*The Korean Economic Review*
Volume 36, Number 2, Summer 2020, 285-317.
DOI : 10.22841/kerdoi.2020.36.2.001

# Hollowing Out or Filling In? The Effects of Multinational Enterprises on Domestic Plant Turnover and Job Growth in Factory Asia*

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*In recent years, multinational enterprises (MNEs) originating from Asian countries, such as China and Korea, have rapidly expanded their global operations. However, the employment effects of these MNEs on their home countries have rarely been studied. By using Korean firm–plant matched data over the period of 2008–2013, we examine the effects of MNEs on domestic plant turnover and job growth. We find that Korean MNEs are more likely to close down their domestic manufacturing plants and open new plants than non-MNEs. Along with active plant turnover, Korean MNEs exhibit great active job reallocation across their domestic manufacturing plants within firms, without resulting in net job loss. In sum, Korean MNEs participating in Factory Asia have restructured their domestic manufacturing bases rather than hollowing them out.*

JEL Classification: F23, F66, L23
Keywords: Employment, Job Reallocation, Multinational Enterprise, Plant Birth, Plant Death

*Received: Sept. 22, 2018. Revised: Sept. 30, 2019. Accepted: Nov. 8, 2019.*

* We express our sincere gratitude to Eric Bartelsman, Teresa Fort, Eiichi Tomiura, Jay Pil Choi, Taiji Furusawa, Tomohiko Inui, and other participants at the 2017 Comparative Analysis of Enterprise Data Conference, the 2017 Asia-Pacific Trade Workshop, the 2017 Hitotsubashi–Sogang Trade Workshop, the 2016 Japan–Korea Microdata Workshop on Firm Dynamics, Innovation, and Globalization, and the 2017 Western Economic Association Annual Conference for their helpful comments. We are also grateful to Statistics Korea and the Korea Statistics Promotion Institute for providing us access to the data used in this study. All results have been reviewed to ensure that no confidential information is disclosed.

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# I. Introduction

Multinational enterprises (MNEs)[1] organize their production at home and foreign countries, thereby simultaneously creating and destroying jobs across different locations. Most advanced countries have experienced hollowing-out of domestic manufacturing jobs due to MNEs' plant shutdown at home countries and relocation to foreign countries[2] (Disney *et al*., 2003; Görg and Strobl, 2003; Bernard and Jensen, 2007; Van Beveren, 2007). By contrast, restructuring global production networks between domestic and foreign plants may fill in manufacturing jobs at home countries through complementing rather than substituting domestic production. Considerable evidence that supports the hollowing-out effect has been provided in existing literature; however, evidence for the filling-in effect, i.e., job creation at the extensive margin (plant entry), is rare (Brainard and Riker, 1997; Becker *et al*., 2005; Konings and Murphy, 2006; Muendler and Becker, 2010).

To investigate the filling-in outcome and address the above research gap, we focus on the massive rise in the outward foreign direct investment (FDI) of MNEs originating from Asian countries (specifically in Korea) during the last decade (Figure 1).[3] Asian MNEs have built production–supply networks, i.e., the so-called *Factory Asia*, within the continent.[4] MNEs in most advanced countries relocate their plants to foreign countries to take advantage of cheap labor costs. Consequently, specialize headquarter services at home negatively affect domestic manufacturing jobs.[5] Consequently, Asian MNEs shut down high-cost assembly lines and establish new plants producing intermediate goods at home, and then re-link the domestic plants to their low-cost assembly lines in foreign countries.[6] In this case,

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[1] We narrowly define the term of MNEs in this study as *manufacturing firms with plants in domestic and foreign countries*. Non-MNEs are defined as those with domestic plants only.

[2] Firm-level evidence in previous studies shows that MNEs in advanced economies tend to have horizontal FDI. For example, Atalay *et al*. (2014) and Ramondo *et al.* (2016) show a weak vertical link between the parent firms and their foreign affiliates.

[3] Asia's share of global outward FDI has increased from 10% in 2000 to 36% in 2013.

[4] Destinations of Asian MNEs are also heavily concentrated in Asian countries. For instance, Korea and China have invested 75% and 70% of total FDI in Asian countries, respectively, according to UNCTAD's FDI database. Thus, Asian countries become host countries of inward and outward FDIs. To distinguish the home-country effect of outward FDI on domestic manufacturing from the inward FDI effect, selecting an Asian country with massive outward FDI and relatively little inward FDI is necessary. In this respect, Korea is a better case study than China.

[5] Hansson (2005) and Head and Rise (2002) show that the MNEs with foreign affiliates in low-wage countries have increased the skill intensity of employment of such countries. In addition, Bernard *et al*. (2017) show that offshoring makes firms reallocate labor away from production toward technology-related occupations.

[6] Motivated by LG electronics' FDI strategy in China, Yoon and Hur (2018) show that while Korean MNEs tend to have core intermediate goods production processes at the home country, they reallocate simple assembly plants in foreign countries. See Chun et al. (2020) for more details on the relationship between technology and cross-border vertical integration of Korean firms.

manufacturing jobs at home can be created through building new domestic plants.

In this study, we focus on Korean MNEs that showcase the Factory Asia concept. Since the mid-2000s, massive increases in outward FDI of Korean MNEs have provided substantial contributions to the establishment of the Asian production–supply network. Consequently, Korean manufacturing has experienced massive restructuring, but the share of employment in manufacturing has slightly changed over the last decade. Using a unique Korean firm–plant matched database for the period of 2008–2013, we examine the impact of MNEs' foreign operations on the death and birth of their domestic manufacturing plants and the resulting employment dynamics in terms of job creation, destruction, and reallocation.

Our main findings are as follows. First, Korean MNEs are more likely to shut down domestic manufacturing plants and open up new plants than non-MNEs. This situation at home countries is evident for the MNEs that have invested in Asian countries, particularly in China, but not in advanced countries. Moreover, the plant turnover is evident for the MNEs that have linked vertically with their foreign affiliates. Asian countries are often interpreted as destinations of *vertical* FDI in existing literature (Hanson *et al*., 2005; Debaere *et al*., 2010). Thus, production will be more efficient if MNEs cut off domestic value chains and relocate plants to low-wage Asian countries. In sum, our findings imply that vertical FDI does not necessarily preclude the possibility of creating new plants at home countries. Active plant turnover (i.e., plant death and birth) can be viewed as a distinct strategy of Korean MNEs' for growth in Factory Asia. Second, along with plant turnover, Korean MNEs have also reallocated domestic manufacturing jobs by destroying and creating jobs simultaneously. Despite of no statistically significant net employment growth effect, the MNEs have filled in domestic jobs at the extensive margin by establishing new manufacturing plants at home countries.

These findings are reasonably robust to a wide range of considerations, such as alternative definitions of MNEs and emerging countries, alternative periods with a three-year interval from 2008 to 2011, and exclusion of foreign-owned firms. We also check for the presence of endogeneity using the propensity score matching method and possible joint decisions vis-a-vis plant shutdown and startup of MNEs.

The findings of this study provide important insights into the role of MNEs in domestic plant turnover and employment dynamics. First, Korean MNEs' foreign activities have induced active reallocation in domestic manufacturing industries by establishing new plants and shutting down existing plants. This restructuring process accompanied by domestic plant entry supports the novel evidence provided in existing MNE literature, but contrasting with most previous findings which suggest that domestic plant closures occur without new entry caused by the expansion of foreign operations in (or offshoring toward) low-wage countries (Gibson and Harris, 1996; Bernard and Jensen, 2007; Bandick, 2010). Second, the job reallocation process in Korean MNEs also contrasts with that observed in

advanced countries' MNEs. Korean MNEs actively reallocate domestic manufacturing jobs through filling in jobs at new plants, whereas other countries' MNEs mainly shut down plants and hollow-out jobs.[7] Studies also suggest that foreign and domestic production or employment is complementary.[8] Muendler and Becker (2010) are the first to provide evidence which suggests that the domestic employment of (German) MNEs can expand at the intensive margin but not at the extensive margin.[9]

Evidence on Korean MNEs provides new perspectives on existing understandings of Asian MNEs in the context of Factory Asia. Since the early 1990s, outward FDI from Korean MNEs characterized by relocation of manufacturing plants to low-cost countries, such as China, shows that MNEs moving to less developed countries have brought negative effects on their employment growth rate at home country (Debaere *et al*., 2010). However, after the mid-2000s, Korean MNEs have established global value chains in Asia to decrease the trade in intermediate inputs between foreign and domestic plants (Ramondo, 2016).[10] Domestic manufacturing restructuring accompanied by domestic plant shutdown are substitutable for foreign inputs, whereas simultaneously establishment of domestic plants is complementary to foreign plants. This argument is consistent with the findings of Harrison and McMillan (2011), indicating that domestic and foreign employment can complement each other if MNEs undertake significantly different tasks at home and foreign countries. The findings of our study contribute to the existing knowledge on Asian MNEs' filling-in processes driven by plant entry at home countries. However, the international division of labor within Asian MNEs remains an issue for future work.[11]

The remaining parts of this study are organized as follows. Section 2 reviews patterns of outward FDI and employment in the Korean manufacturing sector over time. Section 3 describes the firm–plant matched data applied in this study and the construction of plant turnover, employment growth, and job reallocation variables.

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[7] The MNE-driven reallocation process may also affect overall manufacturing productivity at home countries. In this respect, Alfaro and Chen (2016) show that most productivity gains from MNEs are attributable to the selection and reallocation mechanism. However, analyses of reallocation-driven productivity effects of Korean MNEs are beyond the scope of this study and can be explored in future work.

[8] Desai *et al.* (2009) also reveal a positive association between foreign and domestic activities (i.e., investments and employment growths) of American MNEs, but fail to distinguish extensive margins from complementary effects.

[9] They define the extensive margin wherein MNEs enter foreign locations and the intensive margin wherein MNEs operate existing affiliates.

[10] Ramondo (2016) show that MNEs in Asian countries have strong input–output linkages between domestic and foreign plants.

[11] To identify the nature of international division in Asian MNEs, investigating the characteristics of, and intrafirm trade between, domestic and foreign plants is necessary. Such work also requires more detailed datasets.

Sections 4 and 5 present empirical results and robustness checks, respectively. Finally, Section 6 offers conclusion.

# II. Outward FDI and Manufacturing of Korea

Since the mid-2000s, most outward FDI of Korean MNEs has been concentrated in Asian countries. In existing literature (e.g., Hanson *et al*., 2005; Debaere *et al*., 2010), MNEs' investments in Asia are often referred to as *vertical* FDI given that Asian countries have cost advantages in manufacturing compared with developed countries.[12] By establishing vertical manufacturing plants in low-cost Asian countries, Korean MNEs can build their manufacturing networks efficiently. However, Korean MNEs have maintained their traditional status as manufacturers within Korea without downsizing jobs. In this section, we briefly address the regional distribution of Korea's outward FDI and the current status of domestic manufacturing.

## 2.1. Outward FDI of Korean MNEs

Figure 2 shows the annual amounts of outward FDI of MNEs in the Korean manufacturing sector for the period of 1990–2013. Outward FDI has rapidly increased after 2005 and become more concentrated in Asia. This period coincides with the following two events. First, in 2004 and 2005, the Korean government has removed the overseas investment limits imposed on corporate and private investors.[13] Second, in the mid-2000s the Chinese government has begun implementing the WTO's requirement to remove restrictions on investment that create trade distortions, following China's accession to the WTO in 2002.[14] Thus, internal and external conditions in the 2000s are quite favorable to outward FDI of Korean firms.

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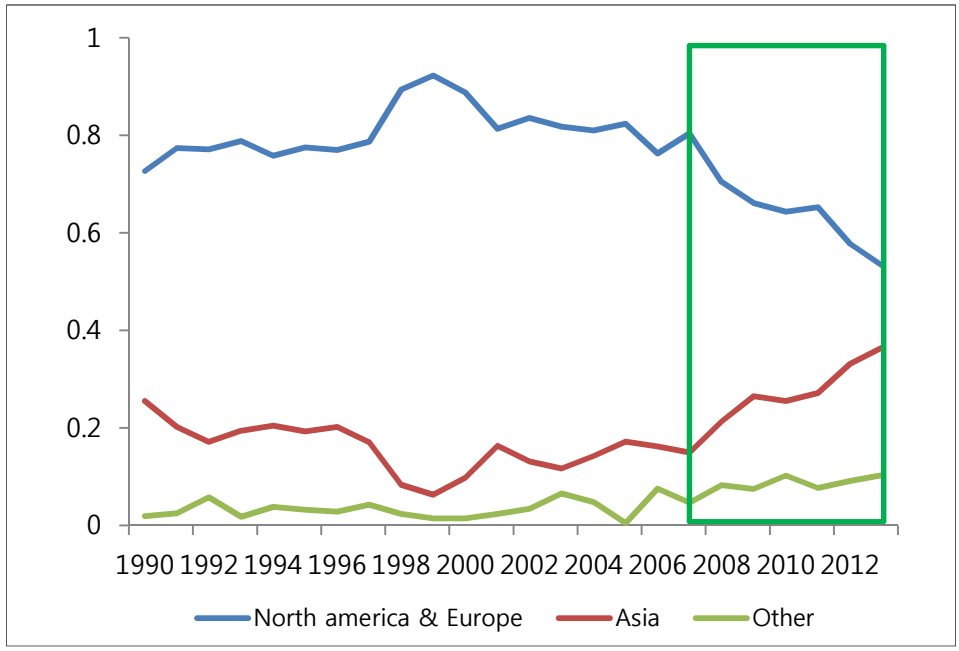
[12] According to the World Integrated Trade Solution trade database, almost 80% of the products imported from China to Korea are intermediate goods as of 2013. Similarly, most exported products from Korea to China are intermediate goods.

[13] See Nicolas *et al*. (2013) for more details on the history of investment liberalization policy reform in Korea.

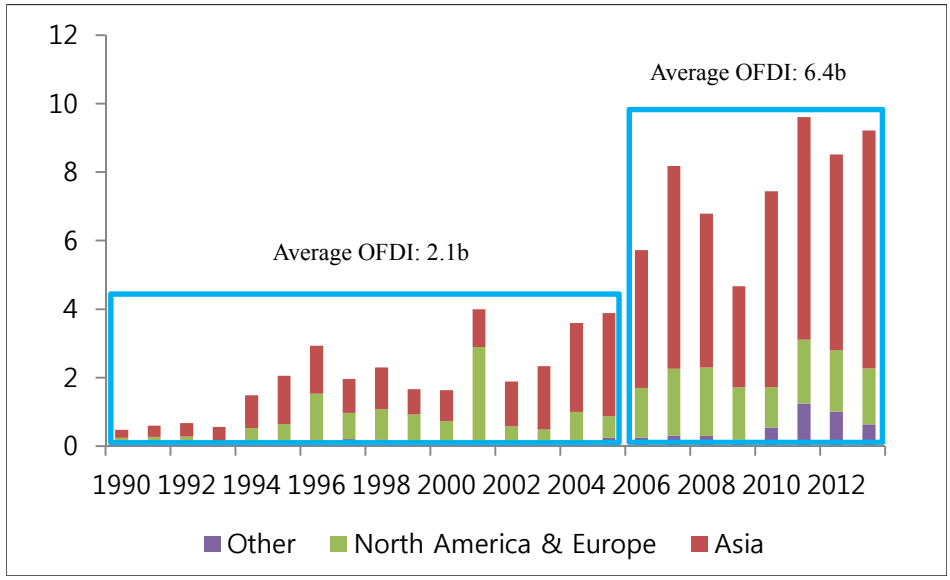
[14] See Bransetter and Lardy (2006) for more details on Chinese investment liberalization and the WTO after 2002. These authors also provide a summary of the developments vis-a-vis Chinese globalization in the 1990s.

**[Figure 1]** Regional Shares of Outward FDI (1990–2013)




Source: UNCTAD FDI Statistics.

**[Figure 2]** Outward FDI of Korean Firms in the Manufacturing Sector: 1990–2013




Source: Export-Import Bank of Korea.
Note: Outward FDI is measured in billion USD.

According to the FDI database of the Export–Import Bank of Korea in 2010, China is the top destination country for Korea's outward FDI, followed by Vietnam, India, and Indonesia for the period of 1996–2009. Since the early 2000s, China has absorbed considerable global FDI from advanced countries and emerging economies. According to the OECD report by Davies (2013), inward FDI into China has surged from 40 billion USD in 2000 to around 120 billion USD in 2011. Two-thirds of this inward FDI is obtained from 10 Asian countries in 2010. Among them, Korea is the third largest contributor, followed by Singapore and Japan, and subsequently, Taiwan.[15] According to Zhang (2005), compared with other Asian economies, Korea has only recently become a major foreign investor and established relatively new production–supply networks since the mid-2000s. In this sense, Korea is probably the key country to understand home-country effects of the formation of global production–supply networks, particularly in Factory Asia.

## 2.2. Manufacturing in Korea

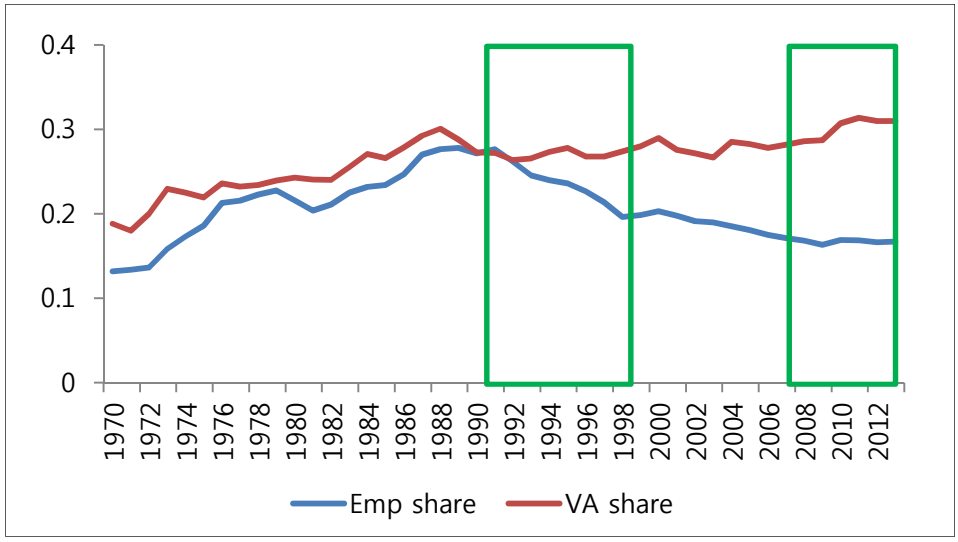
The increased outward FDI from Korea is not associated with a contraction of domestic manufacturing since 2007. Figure 3 shows macro-level stylized facts about the Korean manufacturing sector. First, the manufacturing sector's share of value-added has been reasonably stable and maintained a value higher than 28% since 2000. According to the Mining and Manufacturing Survey of Statistics Korea, this value has reached 30% in 2013. Second, the manufacturing sector's share of employment has remained at a high level. The Survey of Economically Active Population of Statistics Korea shows that this proportion has decreased slightly from 20% in 2000 to 17% in 2007, but remained stable at 17%. Third, the total annual number of manufacturing plants exhibits an upward trend over time. According to the Mining and Manufacturing Survey, the number of plants with more than 10 employees is 51,418 in 2000, 61,785 in 2007, and 65,389 in 2013. In sum, even during the period of rising outward FDI, the domestic manufacturing sector has continued to maintain relatively high shares in employment and value-added and increase the numbers of production plants.

Korean MNEs account for 48% of sales and value-added and 25% of employment in the manufacturing sector as of 2013, according to the Survey of Business Activities by Statistics Korea. Although the macroeconomic data do not provide exact information on the past and current events occurred in the manufacturing sector, we can conjecture that the stable employment share of manufacturing sectors on the aggregate has resulted from Korean MNEs reallocating their plants by simultaneously closing down some while opening up others. Although these two

[15] Although Hong Kong is the largest investing country in Mainland China, it is now a part of China.

opposing dynamics cancel each other out, plant turnover of Korean MNEs can result in active job reallocation (i.e., job creation and destruction) rather than job growth. This hypothesis is what we attempt to test in this study using a unique firm–plant matched data.

**[Figure 3]** Value-added and Employment Shares of Manufacturing in Korea




Sources: National Accounts (Value-added), Bank of Korea.
Economically Active Population Survey (Employment), Statistics Korea.

# III. Data

## 3.1. Firm–Plant Matched Data

To construct a firm–plant matched dataset, we combine two datasets obtained from the Survey of Business Activities (SBA) and the Mining and Manufacturing Survey (MMS), which are conducted annually by Statistics Korea. SBA is a *firm-level* survey that covers all firms located in Korea with 50 or more employees and with 300 million KRW or more capital in all business sectors. SBA includes not only firm characteristics but also various business strategies and activities. In particular, regarding firms' foreign activities, SBA collects country location and two-digit industry information about each foreign plant, of which a Korean parent firm holds at least 20% equity. MMS is a *plant-level* survey that covers all mining and manufacturing plants with 10 or more employees located in Korea. MMS collects detailed information on plant characteristics, including employment, age, and tangible assets.

We use the firm identifier of a plant in MMS to match a firm in SBA. The sample of matched manufacturing firms with their domestic manufacturing plants covered 5,399 manufacturing firms with 7,367 manufacturing plants in 2008. Given that SBA covers firms with 50 or more employees, small plants in MMS are omitted in the matched sample. However, the matched dataset accounts for approximately 75% of sales and 50% of employment of all plants in the 2008 MMS. In addition, given our interest in MNE behavior, the exclusion of small plants may not generate a bias in the construction of a control group of non-MNEs.[16] Thus, our matched dataset is representative for analyzing the effect of MNEs on the domestic manufacturing sector.

Following the massive expansion of manufacturing outward FDI across Asian countries after the mid-2000s, Korea's domestic manufacturing industries experienced massive reallocation and restructuring. To examine the consequences of MNE expansion on domestic manufacturing after mid-2000s, we chose 2008–2013 as the sample period. In this five-year period, domestic manufacturing has expanded with active reallocation along with 1,628 and 1,815 manufacturing plant deaths and births, respectively.

### 3.2. MNEs and Firm Characteristics

Using data from SBA, we construct variables related to MNEs and firm characteristics. First, we construct a measure of MNE status using information on the ownership of foreign plants.[17] A dummy variable of MNE takes a value of 1 if a Korean manufacturing firm own at least one *foreign* manufacturing plant in 2008, and 0 otherwise. As noted in previous studies (e.g., Braconier and Ekholm, 2000; Debaere *et al*., 2010; Harrison and McMillan, 2011), the effect of MNEs on the domestic economy may differ according to the location of foreign activity. To address this argument, we classify MNEs according to country location of their manufacturing plants. The destinations are divided into two groups: advanced and emerging countries.[18] Advanced countries include countries in North America, Europe, Oceania, and Japan, whereas emerging countries include all Asian and developing countries except for Japan. However, a potential problem is observed in this grouping for MNEs. Specifically, the MNE dummies do not necessarily

[16] The Census on Establishments is utilized in this study to include these small plants that are omitted in MMS. Consequently, our main results are qualitatively identical.

[17] We follow SBA's definition on ownership, which is at least 20% capital equity of the foreign plants. However, our results are qualitatively identical when we consider majority-owned (over 50% of equity) foreign plants, because most of them are majority-owned.

[18] MNEs that own foreign affiliates exist in both destination groups. For instance, the 2008 SBA show that the total number of manufacturing firms is 5,339 in which 1,076 refer to the MNEs in emerging group only; 103 refer to those in advanced group only; and 203 refer to those considered belonging to both groups.

indicate that the MNEs with foreign affiliates in advanced are horizontal and the MNEs in emerging countries are vertical. To define the MNEs that have a vertical linkage with their foreign affiliates, we will use a dummy variable if a MNE has at least one vertical-related foreign affiliate. We select pairs of producing and supplying industries when the supplying industry accounts for at least 5% of the total input of the producing industry based on the 2005 Input–Output table of Korea.[19] Vertical relationship between the MNEs and their foreign affiliates include backward and forward integrations. Backward integration is observed when an MNE belongs to the producing industry and its foreign affiliate belongs to the corresponding supplying industry. By contrast, forward integration is observed when an MNE belongs to the supplying industry and its foreign affiliate belongs to the corresponding producing industry.

Next, we construct measures of firm size, firm age, firm capital intensity, firm productivity, and multi-plant and multi-product dummies to control for firm heterogeneity. Firm size is the natural log of the sum of employees in all domestic manufacturing plants owned by a firm. Firm age is the natural log of years of operation of a firm. Firm-level capital intensity is the natural log of the ratio of the sum of plant-level tangible assets to the total manufacturing employment. Firm productivity is defined as the log of total manufacturing sales over total manufacturing employment. Multi-plant is a dummy variable that takes a value of 1 if a firm has at least two domestic manufacturing plants, whereas multi-product is a dummy variable that takes a value of 1 if a firm has a record of sales that belong to at least two three-digit KSIC manufacturing industries.

### 3.3. Plant Deaths and Births

A plant death is observed if a plant in MMS 2008 is absent from MMS 2013. A plant birth is observed if a plant is absent in MMS 2008 but present in MMS 2013. Plant birth and death are defined over the five-year span of the sample period. We construct a dummy variable for plant death at the firm level that takes a value of 1 if a firm has at least one plant death in 2008–2013, and 0 otherwise.[20] A dummy for a plant birth at the firm level is similarly defined. If a firm consists of a single plant (i.e., a single-plant firm) in MMS, plant death also indicates firm death. However, plant death does not necessarily imply firm death if a firm owns multiple plants (i.e., a multi-plant firm). Given that MMS includes plants with 10 or more employees, a

[19] For robustness check, we use 1% criteria in 2005 IO table instead of 5% criteria and find similar results. The results of 1% criteria are reported in Table A4.

[20] The matched dataset is not robust to M&A activities. For example, when firm A acquired firm B in a particular year, firm B's plants will be obtained by firm A. Given that the M&A activities in the SBA, whether M&A firms changed their IDs, and whether the plants changed their IDs are unknown, we are not aware of the share of plant deaths and births from the M&As.

plant death is recorded if the number of people employed at the plant falls below 10 in the sample period. By using the data obtained from the Census on Establishments (CE) that covers all domestic establishments with at least one employed worker, we are able to identify whether plant death represents either plant closure or omission due to being below the minimum 10-worker requirement. However, our main results remain unchanged if the sample is adjusted for true deaths and births of plants.[21]

### 3.4. Employment Growth and Reallocation

Following Davis *et al*. (1998), we construct two measures of employment growth and reallocation at the firm level. First, we define the net employment growth rate of firm *i* as the weighted sum of plant-level employment growth rates:

$$NET_{i,t} = \sum_{j \in i} w_{j,t} EG_{j,t},$$

where $E_{j,t}$ is the number of workers at plant $j$ in year $t$, $EG_{j,t} = (E_{j,t} - E_{j,t-1}) / \bar{E}_{j,t}$ is the employment growth rate of plant $j$, $\bar{E}_{j,t} = 0.5(E_{j,t} + E_{j,t-1})$, and $w_{j,t} = \bar{E}_{j,t} / \sum_{j \in i} \bar{E}_{j,t}$ is the employment weight of plant $j$ in the firm. This growth measure integrates employment growths at continuing (surviving) plants and closed and newly-opened plants. The growth rate lies in the interval [–2, 2] with plant death and birth corresponding to left and right endpoints, respectively.

We also construct an excess job reallocation measure calculated as the sum of job creation and destruction minus the absolute value of net employment growth:

$$EXR_{i,t} = JC_{i,t} + JD_{i,t} - |NET_{i,t}|,$$

where $JC_{i,t} = \sum_{j \in i,\ EG_{j,t}>0} w_{j,t} EG_{j,t}$ is the (gross) job creation rate calculated by the weighted sum of employment growth at continuing plants with positive employment changes and newly-opened plants, and $JD_{i,t} = \sum_{j \in i,\ EG_{j,t}<0} w_{j,t} |EG_{j,t}|$ is the (gross) job destruction rate similarly defined for continuing plants with negative employment changes and closed plants. The reallocation measure captures gross job flows between expanding and shrinking plants, including birth and death plants, which underlie the net employment change. Net employment growth is simply the difference between job creation and destruction. Thus, even when a firm's plants exhibit active job flows within the firm through plant expansion, contraction, births,

[21] Although CE is comprehensive to include all plants in Korea, it has information on employment of plants only. Thus, we still need the MMS for other information, such as capital and sales for this extra exercise.

and death, firm-level employment may remain unchanged if the magnitudes of job creation and destruction are similar. In this respect, the reallocation measure captures the heterogeneity of employment changes across plants, which enables us to identify whether MNEs reorganize their plants at home.

**[Table 1]** Summary Statistics: Korean Manufacturing Firms

| | Mean | Mean (weighted) | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| **Plant turnover at the firm level** | | | | | |
| Plant death | 0.256 | 0.297 | 0.437 | 0 | 1 |
| Plant birth | 0.157 | 0.273 | 0.363 | 0 | 1 |
| **Employment dynamics** | | | | | |
| Employment growth | −0.394 | −0.243 | 0.966 | −2 | 1.927 |
| Excess job reallocation | 0.112 | 0.177 | 0.329 | 0 | 2 |
| **Firm characteristics** | | | | | |
| Firm size | 4.682 | 6.790 | 0.856 | 0 | 11.237 |
| Firm age | 2.766 | 3.031 | 0.683 | 0 | 4.532 |
| Firm capital intensity | 4.448 | 4.984 | 1.092 | −5.017 | 8.676 |
| Firm productivity | 5.626 | 6.077 | 0.854 | −0.068 | 9.907 |
| Multi-plant | 0.236 | 0.545 | 0.424 | 0 | 1 |
| Multi-product | 0.172 | 0.277 | 0.377 | 0 | 1 |

Notes: Figures in the first and second columns are unweighted and weighted means of characteristics for 5,399 Korean manufacturing firms, respectively. Plant death and birth are dummy variables that take a value of 1 if firms have closed and opened domestic manufacturing plants during 2008–2013, respectively. Firm characteristics pertain to 2008. Firm size (employment), firm age, firm capital intensity, and firm productivity are logarithmic values.

### 3.5. Summary Statistics

Table 1 reports summary statistics for Korean manufacturing firms used in our analysis. The first column shows that 25.6% of 5,399 manufacturing firms have closed at least one domestic plant during the period of 2008–2013, whereas 15.7% of the firms have opened new domestic plants during the same period. In the case of employment-weighted means, the probabilities of plant death and birth at the firm level increased by 29.7% and 27.3%, respectively. These values indicate that large firms will have higher probabilities of plant birth and death. However, the findings do not necessarily indicate a positive association between firm size and plant death and birth. Large firms are more likely to have multiple plants, and multi-plant firms have a high plant turnover rate (Dunne *et al*., 1989; Bernard and Jensen, 2007; Kneller *et al*., 2012). Table 1 shows that a quarter of firms in the sample are multi-plant firms, accounting for more than 50% of the total employment in the sample.

Thus, controlling for firm characteristics that may affect plant turnover is crucial. Overall, the findings confirm that Korean manufacturing firms actively pursued reallocation and restructuring by closing and opening domestic plants during the period of 2008–2013.

Employment growth over the five-year period is on average −0.394 (−0.243 for employment-weighted mean) and has a large standard deviation of 0.966. Large negative values of mean employment growth with a substantial standard derivation are a function of our employment growth measure that integrates employment changes of not only continuing plants but also plant (and firm) death and birth. For example, firms with existing plants only have an extreme value of −2. To compare employment growth between MNEs and non-MNEs, employing this integrated measure is necessary because the exit rates of MNEs and non-MNEs are substantially different. Consistent with high plant birth and death, mean excess job reallocation (0.112 and 0.177 for unweighted and weighted means, respectively) indicates substantial job creation and destruction (that cancel each other out and do not change the employment level).

**[Table 2]** Means of Characteristics for MNEs and Non-MNEs

| | MNE | Non-MNE | Difference |
|---|---|---|---|
| **Plant turnover** | | | |
| Plant death | 0.366 | 0.223 | 0.143 (0.012)*** |
| Plant birth | 0.393 | 0.144 | 0.248 (0.011)*** |
| **Employment dynamics** | | | |
| Employment growth | −0.167 | −0.322 | 0.155 (0.020)*** |
| Excess job reallocation | 0.245 | 0.105 | 0.140 (0.009)*** |
| **Firm characteristics** | | | |
| Firm size | 7.847 | 5.667 | 2.180 (0.053)*** |
| Firm age | 3.222 | 2.827 | 0.395 (0.020)*** |
| Firm capital intensity | 5.242 | 4.709 | 0.533 (0.028)*** |
| Firm productivity | 6.368 | 5.767 | 0.601 (0.023)*** |
| Multi-plant | 0.700 | 0.380 | 0.320 (0.012)*** |
| Multi-product | 0.374 | 0.173 | 0.201 (0.012)*** |
| Observations | 1,382 | 4,017 | |
| Employment weight | 0.513 | 0.487 | |

Notes: Figures in the first and second columns are weighted means of characteristics for MNEs and non-MNEs, respectively. Plant death and birth are dummy variables that take a value of 1 if firms have closed and opened domestic manufacturing plants during the period of 2008–2013, respectively. Firm characteristics and employment weights pertain to 2008. Firm size (employment), firm age, firm capital intensity, and firm productivity are logarithmic values. Numbers in parentheses are standard errors.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table 2 reports the weighted mean of each variable for MNEs (1,382) and non-MNEs (4,017). On average, MNEs exhibit higher probabilities of plant death and birth than non-MNEs. In the third column, the differences in death and birth probabilities in the two groups are statistically significant at the 1% level. Employment growth and reallocation are also higher for MNEs than non-MNEs. However, concluding that MNEs have more active reallocation and higher employment growth than non-MNEs is difficult, because MNEs also have different firm attributes that may affect plant turnover. As expected, Table 2 shows that MNEs are larger, older, more capital-intensive, and more productive than non-MNEs. Moreover, MNEs are more likely to be multi-plant and multi-product firms than non-MNEs. Therefore, controlling firm characteristics is crucial when identifying the effects of MNEs on employment growth and reallocation. Accordingly, we conduct multiple regression analyses in the next section.

# IV. Empirical Results

## 4.1. Empirical Specification

In this section, we examine the effect of MNEs not only on plant death and birth but also on employment growth and reallocation at the firm level. To relate firm characteristics including MNEs in year $t$ to the four firm-level outcomes between year $t$ and $t+5$, we estimate regressions of the form as follows:

$$y_i = \alpha + \beta MNE_i + \gamma' X_i + \mu_k + \varepsilon_i .$$

The dependent variables are plant death and birth, net employment growth, and excess job reallocation of firm $i$ between years $t$ (2008) and $t+5$ (2013). Plant death and birth at the firm level are dummy variables that take a value of 1 if firm $i$ has closed or opened a plant during the period of 2008–2013, respectively. The net employment growth rate at the firm level is measured by the weighted average of plant-level employment growth rates. The excess job reallocation rate at the firm level is calculated as the sum of job creation and destruction rates minus the net employment growth rate. $MNE_i$ is a dummy variable indicating whether firm $i$ is an MNE in year $t$. $X_i$ is a vector of firm-level characteristics in year $t$ that includes firm size, firm age, firm capital intensity, firm productivity, and multi-plant and multi-product dummies. The model also includes 61 three-digit industry dummies ($\mu_k$) to control for unobserved factors affecting firm-level outcomes.[22]

[22] Various three-digit industries in which the dependent variable for all firms in an industry has the same value are merged into their closest industries. This process reduces the number of industries from

$\varepsilon_i$ is an error term allowing clustering at the industry level. We employ probit models wherein plant death and birth (both dichotomous) are dependent variables and ordinary least squares estimation to model employment growth and job reallocation. To examine the economic significance of MNE operations, we estimate employment-weighted regressions for all four outcomes in this section.[23]

**[Table 3]** Korean MNEs and Home-Country Effects on Manufacturing Plant Turnover

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Plant death | Plant birth | Plant death | Plant birth | Plant death | Plant birth |
| MNE | 0.130*** | 0.153*** | | | | |
| | (0.043) | (0.034) | | | | |
| MNE: Emerging | | | 0.117*** | 0.103*** | | |
| | | | (0.039) | (0.024) | | |
| MNE: Advanced | | | 0.078 | 0.152** | | |
| | | | (0.059) | (0.059) | | |
| MNE: VI | | | | | 0.144*** | 0.149*** |
| | | | | | (0.043) | (0.043) |
| MNE: Non-VI | | | | | 0.070 | 0.059 |
| | | | | | (0.060) | (0.052) |
| Firm size | −0.044 | 0.032 | −0.052* | 0.017 | −0.050* | 0.029 |
| | (0.032) | (0.025) | (0.029) | (0.023) | (0.029) | (0.023) |
| Firm age | −0.072*** | 0.002 | −0.072*** | 0.004 | −0.075*** | 0.003 |
| | (0.022) | (0.039) | (0.021) | (0.038) | (0.022) | (0.040) |
| Firm capital | −0.008 | −0.019 | −0.007 | −0.017 | −0.008 | −0.020 |
| intensity | (0.017) | (0.017) | (0.017) | (0.016) | (0.017) | (0.016) |
| Firm productivity | 0.003 | 0.048* | $0.005 \times 10^{-1}$ | 0.043* | 0.001 | 0.047* |
| | (0.024) | (0.025) | (0.025) | (0.024) | (0.024) | (0.025) |
| Multi-plant | 0.366*** | 0.033 | 0.369*** | 0.043 | 0.360*** | 0.022 |
| | (0.031) | (0.034) | (0.029) | (0.031) | (0.031) | (0.035) |
| Multi-product | 0.023 | 0.085 | 0.021 | 0.087 | 0.016 | 0.082 |
| | (0.059) | (0.074) | (0.058) | (0.076) | (0.052) | (0.073) |
| Pseudo $R^2$ | 0.313 | 0.277 | 0.315 | 0.281 | 0.318 | 0.278 |
| Sample size | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 |

Notes: The dependent variables in columns (1) and (3) are dummy variables that take a value of 1 if firms have closed domestic manufacturing plants during the period of 2008–2013. Dependent variable in columns (2) and (4) are similarly defined for firms' plant births. Marginal effects of probit estimates are also presented. The sample includes all Korean manufacturing firms with 50 or more employees in 2008 (which are linked to their manufacturing plants with 10 or more employees). All regressions include 61 three-digit industry dummies. All regressions are weighted by firm employment in 2008. Numbers in parentheses are industry-clustered standard errors.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

82 to 61.

[23] Nonetheless, unweighted regressions generate qualitatively similar results (reported in Table A1 in the Appendix).

### 4.2. Plant Deaths and Births

Table 3 reports the marginal effects of MNEs on the probability of plant death and birth at the firm level. Column (1) of Table 3 shows that MNEs have an approximately 13% higher probability of plant shutdown than non-MNEs. This finding is consistent with the effects of MNEs in advanced countries on their plants at home (Bernard and Jensen, 2007). Outward FDI induces plant shutdown in home countries, which hollows out domestic industries. However, column (2) shows that Korean MNEs also have a higher probability of opening a new plant at the home country than non-MNEs. The results in columns (1) and (2) suggest that Korean MNEs shut down their manufacturing plants at home while opening new plants.[24] The magnitude of MNEs' effects on the probabilities of domestic plant death and birth also indicates that the difference in plant birth probability between MNEs and non-MNEs is even larger than that of plant death probability. Thus, Korean MNEs are characterized by active plant opening at the home country, distinguishing them from MNEs in advanced countries. This finding suggests that plant closures in Korea driven by MNEs imply the reorganization of domestic manufacturing industries rather than hollowing out.[25]

In addition to the MNE dummy, columns (1) and (2) show that some firm characteristics are related to plant shutdown and opening. Old firms are less likely to close their plants than young firms, and multi-plant firms are more likely to close their plants than single-plant firms (Dunne *et al*., 1989; Bernard and Jensen, 2007; Kneller *et al*., 2012). Firm productivity is positively related to the probability of plant birth, although this finding is significant only at the 10% level. Firm size and productivity do not affect the probability of plant death. Our findings at the firm level are not directly comparable to those in previous plant-level studies wherein the probability of plant survival is positively related to *plant* size, age, productivity, and capital intensity. A negative relation is also found between plant size and productivity and plant exit decision.[26]

Columns (3) and (4) distinguish MNEs according to their destinations: emerging and advanced countries. A firms' ownership of manufacturing plants in emerging countries have positive effects on the probabilities of plant death and birth at home countries. However, the ownership of plants in advanced countries has a significant positive effect on plant birth only. This result is consistent with that of existing

[24] Closing and opening of plants may not be conducted by the same firm. To address this issue, we employ a bivariate probit model and a multinomial logit model to estimate the association between plant closing and opening decisions. The estimation results suggest a positive association between the two decisions. See Table A3 in the Appendix.

[25] However, we do not investigate other economic effects of this reorganization of manufacturing, such as changes in productivity and production structure.

[26] The results are available upon request.

literature (e.g., Hanson *et al*., 2005; Debaere *et al*., 2010; Harrison and McMillan, 2011) wherein advanced countries' FDI to developing countries is often defined as *vertical* mainly because of the regional advantage of labor costs. However, the definition based on FDI destination does not necessarily imply whether the type of FDI is vertical or horizontal. To clearly address this issue, we redefine the vertical MNE dummies as vertical linkages between domestic parent firms and their foreign affiliates in the context of input–output industry relationship. Columns (5) and (6)

**[Table 4]** Korean MNEs and Home-Country Effects on Employment Dynamics

| | (1) Employment growth | (2) Job reallocation | (3) Employment growth | (4) Job reallocation | (5) Employment growth | (6) Job reallocation |
|---|---|---|---|---|---|---|
| MNE | 0.024 | 0.064*** | | | | |
| | (0.048) | (0.018) | | | | |
| MNE: | | | −0.027 | 0.044** | | |
| Emerging | | | (0.048) | (0.017) | | |
| MNE: | | | 0.122** | 0.074*** | | |
| Advanced | | | (0.060) | (0.028) | | |
| MNE: VI | | | | | −0.008 | 0.070*** |
| | | | | | (0.047) | (0.018) |
| MNE: Non-VI | | | | | 0.087 | 0.043 |
| | | | | | (0.061) | (0.036) |
| Firm size | 0.058*** | 0.002 | 0.047** | −0.005 | 0.056*** | −0.001 |
| | (0.019) | (0.017) | (0.022) | (0.015) | (0.020) | (0.016) |
| Firm age | 0.039* | −0.001 | 0.037 | −0.004 | 0.034 | −0.004 |
| | (0.023) | (0.016) | (0.024) | (0.016) | (0.024) | (0.017) |
| Firm capital intensity | 0.059*** | −0.012 | 0.060*** | −0.010 | 0.060*** | −0.011 |
| | (0.018) | (0.010) | (0.018) | (0.010) | (0.018) | (0.010) |
| Firm productivity | 0.074** | 0.010 | 0.071** | 0.007 | 0.072** | 0.008 |
| | (0.028) | (0.014) | (0.027) | (0.014) | (0.028) | (0.014) |
| Multi-plant | −0.092** | 0.119*** | −0.081** | 0.123*** | −0.096** | 0.113*** |
| | (0.036) | (0.025) | (0.035) | (0.023) | (0.039) | (0.026) |
| Multi-product | −0.011 | 0.053 | −0.005 | 0.055 | −0.015 | 0.050 |
| | (0.041) | (0.041) | (0.040) | (0.041) | (0.040) | (0.038) |
| Adjusted $R^2$ | 0.110 | 0.285 | 0.112 | 0.289 | 0.111 | 0.289 |
| Sample size | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 |

Notes: Employment growth is the net job creation rate defined as the difference between the job creation and destruction rates. The excess job reallocation rate is defined as the sum of job creation and destruction rates minus employment growth (i.e., the net job creation rate). The sample includes all Korean manufacturing firms with 50 or more employees in 2008 (which are linked to their manufacturing plants with 10 or more employees). All regressions include 61 three-digit industry dummies. All regressions are weighted by firm employment in 2008. Numbers in parentheses are industry-clustered standard errors.
* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

**[Table 5]** Contribution of Employment Dynamics

| | (1) JC by entrants | (2) JC by continuers | (3) JD by exiters | (4) JD by continuers | (5) JC by entrants | (6) JC by continuers | (7) JD by exiters | (8) JD by continuers | (9) JC by entrants | (10) JC by continuers | (11) JD by exiters | (12) JD by continuers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MNE | 0.048*** | −0.017 | −0.020 | 0.027* | | | | | | | | |
| | (0.009) | (0.027) | (0.034) | (0.014) | | | | | | | | |
| MNE: Emerging | | | | | 0.033*** | −0.019 | 0.001 | 0.040** | | | | |
| | | | | | (0.008) | (0.023) | (0.037) | (0.017) | | | | |
| MNE: Advanced | | | | | 0.054*** | −0.012 | −0.023 | −0.057 | | | | |
| | | | | | (0.014) | (0.028) | (0.054) | (0.037) | | | | |
| MNE: VI | | | | | | | | | 0.051*** | −0.025 | 0.004 | 0.030* |
| | | | | | | | | | (0.010) | (0.025) | (0.034) | (0.017) |
| MNE: Non-VI | | | | | | | | | 0.017 | 0.005 | −0.016 | −0.049 |
| | | | | | | | | | (0.017) | (0.022) | (0.052) | (0.032) |
| Adjusted $R^2$ | 0.115 | 0.120 | 0.135 | 0.078 | 0.120 | 0.121 | 0.134 | 0.084 | 0.117 | 0.122 | 0.134 | 0.082 |
| Sample size | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 |

Notes: Column (1), (5), and (9) represent job creation rate caused by entrants in a firm. Column (2), (6), (10) show job creation rate from continuers. Similarly, column (2), (6), and (10) are job destruction rate caused by exiters. Column (4), (8), and (12) means job destruction rate contributed by continuers. Higher coefficient means a firm has active job creation and job destruction than others. All regressions include firm size, firm age, firm capital intensity, firm productivity, and multi-plant and multi-product variables as controls. All regressions include 61 three-digit industry dummies. All regressions are weighted by firm employment in 2008. Numbers in parentheses are industry-clustered standard errors.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

show that the MNEs with vertically-related foreign affiliates are likely to open new plants and close existing plants at home countries. Our empirical findings in Table 3 suggest that vertical FDI does not preclude the possibility of establishing new plants at home. Plant death and birth can be viewed as MNEs' strategy of vertically linking domestic and foreign plants. This finding implies that the MNEs have been establishing global value chains.

### 4.3. Employment and Reallocation

Table 4 presents results on net employment growth and job reallocation within firm over the five-year sample period. Column (1) of Table 4 shows that net employment growth in MNEs relative to non-MNEs is positive but statistically insignificant. Column (2) reports that MNEs have more active job reallocation relative to non-MNEs, which is statistically significant at the 1% level.

Columns (3) and (4) of Table 4 present the differential effects of MNEs on employment and reallocation according to the destinations of outward FDI. MNEs with plants in emerging countries exhibit active job reallocation but insignificant net employment growth at home countries. By contrast, MNEs with plants in advanced countries exhibit active job reallocation and positive net employment growth. Moreover, columns (5) and (6) show that the MNEs with vertically-related foreign affiliates have considerable active job reallocation. These results suggest that the effects on net employment growth and job reallocation vary according to the destination of FDI from Korean MNEs and the type of foreign affiliate.

However, the results in Table 4 do not necessarily indicate whether the job reallocations by MNEs are due to the extensive margins (i.e., plant death and birth) or the intensive margin (plant continuation). Table 5 shows the results when we further disaggregate the JC and the JD by plant death, birth, and continuation. According to the results, we find that the JC occurs due to plant births of the MNEs, whereas JD occurs due to continuing plants. Thus, different from non-MNEs, MNEs increase their jobs by plant birth and decrease their jobs by reducing the employment in existing plants. Similar findings are observed in MNEs in emerging countries and those with vertically-related foreign affiliates.

## V. Robustness

To assess the robustness of our findings, we examine various issues related to the main results. First, we examine whether or not our results are robust to alternative definitions of MNEs (i.e., majority-owned foreign plants) and emerging countries (i.e., further disaggregating them to Asian or East Asian countries). Second, we examine alternative sample periods (i.e., sub-periods of 2008–2011 for shorter time

and another sub-period of 2009–2013 to exclude the global crisis years) and alternative sample firms (i.e., excluding firms owned by foreign parent firms). Third, we address possible endogeneity concerns by using propensity score matching methods. Fourth, we check if plant entry and exit decisions are related within an MNE by using bivariate probit and multinomial logit models. This series of robustness tests produces qualitatively similar results to those shown in Tables 3 and 4.

### 5.1. Alternative Definitions: MNEs and Emerging Countries

We define an MNE according to year 2008, i.e., the beginning of the five-year sample period. In this way, we can link the expansion of outward FDI starting in the mid-2000s to the plant turnover effect at home in the late-2000s. However, some firms may also have exhibited outward FDI activities before the mid-2000s, and thus completed reorganizing their manufacturing plants at home countries before the start of our sample period.[27] If the share of these MNEs is non-negligible, our definition of MNEs may not correctly estimate the impact on domestic plant turnover. To address this issue, we define MNEs as firms that undertook outward FDI during the period of 2006–2008 only. Thus, we redefine the MNEs as those who increased the amount of FDIs for existing foreign manufacturing plants or those who set up new plants in foreign countries between 2006 and 2008. This alternative definition covers approximately 86% of MNEs based on the ownership of foreign affiliates as of 2008, indicating a strong association between the ownership of foreign manufacturing plants in 2008 and outward FDI in the mid-2000s.

To examine whether the reallocation effects of MNEs are related to more narrowly-defined emerging countries in Asia, we use two alternative definitions of emerging countries: Asian or East Asian countries. Given that emerging countries are more diversely located in several continents (e.g., Asia and South and North America) compared with advanced countries, examining whether our findings of MNEs to emerging countries are related to global production chains built by Korean MNEs in East Asian countries is important.

Panels A1 and B1 in Table 6 show the results for plant turnover and employment dynamics when the alternative definition of MNEs is used. In the case of advanced countries, MNEs are also more likely to close their domestic plants. Thus, the positive net employment growth effect presented in Table 4 becomes unrelated. Overall, the results are qualitatively identical to those presented in Tables 3 and 4.

[27] Various large Korean firms have transformed into MNEs in the 1990s, but undertook massive outward FDI after the mid-2000s.

Alternative definitions of emerging countries are used in Panels A2 and B2 of Table 6: East Asian countries in columns (1) and (2) and Asian countries in columns (3) and (4).

**[Table 6]** Robustness Checks: Alternative Definitions of MNEs and Emerging Countries

**A. Plant Turnover**

| | (1) Plant death | (2) Plant birth | (3) Plant death | (4) Plant birth | (5) Plant death | (6) Plant birth |
|---|---|---|---|---|---|---|
| **A1. Alternative definition of MNEs** | | | | | | |
| MNE | 0.135*** | 0.154*** | | | | |
| | (0.049) | (0.038) | | | | |
| MNE: Emerging | | | 0.111*** | 0.084*** | | |
| | | | (0.043) | (0.032) | | |
| MNE: Advanced | | | 0.119* | 0.253*** | | |
| | | | (0.069) | (0.087) | | |
| MNE: VI | | | | | 0.150*** | 0.147*** |
| | | | | | (0.051) | (0.048) |
| MNE: Non-VI | | | | | 0.076 | 0.060 |
| | | | | | (0.072) | (0.055) |
| **A2. Alternative definition of emerging countries** | | | | | | |
| MNE: East Asian countries | | 0.115*** | 0.098*** | | | |
| | | (0.040) | (0.029) | | | |
| MNE: Asian countries | | | | 0.117*** | | 0.103*** |
| | | | | (0.039) | | (0.030) |
| MNE: Advanced countries | | 0.080 | 0.155*** | 0.076 | | 0.148** |
| | | (0.060) | (0.060) | (0.059) | | (0.058) |

**B. Employment Dynamics**

| | (1) Employment growth | (2) Job reallocation | (3) Employment growth | (4) Job reallocation | (5) Employment growth | (6) Job reallocation |
|---|---|---|---|---|---|---|
| **B1. Alternative definition of MNEs** | | | | | | |
| MNE | 0.032 | 0.073*** | | | | |
| | (0.049) | (0.020) | | | | |
| MNE: Emerging countries | | | −0.003 | 0.051** | | |
| | | | (0.052) | (0.019) | | |
| MNE: Advanced countries | | | 0.067 | 0.094** | | |
| | | | (0.065) | (0.040) | | |
| MNE: VI | | | | | −0.002 | 0.072*** |
| | | | | | (0.059) | (0.022) |
| MNE: Non-VI | | | | | 0.062 | 0.036 |
| | | | | | (0.067) | (0.042) |

| **B2. Alternative definition of emerging countries** | | | | |
|---|---|---|---|---|
| MNE: East Asian countries | −0.030 | 0.042** | | |
| | (0.049) | (0.019) | | |
| MNE: Asian countries | | | −0.025 | 0.040** |
| | | | (0.046) | (0.018) |
| MNE: Advanced countries | 0.123** | 0.075*** | 0.122** | 0.075*** |
| | (0.060) | (0.028) | (0.061) | (0.028) |

Notes: All regressions include firm size, firm age, firm capital intensity, firm productivity, and multi-plant and multi-product variables as controls. Panel A reports marginal effects of probit estimates. All regressions include 61 three-digit industry dummies. All regressions are weighted using firm employment in 2008. Numbers in parentheses are industry-clustered standard errors.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Results for East Asian countries are qualitatively identical to those pertaining to all emerging countries, which suggests that active plant turnover and job reallocation in domestic manufacturing are related to the rapid expansion of outward FDI toward East Asian countries, particularly in China, during the mid-2000s.

## 5.2. Alternative Samples: Period and Coverage

In our main analysis, we use a five-year sample period spanning 2008–2013 to investigate the effects of outward FDI on domestic plant turnover and employment dynamics. To examine whether our results are robust to a shorter time span, we use two alternative sample periods. First, we use a three-year period spanning 2008–2011, which requires MNEs' effects on reallocation to be realized more quickly than the five-year period. Second, our five-year sample period includes the global financial crisis of 2007–2008, which may affect our results. To address this issue, we use a sample period spanning 2009–2013. Table 7 indicates that different sample periods do not alter the main results on plant turnover and employment dynamics reported in Tables 3 and 4.

Firms owned by foreign parent firms are included in the current analysis. In such a case, given that the foreign parent firms are also MNEs, the outward FDI decisions of firms in our sample may be dependent upon global production strategies of the foreign MNEs. Thus, we exclude such firms owned by foreign parent firms with more than 50% of capital equity. This process results in a minor exclusion of 343 firms owned by foreign parent firms, without altering the previously reported results.[28]

[28] Results pertaining to the sample omitting foreign-owned firms are reported in Table A2 of the Appendix.

**[Table 7]** Robustness Checks: Alternative Sample Periods

**A. Plant Turnover**

| | (1) Plant death | (2) Plant birth | (3) Plant death | (4) Plant birth | (5) Plant death | (6) Plant birth |
|---|---|---|---|---|---|---|
| **A1. Three-year period: 2008–2011** | | | | | | |
| MNE | 0.067** | 0.112*** | | | | |
| | (0.029) | (0.027) | | | | |
| MNE: Emerging | | | 0.059** | 0.087*** | | |
| | | | (0.026) | (0.020) | | |
| MNE: Advanced | | | 0.038 | 0.066 | | |
| | | | (0.046) | (0.051) | | |
| MNE: VI | | | | | 0.082*** | 0.115*** |
| | | | | | (0.028) | (0.028) |
| MNE: Non-VI | | | | | 0.077* | 0.062 |
| | | | | | (0.040) | (0.054) |
| **A2. Excluding the global financial crisis: 2009–2013** | | | | | | |
| MNE | 0.139*** | 0.125*** | | | | |
| | (0.034) | (0.033) | | | | |
| MNE: Emerging | | | 0.130*** | 0.090*** | | |
| | | | (0.030) | (0.023) | | |
| MNE: Advanced | | | 0.067 | 0.095* | | |
| | | | (0.046) | (0.055) | | |
| MNE: VI | | | | | 0.156*** | 0.123*** |
| | | | | | (0.033) | (0.037) |
| MNE: Non-VI | | | | | 0.079 | 0.039 |
| | | | | | (0.050) | (0.044) |

**B. Employment Dynamics**

| | (1) Employment growth | (2) Job reallocation | (3) Employment growth | (4) Job reallocation | (5) Employment growth | (6) Job reallocation |
|---|---|---|---|---|---|---|
| **B1. Three-year period: 2008–2011** | | | | | | |
| MNE | 0.068 | 0.039*** | | | | |
| | (0.058) | (0.010) | | | | |
| MNE: Emerging | | | 0.036 | 0.024** | | |
| | | | (0.054) | (0.010) | | |
| MNE: Advanced | | | 0.087* | 0.055*** | | |
| | | | (0.051) | (0.018) | | |
| MNE: VI | | | | | 0.043 | 0.037*** |
| | | | | | (0.056) | (0.012) |
| MNE: Non-VI | | | | | 0.057 | 0.039** |
| | | | | | (0.061) | (0.017) |
| **B2. Excluding the global financial crisis: 2009–2013** | | | | | | |
| MNE | −0.053 | 0.044*** | | | | |
| | (0.065) | (0.015) | | | | |

| | | | | |
|---|---|---|---|---|
| MNE: | −0.104 | 0.039** | | |
| Emerging | (0.074) | (0.016) | | |
| MNE: | 0.119* | 0.003 | | |
| Advanced | (0.064) | (0.016) | | |
| MNE: VI | | | −0.071 | 0.048*** |
| | | | (0.071) | (0.016) |
| MNE: Non-VI | | | 0.074 | 0.024 |
| | | | (0.056) | (0.023) |

Notes: All regressions include firm size, firm age, firm capital intensity, firm productivity, and multi-plant and multi-product variables as controls. Panel A reports marginal effects of probit estimates. All regressions include 61 three-digit industry dummies. All regressions are weighted by firm employment in 2008. Numbers in parentheses are industry-clustered standard errors.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

## 5.3. Endogeneity

Endogeneity may arise in estimating the effects on outcomes: the probability of plant death or birth, employment growth, and reallocation. To address this issue, we use the MNE variable in year $t$ prior to the outcome variables in years $t$ and $t+5$. We also control for various firm-level characteristics in this study. If unobserved positive shocks exist, such as rising labor costs at home countries, that may induce firms to increase outward FDI and shut down plants, then our estimate of MNEs' effect on the probability of plant death may be biased. Previous studies focusing on plant death can be sensitive to these unobserved shocks. However, our results may circumvent this issue because we examine not only plant death but also plant birth, i.e., reallocation. To address possible endogeneity, we employ propensity score matching methods to estimate the effects of MNEs. Propensity score matching methods have been widely used to reduce endogeneity problems. Propensity scores are fitted by the predicted values of the probit specification, which includes firm size, firm age, firm capital intensity, firm productivity, and multi-plant and multi-product variables. After calculating propensity scores, we pair each MNE with a non-MNE that has a similar propensity score. We impose the requirement that the match must emanate from the same industry and adopt five nearest neighbor non-MNEs.[29] These non-MNEs are assigned equal weights to calculate the treatment effects. We use a bootstrap method for standard errors with 300 replications.

[29] When we use 10 and 20 nearest-neighbor variants, the results are qualitatively similar.

**[Table 8]** Endogeneity: Propensity Score Matching

**A. Plant Turnover**

| | (1) Plant death | (2) Plant birth | (3) Plant death | (4) Plant birth | (5) Plant death | (6) Plant birth | (7) Plant death | (8) Plant birth | (9) Plant death | (10) Plant birth |
|---|---|---|---|---|---|---|---|---|---|---|
| MNE | 0.238** | 0.278*** | | | | | | | | |
| | (0.100) | (0.100) | | | | | | | | |
| MNE: Emerging | | | 0.237** | 0.277*** | | | | | | |
| | | | (0.093) | (0.102) | | | | | | |
| MNE: Advanced | | | | | 0.301* | 0.384** | | | | |
| | | | | | (0.168) | (0.154) | | | | |
| MNE: VI | | | | | | | 0.247** | 0.301*** | | |
| | | | | | | | (0.104) | (0.099) | | |
| MNE: Non-VI | | | | | | | | | 0.272 | 0.341* |
| | | | | | | | | | (0.198) | (0.176) |
| Sample size | 1,382 | 1,382 | 1,279 | 1,279 | 306 | 306 | 1,147 | 1,147 | 385 | 385 |

**B. Employment Dynamics**

| | (1) Employment growth | (2) Job reallocation | (3) Employment growth | (4) Job reallocation | (5) Employment growth | (6) Job reallocation | (7) Employment growth | (8) Job reallocation | (9) Employment growth | (10) Job reallocation |
|---|---|---|---|---|---|---|---|---|---|---|
| MNE | −0.032 | 0.179** | | | | | | | | |
| | (0.028) | (0.077) | | | | | | | | |
| MNE: Emerging | | | −0.046 | 0.176** | | | | | | |
| | | | (0.032) | (0.080) | | | | | | |
| MNE: Advanced | | | | | 0.047 | 0.247* | | | | |
| | | | | | (0.033) | (0.135) | | | | |
| MNE: VI | | | | | | | −0.032 | 0.185** | | |
| | | | | | | | (0.029) | (0.083) | | |
| MNE: Non-VI | | | | | | | | | 0.038 | 0.238 |
| | | | | | | | | | (0.054) | (0.154) |
| Sample size | 1,382 | 1,382 | 1,279 | 1,279 | 306 | 306 | 1,147 | 1,147 | 385 | 385 |

Notes: Dependent variables are plant death and birth dummies at the firm level for Panel A and employment growth and excess job reallocation rates for Panel B. Propensity scores are estimated by the weighted probit model. Matches are assigned within the same three-digit industry. Bootstrapped standard errors are in parentheses.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table 8 reports matching results. The coefficients are the average treatment effect of MNEs. The effects of MNEs remain unchanged. Overall, the matching results confirm that the main results in Tables 3 and 4 are not biased by endogeneity issues.

Finally, our results concerning MNE effects on plant turnover do not necessarily imply that plant deaths and births occur in the same firm, because we estimate birth and death regressions separately. We thus estimate bivariate probit models to

explore whether plant deaths and births are positively related within an MNE. The results suggest that the two decisions concerning plant death and birth within an MNE are positively correlated, and the correlation coefficient (Rho) is statistically significant at the 1% level.[30] In addition, we try to estimate multinomial logit model whether plant deaths and births are done within an MNE. Results show that plant turnover is more likely to occur within the same MNE. This finding confirms that a Korean MNE closes domestic manufacturing plants and then opens new plants.

## VI. Conclusion

In this study, we examine the effects of outward FDI of Korean firms on their choices of domestic plant birth and death using firm–plant matched data. Our empirical results show that Korean MNEs, especially those with vertically-related manufacturing plants in Asian countries, are more likely to shut down and open domestic manufacturing plants than non-MNEs. Korean MNEs also exhibit more active job reallocation than non-MNEs. However, the net job growth effect of MNEs is insignificant.

Our findings suggest that while building Asian supply chains during the 2000s, Korean MNEs have reorganized domestic manufacturing rather than hollowing out. This finding may further imply that the effects of Asian MNEs on their domestic plant turnover and employment dynamics are different from those of advanced countries' MNEs. According to existing literature, the reduction in domestic employment is due to the extensive margin of plant exit, whereas the MNEs increase employment at existing plants at home countries. However, a new pattern is observed in this study. Specifically, Korean MNEs exhibit job gains at the extensive margins of plant entry while they decrease employment at existing plants at the home country. We can interpret this finding as an Asian case of the filling-in effect at the extensive margin.

We also emphasize that Korean MNEs' investment mechanism is distinct from that of advanced countries' MNEs. The former has restructured their manufacturing plants through shutting down existing plants and opening up new plants. However, this argument calls for further studies on what types of plants have been closed and opened within MNEs during the period of building Asian supply chains through outward FDI. One potential avenue in this respect is a technology-driven hypothesis. Although Korean MNEs may remove domestic assembly lines of their final products, they construct domestic and global vertical chains of inputs. The removal of assembly lines may help mitigate cost pressures on domestic manufacturing. Moreover, a linkage of high-tech input producing plants in

[30] Results for the bivariate and multinomial logit models are reported in Table A3 of the Appendix.

domestic to low-tech input producing plants in foreign may elevate their position in the global value chains. Another possible mechanism for the filling-in phenomenon is a market expansion hypothesis. Since the mid-2000s, Korean MNEs have the opportunity to enter huge Chinese markets. As these markets increasingly accept foreign manufacturers, Korean MNEs may invest in domestic and foreign countries to meet increased demand from the global market engagement with China. As the production of Korean MNEs increases, economies of scale will eventually benefit firms that sell products in China. Understanding these reallocation mechanisms led by Korean MNEs will provide new insights into the home-country effects of MNEs in terms of production structure, employment, and productivity growth.

Regardless of the global value chain, other possibilities of high plant turnover of MNEs can exist. Plant death and birth may increase, for example, if the product-cycle of MNEs is shorter than that of purely domestic firms. To address this issue, future studies need to examine more highly disaggregated subsample of industries. Likewise, other possibilities of high job turnover of MNEs can exist. Specifically, skill intensity of labor may increase more rapidly for MNEs compared with purely domestic firms. To address this important issue, future studies need further information on the characteristics of tasks of job creation and destruction caused by MNEs.

# Appendix

**[Table A1]** Plant Turnover Results: Probit Model (Unweighted)

| | (1) Plant death | (2) Plant birth | (3) Plant death | (4) Plant birth | (5) Plant death | (6) Plant birth |
|---|---|---|---|---|---|---|
| MNE | 0.037** | 0.046*** | | | | |
| | (0.016) | (0.009) | | | | |
| MNE: Emerging | | | 0.044** | 0.033*** | | |
| | | | (0.017) | (0.009) | | |
| MNE: Advanced | | | −0.006 | 0.061** | | |
| | | | (0.029) | (0.024) | | |
| MNE: VI | | | | | 0.040** | 0.056*** |
| | | | | | (0.017) | (0.010) |
| MNE: Non-VI | | | | | 0.016 | 0.002 |
| | | | | | (0.018) | (0.018) |
| Firm size | −0.062*** | 0.034*** | −0.062*** | 0.032*** | −0.062*** | 0.033*** |
| | (0.010) | (0.006) | (0.010) | (0.006) | (0.010) | (0.006) |
| Firm age | −0.067*** | −0.012* | −0.067*** | −0.012* | −0.067*** | −0.012* |
| | (0.012) | (0.007) | (0.012) | (0.007) | (0.012) | (0.007) |
| Firm capital intensity | −0.001 $\times 10^{-1}$ | −0.005 | −0.001 $\times 10^{-1}$ | −0.005 | −0.004 $\times 10^{-2}$ | −0.005 |
| | (0.008) | (0.006) | (0.008) | (0.006) | (0.008) | (0.006) |
| Firm productivity | −0.015 | 0.019** | −0.015 | 0.018** | −0.015 | 0.018** |
| | (0.010) | (0.008) | (0.010) | (0.008) | (0.010) | (0.008) |
| Multi-plant | 0.430*** | 0.059*** | 0.429*** | 0.059*** | 0.428*** | 0.057*** |
| | (0.016) | (0.011) | (0.016) | (0.011) | (0.016) | (0.011) |
| Multi-product | −0.008 | 0.081*** | −0.009 | 0.082*** | −0.008 | 0.081*** |
| | (0.016) | (0.013) | (0.016) | (0.013) | (0.016) | (0.013) |
| Pseudo $R^2$ | 0.137 | 0.065 | 0.137 | 0.066 | 0.137 | 0.066 |
| Sample size | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 |

Notes: The dependent variables in columns (1) and (3) are dummy variables that take a value of 1 if firms have closed domestic manufacturing plants during the period of 2008–2013. Dependent variables in columns (2) and (4) are similarly defined for firms' plant births. Marginal effects of probit estimates are also presented. The sample includes all Korean manufacturing firms with 50 or more employees in 2008 (which are linked to their manufacturing plants with 10 or more employees). All regressions include 61 three-digit industry dummies. Numbers in parentheses are industry-clustered standard errors.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

**[Table A2]** Robustness Checks: Excluding Foreign-owned Firms

**A. Plant Turnover**

| | (1) Plant death | (2) Plant birth | (3) Plant death | (4) Plant birth | (5) Plant death | (6) Plant birth |
|---|---|---|---|---|---|---|
| MNE | 0.118*** | 0.157*** | | | | |
| | (0.042) | (0.038) | | | | |
| MNE: Emerging | | | 0.108*** | 0.107*** | | |
| | | | (0.040) | (0.028) | | |
| MNE: Advanced | | | 0.065 | 0.165*** | | |
| | | | (0.065) | (0.058) | | |
| MNE: VI | | | | | 0.135*** | 0.152*** |
| | | | | | (0.044) | (0.048) |
| MNE: Non-VI | | | | | 0.072 | 0.063 |
| | | | | | (0.061) | (0.050) |
| Pseudo $R^2$ | 0.324 | 0.289 | 0.326 | 0.296 | 0.330 | 0.291 |
| Sample size | 5,056 | 5,056 | 5,056 | 5,056 | 5,056 | 5,056 |

**B. Employment Dynamics**

| | (1) Employment growth | (2) Job reallocation | (3) Employment growth | (4) Job reallocation | (5) Employment growth | (6) Job reallocation |
|---|---|---|---|---|---|---|
| MNE | 0.035 | 0.062*** | | | | |
| | (0.053) | (0.019) | | | | |
| MNE: Emerging | | | −0.022 | 0.042** | | |
| | | | (0.052) | (0.019) | | |
| MNE: Advanced | | | 0.143* | 0.083*** | | |
| | | | (0.074) | (0.028) | | |
| MNE: VI | | | | | $-0.002 \times 10^{-1}$ | 0.069*** |
| | | | | | (0.052) | (0.019) |
| MNE: Non-VI | | | | | 0.098 | 0.041 |
| | | | | | (0.071) | (0.036) |
| Adjusted $R^2$ | 0.109 | 0.300 | 0.112 | 0.305 | 0.110 | 0.303 |
| Sample size | 5,056 | 5,056 | 5,056 | 5,056 | 5,056 | 5,056 |

Notes: All regressions include firm size, firm age, firm capital intensity, firm productivity, and multi-plant and multi-product variables as controls. Panel A reports marginal effects of probit estimates. All regressions include 61 three-digit industry dummies. All regressions are weighted using firm employment in 2008. Numbers in parentheses indicate industry-clustered standard errors.

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

**[Table A3]** Plant Turnover Results

**A. Bivariate Probit Model**

| | (1A) Plant death | (2A) Plant birth | (3A) Plant death | (4A) Plant birth | (5A) Plant death | (6A) Plant birth |
|---|---|---|---|---|---|---|
| MNE | 0.100*** | 0.124*** | | | | |
| | (0.033) | (0.027) | | | | |
| MNE: | | | 0.089*** | 0.084*** | | |
| Emerging | | | (0.030) | (0.019) | | |
| MNE: | | | 0.058 | 0.114*** | | |
| Advanced | | | (0.043) | (0.041) | | |
| MNE: VI | | | | | 0.109*** | 0.119*** |
| | | | | | (0.032) | (0.032) |
| MNE: Non-VI | | | | | 0.049 | 0.045 |
| | | | | | (0.043) | (0.039) |
| Rho | 0.375*** | | 0.371*** | | 0.364*** | |
| Wald test for Rho = 0 | 36.00 | | 39.54 | | 37.95 | |
| Log likelihood | −978,343 | | −973,829 | | −974,836 | |
| Sample size | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | |

**B. Multinomial Logit Model**

| | (1B) Plant death | (2B) Plant birth | (3B) Both | (4B) Plant death | (5B) Plant birth | (6B) Both | (7B) Plant death | (8B) Plant birth | (9B) Both |
|---|---|---|---|---|---|---|---|---|---|
| MNE | 0.025* | 0.051*** | 0.068*** | | | | | | |
| | (0.014) | (0.017) | (0.019) | | | | | | |
| MNE: | | | | 0.036** | 0.033* | 0.049*** | | | |
| Emerging | | | | (0.015) | (0.019) | (0.018) | | | |
| MNE: | | | | −0.037 | 0.039 | 0.054*** | | | |
| Advanced | | | | (0.032) | (0.028) | (0.020) | | | |
| MNE: VI | | | | | | | 0.032* | 0.040 | 0.072*** |
| | | | | | | | (0.017) | (0.025) | (0.018) |
| MNE: Non-VI | | | | | | | −0.012 | $-0.001 \times 10^{-1}$ | 0.024 |
| | | | | | | | (0.025) | (0.024) | (0.018) |
| Pseudo $R^2$ | 0.310 | 0.310 | 0.310 | 0.324 | 0.324 | 0.324 | 0.312 | 0.312 | 0.312 |
| Sample size | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 | 5,399 |

Notes: The dependent variables in columns (1A), (3A), (5A), (1B), (4B), and (7B) are dummy variables that take a value of 1 if firms have closed domestic manufacturing plants during the period of 2008–2013. The dependent variables in columns (2A), (4A), (6A), (2B), (5B), and (8B) are similarly defined for firms' plant births. The dependent variables in columns (3B), (6B), and (9B) are dummy variables that take a value of 1 if firms have closed and opened domestic manufacturing plants during the period of 2008-2013. Panel A reports marginal effects of bivariate probit estimates, whereas Panel B shows marginal effects of multinomial logit estimates. The sample includes all Korean manufacturing firms with 50 or more employees in 2008 (which are linked to their manufacturing plants with 10 or

more employees). All regression specifications include firm size, firm age, firm capital intensity, firm productivity, and multi-plant and multi-product variables as controls. All regressions include 61 three-digit industry dummies. All regressions are weighted by firm employment in 2008. Numbers in parentheses are industry-clustered standard errors.
* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

**[Table A4]** Robustness Checks: Alternative Definition of VI

| | (1) Plant death | (2) Plant birth | (3) Employment growth | (4) Job reallocation |
|---|---|---|---|---|
| MNE: VI | 0.124*** | 0.149*** | 0.015 | 0.060*** |
| | (0.040) | (0.031) | (0.048) | (0.017) |
| MNE: Non-VI | 0.225* | 0.167* | 0.058 | 0.104 |
| | (0.133) | (0.091) | (0.072) | (0.065) |
| Sample size | 5,399 | 5,399 | 5,399 | 5,399 |

Notes: All regressions include firm size, firm age, firm capital intensity, firm productivity, and multi-plant and multi-product variables as controls. VI is defined by using 1% criteria in 2005 IO table. All regressions are weighted by firm employment in 2008. Numbers in parentheses are industry-clustered standard errors.
* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

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