Productivity of Foreign Affiliates after Divestment

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Version: November 13, 2021

Abstract: This paper examines the impacts of divestment on foreign affiliates based on firm-level data from Korea for the period 2006–2019, in which financial crises provide exogenous shocks to generate most of the observed divestments. Those divestments provide a unique setting to examine the benefit of foreign ownership and its persistence. Our empirical analysis leads to several conclusions. First, former foreign affiliates experience significant drops in total factor productivity and export even with increase of employment, capital stock, and imported inputs. Second, our results on productivity loss are stronger for former foreign affiliates having a higher capacity to absorb parents' technology and having parents with lower transaction costs to transfer technology. Overall, our results suggest that the benefits of foreign ownership depend on a continuous knowledge transfer, and their persistence is particularly low for former affiliates firms relying on technology transfer. Finally, we rule out that access to trade markets, outsourcing, financial support, and transfer pricing is the main benefits of foreign ownership, and also show that the benefit of foreign ownership cannot be replicated by domestic parent ownership.

Keywords: Foreign Direct Investment, Cross-Border M&As, Multinational Firms, Divestment

JEL codes: F23, F61, G34

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1. Introduction

The global foreign direct investment (FDI) has grown from 1990 until it reached its peak ($2 trillion) in 2015, although it declined approximately 19% on average during the global financial crisis in 2007–2009. FDI results in foreign ownership of domestic firms through equity acquisition. Since 2015, foreign divestment has been increasing over recent years with many countries reporting a decline in net foreign investment outflows. The global FDI inflow decreased by 25% on average from 2015 through 2019, from $2 trillion to less than $1.5 trillion (UNCTAD, 2020).[1] [2] The decline was mainly due to the divestments of multinational enterprises (MNEs) from the United States, and this trend is expected to be intensified by populism (Rodrik, 2018) and cross-border trade and investment barriers (McCann, 2018). However, there are few studies examining the effects of divestment on former foreign affiliates (Javorcik and Poelhekke, 2017; Brucal et al., 2019).[3]

We examine the impacts of divestment on the productivity of former foreign affiliates, which informs the persistence in the benefit of foreign ownership. If the benefit on the productivity of foreign affiliates is driven by continuous inputs from foreign parent firms, then the divestment of foreign parent firms will reverse the benefits of foreign ownership. Conversely, if the benefit on productivity is driven by persistent inputs from foreign parent firms, then the divestment of foreign parent firms will not reverse the benefits of foreign ownership. A negative productivity effect of divestment indicates at least a part of the benefits of foreign ownership depending on the continuous inputs from foreign parent firms.

Prior studies suggest several benefits of foreign ownership on productivity.[4] First, MNEs tend to operate in industries where intangible assets, such as patents, new technologies, and brand names, play an important role (Arnold and Javorcik, 2009; Guadalupe et al., 2012). MNEs improve the productivity of their affiliates by transferring superior technologies in new product innovation (Sadowski and Sadowski-Rasters, 2006; Guadalupe et al., 2012;

[1] These figures are based on our calculation with UNCTAD STAT.

[2] After 2019, the trend of FDI declines more steeply due to the COVID-19 pandemic. Global FDI flows decrease by up to 40% in 2020 from their 2019 value of $1.54 trillion. This would bring FDI below $ 1 trillion for the first time since 2005 (UNCTAD, 2020).

[3] We use the term "affiliates" throughout to cover not only fully-owned subsidiaries, but also partially-owned subsidiaries where the parent firm holds a major shareholding.

[4] Our work focuses on how to evaluate the benefit of foreign ownership on acquired domestic firms. From a broader perspective for evaluating the benefit of FDI, we note that the benefit of foreign ownership on acquired domestic firms needs to be balanced with the mixed spillover effects on competing domestic firms; see Aitken and Harrison (1999), Clougherty et al. (2014) and Jin et al. (2018) for evidence on productivity, wage and innovation, respectively.

Stiebale, 2016; Hsu et al., 2021). Second, foreign ownership reduces transaction costs for transferring technology to foreign affiliates (Dimelis and Louri, 2002). Third, foreign ownership can increase productivity of its affiliates through economies of scale and scope (Bertrand et al., 2012; Wang and Wang 2015), upgrading production process and input quality (Arnold and Javorcik, 2009; Stiebale and Vencappa, 2018), the mix of complementary firm-specific assets (Nocke and Yeaple, 2008; Arkolakis et al., 2018), and better management practice (Bloom and Van Reenen, 2010; Girma et al., 2019).

To examine the effects of divestment on foreign affiliates, we focus on the cases in Korea. There are several advantages of examining Korea as our case of interest. First, there have been substantial variations in foreign ownership in Korea. Interestingly, Figure 1 depicts that the variation of FDI inflow of Korea coincides with that of the world, which suggests that foreign investment and divestment in Korea are mainly subject to external factors. Korea's FDI is about 1% of the world FDI over the period 1990-2019, in which it reaches to about 2% in 2004 given the faster recovery of FDI inflow of Korea than that of the world. The changes in FDI in Korea over the past decades have attracted the attention of many researchers, and as a result, there have been studies using Korean firm-level data exploring the effects of foreign ownership on domestic firms.[5] Second, the technology-oriented industrial structure in Korea provides a unique setting to examine the effects of divestment to technology industries, in addition to traditional industries. FDI-driven spillovers account for a substantial portion of productivity growth, especially in high-tech sectors (Keller and Yeaple, 2009). Accordingly, knowledge transfer in technology-intensive and labor-intensive industries can be substantially different, which may result in different persistence in the benefit of foreign ownership. Third, Korea provides various policy incentives to attract FDI, including tax incentives, cash subsidies, and location support (see Table 1 for details). Therefore, Korea provides an environment that is suitable to discuss the policy implications of our empirical analysis.

[Table 1 and Figure 1 insert about here]

[5] Previous studies find that foreign ownership is shown to increases R&D investment (Lee, 2012), firm productivity (Kim, 2015), and export behaviors (Kim and Choi, 2019).

We construct firm-level data from Korea for the period 2006–2019 to estimate the effect of foreign divestment on former affiliates. Specifically, we measure foreign divestment when a former affiliate was fully or at least 50% owned by a foreign parent firm but now has zero foreign ownership. The primary outcome variable, total factor productivity (TFP), is estimated with a Cobb–Douglas production function as our measure of productivity. To obtain consistent estimates of productivity, we estimate the production function by controlling for simultaneity and selection biases, using the methodology of Olley and Pakes (1996), Levinsohn and Petrin (2003), and Ackerberg et al. (2015), and adjust for markup with the method of Garcia-Marin and Voigtländer (2019). To explore the underlying mechanisms, we supplement other outcome measures such as output, employment, capital stock, R&D expenses, export intensity, and import intensity, which can affect the productivity of foreign affiliates.

The causal effect of foreign divestment on former affiliates' productivity is estimated using a difference-in-differences (DiD) model, where the treatment is defined as divestment. The former foreign affiliates consist of the treatment group, while the firms affiliated with a foreign parent firm throughout the sample period are designated as the control group. Since a divestment might not be selected randomly, we employ propensity score reweighting method to construct a control group of non-divested firms that as if they come from random experiment. Then, we employ DiD methods with firm-specific fixed effects to control for the observed and unobserved firm-level heterogeneities.

Our empirical analysis leads to the following conclusions. First, former foreign affiliates experience significant drops in TFP and export, whereas the employment, capital stock, and imported inputs significantly increase. The former foreign affiliates increase inputs in an attempt to offset the productivity loss to maintain their output. However, such responses lead to a productivity decline. Our results are robust to the uses of alternative matching procedures, event windows, the definition of divestment, and conditioning variables. We suggest that divestment disrupts continuous inputs from foreign parent firms and results in a productivity decline of former foreign affiliates.

Second, we measure the ability of foreign affiliates to learn proprietary knowledge from their parent firms with R&D and intangible assets of the affiliates. We find that the productivity drop of foreign divestment is stronger for affiliates relying more on R&D and

intangible assets. Then, we measure the transaction costs of receiving parents' technology with the share of parents' ownership in its affiliate. In particular, a full ownership of foreign affiliates by parent firms represents lower transaction costs for the parent firms to transfer proprietary knowledge to their affiliates. Our results show that fully-owned affiliates experience productivity decline after divestment, whereas partially-owned affiliates maintain productivity level even after divestment. Interestingly, the benefit of foreign ownership for firms relying on technology transfer is partially transitory. It suggests that continuous input of proprietary knowledge from parent firms is a source of productivity gain of foreign affiliates, which cannot be maintained after divestment. Our results highlight cautious policy implications for promoting FDI.

Third, we provide evidence to argue that the knowledge transfer channel is more pertinent in explaining the main benefits of foreign ownership than other mechanisms, including access to export markets, outsourcing, financial support, and transfer pricing. Also, divestments by domestic owners do not render the same results as our main results, suggesting that our main results are driven by the loss of foreign parent firms instead of the ownership change itself. This highlights the productivity gain from knowledge transfer, which is a unique advantage that distinguishes foreign ownership from domestic ownership (Guadalupe et al., 2012; Stiebale and Vencappa, 2018).

Our study relates to the literature that examines the productivity effects of divestment on former foreign affiliates. In a seminal paper, using a firm-level dataset from Indonesia, Javorcik and Poelhekke (2017) find that divestment of foreign ownership is associated with a drop in TFP, output, markups, employment, wage, export intensity, and import intensity. Brucal et al. (2019) posit that divestment of foreign ownership relates to a drop in output, but an increase in energy and emission intensities. These findings suggest the benefits of foreign ownership cannot be persistently transferred to the domestic affiliates but require continuous inputs from the parent firm. Interestingly, Egger et al. (2020) find that wage premium, particularly for skilled workers, does not disappear after the divestment of foreign ownership.

Our study contributes to the literature by emphasizing how firm heterogeneities affect the persistence in benefit of foreign ownership. Specifically, we exploit two variations of our dataset. First, our sample of Korean firms is unique to serving our purpose because it

includes a larger proportion of firms in technology industries than the sample of Indonesian firms used in Javorcik and Poelhekke (2017) and Brucal et al. (2019). Second, we identify firms with a high absorption capacity and with parents having lower transaction costs to transfer technology. As a result, we provide novel evidence that the benefit of foreign ownership is less persistent for firms relying on technology transfer.

The remaining sections of this paper are organized as follows. Section 2 discusses the literature and develops hypotheses. Section 3 describes the data and empirical methodology. Sections 4 and 5 present the empirical findings. Section 6 concludes.

2. Data and Empirical Strategy

Our empirical analysis is based on a firm-level dataset collected from the Survey of Business Activities, Statistics Korea. The data covers more than 10,000 manufacturing firms in 25 Korean Standard Industry Code (KSIC) two-digit industries (10-34) during the period 2006–2019.

As shown in Table 2, the number of foreign acquisitions and divestments in our sample period are 946 and 175, respectively. A substantial proportion of acquisition and divestment concentrates on technology industries. "Motor vehicles", "Machinery and equipment" "Chemicals and pharmaceutical products", "Radio, TV, and communications equipment", and "Electrical machinery and apparatus" are the top five industries of divestment for foreign affiliates. Note that the distribution of industries experiencing foreign acquisitions is similar to that of foreign divestment, suggesting that the information of foreign divestment is representative to understand the effects of foreign ownership.

[Table 2 insert about here]

Furthermore, the third column of Table 2 compares the divestment in our sample to the Indonesian cases of Javorcik and Poelhekke (2017). The sample of the Indonesian case concentrates on labor-intensive industries such as "Food and beverages," "Textiles," "Apparel," "Leather and leather products," and "Furniture." It suggests that the foreign divestments in our sample are substantially different from that of Javorcik and Poelhekke (2017), providing a unique setting to further understand the benefit of foreign ownership for

technology industries.

2.1.Outcome and Treatment Variables

We employ a large set of outcome variables, capturing productivity, output, input, and trade. The choice of outcome variables is in accordance with Javorcik and Poelhekke (2017) and Stiebale and Vencappa (2018).

We use TFP as a key outcome variable because it summarizes various impacts of divestment on former foreign affiliates. To obtain consistent estimates of productivity, we estimate a Cobb–Douglas production function by controlling for simultaneity and selection biases, using the methodology of Olley and Pakes (1996), Levinsohn and Petrin (2003), and Ackerberg et al. (2015), and adjust for markup using the method of Garcia-Marin and Voigtländer (2019).[6] We name those variables as *OP*, *LP*, *ACF*, and *GMV*.

Furthermore, we supplement the TFP measures with outputs (i.e., value-added), employment, capital stock (i.e., the value of fixed assets), R&D expenses, export intensity (i.e., export/sales), and import intensity (i.e., import/sales). We apply those additional variables to explore the underlying mechanisms of how divestment affects the former foreign affiliates.[7]

For the treatment variable, we construct a measure of foreign divestment: a former affiliate with at least 50% of foreign equity share but now has zero foreign equity share.[8] Figure 2 shows the distribution of foreign equity shares prior to divestment. Notably, our divestment measure captures the former foreign affiliates that were fully or partially owned by foreign parent firms. Two common forms of foreign ownership are having slightly more than 50% or 100% foreign shares.

[Table 3 and Figure 2 insert about here]

Table 3 reports the origins of former parent firms in our sample. The top five countries

[6] For brevity, we discuss the estimation of those productivity measures in Appendix A.
[7] We observe the ownership information of our sample firms starting from 2006. We cannot compute the duration of foreign ownership if the foreign shareholders acquired their equity before 2006.
[8] Our analysis only focuses on the divestments leading to a standalone firm, but excludes those cases when the foreign parent sell their shares to a domestic parent.

having acquisition and divestment in Korea are Japan, United States, Germany, China, and the Netherlands in order. Figure 3 shows that most of the divestiture in our sample occurred in 2008 and 2011, which were likely the outcomes of the global financial crisis and the European debt crisis, respectively. Those financial crises imposed a financial constraint on foreign parent firms in Korea, which in turn leads to divestment. Methodologically, those crises provide exogenous shocks to divestment for our empirical analysis.

2.2. Propensity Score Reweighting Approach

Panel A of Table 4 reports the firm characteristics between former foreign affiliates and the continuing foreign affiliates. The descriptive statistics show that there are differences across a range of characteristics. Such differences may drive the former foreign affiliates to behave differently from the continuing foreign affiliates. To control those confounding factors, we follow Guadalupe et al. (2012) and Stiebale and Vencappa (2018) and estimate a propensity score reweighting estimator (Imbens, 2004).[9]

To estimate the propensity score, we assume each divestment is governed by a Probit model:

$$Divest_{it}^{*} = z_{it-1}\alpha + i.industry + i.year + \eta_{it}, \quad Divest_{it} = 1\{Divest_{it}^{*} \geq 0\} \qquad (1)$$

where $\eta_{it} \sim N(0,1)$ and $Divest_{it} = 1$ if the divestment occurs for firm i in year t, and $Divest_{it} = 0$ otherwise. We control the model with industry and year dummies. The set of explanatory variables z_{it-1} includes the lagged TFP, sales, sales growth, output, capital stock, wage, capital intensity, export intensity, and import intensity, which are associated with foreign ownership (Stiebale and Vencappa, 2018). All explanatory variables are lagged one period and have a log form. Further, we compute block-bootstrapped standard errors to allow for serial correlation within firm.

Table 5 shows the results of propensity score estimation. The coefficients indicate that firms with a higher value of TFP, sales growth, wage, and import intensity are less likely to be divested. Large firms, as proxied by output and capital stock, are associated with a higher

[9] Propensity score reweighting is more efficient compared to nearest neighbor matching (Busso et al. 2014).

propensity of divestment. Using the estimated propensity score, we assign a weigh equal to $\frac{\widehat{Pr}(divestment_t=1|z_{t-1})}{1-\widehat{Pr}(divestment_t=1|z_{t-1})}$ for all firms in the control group.

[Table 4 and 5 insert about here]

2.3. Difference-in-Differences (DiD) Model

To examine how divestment of foreign parent firms affects their former affiliates, we estimate the following equation:

$$\Delta Outcome_{it} = a \cdot 1_{\{0 \le \Delta t \le 3\}} \times Divestment_i + \gamma_{Parent} + \gamma_i + \gamma_t + \varepsilon_{it} \quad (2)$$

The dependent variable $\Delta Outcome_{it}$ represents the annual growth of outcome variable (*TFP measures, output, employment, capital stock, R&D expenses, export intensity, and import intensity)* for firm i at year t. The use of growth measures can control the size effects of each outcome. Panel B of Table 4 reports the summary statistics of outcome variables between former foreign affiliates and the continuing foreign affiliates.

$Divestment_i$ is an indicator for the firm undergoing a divestment during our sample period. Let $\Delta t \equiv t - t_{Divest}$ so the event time indicator $1_{\{\Delta t=r\}}$ represents r years before ($r < 0$) or after ($r \ge 0$) the year of the divestment (t_{Divest}). The parameter a is the coefficient of the interaction between the event time indicators and $Divestment_i$, that is, $1_{\{0 \le \Delta t \le 3\}} \times Divestment_i$. Since we choose the years before the divestment, that is, $r \le -1$, as the baseline years in the analysis, the parameter a measures the difference in firm outcomes between treated and control firms at year $r \ge 0$ relative to the baseline years.

For some foreign affiliates, the origins of parents often changed, although the parent company has continued to be foreign. Among non-divested firms, there are cases where the parent company and its country have changed while maintaining its status as foreign affiliates. To capture the variation of the foreign parent country, we include a set of fixed effects of parent country γ_{Parent}. Furthermore, to control the unobserved heterogeneities of divestment at firm levels, we include a set of firm-specific fixed effects γ_i. Firm-specific fixed effects do not absorb the fixed effects of the parent country because foreign affiliates may be sold from a parent firm from a country (e.g., USA) to another parent firm from a different

country (e.g., Japan). The year-specific fixed effects γ_t control the aggregate shocks to outcome variables. The random variable ε_{jt} is an error term.

3. Empirical Results

3.1. Main Results

Table 6 reports the results of propensity score reweighting-DiD estimation. It shows that former foreign affiliates experience a statistically significant drop in productivity; particularly, the divested firms experience a 27.9% drop in TFP measures estimated with OP method. Also, the former foreign affiliates focus less on export. Examining various firm variables indicates that employment, capital stock, and import significantly increase in response to divestment. We interpret these results as the response of firms counterbalancing the loss of productive capacity relating to foreign parents. However, these increases in inputs lead to a reduction in TFP.

[Table 6 insert about here]

On one hand, a part of these results is consistent with Javorcik and Poelhekke (2017). The benefits of foreign ownership are driven by a continuous supply of headquarter services from the foreign parent. On the other hand, a part of these results is different from Javorcik and Poelhekke (2017), i.e. the former foreign affiliates increase their inputs to offset the productivity decline on output. We attribute this difference to the dominance of technology industries in our sample of Korean firms relative to the sample of Indonesian firms used in Javorcik and Poelhekke (2017) and Brucal et al. (2019).

3.2.Robustness Checks

This subsection provides various robustness checks of our main results reported in Table 6.

Alternative TFP Measures: Since we use the TFP measure estimated with the OP method as our main result, here we perform a robustness check using TFP measures estimated with other methods. The results are reported in Column LP, ACF, and GMV in Table 6, which are consistent with those under Column OP. Our results based on various TFP measures

consistently suggest that divestment has a detrimental effect on TFP of former foreign affiliates.

Assumption of Parallel Trends: Our identifying assumption is that the treated and control firms would not have had differential trends in outcome variables before the divestment. Specifically, if the outcome variables of divested firms have different trends from those of control firms, then the DiD estimate may be partially caused by the differential trends. To this end, we apply an event study approach and estimate the following equation:

$$\Delta Outcome_{it} = (\Sigma_{r = -5, \ldots, -2} a_r \cdot 1_{\{\Delta t = r\}} + \Sigma_{r = 0, \ldots, 3} a_r \cdot 1_{\{\Delta t = r\}}) \times Divestment_i + \gamma_{Parent} + \gamma_t + \gamma_t + \varepsilon_{it} \qquad (3)$$

The set of a_r includes the coefficients of the interactions between the event time indicators and $Divestment_i$, that is, $1_{\{\Delta t = r\}} \times Divestment_i$. Since we choose the year before divestment, that is, r = -1, as the baseline year in the analysis, a_r measures the difference in firm outcomes between treated and non-treated firms at year r relative to the omitted a_{-1}, which is the difference in the year before divestment.

Figure 4 plots the results of the event study showing the change of outcome variables before and after divestment. Overall, there is no significant movement and trend of outcome variables before divestment. All confidence intervals of outcome variables cover zero before t-1, suggesting that there are no pre-trends for all of our outcome variables. Further, the impacts of divestment on TFP, employment, capital, export intensity and import intensity occur in the year of divestment, suggesting that divestment, instead of an omitted factor, is the driver for substantial changes in outcome variables.

[Figure 4 insert about here]

Financial Crisis: Our sample covers the global financial crisis, during which we observe divestment of foreign affiliates and economic downturn. Table B1 documents the countries of parent firms that experience financial crisis and their durations. There is a concern about the adverse effects of divestment are confounded by the economic downturn. Panel A of Table 7 reports that the results of propensity score reweighting DiD with controlling crisis

effects. Encouragingly, these results are close to our main results.

Alternative Length of long-run trends: Our propensity score matching is based on one-year lagged levels of all firm-level outcomes. Here, we control for longer pre-acquisition trends by using three-year lagged levels of all firm-level outcomes. Panel B of Table 7 reports the results of propensity score reweighting DiD from this specification. The results are consistent with our main results.

[Table 7 insert about here]

Alternative Specification of Propensity Score: We include the growth of all outcome variables into the propensity score specification. Put differently, we control lagged level of and growth of TFP, markup, outputs, sales, export intensity, import intensity, capital stock, and wages. Panel C of Table 7 reports the results of propensity score reweighting DiD from this specification of the propensity score. Encouragingly, these results are close to our main results.

Alternative Length of Post-Divestment Window: In our main results, we examine the effect of divestment up to three years after the divestment. Here, we perform a robustness check to examine the effect of divestment up to five years. Panel D of Table 7 reports that the results are mostly similar with our main results.

Alternative Definition of Divestment: In our main analysis, we define divestment as the reduction of foreign ownership to zero. Here, we perform a robustness check to define divestment as the foreign ownership reduces to less than 10%. This increases our sample of divestment from 175 to 177 cases. Panel E of Table 7 reports the results of propensity score reweighting DiD from this sample of divestment. Encouragingly, these results are close to our main results.

The Nearest Neighbor Matching Without Replacement: We implement one-to-one nearest neighbor matching without replacement, implying each divested firm is matched a matched

non-divested firm. Following Chen (2011), Wang and Wang (2015), Javorcik and Poelhekke (2017), and Brucal et al. (2019), we select the control firms from the same year and the same two-digit KSIC industry as the treated firms, and use the caliper-restricted nearest neighbor method to build the control group. In addition, we drop treated observations whose propensity score is higher than the maximum or less than the minimum propensity score of the controls.[10] Finally, we have 148 pairs of the treated firms and the control firms after matching.

Next, we perform a DiD regression based on the matched sample. Panel F of Table 7 reports that the DiD results from the nearest neighbor matching without replacement are close to our main results, suggesting that our results are robust to an alternative matching algorithm.

Intra-Industry Spillover: Divestments may send negative signals to other suppliers, consumers, and stakeholders, which can lead to losses of suppliers and skilled workers, lower sales, and restricted financial resources (Bandick and Karpaty, 2011). Such spillover effects may affect both treated and control foreign affiliates, which violates the stable unit treatment value assumption (SUTVA).

To examine whether the spillover effects bias our main results, we implement one-to-one nearest neighbor matching without replacement in a different industry in order to limit the spillover effects following Javorcik and Poelhekke (2017). Specifically, we construct an alternative control group based on nearest neighbor matching, but the matched control firms come from a different (2-digit KSIC) industry. This procedure reduces the probability that treated and control firms compete in the same product and input markets. We report the results in Panel G of Table 7, which are similar to our main results.

4. Knowledge Transfer as a Potential Channel

In this section, we explore the disruption of knowledge transfer as a potential channel through which divestment affects firm productivity. If our proposed channel is relevant to explain the empirical results, we will observe that our main results are driven by firms

[10] The evidence for verifying common support is available upon request.

excelling in absorbing parents' technology and having parent firms more willing to transfer technology. After that, we examine some confounding channels.

4.1. Absorption Capacity

Absorption capacity theory suggests that firms' ability to absorb and internalize external knowledge increases with the level of prior related knowledge, comprising technical knowledge, and marketing and management know-how (Cohen and Levinthal, 1989; Cohen and Levinthal, 1990). Prior studies measure absorption capacity with R&D inputs, intellectual properties such as patents, trademarks, and copyrights, and intangible assets such as goodwill and brand recognition (Chang et al. 2013a, Arrighetti et al. 2014). Foreign affiliates with a higher level of R&D and intangible assets are more able to absorb the proprietary knowledge from their foreign parent firms. However, those affiliates will suffer a larger productivity drop after divestment because they lose access to proprietary knowledge and may not be able to find a perfect replacement.

In the following two sub-sample analyses, we employ R&D intensity and intangible assets as measures to identify former foreign affiliates having a higher absorption capacity, which benefiting them from knowledge transfer of their parents.[11]

R&D Intensity: We divide firms into two groups according to the R&D intensity (i.e., the ratio of R&D expenses to sales) of their industries, assuming firms in the same industry share similar technology. Specifically, for each industry-year, we calculate its R&D intensity as the median of R&D intensity across all firms. Then, we calculate the R&D intensity of an industry as the time series median of that industry over the sample period. We finally divide our sample into two, namely high R&D intensity (industries with R&D intensity above the median across all industries) and low R&D intensity (industries with R&D intensity below the median across all industries).

Table 8 reports that, for the sub-sample of higher R&D intensity, divestment has a negative impact on TFP and export despite increases in capital, employment and imported inputs. These results are in accordance with our main results, which is reasonable because

[11] Unfortunately, we do not have information about the innovativeness of parent firm.

our sample is dominated by firms in the technology industries. Moreover, these results suggest that those former foreign affiliates with high R&D intensity rely on the continuous input of knowledge from foreign parent firms, but they are not able to maintain those advantages after divestment.

[Table 8 insert about here]

Interestingly, for the sub-sample of a lower R&D intensity, divestment has no significant sign on TFP, output, and export. Moreover, we find negative impacts of divestment on capital input, R&D expenses, and imported inputs. There is no clear evidence that the benefits from foreign ownership disappear after the divestment, suggesting that the productivity spillover effects from foreign parents in traditional industries are more persistent.

Intangible Assets: We divide firms into two groups according to their intangible assets. First, we calculate the median ratio of intangible assets to the total assets of a firm over time. Then, we calculate the intangible assets of an industry as the time series median of that industry over the sample period. Finally, we divide our sample into two, namely high intangible asset intensity (industries with intangible asset intensity above the median across all industries) and low intangible asset intensity (industries with intangible asset intensity below the median across all industries).

Table 9 reports that the results of the sub-sample of high intangible asset intensity are consistent with our main results. Divestment leads to lower TFP and export despite increases in outputs and inputs such as employment, capital stock, and import. These results suggest that those former foreign affiliates with high intangible assets rely on the continuous input of knowledge from foreign parent firms, but they are not able to maintain those advantages after divestment. Conversely, for the sub-sample of low intangible asset intensity, divestment does not affect productivity and export significantly, suggesting that the benefit of foreign ownership on productivity persists even after divestment.

[Table 9 insert about here]

Combining the results from sub-samples of low R&D intensity and low intangible asset intensity, we highlight that more technology-intensive firms are likely to enjoy a less persistent benefit from foreign ownership. Foreign parents are less willing to permanently transfer non-proprietary knowledge, such as unpatented know-how, to their affiliates. In contrast, for less technology-intensive industries or firms, foreign parents are more willing to transfer non-proprietary knowledge, such as management practices, to their affiliates. The latter results are different from those reported in Javorcik and Poelhekke (2017), which focus on divestment cases in labor-intensive industries. Based on our results, traditional industries in Korea can sustain the benefits of foreign ownership even after divestment. Since our study and Javorcik and Poelhekke (2017) employ data from a single country, it seems that country-specific factors may play a role in the effects of divestment on former foreign affiliates. We leave this exploration to future research.

4.2. Transaction Costs of Knowledge Transfer

The degree of ownership affects the technology transfer to their affiliates. A fully owned affiliate would be more efficient because the parent firm had lower transaction costs to transfer knowledge-based assets such as technology, management skills, and brands (Dimelis and Louri 2002; Chang et al. 2013b). Moreover, partial ownership increases the possibility of misappropriation of intangible assets by the affiliates. The appropriation risk not only discourages the foreign parent firm to transfer technology but also increases monitoring costs (Barbosa and Louri 2002). Therefore, we hypothesize that fully-owned affiliates suffer a larger drop in productivity after divestment because they lose access to the proprietary knowledge of their parent firm and may not be able to find a perfect replacement.

Following prior studies, we divide firms into two groups by the share of foreign ownership before divestment, that is, 100% and 50–99% (Dimelis and Louri, 2002; Chang et al., 2013b; Javorcik and Poelhekke, 2017).[12] We consider the foreign affiliates that were fully foreign-owned at time t-1 as 100% foreign-owned, and partially owned otherwise. Table 10 reports that divestment of fully-owned foreign affiliates leads to a reduction of TFP and output despite increases in capital, employment, and R&D expenses. On the contrary, the

[12] We do not include minority ownership in partial ownership sample because those foreign owners are less likely to control their affiliates and have weaker incentive to transfer their knowledge.

partially-owned foreign affiliates do not experience significant changes in TFP, output, capital, R&D expenses, and trade.

[Table 10 insert about here]

The contrasting results suggest that the fully-owned foreign affiliates are more advantageous in productivity than their partially-owned counterparts. However, the productivity advantage of fully-owned foreign affiliates depends on continuous inputs, such as proprietary knowledge transfer, from foreign parents. After the divestment, the former foreign affiliates lose an essential input and hence suffer a productivity loss. Conversely, the partially-owned foreign affiliates mostly benefit from reducing their resource restriction such as employment and capital.

4.3. Other Confounding Channels

In this subsection, we examine whether other confounding channels instead of knowledge transfer from foreign parent firms produce the benefits of foreign ownership.

Access to Export Markets: We test whether the benefit of foreign ownership is derived from better access to export markets but not from knowledge transfer. We address this issue by isolating the negative effect of export demand shock to use a sub-sample of non-exporters. More specifically, we estimate our model with a sub-sample of firms that did not export at t-1 and a sub-sample of firms that exported at t-1.

Table 11 reports that the results from those two sub-samples show similar results. There is no evidence of exporters being hurt by divestment more than non-exporters. It supports that the benefit of foreign ownership for our sample firms is derived from knowledge transfer instead of better access to export markets.

[Table 11 insert about here]

Outsourcing and Financing: We investigate whether the benefit of foreign ownership is derived from better access to outsourcing (Girma and Görg, 2004) and financing (Wang and

Wang, 2015) but not from knowledge transfer. We employ the outsourcing ratio (i.e., outsourcing/sales) to assess the degree of outsourcing, and the liquidity ratio (i.e., the ratio of current assets less current liabilities to total assets) to assess the funding availability. We use the same methodology used in Table 6 to examine the effects of divestment on those two ratios and report the results in Table 12.[13]

[Table 12 insert about here]

There is no evidence of divestment influencing the outsourcing and liquidity ratios of the former foreign affiliates. It supports that the benefits of foreign ownership for our sample firms are derived neither from outsourcing activities nor financing support. These results are consistent with those reported in Stiebale and Vencappa (2018), who also argue that financial factors and outsourcing activities are not the main benefits of foreign ownership.

Transfer Pricing: There is a concern about whether the benefit of foreign ownership is derived from transfer pricing but not from knowledge transfer. Foreign parent firms might have an incentive to manipulate the profits of their affiliates in Korea because of the policy incentives presented in Table 1. As a result, they may inflate output (and hence TFP). Transfer pricing activities stop after divestment, which causes output and TFP to decline, providing an explanation for our main results as well.

Based on Javorcik and Poelhekke (2017), we use the sub-sample of fully-owned foreign affiliates as the case with a stronger incentive to engage in transfer pricing. However, fully-owned foreign affiliates are also a case with a stronger knowledge transfer, which invalidates our test of transfer pricing. As a result, we employ a sub-sample of fully-owned foreign affiliates in the low R&D intensity industries, in which knowledge transfer is less beneficial.

If transfer pricing was a concern, then we would observe this sub-sample of firms reacting more negatively than our main sample because foreign parents not only stop providing input to those foreign affiliates but also stop transferring profit to them. Table 13 reports that there is no significant evidence of this sub-sample of firms being hurt more by the divestment than

[13] The sample size for this analysis is smaller because not all sample firms report the outsourcing ratio and liquidity ratio.

the full sample. This does not support the concern of transfer pricing.

[Table 13 insert about here]

Domestic Divestment: We assess whether the divestment effects identified in our main results are driven by the loss of foreign ownership or the change in ownership in general. Here, we investigate whether the divestment from a domestic parent firm has the same effect as that from a foreign parent firm. If divestment of domestic parent firms has a similar effect on affiliates, then the ownership change, in general, would be the driving force of our results instead of the loss of foreign ownership.

We find 403 cases of domestic divestments. We employ the same methodology as in Table 6 to examine the effects of domestic divestment and report the results in Table 14. There is no evidence of significant results on all outcome variables, except capital. This supports that our main results are driven by the loss of foreign ownership instead of ownership changes, highlighting the productivity gain from knowledge transfer as a unique advantage that distinguishes foreign ownership from domestic ownership (Guadalupe et al., 2012; Stiebale and Vencappa, 2018).

[Table 14 insert about here]

5. Conclusion

This paper examines the benefit of foreign ownership and its persistence with the divestment of multinationals in Korea. We find that former foreign affiliates experience significant drops in TFP and export, in spite of which they increase employment, capital stock, and import. We find that these results are associated with the loss of foreign parent firms. These results are robust to the uses of alternative matching procedures event windows and conditioning variables. In addition, the benefit of foreign ownership is stronger for firms relying more on R&D and intangible assets, and firms having lower transaction costs in receiving parents' technology. It suggests that the benefit of foreign ownership relies on continuous input of knowledge from parent firms, and such benefit is less persistent for firms relying on technology transfer. Finally, we provide evidence to rule out that access to export

markets, outsourcing, financial support, and transfer pricing are the main benefits of foreign ownership. Also, we show that the benefit of foreign ownership cannot be replicated by domestic ownership.

Many governments, such as Korea, encourage FDI by providing policy incentives, such as tax incentives. In a conservative scenario for computing the benefit of foreign ownership, foreign acquirers would divest their share in acquired domestic firms when the tax incentives expired.[14] Our results suggest that at least a part of the benefit of foreign ownership in technology industries is likely to discontinue, while that in traditional industries is likely to persist after the foreign parent firm divests its ownership. Such results highlight different policy implications to attract FDI for technology-intensive and traditional (such as labor-intensive) firms.

[14] In a more positive scenario, one may assume the foreign ownership remains even after the tax incentive expires.

References

Ackerberg, D. A., Caves, K., Frazer, G. (2015). Identification properties of recent production function estimators. *Econometrica*, *83*(6), 2411-2451.

Aitken, B. J., & Harrison, A. E. (1999). Do domestic firms benefit from direct foreign investment? Evidence from Venezuela. *American Economic Review*, *89*(3), 605-618.

Arkolakis, C., Ramondo, N., Rodríguez-Clare, A., & Yeaple, S. (2018). Innovation and production in the global economy. *American Economic Review*, *108*(8), 2128-73.

Arnold, J. M., Javorcik, B. S. (2009). Gifted kids or pushy parents? Foreign direct investment and plant productivity in Indonesia. *Journal of International Economics*, *79*(1), 42-53.

Arrighetti, A., Landini, F., Lasagni, A. (2014). Intangible assets and firm heterogeneity: Evidence from Italy. *Research Policy*, *43*(1), 202-213.

Bandick, R., & Karpaty, P. (2011). Employment effects of foreign acquisition. *International Review of Economics & Finance*, *20*(2), 211-224.

Barbosa, N., & Louri, H. (2002). On the determinants of multinationals' ownership preferences: evidence from Greece and Portugal. *International Journal of Industrial Organization*, *20*(4), 493-515.

Bertrand, O., Hakkala, K. N., Norbäck, P. J., & Persson, L. (2012). Should countries block foreign takeovers of R&D champions and promote greenfield entry?. *Canadian Journal of Economics/Revue canadienne d'économique*, *45*(3), 1083-1124.

Bloom, N., Van Reenen, J. (2010). Why do management practices differ across firms and countries?. *Journal of Economic Perspectives*, *24*(1), 203-24.

Brucal, A., Javorcik, B, Love, I. (2019). Good for the environment, good for business: Foreign acquisitions and energy intensity. *Journal of International Economics* 121, 103247.

Busso, M., DiNardo, J., & McCrary, J. (2014). New evidence on the finite sample properties of propensity score reweighting and matching estimators. *Review of Economics and Statistics*, *96*(5), 885-897.

Chang, S. J., Chung, J., Moon, J. J. (2013a). When do foreign subsidiaries outperform local firms?. *Journal of International Business Studies*, *44*(8), 853-860.

Chang, S. J., Chung, J., Moon, J. J. (2013b). When do wholly owned subsidiaries perform better than joint ventures? *Strategic Management Journal*, *34*(3), 317-337.

Chen, W. (2011). The effect of investor origin on firm performance: Domestic and foreign direct investment in the United States. *Journal of International Economics*, *83*(2), 219-228.

Clougherty, J.A., Gugler, K., Sørgard, L., Szücs, F.W. (2014). Cross-border mergers and domestic-firm wages: Integrating "spillover effects" and "bargaining effects". *Journal of International Business Studies*, 45(4), 450-470.

Cohen, W. M., Levinthal, D. A. (1989). Innovation and learning: the two faces of R & D. *The economic journal*, *99*(397), 569-596.

Cohen, W. M., Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative science quarterly*, 128-152.

De Loecker, J., F. Warzynski (2012). Markups and Firm-Level Export Status. *American Economic Review*, 102(6), 2437–2471.

Dimelis, S., & Louri, H. (2002). Foreign ownership and production efficiency: a quantile regression analysis. *Oxford Economic Papers*, *54*(3), 449-469.

Egger, H., Jahn, E., Kornitzky, S. (2020). Reassessing the foreign ownership wage premium in Germany. *The World Economy*, *43*(2), 302-325.

Garcia-Marin, A., Voigtländer, N. (2019). Exporting and plant-level efficiency gains: It's in the measure. *Journal of Political Economy*, *127*(4), 1777-1825.

Girma, S., Görg, H. (2004). Outsourcing, foreign ownership, and productivity: evidence from UK establishment-level data. *Review of International Economics*, *12*(5), 817-832.

Girma, S., Görg, H., Kersting, E. (2019). Which boats are lifted by a foreign tide? Direct and indirect wage effects of foreign ownership. *Journal of International Business Studies*, 50(6), 923-947.

Guadalupe, M., Kuzmina, O., Thomas, C. (2012). Innovation and foreign ownership. *American Economic Review*, *102*(7), 3594-3627.

Hsu, P. H., Huang, P., Humphery-Jenner, M., & Powell, R. (2021). Cross-border mergers and acquisitions for innovation. *Journal of International Money and Finance*, *112*, 102320.

Imbens, G. W. (2004). Nonparametric estimation of average treatment effects under exogeneity: A review. *Review of Economics and statistics*, *86*(1), 4-29.

Javorcik, B., Poelhekke, S. (2017). Former foreign affiliates: Cast out and outperformed?. *Journal of the European Economic Association*, *15*(3), 501-539.

Jin, B., García, F., Salomon, R. (2019). Inward foreign direct investment and local firm innovation: The moderating role of technological capabilities. *Journal of International Business Studies*, 50(5), 847-855.

Keller, W., & Yeaple, S. R. (2009). Multinational enterprises, international trade, and productivity growth: firm-level evidence from the United States. *The review of economics and statistics*, *91*(4), 821-831.

Kim, M. (2015). Productivity spillovers from FDI and the role of domestic firm's absorptive capacity in South Korean manufacturing industries**.** *Empirical Economics* 48, 807–827.

Kim, M., Choi, M. J. (2019). R&D spillover effects on firms' export behavior: evidence from South Korea. *Applied Economics*, *51*(28), 3066-3080.

Lee, S (2012). Financial Determinants of Corporate R&D Investment in Korea. *Asian Economic Journal* 26 (2), 119-135

Laeven, L., & Valencia, F. (2020). Systemic banking crises database II. *IMF Economic Review*, *68*(2), 307-361.

Levinsohn, J., Petrin, A. (2003). Estimating production functions using inputs to control for unobservables. *The Review ofEconomic Studies*, *70*(2), 317-341.

McCann, L. (2018). *A very short, fairly interesting and reasonably cheap book about globalization*. Sage.

Nocke, V., & Yeaple, S. (2008). An assignment theory of foreign direct investment. *The Review of Economic Studies*, *75*(2), 529-557.

Olley, G. S., Pakes, A. (1996). The Dynamics of Productivity in the Telecommunications Equipment. *Econometrica*, *64*(6), 1263-1297.

Rodrik, D. (2018). Populism and the economics of globalization. *Journal of international business policy*, *1*(1), 12-33.

Sadowski, B. M., Sadowski-Rasters, G. (2006). On the innovativeness of foreign affiliates: Evidence from companies in The Netherlands. *Research Policy*, *35*(3), 447-462.

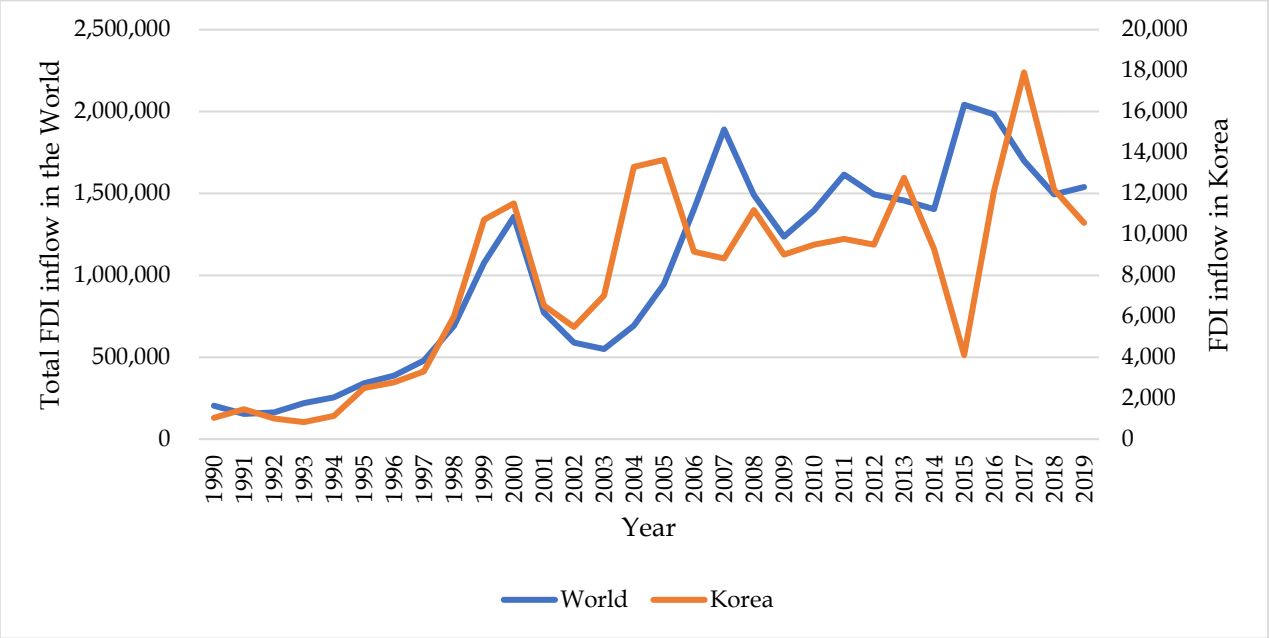
Stiebale, J. (2016). Cross-border M&As and innovative activity of acquiring and target firms. *Journal of International Economics*, *99*, 1-15.

Stiebale, J., Vencappa, D. (2018). Acquisitions, markups, efficiency, and product quality: Evidence from India. *Journal of International Economics*, *112*, 70-87.

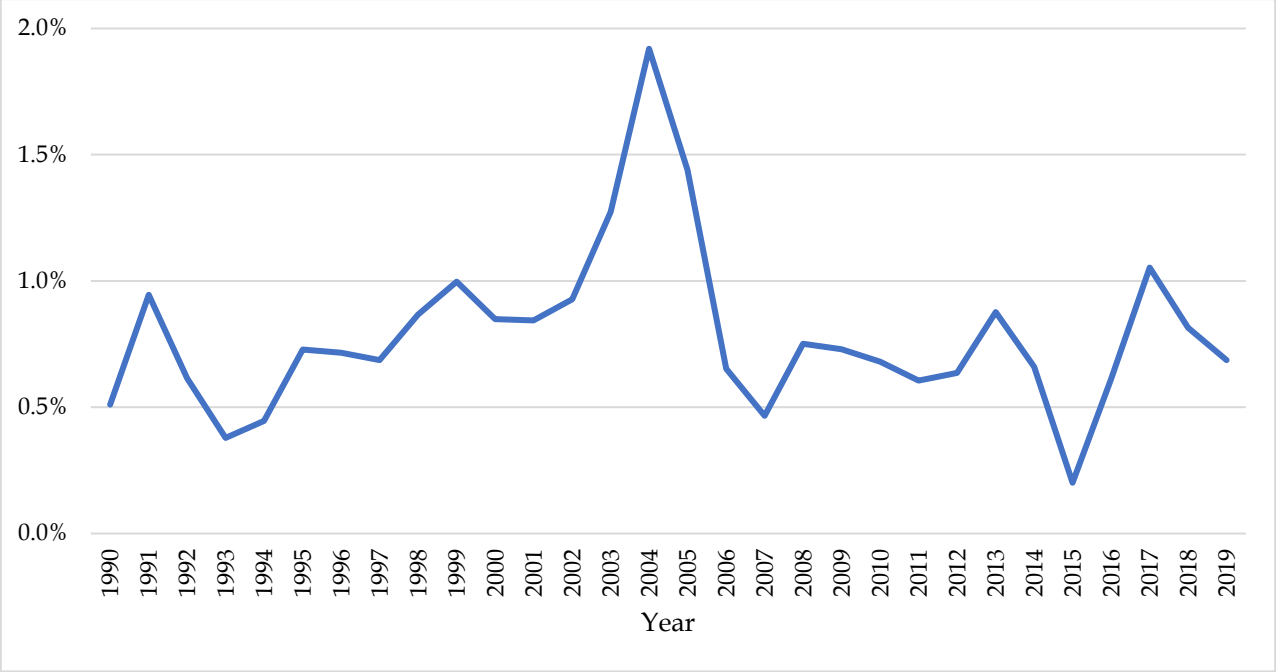
UNCTAD (2020). World Investment Report 2020

Wang, J., Wang, X. (2015). Benefits of foreign ownership: Evidence from foreign direct investment in China. *Journal of International Economics*, *97*(2), 325-338.

Figure 1. Foreign Direct Investment



A: The FDI inflow

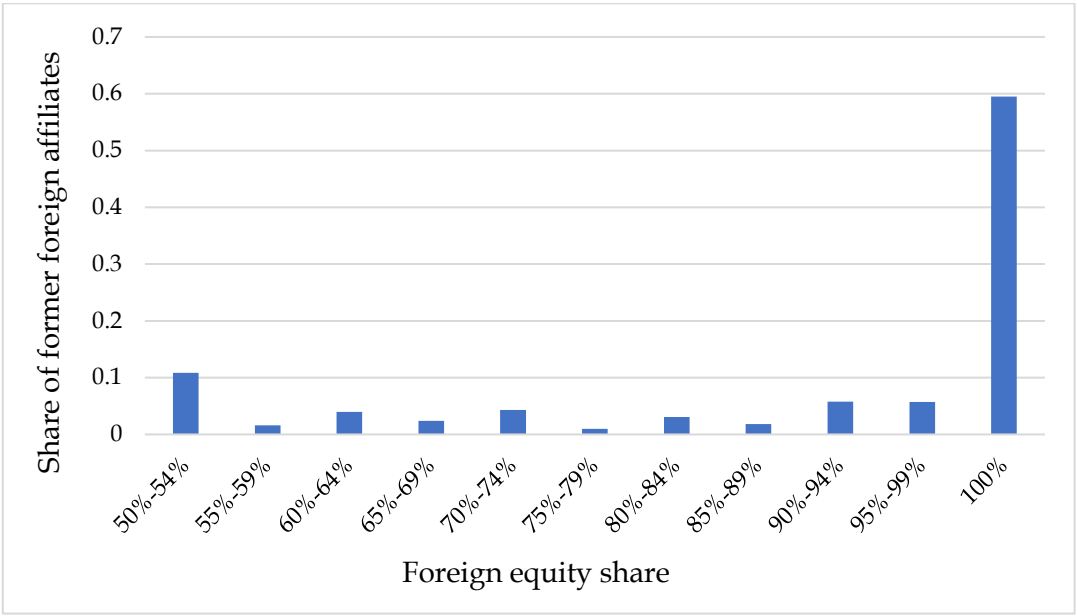


B: The ratio of FDI in Korea to the total FDI in the world

Source: UNCTAD.

Unit: US dollars at current prices in millions for Figure A; % for Figure B.

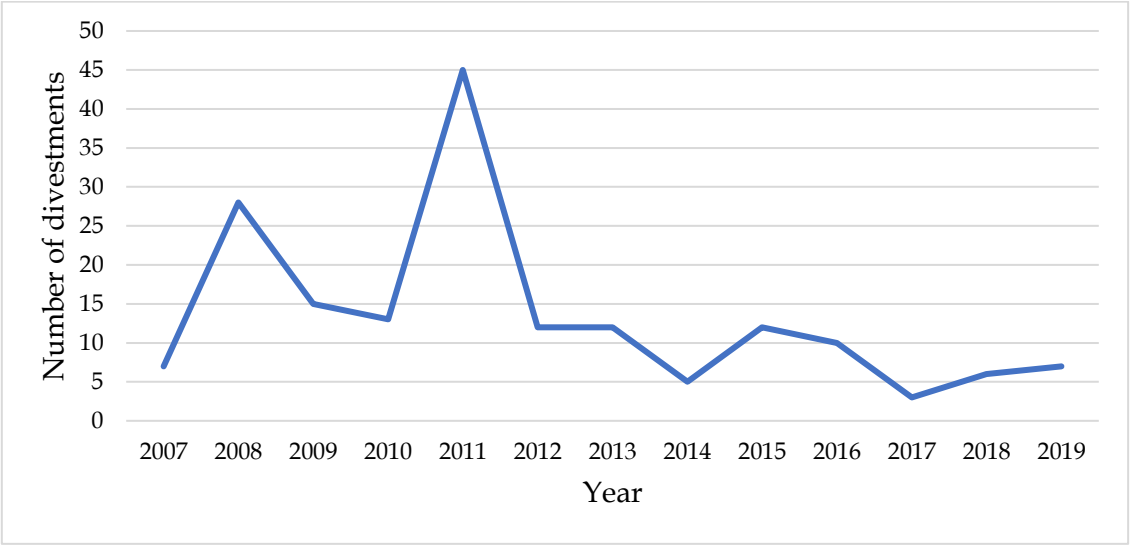
Figure 2. Distribution of foreign equity share prior to divestment



Source: Own calculation from the Survey of Business Activities.

Unit: share of former foreign affiliates

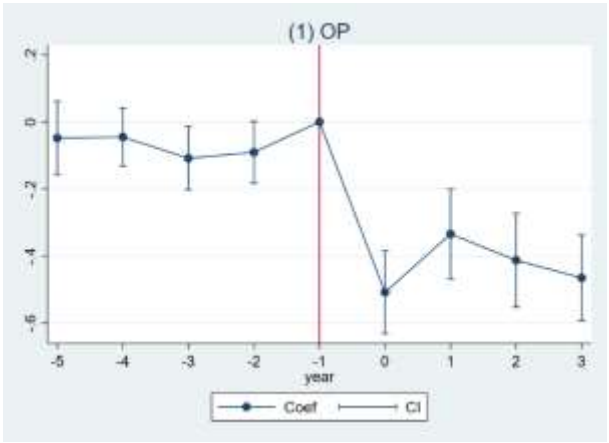
Figure 3. Divestments by Year

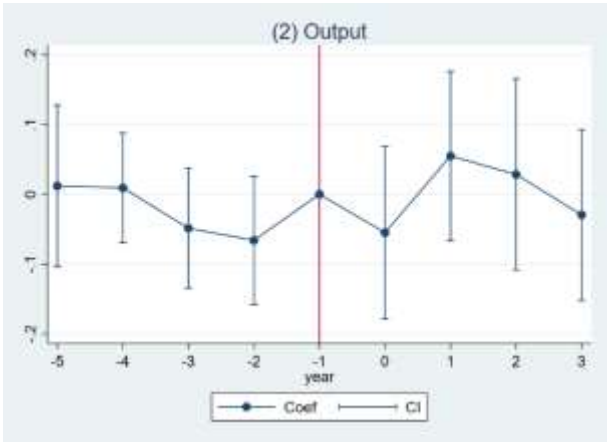


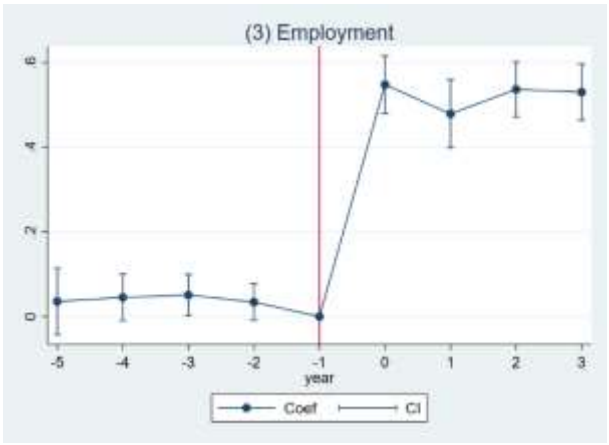
Source: Own calculation from the Survey of Business Activities.

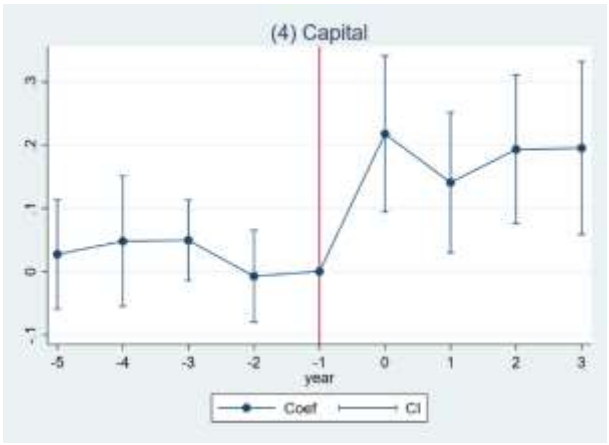
Unit: Number of divestments

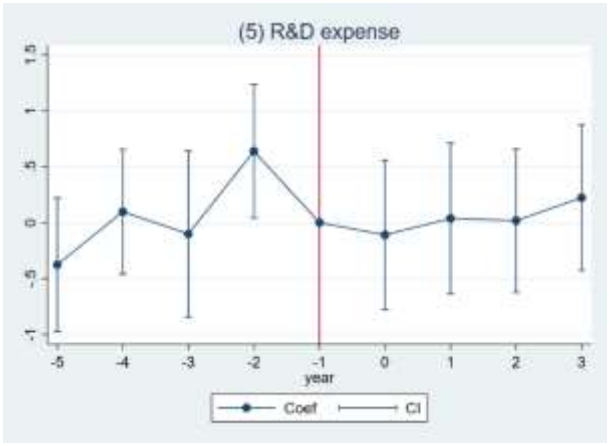
Figure 4. Event Study

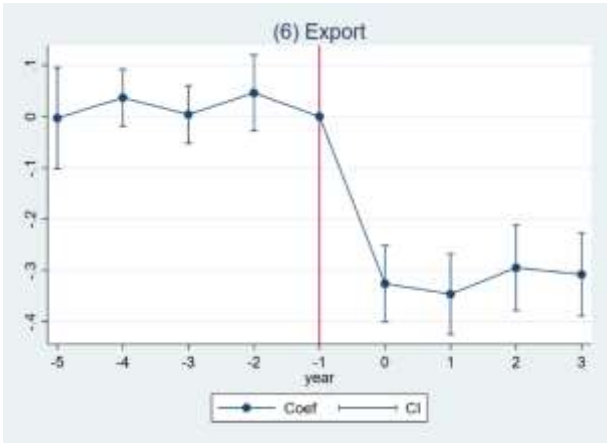












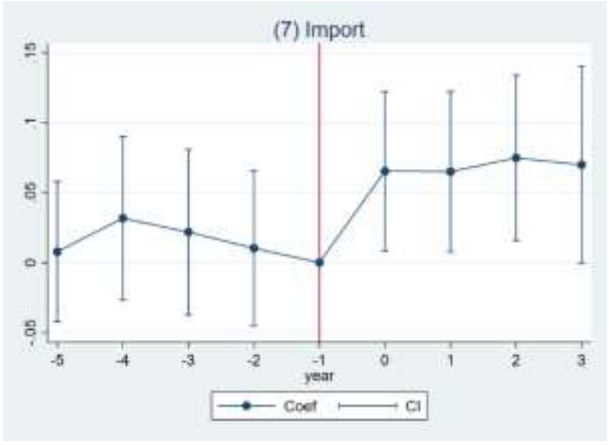


Table 1. Policy Incentives for FDI in Korea

Tax Support	**Cash Support**	**Location Support**
Reduction of corporate tax and income tax	Land purchase cost	Rent reduction and support
Reduction of Local tax (Acquisition tax, property tax)	Rent	Arrange a location
Exemption from customs duties	Employment subsidies and educational training subsidies	

Source: Korea Trade-Investment Promotion Agency (KOTRA), http://www.investkorea.org/kr/foreigner/invest.do

Table 2. Foreign Acquisition and Divestment in Korea

Industries	Acquisition	Divestment	Divestment Javorcik and Poelhekke (2017)
Food and beverages	32 (3.4%)	7 (4.0%)	**23 (14.8%)**
Textiles	13 (1.4%)	3 (1.7%)	**19 (12.3%)**
Apparel	5 (0.5%)	0 (0.0%)	**23 (14.8%)**
Leather and leather products	2 (0.2%)	0 (0.0%)	**11 (7.1%)**
Wood and wood products	0 (0.0%)	0 (0.0%)	7 (4.5%)
Furniture	3 (0.3%)	0 (0.0%)	**17 (11.0%)**
Paper and paper products	20 (2.1%)	1 (0.6%)	1 (0.6%)
Publishing and printing	1 (0.1%)	0 (0.0%)	2 (1.3%)
Coke, refined petroleum products	8 (0.8%)	1 (0.6%)	1 (0.6%)
Chemicals and pharmaceutical products	**172 (18.2%)**	**31 (17.7%)**	10 (6.5%)
Rubber and plastics products	61 (6.4%)	11 (6.3%)	9 (5.8%)
Other nonmetallic mineral products	40 (4.2%)	4 (2.3%)	4 (2.6%)
Base metals	26 (2.7%)	2 (1.1%)	3 (1.9%)
Fabricated metal products	41 (4.3%)	6 (3.4%)	6 (3.9%)
Radio, TV and communications equipment	**118 (12.5%)**	**15 (8.6%)**	1 (0.6%)
Electrical machinery and apparatus	**110 (11.6%)**	**11 (6.3%)**	7 (4.5%)
Machinery and equipment	**149 (15.8%)**	**35 (20.0%)**	6 (3.9%)
Motor vehicles	**139 (14.7%)**	**45 (25.7%)**	3 (1.9%)
Other transport equipment	6 (0.6%)	3 (1.7%)	2 (1.3%)
Total	946 (100%)	175 (100%)	155 (100%)

Note : We follow the industry classification of **Javorcik and Poelhekke (2017)** rather than KSIC. The top 5 industries in each column are shown in bold.

Table 3. Origins of Former Parent Firms

Parent country	Acquisition	Divestment	Parent country	Acquisition	Divestment
Australia	3 (0.3%)	0 (0.0%)	Netherlands	80 (8.5%)	11 (6.3%)
Austria	7 (0.7%)	1 (0.6%)	New Zealand	1 (0.1%)	0 (0.0%)
Belgium	15 (1.6%)	2 (1.1%)	Norway	5 (0.5%)	1 (0.6%)
Bulgaria	2 (0.2%)	0 (0.0%)	Poland	1 (0.1%)	0 (0.0%)
Canada	11 (1.2%)	2 (1.1%)	Portugal	1 (0.1%)	1 (0.6%)
China	30 (3.2%)	12 (6.9%)	Russia	1 (0.1%)	1 (0.6%)
Cyprus	2 (0.2%)	0 (0.0%)	Saudi Arabia	1 (0.1%)	0 (0.0%)
Denmark	5 (0.5%)	0 (0.0%)	Singapore	26 (2.7%)	2 (1.1%)
Eswatini	1 (0.1%)	0 (0.0%)	Slovenia	1 (0.1%)	0 (0.0%)
Finland	6 (0.6%)	0 (0.0%)	Spain	3 (0.3%)	0 (0.0%)
France	47 (5.0%)	9 (5.1%)	Sweden	16 (1.7%)	4 (2.3%)
Gabon	1 (0.1%)	0 (0.0%)	Switzerland	31 (3.3%)	1 (0.6%)
Germany	93 (9.8%)	14 (8.0%)	Taiwan	11 (1.2%)	1 (0.6%)
Hong Kong	18 (1.9%)	2 (1.1%)	Turkey	1 (0.1%)	0 (0.0%)
Hungary	3 (0.3%)	1 (0.6%)	Ukraine	6 (0.6%)	0 (0.0%)
India	5 (0.5%)	1 (0.6%)	United Arab Emirates	1 (0.1%)	0 (0.0%)
Indonesia	1 (0.1%)	0 (0.0%)	United Kingdom	48 (5.1%)	6 (3.4%)
Ireland	2 (0.2%)	2 (1.1%)	United States	187 (19.8%)	43 (24.6%)
Israel	2 (0.2%)	0 (0.0%)	Venezuela	1 (0.1%)	0 (0.0%)
Italy	7 (0.7%)	4 (2.3%)	Vietnam	2 (0.2%)	0 (0.0%)
Japan	224 (23.7%)	47 (26.9%)	Yemen	1 (0.1%)	1 (0.6%)
Kazakhstan	1 (0.1%)	0 (0.0%)	Other Asia Countries	4 (0.4%)	2 (1.1%)
Luxembourg	9 (1.0%)	0 (0.0%)	Other Europe Countries	7 (0.7%)	2 (1.1%)
Malaysia	6 (0.6%)	2 (1.1%)	Other Latin America Countries	6 (0.6%)	0 (0.0%)
Mexico	1 (0.1%)	0 (0.0%)	Other Oceania Countries	1 (0.1%)	0 (0.0%)
Nepal	1 (0.1%)	0 (0.0%)			
			Total	946 (100%)	175 (100%)

Table 4. Summary Statistics

Variables	Definition	Panel A Divested firms			Panel B Non-divested firms		
		N	Mean	S.D.	N	Mean	S.D.
Panel A: Firm Characteristics							
TFP	ln (Total factor productivity)	967	6.039	0.765	3,595	6.058	0.673
Sales	ln (Income from sales)	967	11.462	1.388	3,595	11.373	1.233
Sales growth	△ Sales	967	0.051	0.320	3,595	0.031	0.291
Output	ln (value-added)	967	10.595	1.307	3,595	10.473	1.174
Labor	ln(Wages)	967	9.258	1.160	3,595	9.229	1.039
Capital stock	ln (Gross fixed assets)	967	9.909	1.604	3,595	9.608	1.531
Capital intensity	Capital stock/Labor	967	1.165	0.610	3,595	1.028	0.611
Export intensity	ln (export/sales)	967	0.196	0.207	3,595	0.219	0.211
Import intensity	ln (import/sales)	967	0.127	0.146	3,595	0.197	0.176
Panel B: Outcome Variables							
△ OP	△ ln (OP)	966	0.016	0.406	3,592	0.024	0.385
△ LP	△ ln (LP)	966	0.018	0.401	3,592	0.025	0.379
△ ACF	△ ln (ACF)	966	0.018	0.399	3,592	0.025	0.376
△ GMV	△ ln (GMV)	966	0.022	0.384	3,592	0.027	0.363
△ Output	△ ln (Value-Added)	966	0.032	0.408	3,595	0.030	0.380
△ Employment	△ ln (Number of employees)	967	0.010	0.198	3,595	0.006	0.201
△ Capital	△ ln (Capital stock)	967	0.050	0.310	3,595	0.007	0.483
△ R&D	△ ln (R&D expenditure)	922	0.011	2.108	3,044	-0.032	1.950
△ Export	△ ln (export/sales)	943	-0.002	0.252	3,536	0.005	0.211
△ Import	△ ln (import/sales)	935	0.000	0.178	3,528	0.009	0.219

Note: This table includes the variables used in propensity score reweighting estimation. Panel A and B use a sample of all foreign owned non-divested firms and all divested firms. The divestment firms are assigned to the treated group and the non-divested firms are assigned to the control group in the propensity score reweighting estimation. The choice of determinants of divestments is guided by Stiebale and Vencappa (2018). N indicates the number of observations. All variables are measured by one million Korean Won. OP, LP, ACF, and GMV indicate TFP measures by Olley and Pakes (1996), Leivinsohn and Petrin (2003), Ackerberg et al. (2015), and Garcia-Marin and Voigtländer (2019), respectively. The estimation of TFP is measured by OP and described in Appendix A.

Table 5. Propensity Score Estimation

	(1)	(2)	(3)	(4)	(5)	(6)
				Table 7		
	Equation (1)	Panel B	Panel C	Panel E	Panel F	Panel G
TFP	-0.589***	-0.566***	-0.951***	-0.575***	-0.788***	-1.029***
	(0.123)	(0.161)	(0.205)	(0.162)	(0.130)	(0.141)
Sales	0.003	0.077	0.081	-0.002	0.340***	0.254***
	(0.066)	(0.070)	(0.065)	(0.072)	(0.063)	(0.065)
Sales growth	-0.224***	-0.135	-0.072	-0.217*	0.059	0.003
	(0.079)	(0.159)	(0.164)	(0.114)	(0.099)	(0.099)
Output	0.481***	0.443***	0.761***	0.463***	0.490***	0.768***
	(0.144)	(0.181)	(0.203)	(0.162)	(0.148)	(0.158)
Labor	-0.365**	-0.274**	-0.476***	-0.189	-0.655***	-0.440***
	(0.155)	(0.172)	(0.171)	(0.223)	(0.151)	(0.160)
Capital stock	0.168*	-0.040	0.056	0.011	0.026	-0.024
	(0.091)	(0.054)	(0.151)	(0.160)	(0.122)	(0.129)
Capital intensity	-0.161	0.187*	-0.047	0.083	-0.003	-0.004
	(0.170)	(0.109)	(0.205)	(0.253)	(0.195)	(0.207)
Export intensity	-0.170	-0.256	-0.250	-0.142	-0.251*	-0.111
	(0.091)	(0.184)	(0.201)	(0.164)	(0.139)	(0.147)
Import intensity	-1.295***	-1.142***	-1.733***	-1.312***	-0.941***	-1.053***
	(0.178)	(0.189)	(0.239)	(0.210)	(0.185)	(0.188)
ΔTFP			0.994***			
			(0.292)			
ΔOutput			-0.784***			
			(0.298)			
ΔLabor			0.689***			
			(0.265)			
ΔCapital stock			-0.657**			
			(0.306)			
ΔCapital intensity			1.060**			
			(0.434)			
ΔExport intensity			0.091			
			(0.222)			
ΔImport intensity			0.694***			
			(0.236)			
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,562	2,631	2,896	4,562	2,349	2,193

Note: This table reports the coefficients from Probit estimation. All explanatory variables are lagged for one period and have a log form, except for three periods in Panel B of Table 7. Standard error in parentheses are block-bootstrapped for firms' time series. *** p<0.01, ** p<0.05, * p<0.1

Table 6. The Effects of Divestment

	△OP	△LP	△ACF	△GMV	△Output
Divestment	-0.279***	-0.217***	-0.178***	-0.191***	0.098
	(0.061)	(0.060)	(0.060)	(0.058)	(0.062)
Observations	4,558	4,558	4,558	4,558	4,561
R-squared	0.143	0.147	0.151	0.174	0.174
	△Employment	△Capital	△R&D	△Export	△Import
Divestment	0.442***	0.192***	-0.221	-0.295***	0.088***
	(0.033)	(0.045)	(0.383)	(0.041)	(0.030)
Observations	4,562	4,562	3,966	4,479	4,463
R-squared	0.171	0.262	0.129	0.116	0.176

Note: These results are estimated with Propensity score reweighting DiD. Standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7. Robustness Checks

	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Panel A: Financial Crisis							
Divestment	-0.373***	0.078	0.471***	0.135***	0.080	-0.326***	0.082***
	(0.067)	(0.065)	(0.032)	(0.042)	(0.354)	(0.039)	(0.027)
Crisis	-0.004	0.006	0.002	0.058**	0.003	-0.005	0.000
	(0.045)	(0.041)	(0.025)	(0.028)	(0.175)	(0.030)	(0.017)
Observations	4,558	4,561	4,562	4,562	3,966	4,479	4,463
R-squared	0.143	0.176	0.168	0.247	0.124	0.115	0.149
Panel B: Alternative Length of long-run trends							
Divestment	-0.290***	0.085	0.442***	0.186***	-0.196	-0.390***	0.095***
	(0.069)	(0.072)	(0.029)	(0.051)	(0.396)	(0.042)	(0.028)
Observations	3,264	3,268	3,268	3,268	2,820	3,142	3,122
R-squared	0.148	0.177	0.184	0.298	0.128	0.115	0.131
Panel C: Alternative Propensity Score							
Divestment	-0.324***	0.109	0.518***	0.175***	-0.268	-0.310***	0.082***
	(0.062)	(0.061)	(0.031)	(0.041)	(0.343)	(0.038)	(0.025)
Observations	3,990	3,993	3,993	3,993	3,485	3,900	3,877
R-squared	0.158	0.187	0.178	0.334	0.124	0.114	0.179
Panel D: Alternative Length of Post-Divestment Window							
Divestment	-0.341***	0.061	0.480***	0.167***	-0.019	-0.324***	0.076***
	(0.062)	(0.061)	(0.029)	(0.042)	(0.342)	(0.037)	(0.024)
Observations	4,558	4,561	4,562	4,562	3,966	4,479	4,463
R-squared	0.135	0.164	0.152	0.228	0.110	0.111	0.190
Panel E: Alternative Definition of Divestment							
Divestment	-0.429***	0.851	0.003*	10.553***	0.658**	-0.328***	0.024
	(0.040)	(0.037)	(0.016)	(0.028)	(0.171)	(0.026)	(0.018)
Observations	4,558	4,561	4,562	4,562	3,966	4,479	4,463
R-squared	0.141	0.175	0.141	0.431	0.124	0.114	0.175
Panel F: 1 to 1 Nearest Neighbor Matching Without Replacement							
Divestment	-0.413***	-0.019	0.475***	0.156***	-0.285	-0.307***	0.081***
	(0.083)	(0.072)	(0.035)	(0.058)	(0.333)	(0.043)	(0.027)
Observations	2,372	2,374	2,374	2,374	2,244	2,319	2,312
R-squared	0.086	0.128	0.150	0.184	0.097	0.083	0.085
Panel G: Intra-Industry Spillover							
Divestment	-0.425***	-0.004	0.503***	0.177**	-0.463	-0.321***	0.071**
	(0.084)	(0.074)	(0.035)	(0.069)	(0.318)	(0.045)	(0.029)
Observations	2,219	2,220	2,220	2,220	2,100	2,159	2,163
R-squared	0.087	0.128	0.164	0.109	0.109	0.083	0.085

Note: The results in Panel A, B, C, D and E are estimated with Propensity score reweighting DiD and the results in Panel F and G are estimated with 1 to 1 nearest neighbor propensity score matching without replacement. The propensity score estimation for Panel B, C, E, F and G is reported in Table 5. Standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8. High versus Low R&D Intensity

R&D intensity = High							
	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	-0.206**	0.149**	0.425***	0.143***	0.044	-0.311***	0.086*
	(0.088)	(0.071)	(0.064)	(0.051)	(0.442)	(0.065)	(0.044)
Observations	2,437	2,439	2,439	2,439	2,150	2,389	2,373
R-squared	0.214	0.243	0.216	0.290	0.177	0.144	0.232
R&D intensity = Low							
	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	0.017	-0.053	-0.035	-0.279***	-2.544***	-0.033	-0.364***
	(0.103)	(0.109)	(0.053)	(0.076)	(0.528)	(0.051)	(0.057)
Observations	2,053	2,054	2,054	2,054	1,774	2,004	1,999
R-squared	0.207	0.249	0.170	0.276	0.142	0.162	0.159

Note: These results are estimated with Propensity score reweighting DiD. R&D intensity is defined as the ratio of R&D expenses to sales. We divide our sample into two groups, namely high R&D intensity (industries with R&D intensity above the median across all industries) and low R&D intensity (industries with R&D intensity below the median across all industries). Standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9. High versus Low Intangible Asset Intensity

Intangible Asset = High							
	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	-0.238***	0.167***	0.477***	0.206***	0.058	-0.334***	0.080***
	(0.059)	(0.059)	(0.036)	(0.049)	(0.413)	(0.046)	(0.030)
Observations	2,864	2,866	2,866	2,866	2,518	2,803	2,790
R-squared	0.185	0.206	0.209	0.261	0.149	0.134	0.216
Intangible Asset = Low							
	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	-0.105	-0.201***	-0.057	-0.339***	-2.677***	-0.054	-0.356***
	(0.065)	(0.065)	(0.059)	(0.076)	(0.692)	(0.061)	(0.069)
Observations	1,626	1,627	1,627	1,627	1,406	1,590	1,582
R-squared	0.226	0.288	0.143	0.275	0.161	0.172	0.165

Note: These results are estimated with Propensity score reweighting DiD. Intangible Asset Intensity is defined as industry-level time series median ratio of intangible assets to total assets. We divide our sample into two groups, namely high intangible asset intensity (industries with intangible asset intensity above the median across all industries) and low intangible asset intensity (industries with intangible asset below the median across all industries). Standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10. Fully versus partially foreign ownership

Full ownership (100%)							
	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	-0.486***	-0.366***	0.069*	0.432*	7.936***	0.227	-0.093
	(0.096)	(0.079)	(0.054)	(0.230)	(0.339)	(0.061)	(0.086)
Observations	2,626	2,629	2,629	2,629	2,268	2,571	2,554
R-squared	0.151	0.166	0.214	0.294	0.149	0.198	0.218
Partial ownership (50%-99%)							
	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	-0.041	-0.005	0.039**	0.036	0.333	0.019	-0.009
	(0.053)	(0.056)	(0.019)	(0.034)	(0.207)	(0.030)	(0.020)
Observations	1,839	1,839	1,839	1,839	1,628	1,796	1,791
R-squared	0.156	0.194	0.164	0.243	0.120	0.075	0.128

Note: These results are estimated with Propensity score reweighting DiD. We divide firms into two groups by share of foreign ownership; 100% and 50-99%. Standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11. Exporter vs Non-Exporter

Exporters							
	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	-0.312***	0.093	0.488***	0.143***	-0.048	-0.349***	0.073***
	(0.067)	(0.067)	(0.030)	(0.038)	(0.371)	(0.036)	(0.025)
Observations	4,397	4,400	4,400	4,400	3,831	4,313	4,288
R-squared	0.138	0.169	0.162	0.220	0.121	0.116	0.183
Non-Exporters							
	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	-0.361***	0.027	0.472***	0.115*	0.271	-0.232***	0.098**
	(0.074)	(0.065)	(0.055)	(0.060)	(0.423)	(0.055)	(0.041)
Observations	3,966	3,969	3,969	3,969	3,422	3,875	3,867
R-squared	0.194	0.225	0.201	0.262	0.119	0.099	0.208

Note: These results are estimated with Propensity score reweighting DiD. Standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 12. Divestment effects on Outsourcing and Liquidity

	Outsourcing	Liquidity
Divestment	-0.003	0.004
	(0.006)	(0.017)
Observations	4,350	3,776
R-squared	0.047	0.138

Note: These results are estimated with Propensity score reweighting DiD. Standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 13. Transfer Pricing

Full ownership (100%)							
	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	0.132	-0.142*	-0.368***	0.128	-0.507	0.000	-0.027
	(0.086)	(0.083)	(0.050)	(0.088)	(0.770)	(0.058)	(0.079)
Observations	1,181	1,182	1,182	1,182	1,024	1,158	1,150
R-squared	0.279	0.314	0.221	0.220	0.215	0.223	0.172

Note: These results are estimated with Propensity score reweighting DiD. We use industries with low R&D intensity to control for knowledge transfer. Full (Partial) ownerships are firms with a stronger (weaker) incentive engaging in transfer pricing. Standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 14. Divestment effects from Domestic Parents

	△OP	△Output	△Employment	△Capital	△R&D	△Export	△Import
Divestment	-0.025	-0.035	-0.020	0.043*	0.147	0.003	-0.003
	(0.024)	(0.023)	(0.015)	(0.025)	(0.120)	(0.013)	(0.009)
Observations	6,746	6,752	6,764	6,763	5,983	6,310	6,235
R-squared	0.121	0.155	0.172	0.209	0.110	0.084	0.086

Note: These results are estimated with Propensity score reweighting DiD. Standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix A. Estimation of Productivity

We estimate the firm-level productivity with a log-linearized Cobb–Douglas production function as follows:

$$y_{it} = \alpha l_{it} + \beta k_{it} + \omega_{it} + \eta_{it}.$$

We denote firm and year as i and t, respectively. The variables y_{it}, l_{it}, and k_{it} represent the logarithms of value added, labor, and capital stock, respectively. The error term consists of ω_{it} and η_{it}. ω_{it} is the productivity shock that can be observed by the firm but not by econometricians, and η_{it} is an unexpected productivity shock that is unobserved by both firms and econometricians.

We follow Olley and Pakes (1996), Levinsohn and Petrin (2003) and Ackerberg et al. (2015) to estimate TFP measures. We do not repeat their procedures here, but outline the markup-adjusted TFP measure proposed by Garcia-Marin and Voigtländer (2019). The adjustment of markup is important because our productivity measure, similar to those typically used in the literature, is revenue-based, meaning that it embodies unobserved prices. It is downward biased if more efficient producers charge lower prices. Given that divestment affects markups as well as physical productivity through both knowledge spillover and competition, the productivity gains we found with divestment could have been over- or underestimated, depending on which effect dominated. Following Garcia-Marin and Voigtländer (2019), we decomposed revenue productivity ($TFPR_{it}$) as:

$$TFPR_{it} = P_{it} + TFPQ_{it} = \mu_{it} + MC_{it} + TFPQ_{it},$$

where P_{it} is the output price, MC_{it} is marginal costs, $TFPQ_{it}$ is physical productivity, and μ_{it} is firm-level markup (the price/cost ratio), which absorbs unobserved prices. Hence, we are able to estimate the efficiency gains that are unaffected by price changes by estimating μ_{it} and removing it from the estimated revenue productivity, i.e., $TFPR_{it} - \mu_{it}$. We follow the method of De Loecker and Warzynski (2012) to estimate firm level markup. Given the production function $Q_{it} = Q(L_{it}, K_{it}, \omega_{it})$, cost minimization yields the following first-order condition with respect to L_{it}:

$$\frac{\partial \mathcal{L}}{\partial L_{it}} = w_{it} - \lambda_{it} \frac{\partial Q_{it}(\cdot)}{\partial L_{it}} = 0 \qquad \text{(A1)}$$

λ_{it} is the Lagrangian multiplier, which equals $\frac{\partial \mathcal{L}}{\partial Q_{it}}$. Substituting λ_{it} out and rearranging Eq. (A1) yields: $\mu_{it} = \alpha_{it}^{L}/s_{it}^{L}$, where α_{it}^{L} is the output elasticity with respect to labor, which can be obtained by estimating the production function. s_{it}^{L} denotes the share of expenditures on labor in value added, which is calculated from our data. After obtaining estimates for firm-level markup, we estimate the markup-adjusted productivity by removing markup from revenue productivity.

Appendix B. Financial Crisis Years and Duration

Table B1.

Country	Financial Crisis	Country	Financial Crisis
Australia	-	Mexico	-
Austria	2008-2012	Netherlands	2008-2009
Belgium	2008-2012	New Zealand	-
Bulgaria	-	Norway	-
Canada	-	Poland	-
China	-	Portugal	2008-2012
Cyprus	2011-2015	Russia	2008-2009
Denmark	2008-2009	Singapore	-
Finland	-	Slovenia	2008-2012
France	2008-2009	Spain	2008-2012
Gabon	-	Swaziland	-
Germany	2008-2009	Sweden	2008-2009
Hong Kong	-	Switzerland	2008-2009
Hungary	2008-2012	Taiwan	-
India	-	Turkey	-
Ireland	2008-2012	Ukraine	2008-2010
Italy	2008-2012	United Kingdom	2007-2011
Japan	-	United States	2007-2011
Kazakhstan	2008	Venezuela	-
Luxembourg	2008-2012	Vietnam	-
Malaysia	-	Yemen	-

Source: Laeven and Valencia (2020).

Note: This table reports the start year and the end year of a financial crisis.