant at the 5 percent level. Especially, the results of triple interaction term with 50 percent of foreign shareholding or more are also positive, 15.19 and 1.87, respectively. It implies that during the banking crisis in source countries, it is difficult for foreign affiliates in more financially vulnerable industries to

Table 2.4. Baseline Results

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Amount of exports ($Export_{ikt}$)	Coefficient	dy/dx	Coefficient	dy/dx	Coefficient	dy/dx
Banking crisis dummy (BC_{kt})	-0.63 (1.66)	-0.08 (0.20)	-1.84 (2.12)	-0.23 (0.26)	-0.41 (0.86)	-0.05 (0.11)
FDI(10%) \times Asset tangibility ($FDI10_{ikt} \times Tang_j$)	39.11*** (4.36)	4.82*** (0.50)				
FDI(50%) \times Asset tangibility ($FDI50_{ikt} \times Tang_j$)	15.22*** (3.20)	1.88*** (0.39)				
FDI(100%) \times Asset tangibility ($FDI100_{ikt} \times Tang_j$)	-15.81*** (3.42)	-1.95*** (0.41)				
FDI(10%) \times Trade credit ($FDI10_{ikt} \times Trcrdt_j$)			72.11*** (14.65)	8.99*** (1.82)		
FDI(50%) \times Trade credit ($FDI50_{ikt} \times Trcrdt_j$)			-6.64 (15.74)	-0.83 (1.96)		
FDI(100%) \times Trade credit ($FDI100_{ikt} \times Trcrdt_j$)			-128.57*** (15.93)	-16.02*** (1.84)		
FDI(10%) \times External finance ($FDI10_{ikt} \times Extfin_j$)					3.91*** (1.04)	0.50*** (0.13)
FDI(50%) \times External finance ($FDI50_{ikt} \times Extfin_j$)					0.40 (0.97)	0.05 (0.12)
FDI(100%) \times External finance ($FDI100_{ikt} \times Extfin_j$)					-6.42*** (1.17)	-0.82*** (0.15)

Table 2.4 continued

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Amount of exports ($Export_{ijkt}$)	Coefficient	dy/dx	Coefficient	dy/dx	Coefficient	dy/dx
$BC \times FDI(10\%) \times$ Asset tangibility	14.12**	1.74**				
$(BC_{kt} \times FDI10_{ikt} \times Tang_j)$	(6.33)	(0.77)				
$BC \times FDI(50\%) \times$ Asset tangibility	15.74**	1.94**				
$(BC_{kt} \times FDI50_{ikt} \times Tang_j)$	(6.84)	(0.83)				
$BC \times FDI(100\%) \times$ Asset tangibility	15.19**	1.87**				
$(BC_{kt} \times FDI100_{ikt} \times Tang_j)$	(6.32)	(0.76)				
$BC \times FDI(10\%) \times$ Trade credit			42.11*	5.25*		
$(BC_{kt} \times FDI10_{ikt} \times Trcrdt_j)$			(24.80)	(3.06)		
$BC \times FDI(50\%) \times$ Trade credit			76.39**	9.52**		
$(BC_{kt} \times FDI50_{ikt} \times Trcrdt_j)$			(34.71)	(4.28)		
$BC \times FDI(100\%) \times$ Trade credit			73.78**	9.19**		
$(BC_{kt} \times FDI100_{ikt} \times Trcrdt_j)$			(31.42)	(3.86)		
$BC \times FDI(10\%) \times$ External finance					-0.39	-0.05
$(BC_{kt} \times FDI10_{ikt} \times Extfin_j)$					(1.35)	(0.17)
$BC \times FDI(50\%) \times$ External finance					0.84	0.11
$(BC_{kt} \times FDI50_{ikt} \times Extfin_j)$					(2.03)	(0.26)
$BC \times FDI(100\%) \times$ External finance					2.53	0.32
$(BC_{kt} \times FDI100_{ikt} \times Extfin_j)$					(1.80)	(0.23)

Table 2.4 continued

Dependent Variable: Amount of exports ($Export_{i,kt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
Firm size \times Asset tangibility ($Size_{it} \times Tang_j$)	1.60*** (0.13)	0.20*** (0.01)				
Firm size \times Trade credit ($Size_{it} \times Trcrdt_j$)			4.64*** (0.35)	0.58*** (0.04)		
Firm size \times External finance ($Size_{it} \times Extfin_j$)					0.48*** (0.03)	0.06*** (0.00)
BC \times Firm size \times Asset tangibility ($BC_{kt} \times Size_{it} \times Tang_j$)	-0.86*** (0.07)	-0.11*** (0.01)				
BC \times Firm size \times Trade credit ($BC_{kt} \times Size_{it} \times Trcrdt_j$)			-2.53*** (0.20)	-0.31*** (0.02)		
BC \times Firm size \times External finance ($BC_{kt} \times Size_{it} \times Extfin_j$)					0.17 (0.61)	0.02 (0.08)
Number of observations	82,286	82,286	82,286	82,286	82,286	82,286
Log pseudolikelihood	-83,592		-83,277		-86,977	

Note: The empirical model is based on the baseline specification. The estimation is by Tobit regression and the marginal effects of the specific explanatory variable in the average of the other explanatory variables after Tobit regression with industry fixed effects, common time effects, and country specific time fixed effects. Clustered standard errors at the source country-year level in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively.

increase exports, even though the FDI from the parent company is sufficient. These results support that the banking crisis in source countries worsens the financial constraints of the parent company, and it affects foreign multinationals' exports negatively.

The results of the interaction term between a firm size and the asset tangibility measure imply that bigger foreign multinational exporters export relatively more in less financially vulnerable industries. Both the coefficient and the marginal effect are positive, 1.60 and 0.20, respectively. By contrast, the coefficient on the triple interaction term among the banking crisis dummy, firm size, and an asset tangibility measure is negative. This means that during banking crises in source countries, bigger exporters still export relatively more in less financially vulnerable industries, but the increase in exports decreases relatively.

When trade credit intensity is used as the measure of the industry-level financial vulnerability instead of asset tangibility, the results from the Tobit regression and the marginal effects after the Tobit regression are similar to the results with asset tangibility.⁸ According to Columns (3) and (4), foreign multinational exporters with less than 10 percent of foreign shareholding export more in less financially vulnerable industries, and foreign multinational exporters with more than 50 percent of foreign shareholding export more in more financially vulnerable industries. In addition, during the banking crisis in source countries, exporters with more than 50 percent of foreign shareholding still export relatively more in financially more vulnerable industries, but the amount of the increase in exports is relatively smaller than the amount of the increase in exports during non-crisis period in source countries.

⁸In the case of external finance dependence measure, however, the results from the coefficients and the marginal effects are not similar to the previous results. In Columns (5) and (6), exporters with low level of foreign shareholding export relatively more in financially more dependent industries, and exports with high level of foreign shareholding export relatively more in financially less dependent industries. In addition, banking crisis in source countries does not affect foreign affiliates' exports.

2.5.2 Firm Characteristics

Tables 2.5, 2.6, and 2.7 present the effects of FDI on export of foreign affiliates during banking crises in source countries with different firm characteristics. First, I define a chaebol dummy which takes the value one if the firm is an affiliate of a conglomerate.⁹ According to previous literature, the advantage belonging to a chaebol is easier access to sources of financing (Borensztein and Lee (2002), Lee et al. (2000), and Min (2007)). Hence, a banking crises in source countries may have less of an impact on affiliates of a chaebols. Next, I introduce a publicly-listed-company dummy which equals one, if the firm is listed on the Korean Stock Market.¹⁰ Publicly-listed firms can raise capital from the stock market, so they may suffer less from financial constraints than non-public firms. Last, I define a large firm dummy equal to one, if the firm is not categorized as small and medium enterprises by Ministry of Small and Medium Business and Startups of South Korea.¹¹

⁹According to the Article 14 of Monopoly Regulation and Fair Trade Act, chaebol is the conglomerate whose summation of total assets is more than 5 trillion Korean Won. Each affiliate that belongs to a chaebol cannot acquire or hold any stock of another affiliate which belongs to the same chaebol. The list of chaebol is announced by the Korea Fair Trade Commission on April 1st annually. In 2016, there exist 65 chaebols and 1,741 affiliates belong to 65 chaebols.

¹⁰There are three stock markets in South Korea. First, the following firms can be listed on Korea Composite Stock Price Index (KOSPI): (a) firms with more than 30 billion Korean Won in equity; (b) firms with more than a million listed stocks; and (c) firms with more than 100 billion Korean Won in sales last year and with more than 70 billion Korean Won in average sales over the past 3 years, or firms with more than 200 billion Korean Won in sales last year and with market capitalization of more than 400 billion Korean Won. Next, the following firms can be listed on Korea Securities Dealers Automated Quotation (KOSDAQ): (a) firms, which have been established for 3 years, with more than 3 billion Korean Won in equity, and with market capitalization of more 9 billion Korean Won; (b) startup companies with more than 1.5 billion Korean Won in equity, and with market capitalization of more 9 billion Korean Won. Last, the following firms can be listed on Korea New Exchange (KONEX): (a) firms with more than 1 billion Korean Won in sales, with market capitalization of more 0.5 billion Korean Won, or with more than 0.3 billion Korean Won in net profit.

¹¹According to Framework Act on Small and Medium Enterprises amended by June 30th, 2015, the following firms are categorized as small and medium enterprises: (a) firms with assets less than 500 billion Korean Won; and (b) firms not included in chaebol defined by Monopoly Regulation and Fair Trade Act amended by March 25th, 2009.

Table 2.5. Firm Characteristics (Chaebol)

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Amount of exports ($Export_{i,jkt}$)	Coefficient	dy/dx	Coefficient	dy/dx	Coefficient	dy/dx
Banking crisis dummy (BC_{kt})	0.28 (1.35)	0.03 (0.17)	-0.10 (1.55)	-0.01 (0.19)	-2.61** (1.03)	-0.33** (0.13)
FDI(10%) \times Asset tangibility ($FDI10_{ikt} \times Tang_j$)	45.89*** (4.94)	5.60*** (0.54)				
FDI(50%) \times Asset tangibility ($FDI50_{ikt} \times Tang_j$)	21.31*** (2.91)	2.60*** (0.33)				
FDI(100%) \times Asset tangibility ($FDI100_{ikt} \times Tang_j$)	-4.69 (2.95)	-0.57 (0.36)				
FDI(10%) \times Trade credit ($FDI10_{ikt} \times Trcrdt_j$)			139.00*** (19.18)	17.19*** (2.26)		
FDI(50%) \times Trade credit ($FDI50_{ikt} \times Trcrdt_j$)			72.01*** (17.18)	8.91*** (2.10)		
FDI(100%) \times Trade credit ($FDI100_{ikt} \times Trcrdt_j$)			-25.72 (19.48)	-3.18 (2.40)		
FDI(10%) \times External finance ($FDI10_{ikt} \times Extfin_j$)					4.07*** (1.06)	0.52*** (0.13)
FDI(50%) \times External finance ($FDI50_{ikt} \times Extfin_j$)					0.88 (0.83)	0.11 (0.11)
FDI(100%) \times External finance ($FDI100_{ikt} \times Extfin_j$)					-5.76*** (1.12)	-0.74*** (0.14)

Table 2.5 continued

Dependent Variable: Amount of exports ($Export_{ikt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
$BC \times FDI(10\%) \times \text{Asset tangibility}$	8.30	1.01				
$(BC_{kt} \times FDI10_{ikt} \times Tang_j)$	(5.23)	(0.63)				
$BC \times FDI(50\%) \times \text{Asset tangibility}$	1.39	0.17				
$(BC_{kt} \times FDI50_{ikt} \times Tang_j)$	(4.67)	(0.57)				
$BC \times FDI(100\%) \times \text{Asset tangibility}$	-1.93	-0.24				
$(BC_{kt} \times FDI100_{ikt} \times Tang_j)$	(5.37)	(0.66)				
$BC \times FDI(10\%) \times \text{Trade credit}$			7.65	0.95		
$(BC_{kt} \times FDI10_{ikt} \times Trcrdt_j)$			(17.25)	(2.13)		
$BC \times FDI(50\%) \times \text{Trade credit}$			1.71	0.21		
$(BC_{kt} \times FDI50_{ikt} \times Trcrdt_j)$			(21.38)	(2.64)		
$BC \times FDI(100\%) \times \text{Trade credit}$			-9.24	-1.14		
$(BC_{kt} \times FDI100_{ikt} \times Trcrdt_j)$			(23.96)	(2.97)		
$BC \times FDI(10\%) \times \text{External finance}$					1.79	0.23
$(BC_{kt} \times FDI10_{ikt} \times Extfin_j)$					(1.32)	(0.17)
$BC \times FDI(50\%) \times \text{External finance}$					2.74	0.35
$(BC_{kt} \times FDI50_{ikt} \times Extfin_j)$					(1.85)	(0.24)
$BC \times FDI(100\%) \times \text{External finance}$					6.65***	0.85***
$(BC_{kt} \times FDI100_{ikt} \times Extfin_j)$					(1.73)	(0.21)
Firm size \times Asset tangibility	2.91***	0.36***				
$(Size_{it} \times Tang_j)$	(0.23)	(0.02)				
Firm size \times Trade credit			10.67***	1.32***		
$(Size_{it} \times Trcrdt_j)$			(1.13)	(0.13)		
Firm size \times External finance					-0.03	0.003
$(Size_{it} \times Extfin_j)$					(0.13)	(0.02)

Table 2.5 continued

Dependent Variable: Amount of exports ($Export_{i,kt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
BC × Firm size × Asset tangibility ($BC_{kt} \times Size_{it} \times Tang_j$)	-0.70 (0.45)	-0.09 (0.05)				
BC × Firm size × Trade credit ($BC_{kt} \times Size_{it} \times Trcrdt_j$)			0.37 (2.50)	0.05 (0.31)		
BC × Firm size × External finance ($BC_{kt} \times Size_{it} \times Extfin_j$)					-1.65*** (0.58)	-0.21*** (0.07)
Chaebol × Banking crisis dummy ($CB_{it} \times BC_{kt}$)	-0.95 (3.62)	-0.12 (0.44)	-2.49 (5.09)	-0.31 (0.63)	19.73*** (3.99)	2.53*** (0.50)
Chaebol × FDI(10%) × Asset tangibility ($CB_{it} \times FDI10_{ikt} \times Tang_j$)	-15.94** (7.58)	-1.94** (0.91)				
Chaebol × FDI(50%) × Asset tangibility ($CB_{it} \times FDI50_{ikt} \times Tang_j$)	-22.54** (10.65)	-2.75** (1.28)				
Chaebol × FDI(100%) × Asset tangibility ($CB_{it} \times FDI100_{ikt} \times Tang_j$)	-73.36*** (21.65)	-8.95*** (2.56)				
Chaebol × FDI(10%) × Trade credit ($CB_{it} \times FDI10_{ikt} \times Trcrdt_j$)			0.87 (40.46)	0.11 (5.01)		
Chaebol × FDI(50%) × Trade credit ($CB_{it} \times FDI50_{ikt} \times Trcrdt_j$)			-103.50** (45.73)	-12.80** (5.55)		
Chaebol × FDI(100%) × Trade credit ($CB_{it} \times FDI100_{ikt} \times Trcrdt_j$)			-284.97*** (67.16)	-35.25*** (8.00)		
Chaebol × FDI(10%) × External finance ($CB_{it} \times FDI10_{ikt} \times Extfin_j$)					-2.21 (3.68)	-0.28 (0.47)
Chaebol × FDI(50%) × External finance ($CB_{it} \times FDI50_{ikt} \times Extfin_j$)					-4.72 (7.50)	-0.61 (0.96)
Chaebol × FDI(100%) × External finance ($CB_{it} \times FDI100_{ikt} \times Extfin_j$)					-22.32 (15.82)	-2.86 (2.02)

Table 2.5 continued

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Amount of exports ($Export_{ijkt}$)	Coefficient	dy/dx	Coefficient	dy/dx	Coefficient	dy/dx
Chaebol \times BC \times FDI(10%) \times Asset tangibility	-1.99	-0.24				
$(CB_{it} \times BC_{kt} \times FDI10_{ikt} \times Tang_j)$	(18.39)	(2.24)				
Chaebol \times BC \times FDI(50%) \times Asset tangibility	80.41***	9.81***				
$(CB_{it} \times BC_{kt} \times FDI50_{ikt} \times Tang_j)$	(17.68)	(2.14)				
Chaebol \times BC \times FDI(100%) \times Asset tangibility	116.38***	14.20***				
$(CB_{it} \times BC_{kt} \times FDI100_{ikt} \times Tang_j)$	(26.42)	(3.12)				
Chaebol \times BC \times FDI(10%) \times Trade credit			46.48	5.75		
$(CB_{it} \times BC_{kt} \times FDI10_{ikt} \times Trcrdt_j)$			(120.55)	(14.91)		
Chaebol \times BC \times FDI(50%) \times Trade credit			401.57***	49.67***		
$(CB_{it} \times BC_{kt} \times FDI50_{ikt} \times Trcrdt_j)$			(125.93)	(15.39)		
Chaebol \times BC \times FDI(100%) \times Trade credit			467.12***	57.78***		
$(CB_{it} \times BC_{kt} \times FDI100_{ikt} \times Trcrdt_j)$			(99.22)	(11.82)		
Chaebol \times BC \times FDI(10%) \times External finance					-6.54	-0.84
$(CB_{it} \times BC_{kt} \times FDI10_{ikt} \times Extfin_j)$					(6.39)	(0.82)
Chaebol \times BC \times FDI(50%) \times External finance					0.61	0.08
$(CB_{it} \times BC_{kt} \times FDI50_{ikt} \times Extfin_j)$					(8.17)	(1.05)
Chaebol \times BC \times FDI(100%) \times External finance					7.77	1.00
$(CB_{it} \times BC_{kt} \times FDI100_{ikt} \times Extfin_j)$					(17.82)	(2.28)

Table 2.5 continued

Dependent Variable: Amount of exports ($Export_{ikt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
Chaebol \times Firm size \times Asset tangibility ($CB_{it} \times Size_{it} \times Tang_j$)	-1.27*** (0.13)	-0.15*** (0.01)				
Chaebol \times Firm size \times Trade credit ($CB_{it} \times Size_{it} \times Trcrdt_j$)			-5.83*** (1.00)	-0.72*** (0.12)	0.51*** (0.16)	0.07*** (0.02)
Chaebol \times Firm size \times External finance ($CB_{it} \times Size_{it} \times Extfin_j$)						
Chaebol \times BC \times Firm size \times Asset tangibility ($CB_{it} \times BC_{kt} \times Size_{it} \times Tang_j$)	-0.36 (0.46)	-0.04 (0.06)				
Chaebol \times BC \times Firm size \times Trade credit ($CB_{it} \times BC_{kt} \times Size_{it} \times Trcrdt_j$)			-3.76 (2.71)	-0.47 (0.33)		
Chaebol \times BC \times Firm size \times External finance ($CB_{it} \times BC_{kt} \times Size_{it} \times Extfin_j$)					1.88** (0.74)	0.24** (0.09)
Number of observations	82,286	82,286	82,286	82,286	82,286	82,286
Log pseudolikelihood	-83,285		-82,826		-86,876	

Note: See note below the Table 2.4

Table 2.5 shows the results from empirical model with the interaction terms between a chaebol dummy and other explanatory variables dealt with in Table 2.4. When the interaction terms with a chaebol dummy are included in the baseline specification, the results of the interaction terms between a foreign shareholding dummy and financial vulnerability measures and the triple interaction terms among banking crisis dummy, a foreign shareholding dummy, and financial vulnerability measures are similar to the previous results from the baseline specification. In the case of the interaction terms, all signals of all coefficients are the same as the previous results, but the statistical significance is slightly different than the previous ones. In addition, 8 out of 9 coefficients on triple interaction terms with the banking crisis dummy are statistically insignificant.

In Columns (1) to (4), when I use asset tangibility or trade credit intensity as a measure of financial vulnerability, most coefficients on the triple interaction terms with a chaebol dummy are negative and statistically significant at the 1 or 5 percent level. This means that chaebol exporters with more than 10 percent of foreign shareholding export more in more financially dependent industries. On the other hand, the quadruple interaction terms with a chaebol dummy and a banking crisis dummy in Columns (1) to (4) are positive and statistically significant at the 1 percent level, if their foreign shareholding is 10 percent or more. This implies that during the banking crisis in source countries, chaebol exporters with more than 10 percent of foreign shareholding export more in less financially dependent industries.

The results related to publicly-listed firms are included in Table 2.6. In Columns (1) to (4), the coefficients on the interaction terms between a foreign shareholding dummy and an asset tangibility or a trade credit intensity, and the triple interaction terms with a public dummy imply that publicly-listed foreign multinational exporters export more than non-public foreign multinational exporters in less financially vulnerable industries. By contrast, during banking crises in source countries, publicly-listed foreign multinational exporters

Table 2.6. Firm Characteristics (Publicly Listed Firm)

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Amount of exports ($Export_{ikt}$)	Coefficient	dy/dx	Coefficient	dy/dx	Coefficient	dy/dx
Banking crisis dummy (BC_{kt})	-4.74* (2.52)	-0.58* (0.30)	-4.05 (2.83)	-0.50 (0.35)	-5.49*** (1.32)	-0.70*** (0.16)
FDI(10%) \times Asset tangibility ($FDI10_{ikt} \times Tang_j$)	2.15 (7.74)	0.26 (0.95)				
FDI(50%) \times Asset tangibility ($FDI50_{ikt} \times Tang_j$)	-5.06 (3.59)	-0.62 (0.44)				
FDI(100%) \times Asset tangibility ($FDI100_{ikt} \times Tang_j$)	-20.94*** (5.04)	-2.57*** (0.60)				
FDI(10%) \times Trade credit ($FDI10_{ikt} \times Trcrdt_j$)			-91.93*** (31.16)	-11.41*** (3.79)		
FDI(50%) \times Trade credit ($FDI50_{ikt} \times Trcrdt_j$)			-102.24*** (26.19)	-12.69*** (3.14)		
FDI(100%) \times Trade credit ($FDI100_{ikt} \times Trcrdt_j$)			-169.27*** (29.87)	-21.02*** (3.49)		
FDI(10%) \times External finance ($FDI10_{ikt} \times Extfin_j$)					-3.03 (2.76)	-0.39 (0.35)
FDI(50%) \times External finance ($FDI50_{ikt} \times Extfin_j$)					-2.59*** (0.98)	-0.33*** (0.12)
FDI(100%) \times External finance ($FDI100_{ikt} \times Extfin_j$)					-6.87*** (1.28)	-0.88*** (0.16)

Table 2.6 continued

Dependent Variable: Amount of exports ($Export_{ikt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
$BC \times FDI(10\%) \times \text{Asset tangibility}$	33.01**	4.05**				
$(BC_{kt} \times FDI10_{ikt} \times Tang_j)$	(13.81)	(1.67)				
$BC \times FDI(50\%) \times \text{Asset tangibility}$	23.16***	2.84***				
$(BC_{kt} \times FDI50_{ikt} \times Tang_j)$	(8.87)	(1.06)				
$BC \times FDI(100\%) \times \text{Asset tangibility}$	30.38***	3.73***				
$(BC_{kt} \times FDI100_{ikt} \times Tang_j)$	(9.93)	(1.18)				
$BC \times FDI(10\%) \times \text{Trade credit}$			84.63	10.51		
$(BC_{kt} \times FDI10_{ikt} \times Trcrdt_j)$			(51.83)	(6.37)		
$BC \times FDI(50\%) \times \text{Trade credit}$			72.96*	9.06*		
$(BC_{kt} \times FDI50_{ikt} \times Trcrdt_j)$			(42.05)	(5.16)		
$BC \times FDI(100\%) \times \text{Trade credit}$			102.30**	12.70**		
$(BC_{kt} \times FDI100_{ikt} \times Trcrdt_j)$			(46.80)	(5.72)		
$BC \times FDI(10\%) \times \text{External finance}$					11.38***	1.45***
$(BC_{kt} \times FDI10_{ikt} \times Extfin_j)$					(2.99)	(0.38)
$BC \times FDI(50\%) \times \text{External finance}$					9.13**	1.17**
$(BC_{kt} \times FDI50_{ikt} \times Extfin_j)$					(4.40)	(0.56)
$BC \times FDI(100\%) \times \text{External finance}$					11.62***	1.48***
$(BC_{kt} \times FDI100_{ikt} \times Extfin_j)$					(2.80)	(0.35)
Firm size \times Asset tangibility	1.09***	0.13***				
$(Size_{it} \times Tang_j)$	(0.08)	(0.01)				
Firm size \times Trade credit			3.18***	0.40***		
$(Size_{it} \times Trcrdt_j)$			(0.27)	(0.03)		
Firm size \times External finance					-0.01	-0.001
$(Size_{it} \times Extfin_j)$					(0.31)	(0.04)

Table 2.6 continued

Dependent Variable: Amount of exports ($Export_{i,jkt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
BC \times Firm size \times Asset tangibility	-0.55** (0.23)	-0.07** (0.03)				
$(BC_{kt} \times Size_{it} \times Tang_j)$			-1.53** (0.67)	-0.19** (0.08)		
BC \times Firm size \times Trade credit						
$(BC_{kt} \times Size_{it} \times Trcrdt_j)$					-5.66*** (1.61)	-0.72*** (0.20)
BC \times Firm size \times External finance						
$(BC_{kt} \times Size_{it} \times Extfin_j)$					19.81*** (2.20)	2.53*** (0.26)
Public \times Banking crisis dummy	14.54*** (2.67)	1.78*** (0.31)	10.35*** (2.69)	1.29*** (0.33)		
$(P_{it} \times BC_{kt})$						
Public \times FDI(10%) \times Asset tangibility	41.84*** (8.37)	5.13*** (1.00)				
$(P_{it} \times FDI_{ikt} \times Tang_j)$						
Public \times FDI(50%) \times Asset tangibility	28.86*** (4.54)	3.54*** (0.55)				
$(P_{it} \times FDI_{ikt} \times Tang_j)$						
Public \times FDI(100%) \times Asset tangibility	61.73*** (7.30)	7.57*** (0.80)				
$(P_{it} \times FDI_{ikt} \times Tang_j)$						
Public \times FDI(10%) \times Trade credit			165.09*** (25.00)	20.50*** (2.97)		
$(P_{it} \times FDI_{ikt} \times Trcrdt_j)$						
Public \times FDI(50%) \times Trade credit			102.91*** (18.96)	12.78*** (2.32)		
$(P_{it} \times FDI_{ikt} \times Trcrdt_j)$						
Public \times FDI(100%) \times Trade credit			249.99*** (28.50)	31.04*** (3.13)		
$(P_{it} \times FDI_{ikt} \times Trcrdt_j)$						
Public \times FDI(10%) \times External finance					8.56*** (2.98)	1.09*** (0.38)
$(P_{it} \times FDI_{ikt} \times Extfin_j)$						
Public \times FDI(50%) \times External finance					6.07*** (1.41)	0.78*** (0.18)
$(P_{it} \times FDI_{ikt} \times Extfin_j)$						
Public \times FDI(100%) \times External finance					6.29*** (2.36)	0.80*** (0.30)
$(P_{it} \times FDI_{ikt} \times Extfin_j)$						

Table 2.6 continued

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Amount of exports ($Export_{ijt}$)	Coefficient	dy/dx	Coefficient	dy/dx	Coefficient	dy/dx
Public \times BC \times FDI(10%) \times Asset tangibility	-59.96***	-7.36***				
$(P_{it} \times BC_{kt} \times FDI10_{ikt} \times Tang_j)$	(14.36)	(1.72)				
Public \times BC \times FDI(50%) \times Asset tangibility	-38.10***	-4.67***				
$(P_{it} \times BC_{kt} \times FDI50_{ikt} \times Tang_j)$	(9.56)	(1.15)				
Public \times BC \times FDI(100%) \times Asset tangibility	-52.16***	-6.40***				
$(P_{it} \times BC_{kt} \times FDI100_{ikt} \times Tang_j)$	(11.52)	(1.37)				
Public \times BC \times FDI(10%) \times Trade credit			-145.07***	-18.01***		
$(P_{it} \times BC_{kt} \times FDI10_{ikt} \times Trcrdt_j)$			(50.18)	(6.16)		
Public \times BC \times FDI(50%) \times Trade credit			-87.13**	-10.82**		
$(P_{it} \times BC_{kt} \times FDI50_{ikt} \times Trcrdt_j)$			(41.30)	(5.12)		
Public \times BC \times FDI(100%) \times Trade credit			-133.13***	-16.53***		
$(P_{it} \times BC_{kt} \times FDI100_{ikt} \times Trcrdt_j)$			(45.73)	(5.60)		
Public \times BC \times FDI(10%) \times External finance					-21.93***	-2.80***
$(P_{it} \times BC_{kt} \times FDI10_{ikt} \times Extfin_j)$					(3.62)	(0.45)
Public \times BC \times FDI(50%) \times External finance					-19.93***	-2.54***
$(P_{it} \times BC_{kt} \times FDI50_{ikt} \times Extfin_j)$					(5.26)	(0.66)
Public \times BC \times FDI(100%) \times External finance					-16.69***	-2.13***
$(P_{it} \times BC_{kt} \times FDI100_{ikt} \times Extfin_j)$					(3.94)	(0.50)

Table 2.6 continued

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Amount of exports ($Export_{i,jkt}$)	Coefficient	dy/dx	Coefficient	dy/dx	Coefficient	dy/dx
Public \times Firm size \times Asset tangibility	0.74*** (0.14)	0.09*** (0.02)				
($P_{it} \times Size_{it} \times Tang_j$)						
Public \times Firm size \times Trade credit			2.13*** (0.38)	0.26*** (0.05)		
($P_{it} \times Size_{it} \times Trcrdt_j$)						
Public \times Firm size \times External finance					0.50 (0.32)	0.06 (0.04)
($P_{it} \times Size_{it} \times Extfin_j$)						
Public \times BC \times Firm size \times Asset tangibility	-0.12 (0.25)	-0.01 (0.03)				
($P_{it} \times BC_{kt} \times Size_{it} \times Tang_j$)						
Public \times BC \times Firm size \times Trade credit			-0.42 (0.73)	-0.05 (0.09)		
($P_{it} \times BC_{kt} \times Size_{it} \times Trcrdt_j$)						
Public \times BC \times Firm size \times External finance					6.23*** (1.64)	0.79*** (0.21)
($P_{it} \times BC_{kt} \times Size_{it} \times Extfin_j$)						
Number of observations	82,286	82,286	82,286	82,286	82,286	82,286
Log pseudolikelihood	-82,879		-82,479		-86,751	

Note: See note below the Table 2.4

export more than non-public foreign multinational exporters in more financially vulnerable industries.

In the case of large firms in South Korea in Table 2.7, large foreign multinational exporters with 50 percent or less of foreign shareholding export more than non-large foreign multinational exporters in less financially dependent industries, and large foreign multinational exporters with more than 50 percent of foreign shareholding export more than non-large foreign multinational firms in more financially dependent industries. Large foreign multinational exporters with more than 50 percent of foreign shareholding still export more than non-large foreign multinational exporters in more financially vulnerable industries during a banking crisis in source countries, but the increase in exports decreases in comparison to the amount of exports during a non-crisis period in source countries.

2.6 Conclusion

In this paper, I examine the effect of FDI on exports of foreign multinationals during banking crises in source countries. Using a firm level dataset on firms' annual amount of exports with the banking crises database in South Korea for the 1994-2013 period, I present that banking crises in source countries hinder FDI from promoting exports of foreign affiliates in more financially vulnerable industries. For non-banking crisis periods, more than 50 percent of foreign shareholding promotes the amount of foreign affiliates' exports in financially more vulnerable industries. However, during banking crises in source countries, it is hard for foreign multinationals with even more than 50 percent of foreign shareholding to increase exports in more financially dependent industries.

In addition, I find that firm characteristics also affect foreign multinationals' exports during banking crises in source countries. First, if foreign multinationals are categorized as chaebol, then FDI increases the amount of their exports relatively more than non-chaebol foreign multinationals in more financially vulnerable industries. Thus, chaebol exporters

Table 2.7. Firm Characteristics (Large Firm)

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Amount of exports ($Export_{ikt}$)	Coefficient	dy/dx	Coefficient	dy/dx	Coefficient	dy/dx
Banking crisis dummy (BC_{kt})	-3.24 (2.38)	-0.40 (0.29)	-2.54 (2.24)	-0.31 (0.28)	-5.07*** (1.48)	-0.65*** (0.19)
FDI(10%) \times Asset tangibility ($FDI10_{ikt} \times Tang_j$)	34.02*** (5.78)	4.17*** (0.68)				
FDI(50%) \times Asset tangibility ($FDI50_{ikt} \times Tang_j$)	7.21** (3.17)	0.88** (0.39)				
FDI(100%) \times Asset tangibility ($FDI100_{ikt} \times Tang_j$)	-29.36*** (5.47)	-3.60*** (0.64)				
FDI(10%) \times Trade credit ($FDI10_{ikt} \times Trcrdt_j$)			44.19** (17.20)	5.47** (2.13)		
FDI(50%) \times Trade credit ($FDI50_{ikt} \times Trcrdt_j$)			-32.58** (16.23)	-4.04** (1.99)		
FDI(100%) \times Trade credit ($FDI100_{ikt} \times Trcrdt_j$)			-165.69*** (24.30)	-20.53*** (2.80)		
FDI(10%) \times External finance ($FDI10_{ikt} \times Extfin_j$)					2.50* (1.42)	0.32* (0.18)
FDI(50%) \times External finance ($FDI50_{ikt} \times Extfin_j$)					-0.25 (1.10)	-0.03 (0.14)
FDI(100%) \times External finance ($FDI100_{ikt} \times Extfin_j$)					-7.25*** (1.38)	-0.93*** (0.17)

Table 2.7 continued

Dependent Variable: Amount of exports ($Export_{ikt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
$BC \times FDI(10\%) \times$ Asset tangibility ($BC_{kt} \times FDI10_{ikt} \times Tang_j$)	15.25 (13.08)	1.87 (1.60)				
$BC \times FDI(50\%) \times$ Asset tangibility ($BC_{kt} \times FDI50_{ikt} \times Tang_j$)	4.48 (7.65)	0.55 (0.93)				
$BC \times FDI(100\%) \times$ Asset tangibility ($BC_{kt} \times FDI100_{ikt} \times Tang_j$)	12.14 (10.49)	1.49 (1.28)				
$BC \times FDI(10\%) \times$ Trade credit ($BC_{kt} \times FDI10_{ikt} \times Trcrdt_j$)			6.58 (33.65)	0.82 (4.17)		
$BC \times FDI(50\%) \times$ Trade credit ($BC_{kt} \times FDI50_{ikt} \times Trcrdt_j$)			-1.11 (30.74)	-0.14 (3.81)		
$BC \times FDI(100\%) \times$ Trade credit ($BC_{kt} \times FDI100_{ikt} \times Trcrdt_j$)			12.02 (33.79)	1.49 (4.18)		
$BC \times FDI(10\%) \times$ External finance ($BC_{kt} \times FDI10_{ikt} \times Extfin_j$)					4.24 (3.50)	0.54 (0.45)
$BC \times FDI(50\%) \times$ External finance ($BC_{kt} \times FDI50_{ikt} \times Extfin_j$)					4.35 (2.72)	0.56 (0.35)
$BC \times FDI(100\%) \times$ External finance ($BC_{kt} \times FDI100_{ikt} \times Extfin_j$)					4.61* (2.73)	0.59* (0.35)
Firm size \times Asset tangibility ($Size_{it} \times Tang_j$)	3.59*** (0.18)	0.44*** (0.02)				
Firm size \times Trade credit ($Size_{it} \times Trcrdt_j$)			9.37*** (0.53)	1.16*** (0.06)		
Firm size \times External finance ($Size_{it} \times Extfin_j$)					1.09*** (0.08)	0.14*** (0.01)

Table 2.7 continued

Dependent Variable: Amount of exports ($Export_{ijkt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
BC × Firm size × Asset tangibility ($BC_{kt} \times Size_{it} \times Tang_j$)	20.91*** (4.07)	2.56*** (0.48)	86.36*** (13.77)	10.70*** (1.62)		
BC × Firm size × Trade credit ($BC_{kt} \times Size_{it} \times Trcrdt_j$)					-3.26 (3.14)	-0.42 (0.40)
BC × Firm size × External finance ($BC_{kt} \times Size_{it} \times Extfin_j$)					8.33*** (1.26)	1.07*** (0.15)
Large × Banking crisis dummy ($L_{it} \times BC_{kt}$)	3.62* (1.93)	0.44* (0.23)	-1.13 (2.65)	-0.14 (0.33)		
Large × FDI(10%) × Asset tangibility ($L_{it} \times FDI10_{ikt} \times Tang_j$)	3.41 (4.45)	0.42 (0.55)				
Large × FDI(50%) × Asset tangibility ($L_{it} \times FDI50_{ikt} \times Tang_j$)	8.76** (3.79)	1.07** (0.47)				
Large × FDI(100%) × Asset tangibility ($L_{it} \times FDI100_{ikt} \times Tang_j$)	15.94*** (4.43)	1.96*** (0.53)				
Large × FDI(10%) × Trade credit ($L_{it} \times FDI10_{ikt} \times Trcrdt_j$)			42.45*** (11.48)	5.26*** (1.42)		
Large × FDI(50%) × Trade credit ($L_{it} \times FDI50_{ikt} \times Trcrdt_j$)			41.61** (16.21)	5.16** (2.02)		
Large × FDI(100%) × Trade credit ($L_{it} \times FDI100_{ikt} \times Trcrdt_j$)			50.88*** (16.10)	6.30*** (1.95)		
Large × FDI(10%) × External finance ($L_{it} \times FDI10_{ikt} \times Extfin_j$)					2.83 (1.95)	0.36 (0.25)
Large × FDI(50%) × External finance ($L_{it} \times FDI50_{ikt} \times Extfin_j$)					1.49 (1.48)	0.19 (0.19)
Large × FDI(100%) × External finance ($L_{it} \times FDI100_{ikt} \times Extfin_j$)					1.25 (1.61)	0.16 (0.21)

Table 2.7 continued

Dependent Variable: Amount of exports ($Export_{ijkt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
Large \times BC \times FDI(10%) \times Asset tangibility	-5.09	-0.62				
($L_{it} \times BC_{kt} \times FDI_{10ikt} \times Tang_j$)	(13.12)	(1.61)				
Large \times BC \times FDI(50%) \times Asset tangibility	16.58*	2.03*				
($L_{it} \times BC_{kt} \times FDI_{50ikt} \times Tang_j$)	(9.36)	(1.15)				
Large \times BC \times FDI(100%) \times Asset tangibility	2.80	0.34				
($L_{it} \times BC_{kt} \times FDI_{100ikt} \times Tang_j$)	(11.44)	(1.40)				
Large \times BC \times FDI(10%) \times Trade credit			42.46	5.26		
($L_{it} \times BC_{kt} \times FDI_{10ikt} \times Trcrdt_j$)			(36.36)	(4.50)		
Large \times BC \times FDI(50%) \times Trade credit			147.79***	18.31***		
($L_{it} \times BC_{kt} \times FDI_{50ikt} \times Trcrdt_j$)			(50.27)	(6.19)		
Large \times BC \times FDI(100%) \times Trade credit			104.93**	13.00**		
($L_{it} \times BC_{kt} \times FDI_{100ikt} \times Trcrdt_j$)			(47.25)	(5.85)		
Large \times BC \times FDI(10%) \times External finance					-5.86	-0.75
($L_{it} \times BC_{kt} \times FDI_{10ikt} \times Extfin_j$)					(4.23)	(0.54)
Large \times BC \times FDI(50%) \times External finance					-4.57	-0.59
($L_{it} \times BC_{kt} \times FDI_{50ikt} \times Extfin_j$)					(2.98)	(0.38)
Large \times BC \times FDI(100%) \times External finance					-3.12	-0.40
($L_{it} \times BC_{kt} \times FDI_{100ikt} \times Extfin_j$)					(3.46)	(0.44)

Table 2.7 continued

Dependent Variable: Amount of exports ($Export_{ijkt}$)	(1) Coefficient	(2) dy/dx	(3) Coefficient	(4) dy/dx	(5) Coefficient	(6) dy/dx
Large \times Firm size \times Asset tangibility ($L_{it} \times Size_{it} \times Tang_j$)	-2.00*** (0.20)	-0.25*** (0.03)				
Large \times Firm size \times Trade credit ($L_{it} \times Size_{it} \times Trcrdt_j$)			-4.74*** (0.53)	-0.59*** (0.07)		
Large \times Firm size \times External finance ($L_{it} \times Size_{it} \times Extfin_j$)					-0.61*** (0.07)	-0.08*** (0.01)
Large \times BC \times Firm size \times Asset tangibility ($L_{it} \times BC_{kt} \times Size_{it} \times Tang_j$)	-21.79*** (4.11)	-2.67*** (0.48)				
Large \times BC \times Firm size \times Trade credit ($L_{it} \times BC_{kt} \times Size_{it} \times Trcrdt_j$)			-89.07*** (13.90)	-11.03*** (1.63)		
Large \times BC \times Firm size \times External finance ($L_{it} \times BC_{kt} \times Size_{it} \times Extfin_j$)					3.43 (3.34)	0.44 (0.43)
Number of observations	82,286	82,286	82,286	82,286	82,286	82,286
Log pseudolikelihood	-83,530		-83,191		-86,935	

Note: See note below the Table 2.4

with 10 percent or greater of foreign shareholding export more than non-chaebol exporters in more financially dependent industries. However, during banking crises in source countries, chaebol exporters with 10 percent or more of foreign shareholding export less than non-chaebol exporters in more financially dependent industries. Next, publicly-listed foreign multinational exporters export more than non-public exporters in less financially vulnerable industries, but during banking crises in source countries, publicly-listed foreign multinational exporters export more than non-public exporters in more financially vulnerable industries. Lastly, the results of large firms are similar to the baseline results. Large exporters with 50 percent or less of foreign shareholding export less than non-large firms in more financially vulnerable industries, and large exporters with more than 50 percent of foreign shareholding export more than non-large firms in more financially dependent industries. Large exporters with more than 50 percent of foreign shareholding still export more than non-large exporters in more financially vulnerable industries during banking crises in source countries, but the increase in exports decreases in comparison to the amount of exports during a non-crisis period in source countries.

CHAPTER 3

**THE IMPACT OF MULTINATIONAL PRESENCE ON DOMESTIC
INVESTMENT: FIRM-LEVEL EVIDENCE FROM SOUTH KOREA**

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3.1 Introduction

While it is commonly agreed that foreign direct investment (FDI) relaxes credit constraints 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. 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), Mutenyoo et al. (2010), Morrissey and Udomkerdmongkol (2012), and Ashraf and Herzer (2014) use aggregate data and find that FDI inflows crowd-out domestic investment. In contrast to the large number of studies that use aggregate data, 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.¹ To the best of our knowledge, our paper is the first to provide firm-level evidence on the effects of FDI on firm-level investment decisions through vertical linkages.

The presence of multinationals in vertically and horizontally integrated industries can affect investment behavior differently. In the horizontal linkage 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

¹Using aggregate data for the 1985-1999 period, Deok-Ki Kim and Seo (2003) find that FDI neither crowded-in nor crowded-out domestic investment in South Korea.

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 foreign multinationals' presence on domestic firms' investment decisions, and to evaluate these 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 inflows, 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 construct our baseline linkage measures following the methodology in Javorcik (2004). 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 important firm-level factors, such as firm size and public status, that influence how linkages with foreign multinationals 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 3.24 percentage points. Since the mean investment rate is 22 percent of the existing capital stock, this increase corresponds to a 14.50 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, firms that are not part of a conglomerate (chaebol), 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 0.55 percentage points. This effect is larger if the domestic firm is part 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, leading to a 0.56 percentage point increase in investment. Our results are robust to using alternative measures of using vertical linkages, in particular to the ones that take into account indirect linkages between industries (Antràs et al. (2012)).

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.² 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 into the upstream industries, which increase the number of multinational suppliers, can especially 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

²In addition to improving within firm productivity through spill-overs, multinationals can enhance aggregate productivity through market reallocation and between firm selection. Using a cross-country firm-level panel dataset, Alfaro and Chen (2018) show that the latter mechanism account for the majority of the productivity gains.

investment Euler equations using data from the Ivory Coast, and show that borrowing by foreign firms exacerbate domestic firm credit constraints, and thereby crowd-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 linkages with multinationals contribute to capital accumulation also by relaxing the liquidity constraints faced by domestic firms.

The rest of the paper is organized as follows. In section 3.2, we describe the hypotheses regarding 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 3.3 we describe the firm-level data and how we construct the foreign presence measures of interest. Section 3.4 discusses our findings, and section 3.5 concludes the paper.

3.2 Foreign Multinational Presence and Domestic Firms' Investment

In order to motivate the empirical specification, and to describe how foreign multinationals' presence in the vertically and horizontally integrated industries can affect investment decisions of domestic firms, in this section we discuss a simple investment problem of the firm. 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 the upstream industries, in which case the domestic firm has forward linkages with the multinationals. We start by describing the investment decision of the firm, and the hypotheses we test in our empirical application. Then, we describe our empirical set-up, and the estimation methodology.

3.2.1 Investment Decisions and the Hypotheses

To obtain the investment Euler equation, we consider the standard investment problem of a firm (see for example Love (2003) and Harrison et al. (2004)). At the beginning of period t , the firm optimally chooses the level of variable inputs, output price, and the investment expenditures. 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:

$$V_{it}(K_{it-1}) = \max_{I_{it}} \{ \Pi_{it} - G(K_{it-1}, I_{it}) - I_{it} + \beta E_t [V_{it+1}(K_{it})] \} \quad (3.1)$$

subject to

$$K_{it} = (1 - \delta)K_{it-1} + I_{it}, \quad (3.2)$$

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:

$$1 + \frac{\partial G(K_{it-1}, I_{it})}{\partial I_{it}} = \beta E_t \left[\frac{\partial \Pi_{it+1}}{\partial K_{it}} - \frac{\partial G(K_{it}, I_{it+1})}{\partial K_{it}} + (1 - \delta) \left(1 + \frac{\partial G(K_{it}, I_{it+1})}{\partial I_{it+1}} \right) \right]. \quad (3.3)$$

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.

Following Love (2003), we measure the marginal profitability of capital, $\frac{\partial \Pi_{it+1}}{\partial K_{it}}$, using the firm's sales-to-capital ratio. Additionally, we assume that the presence of foreign multinationals can affect the investment decisions by altering the marginal profitability of capital.

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)). Given an increase in the number of foreign suppliers, FDI spill-overs through forward linkages lower the cost of intermediates, and also potentially increase the quality of available varieties. Since capital and intermediate inputs are used in conjunction, higher quality and/or lower input costs in turn would improve the marginal profitability of capital, and therefore allow domestic firms to increase investment.³ 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. Additionally, the presence of multinational firms in the downstream industries might lead domestic firms to increase investment by requiring them to upgrade the quality of their products (Javorcik (2004)).

In the case of horizontal linkages, the presence of multinationals can have both positive and negative effects on domestic firms' investment decisions. An increase in the foreign multinational presence can lower marginal profitability of capital and thereby reduce investment by intensifying competition, acquiring market shares and lowering the domestic firms' 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.

³Similar to this mechanism through which FDI spill-overs through forward linkages impact marginal profitability of capital, imported inputs can also improve firm's productivity (see for example Halpern et al. (2015) and the references therein) and lead to more investment. Ideally, we would want to distinguish the effect of imported inputs on investment from the impact of forward linkages by controlling for both mechanisms simultaneously. Unfortunately, we do not have information on the firms' imports; therefore, we cannot differentiate between these two mechanisms in our sample.

Hence, the net effect of FDI spillovers on firm’s domestic investment through horizontal linkages is á priori ambiguous, and needs to be determined empirically.

3.2.2 Empirical Investment Equation and Estimation

In order to test for the mechanisms through which the 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 spill-overs on domestic firms’ investment decisions, we estimate a standard reduced form investment equation instead of focusing on a structural relationship.

We start by estimating the following baseline specification

$$\frac{I_{ijt}}{K_{ijt-1}} = \alpha_1 \frac{I_{ijt-1}}{K_{ijt-2}} + \alpha_2 \frac{S_{ijt}}{K_{ijt-1}} + \alpha_3 \frac{C_{ijt}}{K_{ijt-1}} + \alpha_4 FP_{jt}^H + \alpha_5 FP_{jt}^B + \alpha_6 FP_{jt}^F + v_i + \eta_t + \tau_{jt} + \varepsilon_{ijt}, \quad (3.4)$$

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.⁴ The term FP_{jt}^H is a measure for foreign presence in the same sector as the firm operates in, i.e., sector j , and captures the horizontal linkages; FP_{jt}^B is a proxy for foreign presence in sectors that are supplied by sector j , and provides a measure for backward linkages; and FP_{jt}^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 sales-to-capital ratio in order to control for marginal profitability of capital, and cash flow as a proxy for financing constraints,

⁴One can obtain a linearized Euler equation similar to the one presented in equation (3.4) by adopting a functional form for the adjustment costs, and taking a first-order Taylor approximation of the resulting Euler equation (see Love (2003) for derivation of such a model).

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 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, v_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 between two-digit industry dummies and a linear time-trend, τ_{jt} , to allow for industry-specific trends.⁵

Given the short time dimension of our panel data-set (9 year), we estimate the dynamic investment equation (3.4) 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, v_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.⁶ We report the second order serial correlation tests and the Sargan-Hansen tests of over-identification to show the validity of our instruments. Finally,

⁵We construct the measures of foreign presence in the horizontally and vertically linked industries using the input-output matrix at the two-digit level. If we were to include two-digit industry-year fixed effects in our specification, we would not be able to identify the coefficients on the foreign presence measures of interest since they vary at the two-digit industry-year level. Therefore, we are only able to include industry-specific time trends.

⁶In 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.

we cluster the standard errors at the industry-year level since firms in the same industry j may experience the same shocks in a given year.

3.3 Data

3.3.1 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 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.⁷ 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.⁸

The data-set includes information on sales, costs, as well as various types of assets that allow us to construct the investment rate $\left(\frac{I_{ijt}}{K_{ijt-1}}\right)$, 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 the real investment and the real capital stock measures. 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 land and lease assets) plus depreciation costs. We construct the real capital stock using the perpetual inventory method with an 11 percent depreciation rate, and the real investment described above. As the measure of initial capital stock, we use the real book value of capital in the first year the firm appears in the data-set.

⁷KIS 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.

⁸Before 2006, total sales of firms recorded in the KIS data is less than 75% of the total sales of all manufacturing firms with at least 5 employees in Korea reported by the Mining and Manufacturing Survey of Statistics Korea.

Table 3.1. 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 linkages (FP_{jt}^F)	0	0.034	0.023	0.219
Backward linkages (FP_{jt}^B)	0	0.032	0.032	0.186
Horizontal linkages (FP_{jt}^H)	0	0.099	0.076	0.548
Industry sales	1.173	45.245	49.374	199.583
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
Downstream foreign presence	0.023	0.177	0.094	0.723
Upstream foreign presence	0.000	0.144	0.145	0.907

Note: This table shows the descriptive statistics for the 31,608 observations from 6,285 firms used in the estimations. Industry sales and industry demand are in units of 2010 billions of Korean Won.

Since our focus is the impact of foreign presence on domestic firms' investment behavior, we exclude firms with foreign ownership of more than 10 percent from the sample. However, we show the robustness of our results to also including firms with foreign ownership. Additionally, we drop the observations in the top and bottom 1 percent of the sample based on investment rate, sales and cash-flow in order to eliminate outliers. As a result, we end up with 6,285 firms over the 2006-2014 period.⁹ We present the descriptive statistics for the variables included in our estimations in Table 3.1.

⁹We end up with an unbalanced sample as there are firm entries and exits between 2006 and 2014.

3.3.2 Horizontal and vertical linkage measures

In constructing the foreign presence measures, we follow Javorcik (2004) closely, and calculate 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, FP_{jt}^H , 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:

$$FP_{jt}^H = \frac{\sum_{\text{for all } i \in j} \text{ForeignShare}_{it} * S_{it}}{\sum_{\text{for all } i \in j} S_{it}}, \quad (3.5)$$

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, measure the extent of backward linkages and are captured with the FP_{jt}^B variable constructed as

$$FP_{jt}^B = \sum_{k, k \neq j} \gamma_{jkt} FP_{kt}^H. \quad (3.6)$$

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 . In using time-varying input-output coefficients to construct the backward linkage measure, we allow for potential changes in the relationships between the sectors. However, we check the robustness of our results to constructing the foreign presence measures using fixed input-output coefficients. This measure of backward linkages does not include inputs supplied within sector j ($k \neq j$), since they are already included in the horizontal linkages measure, FP_{jt}^H .

The proxy for forward linkages is FP_{jt}^F , 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.,

$$FP_{jt}^F = \sum_{m, m \neq j} \sigma_{jmt} \frac{\sum_{\text{for all } i \in m} ForeignShare_{it} * (S_{it} - X_{it})}{\sum_{\text{for all } i \in m} (S_{it} - X_{it})}. \quad (3.7)$$

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

Table 3.1 presents the descriptive statistics for the horizontal, backward, and forward linkage measures for the overall sample, and Table 3.2 presents the average value of the three measures for each of the two digit industries, ranked by the average horizontal foreign presence measure. There is considerable variation across industries for each of the foreign presence measures. While the overall average for the horizontal linkage 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 linkage measure is 3.2 percent. It takes on a value zero for ship building and tobacco product manufacturing, suggesting that those two 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 linkage 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.

3.4 Results

We start by estimating the impact of horizontal, backward, and forward linkages on domestic firms' investment decisions in South Korea, as specified by equation (3.4). In the first subsection, we discuss the main effects of these three foreign presence measures on investment decisions, show that the results are robust to including firms with foreign ownership in the

Table 3.2. Foreign Presence 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

Note: This table shows the average foreign presence values for each of the 2-digit industries as defined by Bank of Korea. The values are in percentages.

sample, and to accounting for the financial crisis years. Also, within that subsection, we show the robustness of our results to using alternative measures of foreign presence in the vertically linked industries. Next, we discuss the heterogeneity in the impact of the foreign presence 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 foreign firm presence on domestic investment.

3.4.1 Main Effects of FDI on Domestic Firms' Investment Decisions

Table 3.3 presents the results from our baseline specification (3.4) for investment, which includes firm and year fixed effects, as well as industry specific time trends. Additionally, it includes total domestic sales of the two-digit industry the firm is operating in (industry j) as a measure of aggregate size of the industry.¹⁰ Column (1) of Table 3.3 shows that all three foreign presence measures have positive and significant effects on domestic firms' investment decisions. 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 firms and could be correlated with foreign firm presence.¹¹ Following Javorcik (2004), in column (3), we further include a measure of total demand for the (two-digit) 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.¹² The results from this augmented specification show that all three measures are positive, but only the forward and horizontal linkage

¹⁰We are not able to construct industry-specific control variables or include industry-year fixed effects at a more disaggregate level due to the fact that Bank of Korea changed industry classifications during our sample period, and there is no straightforward mapping between the new and old classifications.

¹¹The Herfindal index is constructed as the sum of squared sales share of firms in each two digit industry.

¹²More 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.

measures are statistically significant. The largest impact is obtained for the forward linkage variable with a coefficient of 1.622, which implies that a one standard deviation increase in the presence of foreign suppliers—corresponding roughly to a 2 percentage point increase in FP_t^F —, the domestic customers increase investment rate by 3.24 percentage points. Given that the average investment rate in the sample is 22.38 percent, this increase corresponds to a 14.50 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 potentially lowering the cost of intermediates and/or improving the quality of available varieties.

The coefficient on the backward linkage measure is smaller at 0.276, and it is not statistically significant. The size of the coefficient implies that a similar 2 percentage point increase in foreign presence in the downstream sectors, where the customers are multinationals, raises investment by 0.55 percentage points, corresponding to a 2.47 percent increase in the investment rate. This result suggests that backward linkages potentially can increase investment by raising the demand for domestic suppliers' products and increasing their profitability. However, in addition to being insignificant, 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.¹³ We find a positive and significant effect of horizontal FDI on domestic firms' investment decisions. At 0.280, the coefficient on FP_t^H implies an addition of 0.56 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 allowing for knowledge spill-overs within the same industry, horizontal linkages lead firms to invest more, but its impact is relatively small.

¹³More specifically, Javorcik (2004) finds that a 4 percentage point increase in the backward linkages is associated with a 15 percent rise in output of the firms in the supplying industry.

Table 3.3. 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 $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.114*** (0.012)	0.115*** (0.011)	0.115*** (0.011)	0.116*** (0.011)	0.117*** (0.013)	0.118*** (0.011)
Sales $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.008* (0.004)	0.008* (0.004)	0.008* (0.004)	0.008* (0.004)	0.008* (0.004)	0.006** (0.003)
Cash-flow $\left(\frac{C_{ijt}}{K_{ijt-1}}\right)$	0.038** (0.019)	0.042** (0.019)	0.041** (0.019)	0.039** (0.019)	0.037 (0.025)	0.029** (0.014)
Forward linkages (FP_{jt}^F)	0.951** (0.451)	1.412*** (0.524)	1.622*** (0.603)	1.629*** (0.599)	1.994** (0.785)	1.023** (0.499)
Backward linkages (FP_{jt}^B)	0.574*** (0.207)	0.793*** (0.252)	0.276 (0.232)	0.195 (0.234)	0.388 (0.409)	0.235 (0.180)
Horizontal linkages (FP_{jt}^H)	0.235** (0.099)	0.288*** (0.106)	0.280*** (0.106)	0.294*** (0.107)	0.410*** (0.131)	0.208** (0.086)
Industry sales	0.0004*** (0.0001)	0.0002 (0.0001)	0.0003** (0.0001)	0.0003** (0.0001)	0.0003 (0.0002)	0.0002*** (0.0001)
Herfindahl index		1.096*** (0.374)	1.007*** (0.350)	1.004*** (0.343)	1.069*** (0.402)	0.741** (0.311)
Industry demand			0.001** (0.001)	0.002** (0.001)	0.002 (0.001)	0.001* (0.001)
Foreign ownership						0.058*** (0.010)
Crisis dummy*Industry interactions	no	no	no	yes	no	no
Observations	31,608	31,608	31,608	31,608	22,995	37,041

Table 3.3 continued

Dependent Variable: $\frac{I_{ijt}}{K_{ijt-1}}$	(1)	(2)	(3)	(4)	(5)	(6)
Number of firms		6,285	6,285	6,285	5,876	7,061
Hansen-Sargan test (p-value)		0.181	0.262	0.258	0.225	0.273
1st order serial corr. test (p-value)		0	0	0	0	0
2nd order serial corr. test (p-value)		0.692	0.717	0.737	0.741	0.698

Note: The estimates are obtained from the two-step system GMM procedure. Standard errors are clustered at the industry-year level and 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.

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 at the 10 percent level. 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 impact of industry sales and the Herfindahl index, suggesting that larger and less competitive industries (higher values of the Herfindahl index) are associated with higher investment rates, as the firms' profit margins are likely to be higher. Additionally, we obtain a positive and significant coefficient on the industry demand variable, which means that when the demand for the industry's output increases, firms become more profitable and expand investment.

The specifications in Table 3.3 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.¹⁴ The fact that the errors only have first order autocorrelation confirms the validity of instruments dated $t - 2$ and $t - 3$.

In columns (4) and (5) of Table 3.3, we consider the sensitivity of our results to accounting for the 2007-2008 global crisis, which might have adversely affected both the investment decisions of firms and FDI flows. The year dummies we include in our specifications control for the effect of the crisis that are common to all the firms. However, some industries might

¹⁴Assuming that the residuals, ε_{ijt} , in equation (3.4) are i.i.d, we expect $\Delta\varepsilon_{ijt}$ in the first-differenced equations to have first order autocorrelation.

have been impacted more by the crisis, for example due to their import or export exposures. In order to control for the heterogeneous impact of the crisis across the industries, in column (4) we include interaction terms between the industry dummies and a crisis indicator that takes on a value one for 2007 and 2008, and zero otherwise. The results mainly remain unchanged from the estimates we obtain for the baseline specification in column (3). In column (5), we further analyze the sensitivity of our results by excluding the 2007-2008 global crisis years, hence limiting the time span of our sample to 2009-2014. The results show that the impact of each of the three foreign presence 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 linkages with foreign multinationals during the financial crisis as much as they did during the non-crisis years.

The last column of Table 3.3 reports the estimates obtained from a sample that also includes firms with partial or full foreign ownership, for the full set of years (2006-2014). In this specification, we add a foreign ownership dummy variable, which takes on a value one if and when the firm receives foreign participation, to the previous set of covariates. When we include firms with foreign equity, the coefficients on all three foreign linkage measures decline in size, and the forward linkage and the horizontal linkage coefficients remain statistically significant. This suggests that purely domestic firms in the downstream sectors benefit more from forward linkages compared to firms with foreign ownership, since multinationals likely already have access to cheaper inputs through their international supply networks. Similarly, purely domestic firms may be gaining more from knowledge spillovers through horizontal linkages because the multinationals firms with foreign ownership already have access to better technology, and therefore higher marginal profitability of capital. Finally, the positive and significant coefficient on the foreign ownership indicator shows that in general multinationals have higher investment profiles.

In Table 3.4, we check the robustness of our results to using alternative measures of foreign presence in the vertically linked industries. One potential concern with our baseline

measures constructed using time-varying input-output coefficients is that the input-output linkages may change with the firms' investment, in which case our linkage measures might be endogenous. To check whether our results are affected by this potential endogeneity issue, we construct the backward and forward linkage measures in equations (3.6) and (3.7) using the input-output coefficients (γ_{jk} and σ_{jm}) for 2006, and therefore eliminating the time-variation in the foreign presence measures arising from the changes in these coefficients. Using these alternative measures, we obtain stronger results. The results reported in column (1) of Table 3.4 show that the coefficient on backward linkages more than triples in magnitude (compared to the baseline results in column (3) of Table 3.3), and becomes statistically significant. While the coefficient on forward linkages slightly declines, it remains statistically and economically significant.

An additional consideration when constructing the foreign presence measures is the indirect linkages between industries. Even if a domestic supplier in an upstream industry j is not directly selling inputs to a foreign multinational, it might be selling its product to domestic firms in an other industry (industry l) that provides inputs to a further downstream industry k , where foreign multinationals operate. An increase in the foreign presence in industry k can affect the investment decisions of firms in industry l directly as it increases the marginal profitability in industry l . Furthermore, it can impact the firms in industry j indirectly as it improves the marginal profitability in industry l , which purchases inputs from industry j . Similarly, domestic firms in downstream industries might be affected by an increase in the foreign presence of suppliers that they are not directly sourcing inputs from. In order to check the robustness of our results to accounting for indirect linkages between industries, we construct variables capturing foreign presence in vertical industries based on the upstreamness measure developed in Antràs et al. (2012).¹⁵ Specifically, we

¹⁵See Chor et al. (2014) for an application of this upstreamness index to Chinese firms' exports and imports.

Table 3.4. Alternative Measures

Dependent Variable: $\frac{I_{ijt}}{K_{ijt-1}}$	(1)	(2)
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.115*** (0.011)	0.116*** (0.011)
Sales $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.008* (0.004)	0.008* (0.004)
Cash-flow $\left(\frac{C_{ijt}}{K_{ijt-1}}\right)$	0.044** (0.019)	0.042** (0.019)
Forward linkages, fixed coefficient in 2006 $\left(FP_{jt}^{F, fixed}\right)$	1.338** (0.533)	
Backward linkages, fixed coefficient in 2006 $\left(FP_{jt}^{B, fixed}\right)$	0.882*** (0.298)	
Horizontal linkages	0.275*** (0.105)	0.247** (0.108)
Industry sales	0.0003** (0.0001)	0.0002 (0.0001)
Herfindahl index	1.060*** (0.369)	0.888** (0.351)
Industry demand	0.001* (0.001)	0.001 (0.001)
Foreign presence, downstream $\left(FP_{jt}^D\right)$		0.367** (0.175)
Foreign presence, upstream $\left(FP_{jt}^U\right)$		0.121** (0.052)
Observations	31,608	31,608
Number of firms	6,285	6,285
Hansen-Sargan test (p-value)	0.268	0.246
1st order serial corr. test (p-value)	0	0
2nd order serial corr. test (p-value)	0.731	0.755

Note: See Table 3.3 for note.

consider the following measure for foreign presence in downstream industries supplied by a firm in upstream industry j

$$FP_{jt}^D = FP_{jt}^H + 2 \sum_l^N \delta_{jl} FP_{jt}^H + 3 \sum_j^N \sum_k^N \delta_{il} \delta_{lk} FP_{jt}^H + \dots,$$

where FP_{jt}^H denotes foreign presence in industry j as defined in equation (3.5); and, δ_{jl} captures the value of inputs produced in industry j needed to produce one dollar worth of output in industry l and corresponds to the direct requirement coefficient (adjusted by exports and imports of industry l) obtained from the input-output tables. Following Antràs et al. (2012), we construct a vector of foreign presence measure, whose j^{th} entry captures the foreign presence in downstream industries supplied by industry j as

$$FP_t^D = [I - D]^{-1} FP_t^H. \quad (3.8)$$

Similarly, we use the transpose of the direct coefficients matrix, D^T , to construct measures of foreign presence in upstream industries j sources inputs from using

$$FP_t^U = [I - D^T]^{-1} FP_t^H. \quad (3.9)$$

The results in column (2) of Table 3.4 show that both vertical linkage measures and the horizontal linkage measure are positive and significant. The coefficient of 0.367 on FP_{jt}^D implies that if foreign presence in downstream industries increases by two percentage points, investment of a domestic firm will increase by 0.73 percentage points. If we consider a one standard deviation (14.53 percentage points) increase, investment rises by 5.33 percentage points. Following a two percentage point or a one standard deviation (9.44 percentage points) increase in foreign presence in upstream industries, domestic firms foster investment by 0.24 or 1.13 percentage points. Hence, the results remain economically and statistically similar to the findings from our baseline measures when we use foreign presence measures that account for indirect vertical linkages between the industries.

3.4.2 Firm Characteristics

Next, we analyze 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 enterprise by the Korean Small and Medium Business Administration.¹⁶ We then interact the large firm dummy variable with the three foreign presence measures and include them in our baseline specification (see Table 3.3, column 3). The coefficients on the main foreign linkage variables capture the effect of foreign presence in horizontally and vertically linked 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 3.5 show a statistically significant difference for large firms only with the forward linkage measure. The negative and significant interaction between the large firm dummy and FP_t^F together with the main coefficient on FP_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 3.38 percentage points, whereas large enterprises increase it by 2.13 percentage points. This result conforms with 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 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 less impacted by an increase in horizontal linkages, although the coefficient on the interaction term with FP_t^H is small and insignificant. By contrast, the interaction term with the backward linkage variable is positive, but also insignificant.

¹⁶The Small and Medium Business Administration categorizes firms into two as large enterprises and small and medium enterprises. The classification is based on industry-specific sales cut-offs or total asset values.

Table 3.5. Firm Characteristics

Dependent Variable:	(1)	(2)	(3)	(4)	(5)
	Full sample	Full sample	Full sample	Exporters	Non-exporters
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.115*** (0.011)	0.115*** (0.011)	0.115*** (0.011)	0.140*** (0.024)	0.113*** (0.010)
Sales $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.008* (0.004)	0.008* (0.004)	0.008* (0.004)	-0.005 (0.008)	0.008 (0.005)
Cash-flow $\left(\frac{C_{ijt}}{K_{ijt-1}}\right)$	0.041** (0.019)	0.041** (0.019)	0.041** (0.019)	0.094** (0.043)	0.049** (0.023)
Forward linkages (FP_{jt}^F)	1.690*** (0.611)	1.668*** (0.616)	1.745*** (0.617)	0.212 (0.826)	2.193*** (0.692)
Backward linkages (FP_{jt}^B)	0.254 (0.247)	0.222 (0.237)	0.232 (0.246)	0.334 (0.382)	0.509* (0.306)
Horizontal linkages (FP_{jt}^H)	0.286** (0.122)	0.277*** (0.107)	0.257** (0.112)	0.252 (0.171)	0.304*** (0.115)
Industry sales	0.0002* (0.0001)	0.0002** (0.0001)	0.0003** (0.0001)	0.0001 (0.0002)	0.0002 (0.0002)
Herfindahl index	0.967*** (0.347)	0.998*** (0.351)	0.981*** (0.346)	0.361 (0.666)	1.170*** (0.385)
Industry demand	0.001* (0.001)	0.001** (0.001)	0.001** (0.001)	0.000 (0.001)	0.002** (0.001)
Forward linkages*Large firm ($FP_{jt}^B * LF_i$)	-0.623*** (0.211)				
Backward linkages*Large firm ($FP_{jt}^B * LF_i$)	0.076 (0.240)				
Horizontal linkages*Large firm ($FP_{jt}^H * LF_i$)	-0.078 (0.085)				

Table 3.5 continued

Dependent Variable: $\frac{I_{ijt}}{K_{ijt-1}}$	(1)	(2)	(3)	(4)	(5)
	Full sample	Full sample	Full sample	Exporters	Non-exporters
Forward linkages*Chaebol ($FP_{jt}^F * CH_i$)		-0.721*** (0.271)			
Backward linkages*Chaebol ($FP_{jt}^B * CH_i$)		0.900* (0.476)			
Horizontal linkages*Chaebol ($FP_{jt}^H * CH_i$)		-0.061 (0.098)			
Forward linkages*Avg. Exports ($FP_{jt}^F * EX_i$)			-0.991*** (0.303)		
Backward linkages*Avg. Exports ($FP_{jt}^B * EX_i$)			0.182 (0.378)		
Horizontal linkages*Avg. Exports ($FP_{jt}^H * EX_i$)			0.081 (0.100)		
Observations	31,608	31,608	31,608	6,041	23,288
Number of firms	6,285	6,285	6,285	1,353	5,352
Hansen-Sargan test (p-value)	0.229	0.254	0.237	0.404	0.600
1st order serial corr. test (p-value)	0	0	0	0	0
2nd order serial corr. test (p-value)	0.725	0.734	0.728	0.977	0.435

Note: See Table 3.3 for note.

In the second column of Table 3.5, 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 it with the three FDI measures.¹⁷ We find that the signs of the interaction terms are the same as the interaction terms for the large firm dummy.¹⁸ 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 1.80 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. These results suggest that local suppliers that are part of a business conglomerate find it easier to serve multinational customers, and benefit more from the backward linkages. As in the previous column, the interaction term between the forward linkage measure and the chaebol dummy is negative and significant. Hence, we find that firms belonging to a chaebol do not benefit from an increase in the presence of foreign suppliers as much, likely because they source inputs through their own production networks.

The next characteristic we consider is the exporting status of the firm, defined as the average exports to total sale ratio for each firm. We interact the average export ratio with the three foreign presence measures and report the results in column (3). Consistent with the results in the previous columns, the coefficient on the forward linkage interaction is negative, and the coefficients on backward and horizontal linkage interactions are positive, although only the coefficient on the forward one is significant. The coefficient of 1.745 on FP_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 3.49 percentage points. By

¹⁷The chaebol dummy is not time-varying; i.e., all firms in our data-set are either a part of the chaebol or not throughout the sample period. Therefore, we cannot estimate the impact of being a part of a chaebol on investment directly in our specification, since it already accounts for firm fixed effects.

¹⁸The correlation between the chaebol dummy and the large firm dummy is 0.34.

contrast, a domestic firm that exports half of its output will increase investment rate by 2.50 percentage points.¹⁹ 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.

In addition to responding to the presence of foreign firms differently, exporters and non-exporters in general might have different investment profiles. To allow for the overall investment dynamics to differ across the two groups, we estimate our baseline specification separately for the exporter and non-exporter sub-samples. We define a firm to be an exporter if the firm exports at least for two years during our sample period. The results in the last two columns of Table 3.5 show that an increase in the presence of foreign multinationals affects just the non-exporter firms through both vertical and horizontal linkages. While the coefficients on all three foreign presence measures are positive for the exporters, they are not significant. By contrast, the coefficients on the foreign presence measures are statistically significant for the non-exporters and the implied impacts are larger than the ones obtained for the full sample (see column 3 of Table 3.3). In particular, we find that a 2 percentage point increase in the foreign presence in the upstream and downstream industries increases investment by 4.39 and 1.02 percentage points through forward and backward linkages, respectively. A similar increase in the horizontal linkages increases investment by 0.61 percentage points. Overall, these results suggest that the benefits of FDI might accrue to the non-exporter firms that do not already have international production or sales networks.

¹⁹In an alternative specification, we defined the exporting status of the firm as the median level of exports to total sale ratio for each firm. The results are very similar to the ones reported in column 3 of Table 3.5 and are available upon request.

3.4.3 Financial Constraints

Heterogeneity in the spill-overs from FDI to domestic investment can also depend on the financial constraints that the firms face. In their paper, Alfaro et al. (2010) suggest that external financing is necessary for local entrepreneurs to start supplying inputs to multinationals and to benefit from FDI through 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 linkages) 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 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. We interact the public status dummy with the foreign presence measures and examine the differential effects of foreign presence on publicly traded firms. Second, we interact cash flow with the foreign presence measures, and analyze whether an increase in the presence of multinationals contributes to firm's investment by alleviating liquidity constraints. Lastly, we consider an industry-specific measure of external finance dependence provided by Braun (2003), and interact it with the foreign presence measures.²⁰ 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.²¹ Higher values of the external finance

²⁰This measure of external finance dependence have been previously used in studies that focus on financial constraints and international activity, such as Manova (2008).

²¹The correspondence between the 3-digit ISIC industries and the Korean industry classification is available upon request.

Table 3.6. Financial Constraints

Dependent Variable: $\frac{I_{ijt}}{K_{ijt-1}}$	(1)	(2)	(3)	(4)
Lagged investment rate $\left(\frac{I_{ijt-1}}{K_{ijt-2}}\right)$	0.113*** (0.011)	0.112*** (0.011)	0.133*** (0.017)	0.114*** (0.011)
Sales $\left(\frac{S_{ijt}}{K_{ijt-1}}\right)$	0.008** (0.004)	0.006 (0.004)	0.004 (0.004)	0.008* (0.004)
Cash-flow $\left(\frac{C_{ijt}}{K_{ijt-1}}\right)$	0.038** (0.019)	0.040** (0.019)	0.053** (0.023)	0.044** (0.019)
Forward linkages (FP_{jt}^F)	1.123** (0.554)	1.251*** (0.572)	1.081* (0.554)	0.778 (0.484)
Backward linkages (FP_{jt}^B)	0.275 (0.234)	0.374* (0.207)	0.607** (0.254)	0.574* (0.306)
Horizontal linkages (FP_{jt}^H)	0.236** (0.101)	0.237** (0.115)	0.260** (0.109)	0.123 (0.088)
Industry sales	0.0002 (0.0001)	0.0002* (0.0001)	0.0002* (0.0001)	0.0003* (0.0001)
Herfindahl index	0.794** (0.339)	0.725** (0.325)	0.607 (0.390)	0.796** (0.353)
Industry demand	0.001 (0.001)	0.001* (0.001)	0.001 (0.001)	0.001* (0.001)
Public dummy (P_{it})	0.041* (0.023)	0.107 (0.084)	0.002 (0.046)	0.170** (0.084)
Public dummy*Forward linkages $(P_{it} * FP_{jt}^F)$		-1.225* (0.743)		
Public dummy*Backward linkages $(P_{it} * FP_{jt}^B)$		-0.650 (0.439)		
Public dummy*Horizontal linkages $(P_{it} * FP_{jt}^H)$		-0.289 (0.281)		

Table 3.6 continued

Dependent Variable: $\frac{I_{ijt}}{K_{ijt-1}}$	(1)	(2)	(3)	(4)
Public dummy*			0.031	
Cash-flow $\left(P_{it} * \frac{C_{ijt}}{K_{ijt-1}}\right)$			(0.031)	
Cash-flow*Forward linkages $\left(\frac{C_{ijt}}{K_{ijt-1}} * FP_{jt}^F\right)$			-0.137	
Cash-flow*Backward linkages $\left(\frac{C_{ijt}}{K_{ijt-1}} * FP_{jt}^B\right)$			(0.181)	
Cash-flow*Horizontal linkages $\left(\frac{C_{ijt}}{K_{ijt-1}} * FP_{jt}^H\right)$			-0.289*	
Public dummy*External Finance Dependence $(P_{it} * EFD_j)$				-0.262**
External Finance Dependence*				(0.123)
Forward linkages $(EFD_j * FP_{jt}^F)$				1.235*
External Finance Dependence*				(0.724)
Backward linkages $(EFD_j * FP_{jt}^B)$				-1.025*
External Finance Dependence*				(0.548)
Horizontal linkages $(EFD_j * FP_{jt}^H)$				0.254
				(0.173)
Observations	31,608	31,608	31,608	31,608
Number of firms	6,285	6,285	6,285	6,285
Hansen-Sargan test (p-value)	0.373	0.226	0.414	0.376
1st order serial corr. test (p-value)	0	0	0	0
2nd order serial corr. test (p-value)	0.624	0.617	0.537	0.671

Note: See Table 3.3 for note.

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.

We begin with a specification that adds the public status of the firm to our baseline specification.²² The positive and significant (at the 10 percent level) coefficient on the public status dummy in column (1) of Table 3.6 confirms the notion that on average public firms are able to invest more as they are less credit constrained. When we include the interaction terms between the public status dummy with the three foreign presence measures in column (2), we obtain negative coefficients on all three interaction terms; however, only the one with the forward linkage measure is statistically significant. The negative interaction term together with the coefficient on forward linkage variable suggest that a 2 percentage point increase in the presence of multinational suppliers leads private firms to raise investment by 2.5 percentage points, whereas it does not impact the public firms' investment decisions. This result suggests that, potentially by lowering the cost of inputs, an increase in the presence of multinational suppliers improves the marginal profitability of capital and allows credit constrained private firms to increase investment. By contrast, public firms are not affected as they are able to finance inputs more easily.

Next, in column (3) of Table 3.6, we analyze the role of linkages with foreign multinationals 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 foreign presence measures with the cash flow variable. If FDI in vertically and horizontally integrated industries relaxes liquidity constraints for the domestic firms, then we would expect it to lower the sensitivity of investment to cash flow. Thus, we would expect the interaction terms to be negative. Moreover, we include an interaction term between the public status dummy and cash-flow to allow for the fact that publicly traded firms may

²²The public status dummy variable is time-varying for some firms, as they become publicly traded during our sample period. Therefore, we are able to identify the impact of becoming publicly traded in our specification with firm fixed effects.

be less sensitive to liquidity constraints. As expected, the three interaction terms with the foreign linkage measures are negative, although only the interaction term with the backward linkage measure is statistically significant (at the 10 percent). The coefficient on the cash-flow and its interaction with the backward linkage measure together imply that a domestic firm in an industry that does not supply any inputs to multinationals (no backward linkage linkage) has an elasticity of investment to cash-flow equal to 0.33 at the mean values of investment and cash flow. The elasticity goes down to 0.27 for a firm in an industry with horizontal linkage measure equal to the mean (0.032). Although statistically insignificant, the negative interaction term between cash flow and the forward linkage measure implies that having multinational suppliers may also lower the sensitivity of investment to cash flow and therefore lead the firm to invest more by relaxing liquidity constraints. Contrary to our expectations, we do not uncover a significant impact of publicly traded status on the sensitivity of cash-flow.²³

Finally, column (4) of Table 3.6 provides the results for the specification that includes the interaction terms between industry's external finance dependence measure and the three foreign presence measures, as well as the public status dummy. The negative coefficient on the interaction term with the backward linkage measure suggests that firms in more external finance dependent industries are not able to benefit from an increase in the multinational customers as much. Combined with the main effect backward linkage variable, the interaction term suggests that a firm in an industry with an external finance dependence measure equal to the mean (0.404), increases investment only by 0.32 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

²³In an alternative specification, we included an interaction term between cash-flow and the chaebol dummy, instead of the interaction term between cash-flow and the public status dummy. We found the interaction with the chaebol dummy to be also negative and insignificant. The results are available upon request.

($0.404-0.332=0.072$; see Table 3.1 for the descriptive statistics), increases investment by 1 percentage point following a similar increase in the presence of multinational customers. These findings suggest that financially constrained domestic firms that rely more heavily on external financing find it more difficult to start supplying inputs to multinationals and therefore they do not benefit from FDI through backward linkages as much. These findings also conform 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 linkage measure suggests that firms in the more external finance dependent industries are able to benefit more from the increase in the presence of foreign suppliers. FDI spill-overs through forward linkages are expected to lead to higher investment by lowering the cost of intermediates, and also potentially by increasing the quality of available varieties. Since financing intermediates is more expensive for credit constrained firms that rely on external markets, a reduction in the inputs' cost would increase their marginal profitability by more (compared to a firm that can purchase inputs with internal financing). Therefore, firms in external finance dependent industries can benefit more from an increase in the presence of foreign suppliers. Our results provide support to this hypothesis. Specifically, the coefficients on the interaction term implies that firms in the most external finance dependent industries increase their investment by an additional 1.82 percentage points compared to the firms that are in the average external finance dependent industries, following a 2 percentage point increase in the forward linkages. Similar to the results in the previous columns, these findings highlight the impact of the presence of multinational suppliers in improving the marginal profitability of capital (potentially by lowering the input costs) and allowing the credit constrained private firms to increase investment.

3.5 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 foreign multinationals' presence increase investment rate of domestic firms through both horizontal and vertical linkages. We also show that the largest gains are 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 3.24 percentage points, which corresponds to a 14.50 percent increase. We also find that this effect is larger for small and medium firms, private firms, non-exporters, firms not part of a chaebol, 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 0.55 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 also smaller at 0.56 percentage points.

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

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