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Labor Market Rigidity at Home and Multinational Corporations' Flexible Task Reallocation Abroad

JaeBin Ahn
Jaerim Choi
Sunghoon Chung

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Abstract

An unprecedented regime change following the 2017 presidential impeachment led to a dramatic shift to more rigid labor market policies in the Republic of Korea, represented by consecutive double-digit hikes in the minimum wage in the next two years. Using a firm-level data set with detailed information about foreign affiliates for 2013–19, this paper assesses the employment consequences of stricter labor market regulations. The empirical evidence uncovers a relatively unexplored mechanism through which domestic labor market rigidity can potentially reduce domestic employment as multinational firms with flexible internal networks reallocate tasks across borders.

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JaeBin Ahn† Jaerim Choi‡ Sunghoon Chung§

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*The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors and do not necessarily represent the views of the World Bank and its affiliated organizations, or those of the Executive Directors or the countries they represent. All errors are our responsibility.

†Graduate School of International Studies, Seoul National University. E-mail: jaebin.ahn@snu.ac.kr.
‡Department of Economics, University of Hawai'i at Mānoa. E-mail: choijm@hawaii.edu.
§Development Research Group, The World Bank. E-mail: schung5@worldbank.org.

1 Introduction

Over the past three decades, the world has witnessed a fundamental transformation of global production and trade (Elms and Low, 2013). Across-the-board liberalization of trade accompanied by advances in information and communications technology (ICT) has greatly facilitated production fragmentation and international production sharing, giving rise to rapid growth in global trade and the proliferation of multinational corporations (MNCs) over the period. Hence it has been called the age of global value chains (GVCs) (Antràs, 2020).

Beyond their direct impact on the pattern of international trade, GVCs have shaken up traditional trade policy beliefs and practices: A growing share of imported inputs, not least via intrafirm trade, calls for recalibrating optimal tariffs to prevent adverse effects on domestic economies (Blanchard et al., 2017). Moreover, footloose MNCs can make bilateral trade remedies such as anti-dumping duties impotent by easily relocating production to foreign affiliates in third countries (Chung et al., 2016; Flaaen et al., 2020).

A relatively unexplored aspect of the policy implications of GVCs is the extent to which the presence of MNCs may affect the effectiveness of domestic policy. A case in point is labor market regulation such as raising the minimum wage. In the literature, the standard way of identifying the employment effects of the minimum wage is to identify the variation in the fraction of workers initially earning less than the new minimum wage across firms *within* a country.[1] From this perspective, large firms, such as MNCs, should be less affected than smaller firms by a minimum wage hike because they tend to have a smaller share of workers earning less than the new minimum wage. In the age of GVCs, however, MNCs may respond more sensitively to a minimum wage change; they can reallocate production tasks to foreign affiliates via their internal networks in a country with cheaper labor costs, possibly amplifying the adverse effects of the minimum wage increase on domestic employment.

Although the idea is intuitive from existing theories of MNCs (e.g., Helpman et al., 2004), there is scant empirical evidence on firm-level responses to more stringent labor market regulation in the context of international production sharing within MNCs. This paper contributes to the literature by providing detailed firm-level evidence on MNCs' task reallocation abroad after an abrupt introduction of stricter labor market regulations

[1] Researchers have compared the effects of the minimum wage on workers who earned less than the minimum wage with other workers (Cengiz et al., 2019; Dustmann et al., 2022). Similarly, in the absence of individual-level data, researchers have utilized the minimum wage "bite" approach, dating back to Card (1992), which relies on the treatment intensity based on the variation in the fraction of workers initially earning less than the new minimum wage across firms, regions, or industries.

in the Republic of Korea.

Korea offers a unique setting for the purpose of this study.[2] First, an unprecedented regime change following the country's impeachment of President Park Geun-hye in 2017 led to a dramatic shift toward more rigid labor market policies, including consecutive double-digit yearly minimum wage hikes and a reduction in the maximum allowed number of working hours per week by 16 hours (i.e., from 68 to 52 hours a week). The series of events around 2017 and subsequent changes in labor market regulations were unanticipated in the eyes of firms, yielding the consequent adverse labor cost shock as an effective source of exogenous variation for our empirical study. What is more, firm-level survey data from the Korea national statistical office provides a comprehensive set of operational information, including locations and industries of each firm's foreign affiliates (if any), which enables us to identify MNCs and their responses to the labor cost shock through foreign internal networks.

Using the data set for the period 2013~2019, we investigate the differential impacts of the stricter labor market regulations across firms. We begin by conducting an event study analysis to track employment trends separately for Korean firms with foreign affiliates (i.e., MNCs) and for firms without foreign affiliates non-MNCs, finding that only the former group of firms experienced a decline in employment after 2017. To control for any potential time-varying confounding effects, we then estimate difference-in-differences as well as dynamic treatment effects by including industry-region-year fixed effects. In addition, to alleviate concerns about sample selection bias due to observable differences between MNCs and non-MNCs, we employ a propensity score matching (PSM) method. Overall, our empirical results suggest that, as a result of stricter labor market regulations, domestic employment declined by 3% in firms with foreign affiliates.[3]

The negative employment effects for MNCs are consistent with task substitution between domestic workers and foreign factors of production through MNCs' internal networks. In addition to the decline in employment, MNCs reduced production tasks; the reductions in employment were particularly pronounced in firms with foreign affiliates in emerging Asian countries and in firms with foreign affiliates performing similar tasks. Our findings are inconsistent with possible alternative explanations such as the replacement of domestic labor with domestic capital (or the replacement of one set of workers with differently skilled workers). Furthermore, the estimated results do not appear to be driven by foreign demand shocks. Collectively, all the evidence supports the interpre-

[2]Throughout the paper, "Korea" is used to refer to the Republic of Korea.

[3]We further confirm that the estimated effects are not driven by pre-period differences in employment trends, while they are robust to controlling for any time-varying firm attributes or to alternative strategies of categorization.

tation that MNCs reallocated tasks across borders through flexible internal networks in response to a steep rise in labor costs induced by more stringent labor market regulations.

Our study contributes to a vast literature on firms' employment responses to minimum wage increases, a topic that has long been central in labor economics (See Neumark et al., 2007, for a survey). Prior studies have focused largely on two economic types of adaptations by firms. One is to increase their use of high-skilled workers because the wages for those high-skilled workers become relatively cheaper than the ones for low-skilled workers. This possibility has been supported by some empirical studies (Fairris and Bujanda, 2008; Giuliano, 2013; Clemens and Wither, 2019), but no definitive conclusion has yet been reached (e.g., Cengiz et al., 2019). Another way for firms to adapt in a new minimum wage environment is to replace labor with capital, or more narrowly, automation technologies. A burgeoning literature has emphasized this second factor as an important channel through which firms adjust employment in response to minimum wage increases (Aaronson and Phelan, 2019; Lordan and Neumark, 2018; Harasztosi and Lindner, 2019; Hau et al., 2020, among others).[4] We checked for two substitution channels as compounding employment adjustment mechanisms and found that they were not apparent in our context.

Another factor that has received little attention in the minimum wage literature is the substitution between domestic workers and foreign factors of production, particularly within multinationals. In this paper, we provide supportive evidence for the employment adjustment channel via MNCs' global internal networks. To our best knowledge, the present paper is the first to investigate explicitly the role of MNCs in cross-national task reallocation following domestic minimum wage increases. A few studies have assessed this channel in a broader offshoring context. Aaronson and Phelan (2019), for example, find no evidence of minimum wage-induced foreign outsourcing of cognitively routine tasks that pay low wages. By contrast, we propose a distinct substitution mechanism that works flexibly through MNCs' internal networks across countries.[5]

[4]Firms can also adapt to a minimum wage hike by adjusting non-employment margins such as non-cash compensation, output prices, and firm profits. See Clemens (2021) for a comprehensive review of the literature. Although investigating non-employment margins would be an interesting topic, our interest is the employment margin in response to minimum wage hikes.

[5]Our mechanism is quite similar to the substitution effect of Grossman and Rossi-Hansberg (2008) in a task-based offshoring literature, wherein they predicted that (broadly defined) offshoring generates both the substitution effect and the productivity effect in the source country. Using US industry-level data, Ottaviano et al. (2013) found that offshoring reduces the share of natives among less-skilled workers but pushes natives toward jobs that are more skill-intensive. We also add to this task-based offshoring literature but go beyond the existing studies by providing firm-level, instead of industry-level, evidence on the task substitution mechanism through MNCs' internal networks across borders. Furthermore, unlike Ottaviano et al. (2013), we exploit an exogenous change in labor market policy such as the minimum wage hikes.

Turning our attention to the international trade literature, this paper is related to existing studies on the nexus between stringent domestic labor market policy and offshoring activities. In the international trade literature, high labor costs due to a high minimum wage and frictions in the domestic labor market are commonly perceived as drivers of task offshoring and outward foreign direct investment (FDI). Although the literature has actively investigated the economic consequences of those international activities (offshoring and outward FDI), which and how domestic labor market policies or shocks at home could trigger them has been relatively under-explored empirically. The few exceptions include studies by Gan et al. (2016) and Fan et al. (2018). Gan et al. (2016) found that export market participation by Chinese firms weakened after a continuing rise in the minimum wage, likely reflecting China's loss of external competitiveness due to an increase in labor costs. Fan et al. (2018) found that a minimum wage increase promotes outward FDI by Chinese firms. Our paper's focus is quite close to, but distinct from, that of Fan et al. (2018) in that they investigated the extensive margin channel by which firms establish new foreign affiliates in response to minimum wage increases, whereas we focus on the labor reallocation channel at the intensive margin through *existing* foreign affiliates. Another notable difference is that Fan et al. (2018) consider medium-run responses of domestic firms to the minimum wage increase over a 12-year sample period, while our primary focus is on the immediate, short-run responses (i.e., about three years after a minimum wage increase) of MNCs that have already set up foreign affiliates.

Last but not least, our study complements previous research on multinational labor substitution in the international trade literature. For example, Muendler and Becker (2010) assess how the wage differential between home and abroad affects German MNCs' demand for labor and find significant labor substitution between headquarters and foreign affiliates at both the intensive and extensive margins;[6] Harrison and McMillan (2011) use US firm-level data to identify the labor substitution channel such that offshoring to low-wage countries substitutes for domestic employment.[7] Here, we investigate the labor substitution channel through MNCs' internal networks (i.e., the intensive margin), but break new ground on this important channel by exploiting unanticipated labor market policy changes to identify the mechanism.[8]

[6] Muendler and Becker (2010) categorized two critical margins of multinational labor substitution whereby an MNC's labor demand responds to international wage differentials (1) at the extensive margin, when the MNC enters a foreign market; and (2) at the intensive margin, when the MNC operates through existing foreign affiliates.

[7] Harrison and McMillan (2011) also explored a complementary effect such that for firms that do significantly different tasks at home and abroad, foreign and domestic employment are complements. They found that the overall effect is a small decline in manufacturing employment.

[8] Several other earlier studies failed to find any impact on home employment through MNC operations

The paper is organized as follows. Section 2 provide some background, in which we highlight the unique setting of a quasi-experimental design in Korea. Section 3 introduces the sample data for our main analysis. Section 4 presents the main empirical finding and the estimation models. Section 5 presents evidence on the task reallocation mechanism. Section 6 examines potentially alternative drivers of the main empirical finding. Section 7 concludes.

2 Background

2.1 An Unforeseen Change in Labor Market Policy

Stringent labor market regulations had long been pointed to as a major factor hindering the competitiveness of the Korean economy. According to the Global Competitiveness Report (Schwab and Sala-i Martin, 2015), Korea was once ranked 115 out of 140 countries for the efficiency of its hiring and firing practices. Against that background, President Park Geun-hye's administration pursued increasing labor market flexibility after taking office in 2013.

Unexpectedly, however, the impeachment of President Park from December 2016 to March 2017 due to a series of scandals, followed by the regime change in two months, led to more rigid labor market policies in the coming years.[9] Elected as Park's successor on May 9, 2017, and inaugurated just one day later, President Moon Jae-in took a distinctly different labor policy stance from that of the previous government. The new administration quickly proposed guidelines for converting irregular workers to regular workers in July 2017 and an annual conversion plan three months later.[10] The government also pushed for a revision of the Labor Standards Act, which includes reducing maximum working hours from 68 hours to 52 hours a week. The amendment was passed in February 2018 and implemented for firms with 300 or more employees in July of the same year.[11]

Yet another, and arguably much more impactful, labor policy came into force in 2017,

in low-wage locations: Slaughter (2000) in US industries and Konings and Murphy (2006) using European multinationals. Although these earlier studies explored the intensive margin channel of MNCs, the unit of analysis is broad (i.e., industry) and the estimation strategy does not fully address endogeneity issues.

[9]The Encyclopedia Britannica (www.britannica.com/biography/Park-Geun-Hye) provides a detailed description about the impeachment and related events.

[10]Although the plan was supposed to apply only to workers in the public sector, moral suasion encouraged the private sector to follow the same practice voluntarily.

[11]Since its first implementation for large firms, the 52 working hours restriction has been sequentially activated for firms that hire 50~299 workers in January 2020 and for the rest of small firms in July 2021.

namely, a sharp increase in the minimum wage. Specifically, the government raised the minimum wage by nearly 30% in the two years after President Moon's inauguration, a move that firms did not expect before December 2016. Given that a significant number of Korean firms had foreign affiliates in 2016, we hypothesize that firms with foreign affiliates attempted to mitigate the shock to the domestic labor market by adjusting their workforce (or task) composition between home and foreign countries, thereby resulting in adverse domestic employment effects.

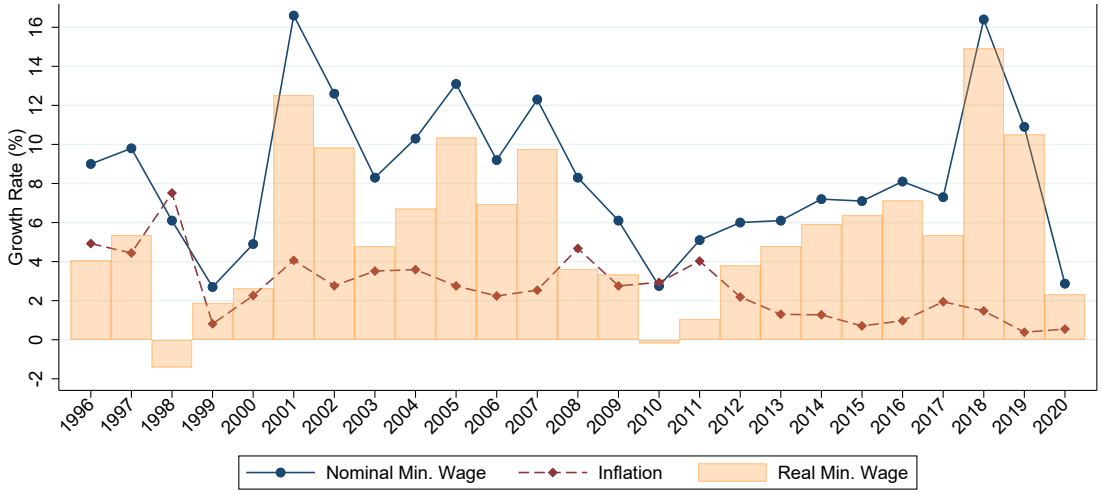
2.2 Minimum Wage Increases in Korea

The minimum wage increase was one of the most prominent pledges that Moon had emphasized during his campaign for the presidency. He promised to raise the hourly minimum wage to 10,000 won by 2020, which could only be achieved if it rose by 15.7% per year over the next three years. In support of the president's pledge, the Minimum Wage Commission decided to increase the 2018 minimum wage by 16.4% on July 15, 2017.[12] Another steep increase of 10.9% in the following year, a cumulative increase of 29.1% in just two years, raised strong concern about negative effects on employment and hence on the economy. In response, the government later moderated its initial plan and reduced the minimum wage increase to 2.9% and 1.5% in 2019 and 2020, respectively.

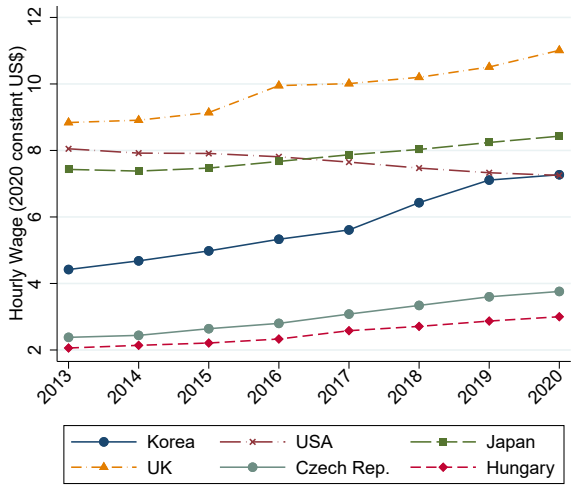
Figure 1 shows the minimum wage increases in 2017 and 2018. In panel (a), the yearly increase in the nominal minimum wage is illustrated with annual inflation rates. Each bar denotes the difference between the two – the yearly increase in the real minimum wage. The minimum wage increase in 2018 was the highest since 2001, when Korea was recovering from a deep economic recession associated with the Asian financial crisis. Relatively low inflation rates in recent years confirm that the minimum wage growth in *real* terms was also the highest in 20 years. Panel (b) compares Korea's steep increase in the minimum wage with that in other countries. Korea's minimum wage grew faster than in most advanced countries or in emerging market economies such as the Czech Republic and Hungary. According to the OECD Statistics Database, the ratio of minimum to median wages in Korea rose from 50% in 2016 to 63% in 2019 (see panel (c)), the highest percentage point increase among OECD countries. This suggests that the minimum wage increases indeed exerted strong cost push shocks on Korean firms.

[12]The minimum wage law applies to entire establishments in Korea with a single rate. That is, the minimum wage rate in Korea does not have region, industry, or occupation variations. The minimum wage must be determined by August 5th for the next year according to Article 8, Paragraph 1 of the Minimum Wage Act and is effective from January 1st in the next year.

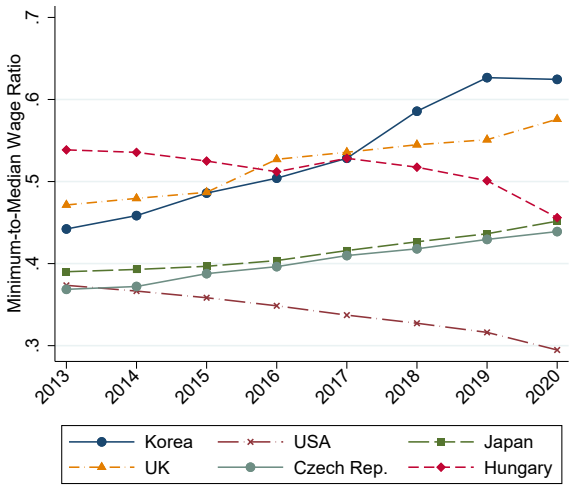
Figure 1: Minimum Wages in Korea



(a) Minimum Wages and Inflation Trend



(b) Hourly Real Minimum Wages



(c) Minimum-to-Median Wage Ratio

Notes: Panel (a) shows the annual growth rates of nominal minimum wages (blue) and consumer price index (CPI, red), respectively, of which the difference is real minimum wages (orange bar). Panel (b) presents hourly real minimum wages for selective countries, while panel (c) compares their minimum to median wage ratios. All values in panels (b) and (c) are in constant prices at 2020 USD exchange rates. The data come from OECD Statistics Database.

2.3 Korean MNCs' Foreign Affiliates

Here we describe trends in Korean outward foreign direct investment (FDI) and employment by foreign affiliates. Korea first began collaborating with foreign affiliates in the mid-1990s; this activity increased significantly in the 2000s, as shown in panel (a) in Fig-

ure 2. In particular, investment in China, which is geographically close to Korea and has both a huge market and low-wage workforce, had soared before the global financial crisis. In the 2010s, however, the geographic pattern of Korean outward FDI began to shift from China to the ASEAN countries of Southeast Asia partly owing to the rapid rise in low-skilled wages in China. In all, about half of Korea's new foreign affiliates were in China and Southeast Asia.

Panel (b) in Figure 2 presents the nominal foreign investment value, net of divestment, over the same periods. A consistent pattern with panel (a) is observed in general. One notable fact is that the investment amount in 2017-2020 rose sharply, which coincides with the period after the rapid minimum wage hikes. Panels (a) and (b) indicate that the rise in FDI was greater at the intensive margin than at the extensive margin. This suggests that there has been a large amount of incremental investment in existing foreign affiliates since 2017.

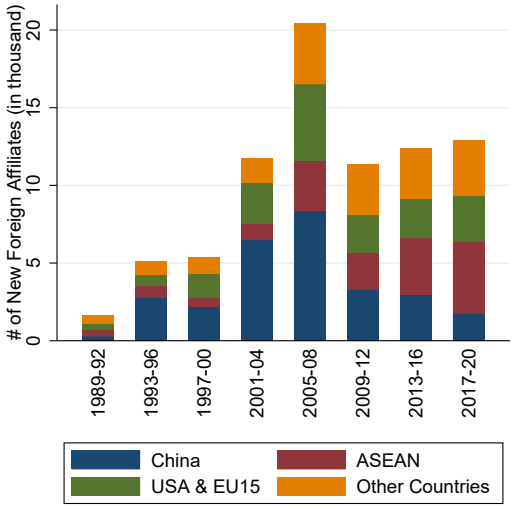
The recent trend in employment by foreign affiliates of Korean MNCs is depicted in panels (c) and (d) in Figure 2.[13] Several things stand out. First, panel (c) shows that total employment was concentrated in ASEAN countries from 2014 through 2019, the best available period in our data at hand, and their employment share continued to rise, with a notable leap in 2018-2019. More specifically, the number of employees in the ASEAN countries increased by about 40%, from 0.9 million in 2016 to 1.26 million in 2019.[14] Although this may look somewhat contrary to panel (b) where the largest share of FDI is accounted for by high-income Western countries, it can be easily reconciled by considering the high labor intensity of tasks performed in ASEAN countries. Panel (c) also confirms the observation from panel (a) that Korea's production bases have been moving from China to ASEAN countries. Panel (d) further indicates that the tasks are performed primarily by local workers; Koreans employed by foreign affiliates and receiving wages similar to those paid by their parent firm account for at best 1% of the total employees in the ASEAN countries during this period. The two panels thus provide a strong indication of Korean MNCs' increasing reliance on cheap labor in low-income countries, especially those close to the home country, for low-skilled tasks.

The rising outward foreign investment and employment abroad over the last couple of years, especially in ASEAN countries, coincides with the sudden labor policy changes in

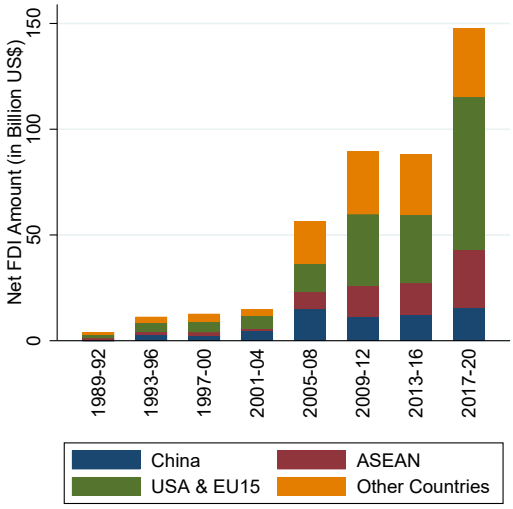
[13] Caution is needed in interpreting the statistics in panels (c) and (d) as the data cover only relatively large foreign affiliates of Korean MNCs. See notes to Figure 2 for the details.

[14] We expect, however, that the actual employment growth of foreign affiliates in the ASEAN countries may be greater than 40% over the period because most of the small affiliates omitted from the data are likely located in developing countries. Our expectation is indeed confirmed by the pattern in panels (a) and (b): the FDI amounts per foreign affiliate in China and the ASEAN nations are much lower than those in the US and EU15.

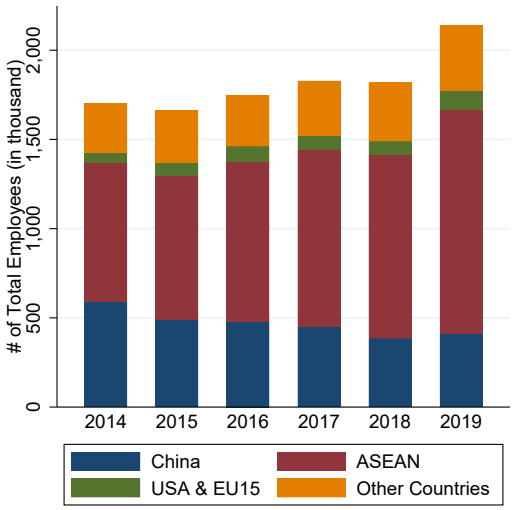
Figure 2: Trends in Korean Outward FDI and Employment of Foreign Affiliates



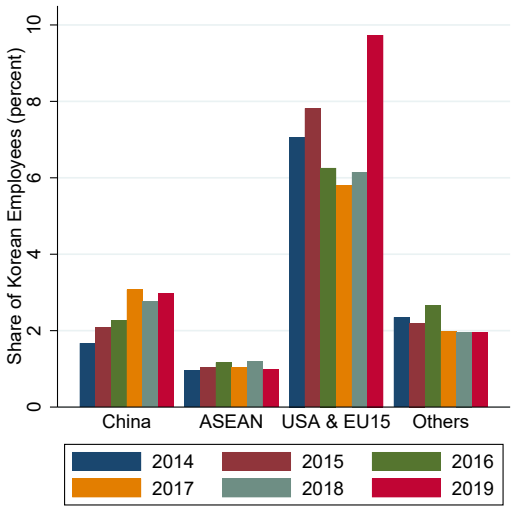
(a) Number of New Foreign Affiliates



(b) Net Foreign Investment Amount



(c) Total Employees in Foreign Affiliates



(d) Share of Korean Employees in Foreign Affiliates

Notes: Values in each bar in both panels (a) and (b) are aggregated over the four-year period. Investment in countries frequently regarded as tax havens is excluded from the calculation. Statistics in panels (c) and (d) are based on foreign affiliates of Korean MNCs that satisfy all of the following criteria: (i) total investment by the Korean headquarters firm is at least 2 million US dollars, (ii) classified as a firm in the non-financial sector, and (iii) reliability of the survey response is verified by the Korea Export-Import Bank, the administrator of the survey. About 60-70% of all foreign affiliates subject to data collection are included in the sample each year because of the third criterion, which requires caution in interpretation. All data come from the Korea Export-Import Bank Foreign Direct Investment Database.

Korea, but is there a causal relationship? The answer hinges critically on whether we can find evidence that the domestic employment of Korean MNCs declined relatively more than that of non-MNCs after the policy changes. A disproportionate drop in domestic employment in MNCs after the labor market shock can be interpreted as task substitution between domestic workers and foreign factors of production within their internal network. Formally, we test whether Korean firms that already had foreign affiliates before 2017 reduced their domestic employment to relocate tasks abroad in response to the exogenous domestic labor market policies. The task reallocation would take place primarily through foreign affiliates in nearby low-wage countries if cost saving was the key motive. A subsequent assessment therefore is centered on whether MNCs with foreign affiliates in those countries experienced a steeper decline in domestic employment. Since our data set comprises a nontrivial number of Korean firms with affiliates in China and the ASEAN countries prior to the labor policy changes, the current economic, geographic, and policy circumstances all provide a unique setup for our empirical test.

3 Data

Our primary data set is the Survey of Business Activities (SBA) from Statistics Korea, an annual firm-level panel survey that was first carried out in 2006. The data set covers firms that conduct business activities in Korea as of the survey reference date, employing at least 50 full-time employees and reporting a capital stock value of at least 300 million Korean won (about 267,869 USD using the 2010 exchange rate). The sample size in each year is approximately 13,000 firms in Korea, which represent 80% of the total output of Korea in the year 2008.

The data set provides typical firm-level variables such as employment, tangible assets, sales, purchases, value added, wage bill, exports, and imports. In addition, it allows us to identify each firm's foreign affiliates and their locations (if any), along with equity shares.[15] For each firm, we can also identify the region, sector, and industry. The regions match 16 first-tier administrative divisions of Korea: one special city, six metropolitan cities, eight provinces, and one special autonomous province.[16] The sectors are identified by 18 one-digit divisions based on the Korean Standard Industrial Classification.[17] At a

[15]This data set is also used by Choi and Greaney (2022). They found that foreign acquisition increases the share of women in management positions by exploiting information on foreign ownership in the data set. In contrast, in this paper, we utilize the information on Korean firms' foreign affiliates.

[16]Note that, in July 2012, Sejong Special Self-Governing City was created. We classify Sejong as Chungcheongnam Province (Sejong City's original province before July 2012) throughout the paper.

[17]From 2007 to 2016, the KSIC is based on revision 9; while, from 2017 to 2019, the KSIC is based on

more disaggregated level, we can identify the industries with 64 two-digit divisions based on the Korean Standard Industrial Classification.[18] In the manufacturing sector, our focus of interest, there are 24 two-digit industries.

To explore the effect of the abrupt minimum wage increase announcement in August 2017 following a series of events associated with the political scandal that started in late 2016, we restrict the sample to the years 2013 through 2019, a seven-year horizon that includes four pre-period years and three post-period years.[19] Our key conjecture is that, faced with the minimum wage hikes, Korean firms with foreign affiliates adjusted their workforces differently than firms with no foreign affiliates. We therefore divide Korean firms into two groups: (i) firms with at least one foreign affiliates in the period 2013–2016 (MNCs); and (ii) firms with no foreign affiliates (non-MNCs) during the same period. Note that a sizable portion of Korean firms operated in foreign countries in 2016, which provides a good setup for our empirical analysis.[20]

Table 1 summarizes the geographic distribution of foreign affiliates included in our data set in 2016 by region and country of destination.[21] In Korean manufacturing, other Asian countries were the top destination with 3,237, or 78.9% of the 4,103 in total, followed by North America with 356 (8.68%) and Europe with 315 (7.68%). At the country level, China accounts for 1,851 subsidiaries (15.11%), followed by Vietnam with 488 (11.89%), and then the USA with 343 (8.36%). Korean MNCs' global production sharing is most pronounced in emerging Asian countries such as China and Vietnam.[22]

Although the division of Korean firms into two groups may provide new insights into the impacts of minimum wage increases, identifying the employment effects is not straightforward. There are observable (and unobservable) differences between MNCs and non-MNCs (see Table 2). MNCs tend to be larger than non-MNCs in many dimen-

revision 10. Hence, we match the two different revisions based on revision 9 throughout the paper.

[18] If a firm produces multiple products across different industries, the survey identifies the industry of a firm as the one with the highest sales value. If a firm has multiple plants, the survey identifies the firm's region based on its headquarters' location.

[19] Note that the baseline year is set to 2016 as the sequence of events in 2017 was totally unexpected in the eyes of firms in 2016. Hence, four pre-event periods are 2013, 2014, 2015, and 2016; three post-event periods are 2017, 2018, and 2019.

[20] In our data set, there is a total of 12,151 firms, 2,786 of which had at least one foreign affiliate in 2016 (23% of the total). In the manufacturing sector, there are 5,916 firms, 1,939 of which had at least one foreign affiliate in 2016 (33% of the total).

[21] A summary of industry affiliations for Korean MNCs' foreign affiliates is provided in Appendix Table A.1. Of the 24 manufacturing industries, "Motor Vehicles, Trailers and Semitrailers" accounts for 761 subsidiaries, or 18.55% of the 4,103 in total, followed by "Electronic Components and Computer" with 738 (17.99%) and "Other Machinery and Equipment" with 359 (8.75%).

[22] Ahn and Park (2021, 2022) document that Korean outward FDI in emerging Asian countries is mostly vertical, with cost saving as the main motive; FDI in advanced countries is mainly horizontal with market penetration as the goal.

Table 1: Distribution of Foreign Affiliates by Region and Country, 2016

Region/Country	# of Subsidiaries	Share
Panel A. Asia	3,237	78.89
China	1,851	45.11
Vietnam	488	11.89
Indonesia	174	4.24
India	165	4.02
Japan	81	1.97
Thailand	80	1.95
Hong Kong SAR, China	68	1.66
Malaysia	60	1.46
Philippines	58	1.41
Panel B. North America	356	8.68
United States	343	8.36
Panel C. Europe	315	7.68
Poland	44	1.07
Russian Federation	40	0.97
Germany	40	0.97
Panel D. Latin America	161	3.92
Mexico	91	2.22
Brazil	39	0.95
Panel E. Rest of the World	34	0.83
Total	4,103	100.00

Notes: The data comes from the Survey of Business Activities (SBA) in 2016. The sample is restricted to Korean parent firms in manufacturing. There are 1,939 Korean manufacturing firms that have 4,103 foreign affiliates. Regions are classified into five areas (Asia, North America, Europe, Latin America, and Rest of the World). The top 15 countries are also presented.

Table 2: MNCs and Non-MNCs Observable Characteristics, 2016

	MNCs	Non MNCs	Difference
Employees (number)	602	153	449
Share of production workers (percent)	55	63	-8
Wage bill (million Korean won)	46,689	8,752	45,814
Capital stocks (million Korean won)	212,424	28,859	183,565
Average wage (million Korean won)	58	53	5
Capital stocks per worker (million Korean won)	197	175	22
Sales (million Korean won)	510,629	73,191	437,138
Purchases (million Korean won)	286,926	40,968	245,958
Exports (million Korean won)	194,215	12,653	181,562
Imports (million Korean won)	105,913	11,097	94,816
Observations	1,939	3,977	

Notes: The data come from the Survey of Business Activities (SBA) in 2016. The sample is restricted to Korean parent firms in manufacturing. There are a total of 5,916 Korean manufacturing firms. The values indicate the average observable characteristics for MNCs and non MNCs.

sions, such as the number of employees, capital stocks, sales, and purchases. MNCs also pay more, hire less production task workers, and engage in more international trade than non-MNCs. Although these differences are well known in the international trade literature (Bernard and Jensen, 2007; Bernard et al., 2007), it is conceivable that employment trends among non-MNCs do not represent reasonable counterfactual employment trends for MNCs in our empirical procedure.

We address this concern in three ways. First, throughout our analysis, using the panel data, we specify two-way fixed effects regressions to adjust for unobserved firm-specific and time-specific confounders. Second, we estimate specifications with leads and lags that investigate whether there are any departures in employment trends between MNCs and non MNCs prior to the minimum wage hike. Third, we estimate specifications that restrict the non-MNCs by matching observable characteristics to the MNCs.

Table 3: Summary Statistics

	Mean (1)	SD (2)	p1 (3)	p99 (4)	Observations (5)
Panel A. Main Dependent Variable					
Log employment	4.95	0.84	3.91	7.90	41,793
Panel B. Firm Characteristics					
Log value-added	9.32	1.16	7.08	13.05	41,052
Log wage bill	8.77	0.99	7.32	12.24	41,793
Log average wage	3.82	0.38	2.90	4.76	41,793
Log capital stocks	9.58	1.47	5.47	13.71	41,767
Log capital per worker	4.63	1.10	0.85	6.90	41,767
Log sales	10.83	1.26	8.62	14.59	41,789
Log purchase	10.06	1.58	5.93	14.19	40,632
Exporter dummy	0.75	0.43	0	1	41,793
Importer dummy	0.73	0.45	0	1	41,793
Panel C. Key Independent Variables					
Foreign affiliates dummy	0.35	0.48	0	1	41,793
Post dummy	0.44	0.50	0	1	41,793

Notes: The table presents mean, standard deviation (SD), and the first (p1) and ninety-ninth (p99) percentiles of the main variables used in the empirical analysis. The sample is restricted to the manufacturing sector. In Panels A and B, all variables are in real terms. In Panel C, the foreign affiliates dummy is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. Post dummy is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise.

Table 3 provides the summary statistics used in the empirical analysis, which pools all years from 2013 through 2019. We focus on the manufacturing sector only. There are 41,793 firm-year observations. In each year, there are about 6,000 unique firms. In Panel A, descriptive statistics of the main dependent variable (log employment) and other auxiliary dependent variables (log value added, log wage bill, log average wage, log capital

stocks and log capital per worker) are presented. In Panel B, descriptive statistics of the time-varying firm-level control variables are presented, which can control for size (log sales), production technology (log purchase), and trade activities (exporter and importer dummies). In Panel C, descriptive statistics of two key dimensional variables (firm and time) are presented. Note that across all years, about 35% of firms in the data set had foreign affiliates in the period 2013–2016.

4 Firm-Level Employment Adjustments

4.1 Preliminary Evidence: Event Study Analysis

We start by estimating employment trends by year for MNCs and non-MNCs, focusing on the sample in all sectors for the period 2013–2019. We document the average employment evolution before and after the 2017 labor market policy changes, and attempt to detect any differential patterns between the two groups. Specifically, we estimate the following event study regression, first for the MNC group and then for the non-MNC group:

$$\ln \mathrm{E}_{it} = \sum_{s \neq 2016} \beta_s \times \mathbb{1}\{s = t\} + \psi_i + \varepsilon_{it} \tag{1}$$

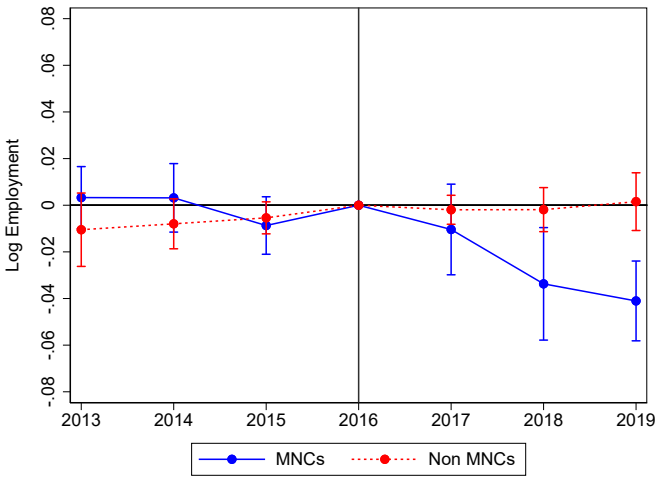
where the dependent variable, $\ln \mathrm{E}_{it}$, is the log of employment for firm i in year t. Firm fixed effects are captured by ψ_i, and $\mathbb{1}\{s = t\}$ is an indicator variable corresponding to a time indicator that equals 1 if the time (year) is t and 0 otherwise. The sample period is 2013~2019, with 2016 as the reference year. We cluster standard errors at the sector level.

Figure 3 plots the β_s coefficients for Korean firms with foreign affiliates (in blue) and Korean firms with no foreign affiliates (in red). We do not detect differential pretrends between the two groups as the lead coefficients up to the year 2016 are all statistically insignificant for both groups. Following the minimum wage announcement in 2017, employment levels among the non-MNC group remained almost the same through the year 2019. On the contrary, employment in the MNC group declined by 1.0% in 2017, 3.4% in 2018, and 4.1% in 2019. These differences suggest that the MNCs may have reduced domestic labor in Korea and replaced those domestic workers with foreign factors of production associated with their subsidiaries in foreign countries.

To further investigate the possible labor substitution channel, we zoom in on the manufacturing sector for the following reasons. First, Korean firms' outward FDI has been highly concentrated in manufacturing (see section 3 for more details). Second, international production fragmentation and the growth in global value chains occurred predom-

inantly in the manufacturing sector. Third, by their nature, domestic workers in the service sector cater mostly to domestic demands and are not easily replaced by workers abroad. Hence, we conjecture that the presence of the labor substitution channel should be consistent with pronounced negative employment effects in the manufacturing sector.

Figure 3: Event Study Analysis: All Sectors

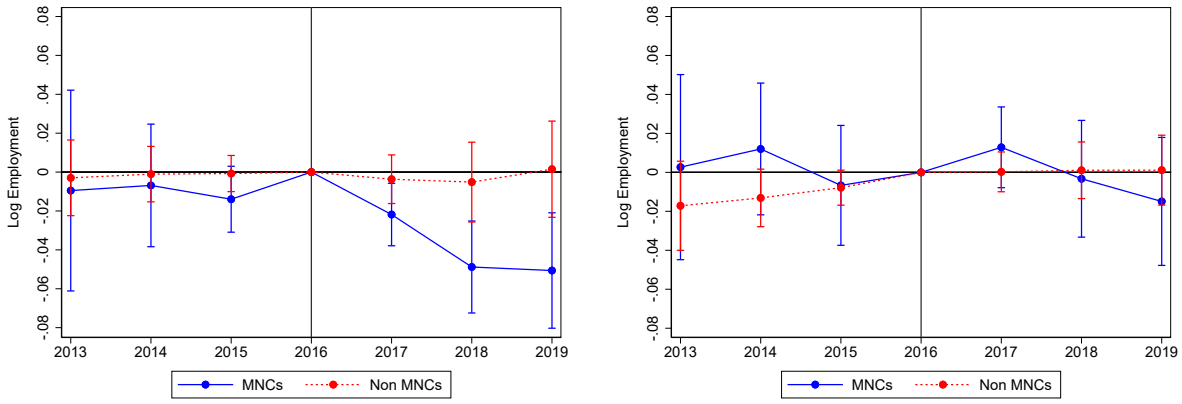


Notes: The figure plots event study analysis results from equation (1) where the dependent variable is the log of employment. The results are illustrated separately for firms with foreign affiliates (blue circles) and firms with no foreign affiliates (red circles). Coefficients along with 95% confidence intervals are illustrated. Standard errors are clustered at the sector level.

Figure 4 repeats the event study regression in equation (1) by sector. Panel (a) reports the results in the manufacturing. As in the previous analysis, we do not find differential pretrends between the two groups. More importantly, for the MNCs, the employment levels dropped by 2.2% in 2017, 4.9% in 2018, and 5.1% in 2019, respectively.[23] In contrast, we do not find any downward trends in employment after 2017 for both groups in the non-manufacturing sector. Indeed, none of the coefficient estimates in panel (b) is statistically significant. Taken together, the event study results appear to support the presence of a labor substitution channel in the manufacturing sector. The rest of the paper corroborates these baseline results in various dimensions.

[23]Note further that when we restrict our sample to the manufacturing sector, the coefficient of the year indicator 2017 becomes significant, unlike when we use all sectors.

Figure 4: Event Study Analysis: Manufacturing and Others



(a) Manufacturing (b) Non-Manufacturing

Notes: The figure plots event study analysis results from equation (1) where the dependent variable is the log of employment. In panel (a), the results are illustrated for the manufacturing sector; in panel (b), the results are illustrated for the non-manufacturing sector. Coefficients along with 95% confidence intervals are illustrated. Standard errors are clustered at the industry level.

4.2 Employment Adjustments in Manufacturing

The event study estimates for the manufacturing sector may be biased if time-varying industry-specific, region-specific, and/or industry-region-specific shocks were compounded and thus affected the MNC and non-MNC groups differently. We address such concerns by employing a difference-in-differences estimator with industry-region-year fixed effects.

4.2.1 Difference-in-Differences

We estimate the following difference-in-differences specification:

$$\ln \mathrm{E}_{it} = \beta \mathrm{MNC}_i \times \mathrm{Post}_t + \gamma_i + \psi_{jrt} + \varepsilon_{it} \tag{2}$$

where i is a firm, j is an industry, r is a region, and t is time (i.e., year). The dependent variable is the log of employment for firm i in year t. MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. Post_t is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. γ_i and ψ_{jrt} capture firm fixed effects and industry-region-year fixed effects, respectively. Standard errors are clustered at the industry level. The sample is restricted to the manufacturing sector.

Table 4 presents the estimates of equation (2). We include firm fixed effects only in column (1) and add year fixed effects, region-year fixed effects, and industry-region-year fixed effects in columns (2) through (4), respectively. Across all columns, we find negative coefficients with statistical significance at the 10% level. In column (4), the preferred specification, the coefficient estimate suggests that employment by the MNC group is 3.0% lower than by the non-MNC group.[24] In Appendix Table A.2, we repeat the analysis in Table 4 using the non-manufacturing group only and find that the treatment effect is statistically insignificant.

Table 4: MNCs and Employment in Manufacturing, 2013~2019

	Dependent Variable: Log of Employment			
	(1)	(2)	(3)	(4)
$MNC_i \times Post_t$	-0.0325*	-0.0312**	-0.0329***	-0.0295***
	(0.0158)	(0.0114)	(0.0117)	(0.0101)
Observations	41,036	41,036	41,035	41,030
R-squared	0.9502	0.9502	0.9507	0.9541
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Year	No	Yes	No	No
Region-Year	No	No	Yes	No
Industry-Region-Year	No	No	No	Yes

Notes: MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. $Post_t$ is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

4.2.2 Dynamic Treatment Effects

Although the difference-in-differences estimates can control for time-varying industry-region-specific shocks, one might still argue that they are not informative if those Korean firms with foreign affiliates would have experienced a slowdown in employment growth even in the absence of the labor market policy changes. This would be particularly the case if Korean firms with foreign affiliates had already been experiencing a relative decline in employment growth even before the labor market policy changes. To alleviate concern about a possible parallel trend, we check for differential employment trends between MNCs and non-MNCs in the three years leading up to the labor market policy

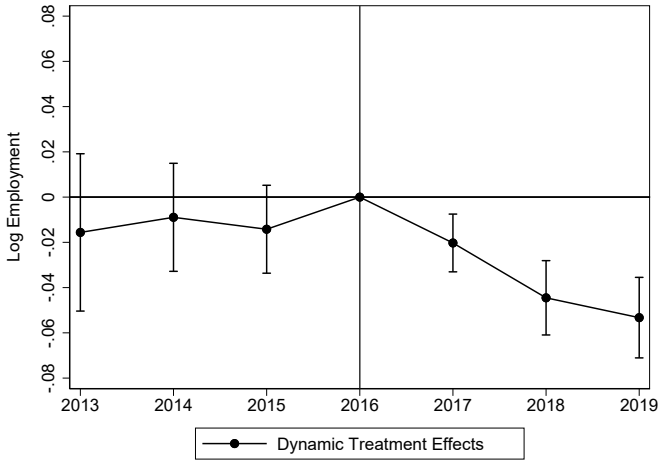
[24] We estimate equation (2) with a common linear time trend, excluding time fixed effects, and find that the coefficient of the common linear time trend is statistically indistinguishable from zero. We cautiously interpret the absence of the common linear trend as an indication that employment level for the non-MNCs group remained the same while the one for the MNCs group declined by 3.0%, corroborating the event study result in panel (a) of Figure 4.

changes by specifying the following regression:

$$\ln \mathrm{E}_{it} = \sum_{s \neq 2016} \beta_s \mathbb{1}\{s = t\} \times \mathrm{MNC}_i + \gamma_i + \psi_{jrt} + \varepsilon_{it} \tag{3}$$

where $\mathbb{1}\{s = t\}$ is an indicator variable that equals 1 if the time is t and 0 otherwise. All the rest is the same as before.

Figure 5: Dynamic Treatment Effects: Manufacturing



Notes: Manufacturing only. The figure plots coefficient estimates on β_s's from the dynamic treatment effects analysis as specified in equation (3) where the dependent variable is the log of employment.

Figure 5 plots the coefficient estimates from regressions in equation (3) with lead indicators for the three years leading up to the year 2016 and lag indicators for the three years after 2016. We do not detect any differential pretrends in that employment growth for the two groups shows a similar trend leading up to 2016. Moreover, the effect of the minimum wage increases grew over time: following the minimum wage change announcement in July 2017, the employment drops by 2 percent immediately. In the year 2018, the first effective year of Moon Jae-in's regime, employment declines by 4.5%; it then drops by 5.3% in 2019.[25]

[25] In Appendix Figure B.1, we estimate equation (3) in non-manufacturing firms only and find no negative employment effects.

4.3 Robustness

4.3.1 Propensity-Score Matched Sample

Our estimation approach is to compare MNCs with non-MNCs where the latter group includes all domestic firms in our data set. One potential problem with this approach is that multinational firms may be significantly different from most non-multinational firms in the composition of their production factors. MNCs tend to be both more capital-intensive and more skill-intensive than non-MNCs. Put another way, non-MNCs may hire more workers who receive less than the new minimum wage than MNCs. MNCs are therefore less likely to be affected by the minimum wage increases, which in turn may nullify our comparison approach. To the extent that the traditional employment response channel would predict a decline in employment for non-MNCs relative to MNCs, our findings so far tend to reject the compositional difference hypothesis. Despite this favorable interpretation for the new channel (task reallocation channel), we conduct a propensity score (PS) matching procedure. That is, we restrict the comparison to firms whose workforce composition characteristics are similar to MNCs'.

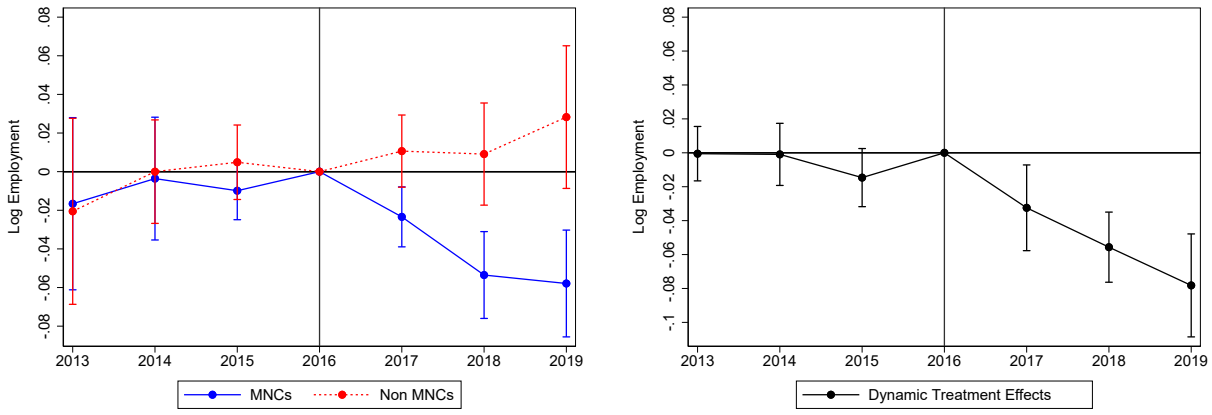
To obtain a proper subset of non-multinational firms, the indicator variable of MNCs is regressed on three firm-level factor compositions based on 2016 values: (log of) capital per worker, (log of) wage bill per worker, and the share of production workers. The employment growth rate over the years 2013–2016 is included as a control to reflect firm-specific employment time trends prior to the policy change. Moreover, we run this logistic regression for each 2-digit manufacturing industry so that the matching occurs only within the same industry (with replacement).[26] The estimated propensity scores are used to select the single nearest match for each MNC under the common support restriction.[27] Table A.3 reports mean and median values of the matching variables by group. In all characteristics, the matched non-MNCs are now more similar to MNCs than the other non-MNCs.

Panels (a) and (b) of Figure 6 show the estimation results of equations (1) and (3), respectively, with the PS matched sample. We use the frequency-based weighted regressions to account for the duplicated non-MNC observations, since non-MNCs can be cho-

[26] As some industries have only a few active firms, exact matching of industries is not feasible. We incorporated these industries into industry groupings that produce similar goods (e.g., we merged the beverage industry with the food industry). As a result the number of industries used for the matching was reduced from 23 to 15.

[27] We applied various methods to check the sensitivity of PS matching and subsequent estimation results, including the selection of the five nearest neighbors (instead of one), no replacement of once selected match, without the common support restriction, or using the average values of matching variables over the pre-policy period (2013~2016) instead of 2016 values. Our estimation results do not change qualitatively in any method.

Figure 6: Estimation with Propensity-Score Matched Sample



(a) Event Study Analysis

(b) Dynamic Treatment Effects

Notes: Manufacturing only. Each subfigure is analogous to Figure 4-(a) and Figure 5, respectively, but now with the PS matched sample and frequency-weighted regressions.

sen multiple times with replacement. The average employment response of the matched non-MNCs in (a) does not look different from either the MNC group or the entire non-MNC group (see Figure 4-(a)) up to 2016; we do observe slight (statistically insignificant) increases in employment from 2017 through 2019. The gradual employment growth among the matched non-MNCs is reflected in panel (b), so the estimates over the post-policy period are greater in absolute terms. The bottom line is, however, that our main findings remain robust.

4.3.2 Additional Robustness Checks

We conduct additional robustness checks. First, we check the robustness of our results by adding time-varying firm attributes in the specification. Considering that the employment effects could be also affected by within-firm changes that are omitted in the baseline specification, we add essential firm-level variables—(log of) sales, (log of) purchase, exporter dummy, and importer dummy—into equation (2) to control for time-varying firm characteristics that may have affected employment.[28] Table 5 presents the estimation results. Column (1) is from column (4) in Table 4 and shown here as a benchmark. We add sales and purchase variables in column (2); and exporter and importer dummies in column (3). All the columns yield negative and statistically significant coefficient estimates on the interaction term, confirming the baseline result above. In addition, coefficient es-

[28] Note that time-invariant firm-level attributes are controlled for by firm fixed effects.

timates on firm-level control variables show expected signs. Sales, export, and import are positively associated with employment, while purchase is negatively associated with employment. Columns (4) through (6) repeat the same estimations as (1) - (3) with the PS matched sample and frequency-weighted regressions. All estimates do not change qualitatively.

Second, we apply an alternative definition of the non-MNC group. To the extent that labor market policy changes (such as an abrupt minimum wage hike) induce firms to conduct outward foreign direct investment (Fan et al., 2018), Korean firms without any foreign affiliates before the abrupt minimum wage announcement in 2017 may have decided to establish new foreign affiliates in response to rising labor costs (i.e., in 2017, 2018, and 2019). One could argue that classifying them as non-MNCs is problematic. To address this concern, we drop Korean firms that established new foreign affiliates after 2017 from the sample and redo the analysis. Column (1) of Table 6 presents the estimation result with the alternative definition of non-MNCs. Reassuringly, the core result is the same, which is not surprising given that non-MNCs account for much less than 5%

Table 5: Additional Firm-Level Controls in Manufacturing, 2013~2019

	Dependent Variable: Log of Employment					
	Full Sample			Matched Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
$MNC_i \times Post_t$	-0.0295***	-0.0159**	-0.0152**	-0.0507***	-0.0251***	-0.0244***
	(0.0101)	(0.0066)	(0.0065)	(0.0124)	(0.0088)	(0.0086)
Log sales		0.3290***	0.3288***		0.3610***	0.3608***
		(0.0107)	(0.0107)		(0.0097)	(0.0096)
Log purchase		-0.0019	-0.0022		-0.0076	-0.0078
		(0.0056)	(0.0057)		(0.0050)	(0.0050)
Exporter			0.0088			0.0178
			(0.0057)			(0.0116)
Importer			0.0077			0.0027
			(0.0051)			(0.0059)
Observations	41,030	39,607	39,607	26,618	25,785	25,785
R-squared	0.9541	0.9644	0.9644	0.9593	0.9691	0.9692
Fixed Effects:						
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Region-Year	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1)-(3) use the full sample, while columns (4)-(6) are based on the PS matched sample and frequency-weighted regressions. MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. $Post_t$ is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Sales and purchases are in real terms. Exporter (Importer) dummy indicates whether the firm exports (imports) in each year. Standard errors are clustered at the industry level. The number of observations differs across columns because some observations of firm-level control variables are missing or zero. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Alternative non-MNC Group in Manufacturing, 2013~2019

	Dependent Variable: Log of Employment					
	Full Sample			Matched Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
$MNC_i \times Post_t$	-0.0242**	-0.0125*	-0.0118*	-0.0373**	-0.0187**	-0.0180**
	(0.0103)	(0.0067)	(0.0066)	(0.0136)	(0.0086)	(0.0084)
Log sales		0.3294***	0.3292***		0.3571***	0.3571***
		(0.0108)	(0.0107)		(0.0124)	(0.0125)
Log purchase		-0.0018	-0.0022		-0.0029	-0.0032
		(0.0056)	(0.0056)		(0.0053)	(0.0054)
Exporter			0.0082			0.0026
			(0.0059)			(0.0078)
Importer			0.0080			0.0081
			(0.0049)			(0.0055)
Observations	38,730	37,358	37,358	26,448	25,585	25,585
R-squared	0.9553	0.9653	0.9653	0.9601	0.9699	0.9699
Fixed Effects:						
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Region-Year	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1)-(3) use all of the alternative non-MNC firms as the comparison group, while columns (4)-(6) use a subset with the PS matching procedure described in 4.3.1 and run frequency-weighted regressions. MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. $Post_t$ is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Sales and purchases are in real terms. Exporter (Importer) dummy indicate whether the firm exports (imports) in each year. Standard errors are clustered at the industry level. The number of observations differs across columns because some observations of firm-level control variables are missing or zero. *** p<0.01, ** p<0.05, * p<0.1.

of the sample from a comparison of the number of observations in Table 5 and Table 6. Adding time-varying firm-level controls in columns (2) and (3) yields qualitatively identical results. Note that the alternative definition of the non-MNC group may produce a different PS matched sample. Columns (4) through (6) redo the PS matching with the alternative non-MNC group and show the frequency-weighted regression results. Again, all estimates are qualitatively the same.

5 MNCs' Task Reallocation Abroad

So far, we have confirmed robust findings that, in response to the abrupt labor market policy changes, Korean manufacturing firms with foreign affiliates reduced domestic employment more than those without foreign affiliates. We now investigate the specific mechanisms responsible for our findings. In particular, we hypothesize that the negative employment effects are associated with task substitution between domestic workers and

foreign factors of production within the MNCs' internal network.

In 2016, about one-third of the Korean manufacturing firms in our sample had foreign affiliates, and the majority of foreign affiliates were located in East Asian countries whose comparative advantage lies in an abundance of cheap labor, as shown earlier in Table 1. As long as an increase in labor costs associated with changes in labor market policies in Korea implies a decrease in *relative* operating costs abroad, it is likely to have induced Korean MNCs to save costs by reducing domestic production tasks through task substitution: that is, using already established foreign networks to concentrate R&D activities and non-production tasks, for example.[29]

In this section, we test this mechanism (MNCs' task reallocation abroad) in detail as follows. First, if task substitution occurred, then we would expect to see a reduction in domestic tasks in addition to a decline in employment. Second, the negative employment effects should be most pronounced between parent-foreign affiliate pairs that perform similar tasks and/or those firms whose subsidiaries were located in low-wage countries close to Korea (e.g., China and the ASEAN members). In both cases, firms would be relatively easier to substitute tasks in response to the increase in labor costs.

5.1 Reducing Production Tasks in the Domestic Market

To investigate the task substitution channel, we first check whether Korean MNCs' domestic production contracted more than other firms as a result of the task reallocation to foreign affiliates in response to the labor market policy changes. For this, we replace the dependent variable in equation (2) with real value added in the log, the results of which are summarized in Table 7. As earlier, we begin by including firm fixed effects only, and adding year fixed effects, region-year fixed effects, and industry-region- year fixed effects, respectively, from columns (1) through (4). In column (4), the preferred specification, the coefficient estimate is -0.0459 and statistically significant at the 5% level. Quantitatively, the real value added of the MNC group contracted by 4.6% more than that of the non-MNC group. This finding corroborates our earlier finding that Korean MNCs reduced domestic employment more than other Korean firms by reallocating tasks to foreign affiliates, which would have also led to a disproportionate drop in domestic production among Korean MNCs.[30]

[29] Korean MNCs with foreign production networks do not need to spend money on setting up new plants as additional fixed costs (Markusen, 1984; Helpman, Melitz and Yeaple, 2004), so task substitution is easier than it is for firms with no foreign affiliates.

[30] Appendix Figure B.2 illustrates corresponding event study analyses and dynamic treatment effects, confirming the robustness of the results summarized in Table 7.

Table 7: MNCs and Value Added in Manufacturing, 2013~2019

	Dependent Variable: Log of Real Value Added			
	(1)	(2)	(3)	(4)
$MNC_i \times Post_t$	0.0083	-0.0409*	-0.0416*	-0.0459**
	(0.0239)	(0.0207)	(0.0205)	(0.0208)
Observations	40,275	40,275	40,275	40,270
R-squared	0.9045	0.9057	0.9063	0.9137
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Year	No	Yes	No	No
Region-Year	No	No	Yes	No
Industry-Region-Year	No	No	No	Yes

Notes: MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. $Post_t$ is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

5.2 Production Networks in Low-Wage Countries Nearby

One notable pattern of Korean manufacturing over the past three decades has been the relocation of manufacturing to a host of emerging Asian countries such as China and Vietnam as firms seek lower costs in labor inputs. Korean MNCs have already set up a large number of manufacturing plants in those emerging Asian countries.[31] Indeed, according to our sample data, there were 1,851 manufacturing subsidiaries (45.11% of the total) operating in China and 488 subsidiaries (11.89% of the total) in Vietnam, respectively (see Table 1). Unlike foreign affiliates in the more developed countries of Europe and in the US and Japan, the main motive for foreign direct investment in "Factory Asia" is often to leverage cheap labor costs. Faced with the stronger labor market policies, we would therefore expect Korean MNCs with subsidiaries in emerging Asian countries to reduce domestic employment (and production) more than those with foreign affiliates in other countries. We thus make the most of the data set that allows us to identify the geographic location of foreign affiliates.

To investigate the task reallocation channel, we first define MNC_i as an indicator variable that equals 1 if a firm i has foreign affiliates in a *specific country* in the years 2013~2016 and 0 for non-MNCs. Here, we have eight different countries (or regions) as follows: China, Vietnam, Japan, Other Asia, Europe, North America, Latin America, and Rest of the World. We then estimate equation (2) separately for each one. Columns (1) through (8) in Table 8 shows the estimation results. In each column, we include firm and industry-region-year fixed effects. Throughout the eight columns, we found patterns that

[31] Samsung's smartphone factories in a northern province of Vietnam is a good example.

Table 8: MNCs and Employment by Country in Manufacturing, 2013~2019

	Dependent Variable: Log of Employment			
	China	Vietnam	Japan	Other Asia
	(1)	(2)	(3)	(4)
$MNC_i \times Post_t$	-0.0362***	-0.0617***	-0.0205	-0.0363**
	(0.0120)	(0.0215)	(0.0284)	(0.0147)
Observations	36,060	29,365	27,829	31,755
R-squared	0.9538	0.9473	0.9493	0.9566
	Europe	North America	Latin America	ROW
	(5)	(6)	(7)	(8)
$MNC_i \times Post_t$	-0.0127	-0.0181	-0.0014	-0.0552
	(0.0197)	(0.0128)	(0.0243)	(0.0586)
Observations	28,855	30,962	27,573	26,792
R-squared	0.9591	0.9588	0.9538	0.9488
	Q_1	Q_2	Q_3	Q_4
	(9)	(10)	(11)	(12)
$MNC_i \times Post_t$	-0.0608***	-0.0269**	-0.0201	-0.0067
	(0.0173)	(0.0116)	(0.0132)	(0.0191)
Observations	29,864	31,149	29,669	29,348
R-squared	0.9368	0.9386	0.9537	0.9472
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Industry-Region-Year	Yes	Yes	Yes	Yes

Notes: MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. In each column, foreign affiliates are restricted to the specific country or wage group. For instance, in column (1), MNC_i refers to foreign affiliates in China. Q_1~Q_4 in columns (9) through (12) refers to the quartile group of MNCs according to the level of (weighted) average wages in the countries where their foreign affiliates operate, respectively. $Post_t$ is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

are exactly aligned with the employment adjustment channel through GVCs in Factory Asia. For the emerging Asian countries, China, Vietnam, and Other Asia, the coefficient estimates are -0.0362, -0.0617, and -0.0363, respectively, and they are all statistically significant at the 5% level. In stark contrast, for other countries/regions (Japan, Europe, North America, Latin America, and Rest of the World), all the coefficient estimates are statistically insignificant.[32]

Alternatively, we look at whether the MNCs reduced their employment when their foreign affiliates operate in low-wage countries, regardless of the geographic location. To do so, we classify the Korean MNCs into four quartiles according to the level of (weighted) average wages in the countries where their foreign affiliates operate.[33] Each

[32]We provide event study analyses and dynamic treatment effects corresponding to Table 8 in Appendix Figures B.3, B.4, and B.5.

[33]The wages in each host country of foreign subsidiaries are measured by the average monthly earnings of employees in all industries (converted to 2017 US$ PPP; data source: ilostat.ilo.org/topics/wages). If

quartile group of the MNCs is then separately compared to the common non-MNC group through the same equation 2. The estimation results are presented in column (9) through (12) in Table 8. Consistent with our intuition, the negative employment effect is the largest at -0.0608 when the foreign affiliates are located in the lowest-wage countries. Both economic and statistic significances reduce gradually to nil as the wages in host countries rise.

In Table A.4, we also show that the value added, a proxy for domestic production activities, declined the most for the emerging Asian countries (China, Vietnam, and Other Asia) or the lowest-wage countries. The results corroborate our key interpretation that the employment adjustment is mainly driven by already established foreign production network channels in low-wage countries near Korea.

5.3 Task Proximity in Parent-Subsidiary Pairs

If the task reallocation channel played a dominant role in generating our baseline results, then the employment effects should also be more noticeable in Korean firms whose foreign affiliates are in the same sector (or same industry). As an example, suppose that Korean manufacturing firm A has a foreign affiliate in the manufacturing sector and Korean manufacturing firm B has a foreign affiliate in a non-manufacturing sector. We would expect within-firm task reshuffling to be more likely for firm A than for firm B because the tasks performed by firm A and its foreign affiliate are more similar than those performed by firm B and its foreign affiliate (i.e., task proximity in the parent-subsidiary pairs is closer in firm A than in firm B).

To examine the role of task proximity, we define Same SEC_i as an indicator variable that equals 1 if a firm i's foreign affiliate is in the same sector (i.e., manufacturing) and 0 otherwise. We further define Same IND_i as an indicator variable that equals 1 if a firm i's foreign affiliate is in the same industry (i.e., 2-digit manufacturing industry) and 0 otherwise. We then modify equation (2) with a triple interaction term ($\text{MNC}_i \times \text{Same SEC}_i \times \text{Post}_t$). Next, we use a double interaction term ($\text{MNC}_i \times \text{Post}_t$) and triple interaction term ($\text{MNC}_i \times \text{Same SEC}_i \times \text{Post}_t$) together in order to separate out the employment effects of the effect with foreign affiliates in manufacturing from the effect with foreign affiliates in non-manufacturing. We repeat the analyses using the same industry criterion.[34]

an MNC has multiple foreign subsidiaries in different countries, the weighted average of the wages is calculated where the weight is the equity share value of Korean MNC for its subsidiary.

[34]Since the Same SEC_i and Same IND_i variables equal 1 only if a firm has a foreign affiliate, their double interaction terms with Post_t will be redundant.

Table 9: MNCs and Task Proximity in Manufacturing, 2013~2019

	Dependent Variable: Log of Employment				
	Baseline	Same Sector		Same Industry	
	(1)	(2)	(3)	(4)	(5)
$MNC_i \times Post_t$	-0.0295***		0.0254		-0.0128
	(0.0101)		(0.0168)		(0.0135)
$MNC_i \times Same\ SEC_i \times Post_t$		-0.0414***	-0.0644***		
		(0.0104)	(0.0167)		
$MNC_i \times Same\ IND_i \times Post_t$				-0.0355***	-0.0250*
				(0.0101)	(0.0132)
Observations	41,030	41,030	41,030	41,030	41,030
R-squared	0.9541	0.9542	0.9542	0.9541	0.9541
Fixed Effects:					
Firm	Yes	Yes	Yes	Yes	Yes
Industry-Region-Year	Yes	Yes	Yes	Yes	Yes

Notes: MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. Same SEC_i is an indicator variable that equals 1 if a firm i's foreign affiliate is in the same sector (i.e. manufacturing) and 0 otherwise. Same IND_i is an indicator variable that equals 1 if a firm i's foreign affiliate is in the same industry and 0 otherwise. $Post_t$ is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

Table 9 shows the estimation results. Column (1) shows the benchmark case as in column (4) of Table 4. In column (2), with a triple interaction term ($MNC_i \times Same\ SEC_i \times Post_t$), the employment effect becomes larger such that the coefficient estimate is -0.0414 with statistical significance. The result is consistent with the task proximity channel, wherein Korean manufacturing firms with same-sector foreign affiliates experienced a larger employment reduction than other Korean manufacturing firms. In column (3), we further separate employment effects into those for Korean manufacturing firms with foreign affiliates in non-manufacturing and those for Korean manufacturing firms with foreign affiliates in manufacturing. We find that the domestic employment effects from our baseline results are exclusively driven by Korean manufacturing firms with manufacturing foreign affiliates. In columns (4) and (5), we repeat the analysis with a stricter criterion and find a similar pattern.[35] Taken together, we conclude that Korean manufacturing firms responded to domestic labor cost shocks by substituting production tasks through foreign affiliates performing similar tasks.

[35] Appendix Figure B.6 illustrates corresponding event study analyses and dynamic treatment effects, confirming the robustness of the results summarized in Table 9.

6 Task Reallocation Abroad versus Other Mechanisms

In this section, we explore the consistency of our main results with alternative mechanisms: first, we examine whether Korean MNCs replaced domestic labor with either domestic capital or domestic labor with different skill levels within domestic entities; next, we investigate whether foreign demand shocks can explain the observed patterns of negative domestic employment effects for Korean MNCs.

6.1 Labor-Capital Substitution

It is possible that, instead of reallocating tasks abroad, Korean MNCs replaced domestic labor with domestic capital in their home operations. Exploiting regional variation in minimum wage changes in China between 2002 and 2008, Hau et al. (2020) found that minimum wage hikes accelerated the input substitution of capital for labor in low-wage Chinese firms. If employment adjustment occurs through domestic capital instead of foreign linkages, then we would expect capital trajectories for the MNC group after the 2017 policy change to diverge from those of the non-MNC group. More precisely, if there had been input substitution of capital for labor within firms, we would expect the capital effects to be positive or zero for Korean firms with foreign affiliates.

Table 10: MNCs and Capital in Manufacturing, 2013~2019

Panel A. Dependent Variable: Log of Real Capital Stocks				
	(1)	(2)	(3)	(4)
$MNC_i \times Post_t$	0.0075	-0.0598**	-0.0587**	-0.0525**
	(0.0279)	(0.0267)	(0.0272)	(0.0241)
Observations	41,009	41,009	41,008	41,003
R-squared	0.9456	0.9461	0.9464	0.9493
Panel B. Dependent Variable: Log of Real Capital Stocks per Worker				
	(5)	(6)	(7)	(8)
$MNC_i \times Post_t$	0.0401**	-0.0282	-0.0253	-0.0226
	(0.0184)	(0.0232)	(0.0233)	(0.0233)
Observations	41,009	41,009	41,008	41,003
R-squared	0.9022	0.9030	0.9035	0.9078
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Year	No	Yes	No	No
Region-Year	No	No	Yes	No
Industry-Region-Year	No	No	No	Yes

Notes: MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. $Post_t$ is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

To investigate the validity of labor-capital substitution within Korean MNCs, we modify equation (2) by replacing the dependent variable with real capital stock or with real capital stocks per worker. Analogous to the baseline analysis, we begin by including firm fixed effects only, and adding year fixed effects, region-year fixed effects, and industry-region-year fixed effects, respectively, in columns (1) through (4) in Panel A of Table 10. In column (4), the preferred specification, the coefficient estimate is 0.0525 and statistically significant. Quantitatively, it implies that capital stocks of the Korean firms with foreign affiliates declined on average by 5.3% more than those of the non-MNC group, invalidating the idea that there was labor-capital substitution within Korean MNCs. Panel B of Table 10 summarizes estimation results with capital stocks per worker as a dependent variable. In column (8), the coefficient estimate is -0.0226 and statistically insignificant, suggesting that Korean MNCs do not appear to have replaced labor with capital.[36]

6.2 Labor-Labor Substitution

It has been well documented that minimum wage changes can change the within-firm skill mix of workers (Fairris and Bujanda, 2008; Giuliano, 2013; Clemens and Wither, 2019). According to the literature, firms can respond to minimum wage increases by switching their personnel policies from low-skilled labor to higher-skilled labor. To the extent that an increase in domestic high-skilled workers was more than offset by a decrease in domestic low-skilled workers among Korean MNCs, our baseline findings could be potentially consistent with such labor-labor substitution within Korean MNCs. In other words, since wages should be lower for low-skilled workers than for high-skilled workers, the observed decline in domestic employment could reflect a workforce reorganization within Korean MNCs. In the absence of worker-level data, we cannot directly test the validity of this hypothesis. Nevertheless, we are able to compare the average wage—defined as total wage bill divided by the number of total workers at the firm level—of the MNC group with that of the non-MNC group, whereby a relative increase in the average wage of the MNCs would be potentially consistent with the labor-labor substitution within Korean MNCs.

To examine the validity of labor-labor substitution within Korean MNCs, we estimate equation (2) with average wages in log as a new dependent variable. Similarly to the main analysis, we begin by including firm fixed effects only, and adding year fixed effects, region-year fixed effects, and industry-region-year fixed effects, respectively, in columns

[36] In Appendix Figure B.7, the event study analyses and the dynamic treatment effects are presented, which corresponds to Table 10.

Table 11: MNCs and Wage Bill in Manufacturing, 2013~2019

	Panel A. Dependent Variable: Log of Average Wage			
	(1)	(2)	(3)	(4)
$MNC_i \times Post_t$	0.0661***	-0.0093	-0.0094	-0.0082
	(0.0070)	(0.0075)	(0.0074)	(0.0068)
Observations	41,036	41,036	41,035	41,030
R-squared	0.7227	0.7310	0.7323	0.7431
	Panel B. Dependent Variable: Log of Real Wage Bill			
	(5)	(6)	(7)	(8)
$MNC_i \times Post_t$	0.0336*	-0.0405**	-0.0423**	-0.0377***
	(0.0193)	(0.0163)	(0.0165)	(0.0130)
Observations	41,036	41,036	41,035	41,030
R-squared	0.9535	0.9546	0.9551	0.9583
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Year	No	Yes	No	No
Region-Year	No	No	Yes	No
Industry-Region-Year	No	No	No	Yes

Notes: MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. $Post_t$ is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

(1) through (4) in Panel A of Table 11. In column (4), the preferred specification, the coefficient estimate is -0.0082 and statistically insignificant, invalidating the idea that there was labor-labor substitution within Korean MNCs. Replacing the dependent variable in equation (2) with real wage bills in log, Panel B of Table 11 summarizes estimation results, whereby column (8), the preferred specification, shows that the coefficient estimate is -0.0377 and statistically significant at the 1% level. Quantitatively, the real wage bill of the Korean firms with foreign affiliates declined by 3.8% more than that of the Korean firms with no foreign affiliates, which is contrary to what the labor-labor substitution hypothesis would predict for Korean MNCs.[37]

6.3 Foreign Demand Shocks

Global trade has been sluggish since the recovery from the global financial crisis (Bems et al., 2013; Boz et al., 2015; Aslam et al., 2018; Shin, 2019; Constantinescu et al., 2020). If global trade slowdown reduced overall global demand, then Korean MNCs may be affected by external demand shocks and thus reduced employment. Therefore it is plausible to hypothesize that our baseline findings simply reflect the fact that weak global

[37] In Appendix Figure B.8, the event study analyses and the dynamic treatment effects are presented, which corresponds to Table 11.

demand hit Korean MNCs harder than other Korean firms.

To check for this possibility, we first restrict the sample to firms without any foreign affiliates in the period 2013~2016 to eliminate the labor reallocation channel via internal foreign network. Then we divide the remainder of the sample into two groups: (i) Korean firms with no foreign affiliates and no exporting during the period 2013~2016, which should have been less vulnerable to external demand shocks; and (ii) Korean firms with no foreign affiliates but with exporting during the period 2013~2016, which should have been more vulnerable to external demand shocks.[38] The corresponding estimation equation is as follows:

$$\ln \mathrm{E}_{it} = \beta \mathrm{Exporter}_i \times \mathrm{Post}_t + \gamma_i + \psi_{jrt} + \varepsilon_{it} \tag{4}$$

where $\mathrm{Exporter}_i$ is an indicator variable that equals 1 if a firm i conducts exporting in the years 2013~2016 and 0 otherwise. All the rest is the same as before. If foreign demand shocks had driven the negative employment effects for Korean MNCs, then we would expect to see the coefficient estimate of β in equation (4) to be negative.

Table 12: Exporters and Employment in Manufacturing, 2013~2019

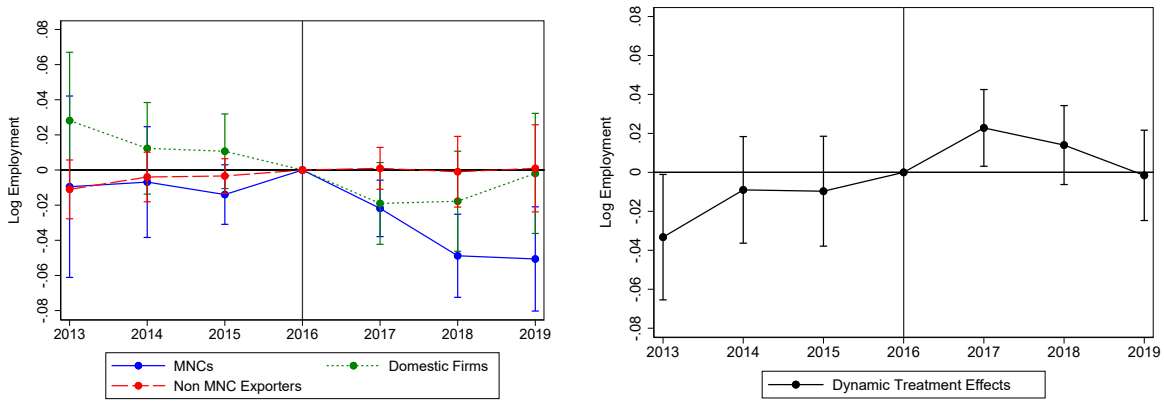
	Dependent Variable: Log of Employment			
	(1)	(2)	(3)	(4)
$\mathrm{Exporter}_i \times \mathrm{Post}_t$	0.0046	0.0293**	0.0264*	0.0239
	(0.0106)	(0.0141)	(0.0135)	(0.0148)
Observations	26,364	26,364	26,364	26,338
R-squared	0.9267	0.9267	0.9276	0.9342
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Year	No	Yes	No	No
Region-Year	No	No	Yes	No
Industry-Region-Year	No	No	No	Yes

Notes: The sample is restricted to firms without foreign affiliates in 2013~2016. $\mathrm{Exporter}_i$ is an indicator variable that equals 1 if a firm i conducts exporting in the years 2013~2016 and 0 otherwise. Post_t is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

Table 12 shows the estimation results. Across all columns, the coefficient estimates are positive. In column (4), our preferred specification, the coefficient estimate is positive and statistically insignificant, implying that foreign demand shocks are less likely to have played a role.

[38] Here, we classify firms as exporters if they reported positive amounts of exports at least once in the period between 2013 and 2016.

Figure 7: Foreign Demand Shocks: Event Study and Dynamic Treatment Effects



(a) Event Study Coefficients

(b) Dynamic Treatments

Notes: The sample is restricted to the manufacturing sector only. The left figure plots event study analysis results from equation (1) where the dependent variable is the log of employment. There are three groups in the left panel: (i) Korean firms with no foreign affiliates and no exporting during the period 2013~2016 (in green); (ii) Korean firms with no foreign affiliates and exporting during the period 2013~2016 (in red); (iii) Korean firms with foreign affiliates during the period 2013~2016 (in blue). The right figure plots dynamic treatment effects results where the dependent variable is the log of employment. Coefficients along with 95% confidence intervals are illustrated. Standard errors are clustered at the industry level.

Figure 7 shows the event study (panel (a)) and dynamic treatment effects (panel (b)) results. In panel (a), for the first group (in green) and the second group (in red), the estimated coefficients are all statistically insignificant throughout the sample period. In contrast, the MNCs group (in blue) shows a downward employment trend after the labor market policy change. In panel (b), we estimate equation (4) with dynamic coefficients. Although the 2017 lag indicator is estimated to be positive and statistically significant, all other coefficient estimates are statistically insignificant, lending further support to the previous result (i.e., a negligible role of foreign demand shocks).

7 Conclusion

As the role of MNCs in the economy grows, it is increasingly important to reassess the effects of not only trade policies but also other domestic policies from a transnational perspective. Still, the focus of trade researchers tends to be limited to trade policy, and labor studies rarely consider the prevalence of MNCs in their evaluation of domestic labor policy. This paper addresses one of such unexplored links between the two research areas by investigating how MNCs adjust their employment differently from domestic firms in

response to an unexpected, radical minimum wage hike in Korea. Contrary to the conventional wisdom that MNCs would be the least likely to be affected by the minimum wage increase, we find strong evidence of their relative reduction of employment by about 3% after the policy shock compared to non-MNCs. Further analyses reveal that MNCs reallocated manufacturing tasks to their foreign affiliates, particularly located in nearby low-wage countries. Our results thus highlight that the cross-country network within MNCs may lead to unintended consequences of domestic labor market policies. Policy makers need to be aware of the possibility and be better prepared with labor adjustment programs, such as retraining, to mitigate the negative effect.

The results also provide a new insight into the ongoing minimum wage discussion. Previous minimum wage studies have typically focused on employment effects for young and unskilled workers; and they have not found consistent results (Card, 1992; Neumark and Wascher, 1992; Neumark et al., 2014; Allegretto et al., 2017). In this study, we find negative employment effects for MNCs, arguably the most productive and largest firms (Bernard and Jensen, 2007; Bernard et al., 2007). An important implication of the finding is that a relatively swift decline in employment by MNCs may imply a deterioration in aggregate labor productivity. Put differently, the jobs specifically vulnerable to being replaced by foreign workers due to minimum wage hikes may be "better" paying jobs in an MNC-prevalent economy. This idea is somewhat different from the general view in the literature that minimum wage increases have the greatest effect on the lowest-paid workers, causing them to move from less to more productive establishments (Dustmann et al., 2022). Further research is warranted for these seemingly contradictory views.

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Appendix

Appendix A: Tables

Table A.1: Industrial Variations of Foreign Affiliates, 2016

Industry	# of Subsidiaries	Share
Food Products	149	3.63
Beverages	13	0.32
Tobacco Products	8	0.19
Textiles, Except Apparel	115	2.80
Wearing Apparel, Clothing Accessories and Fur Articles	249	6.07
Leather, Luggage and Footwear	79	1.93
Wood	14	0.34
Pulp, Paper and Paper Products	22	0.54
Printing	11	0.27
Coke, Briquettes and Refined Petroleum Products	13	0.32
Chemicals and Chemical Products	261	6.36
Pharmaceuticals, Medicinal Chemical and Botanical Products	72	1.75
Rubber and Plastics Products	212	5.17
Other Non-Metallic Mineral Products	67	1.63
Basic Metals	172	4.19
Fabricated Metal Products	201	4.90
Electronic Components and Computer	738	17.99
Medical, Precision and Optical Instruments, Watches and Clocks	146	3.56
Electrical Equipment	287	6.99
Other Machinery and Equipment	359	8.75
Motor Vehicles, Trailers and Semitrailers	761	18.55
Other Transport Equipment	55	1.34
Furniture	52	1.27
Other Manufacturing	47	1.15
Total	4,103	100.00

Notes: Industry is defined at the KSIC 2-digit level. There are 24 manufacturing industries. The data come from the Survey of Business Activities (SBA) in 2016. The sample is restricted to Korean parent firms in manufacturing. There are 1,939 Korean manufacturing firms that have 4,103 foreign affiliates.

Table A.2: MNCs and Employment in Non-manufacturing, 2013~2019

	Dependent Variable: Log of Employment			
	(1)	(2)	(3)	(4)
$\text{MNC}_i \times \text{Post}_t$	-0.0032	-0.0130	-0.0176	-0.0137
	(0.0137)	(0.0147)	(0.0150)	(0.0146)
Observations	43,295	43,295	43,291	43,281
R-squared	0.9555	0.9555	0.9572	0.9586
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Year	No	Yes	No	No
Region-Year	No	No	Yes	No
Industry-Region-Year	No	No	No	Yes

Notes: MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. Post_t is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

Table A.3: Propensity Score Matched Sample Statistics

	MNCs			Non-MNCs: All			Non-MNCs: Matched		
	Obs.	Mean	p50	Obs.	Mean	p50	Obs.	Mean	p50
Log capital per worker	1970	4.738	4.806	3773	4.576	4.688	1970	4.740	4.781
Log average wages	1970	3.857	3.842	3774	3.795	3.778	1970	3.838	3.816
Production worker share	1970	0.570	0.629	3774	0.629	0.699	1970	0.562	0.650
Employment growth rate	1970	0.017	0.023	3190	0.012	0.015	1970	0.021	0.028

Notes: The table compares mean and median (p50) of the matching variables by group. The sample only includes Korean manufacturing firms. All values are as of 2016 (Employment growth rate is the employment growth over the years 2013~2016). The propensity score matching is conducted separately for each of fourteen 2-digit manufacturing industries. Some non-MNCs are selected multiple times during the matching procedure due to the replacement. Thus, for non-MNCs, the mean and p50 of the variables are weighted by their selection frequency. Unmatched observations—in part by the common support restriction—receive zero weight.

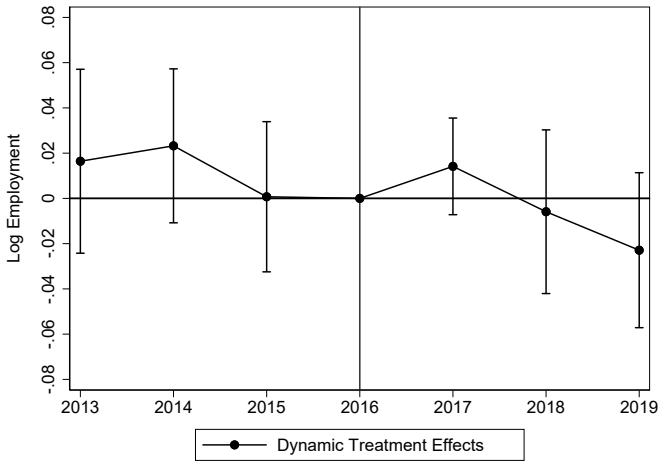
Table A.4: MNCs and Value Added by Country in Manufacturing, 2013~2019

	Dependent Variable: Log of Real Value-Added			
	China	Vietnam	Japan	Other Asia
	(1)	(2)	(3)	(4)
$\text{MNC}_i \times \text{Post}_t$	-0.0454**	-0.1209***	-0.0312	-0.0464***
	(0.0209)	(0.0424)	(0.0339)	(0.0135)
Observations	35,433	28,883	27,371	31,217
R-squared	0.9144	0.9027	0.9092	0.9188
	Europe	North America	Latin America	ROW
	(5)	(6)	(7)	(8)
$\text{MNC}_i \times \text{Post}_t$	-0.0426*	-0.0487**	-0.0337	-0.0378
	(0.0226)	(0.0183)	(0.0277)	(0.0505)
Observations	28,385	30,405	27,139	26,364
R-squared	0.9207	0.9207	0.9154	0.9068
	Q_1	Q_2	Q_3	Q_4
	(9)	(10)	(11)	(12)
$\text{MNC}_i \times \text{Post}_t$	-0.1114***	-0.0296	-0.0220	-0.0437
	(0.0370)	(0.0209)	(0.0202)	(0.0320)
Observations	29,387	30,641	29,184	28,804
R-squared	0.8897	0.8931	0.9140	0.9038
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Industry-Region-Year	Yes	Yes	Yes	Yes

Notes: MNC_i is an indicator variable that equals 1 if a firm i has foreign affiliates in the years 2013~2016 and 0 otherwise. In each column, foreign affiliates are restricted to the specific country. For instance, in column (1), MNC_i refers to foreign affiliates in China. Post_t is an indicator variable that equals 1 if the time t is after 2016 (i.e., 2017, 2018, and 2019) and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

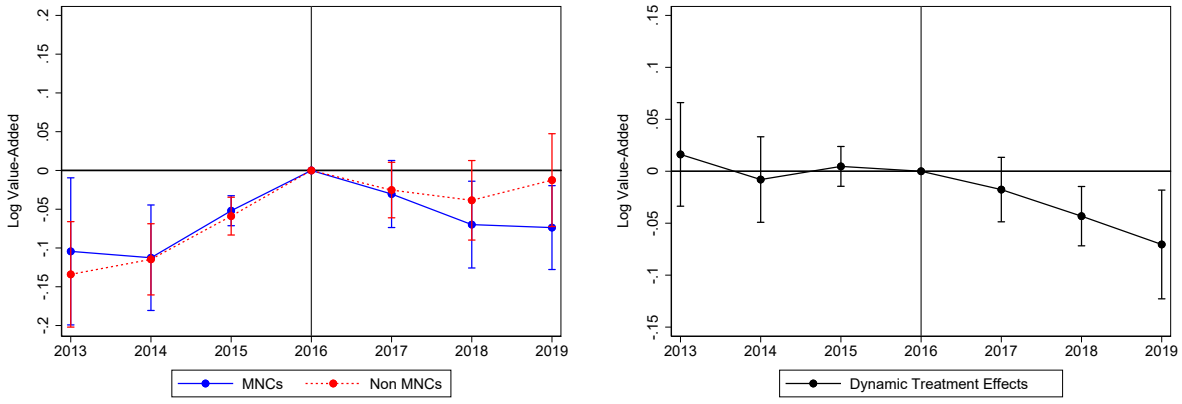
Appendix B: Figures

Figure B.1: Dynamic Treatment Effects: Non - manufacturing



Notes: Non - manufacturing only. The figure plots coefficients estimate on β_s's from the dynamic treatment effects analysis as specified in equation (3) where the dependent variable is the log of employment.

Figure B.2: MNCs and Value Added: Event Study and Dynamic Treatment Effects

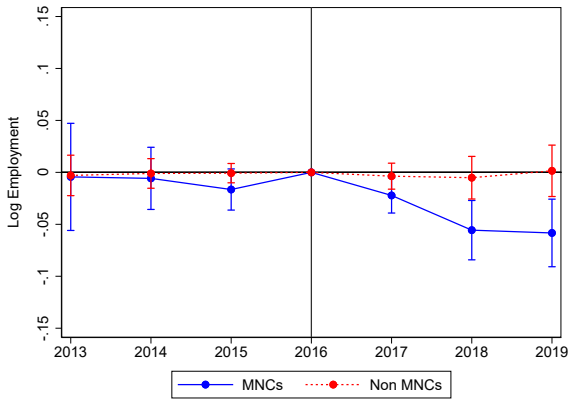


(a) Event Study Coefficients

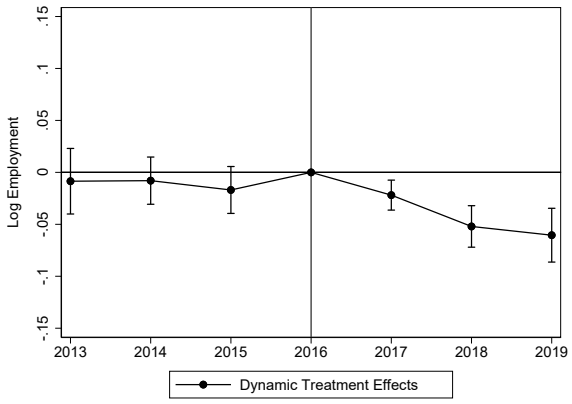
(b) Dynamic Treatments

Notes: The sample is restricted to the manufacturing sector only. The left figure plots event study analysis results from equation (1) where the dependent variable is the log of real value added. The right figure plots dynamic treatment effects results from equation (3) where the dependent variable is the log of real value added. Coefficients along with 95% confidence intervals are illustrated. Standard errors are clustered at the industry level.

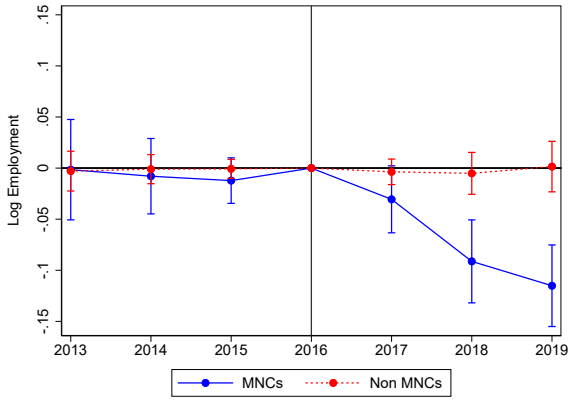
Figure B.3: MNCs and GVCs: Event Study and Dynamic Treatment Effects



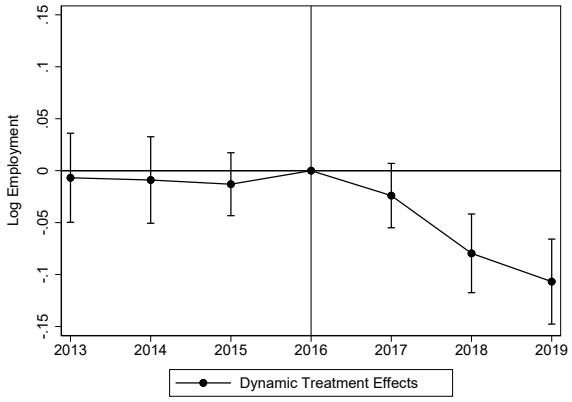
(a) Event Study Coefficients (China)



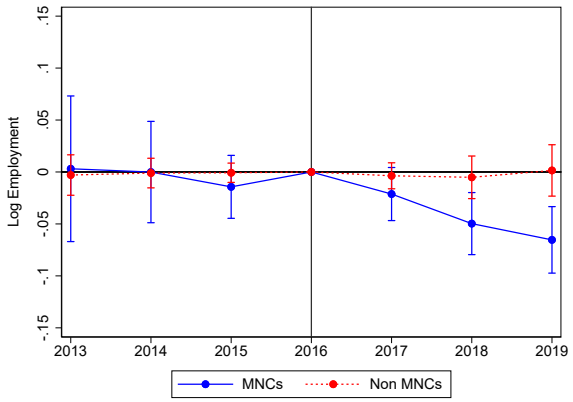
(b) Dynamic Treatments (China)



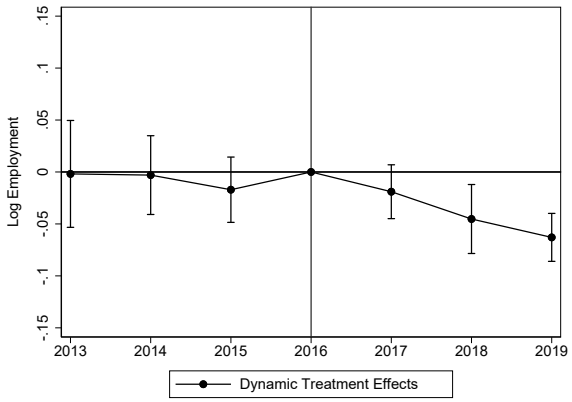
(c) Event Study Coefficients (Vietnam)



(d) Dynamic Treatments (Vietnam)



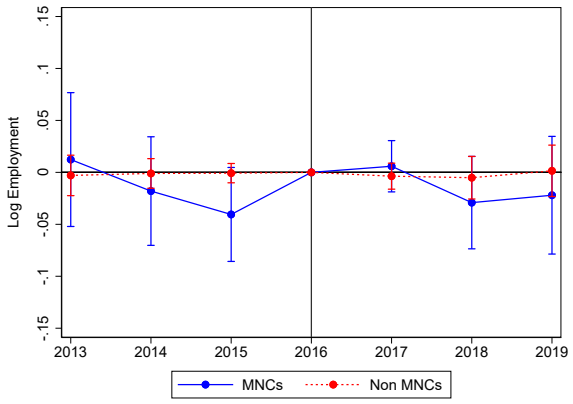
(e) Event Study Coefficients (Other Asia)



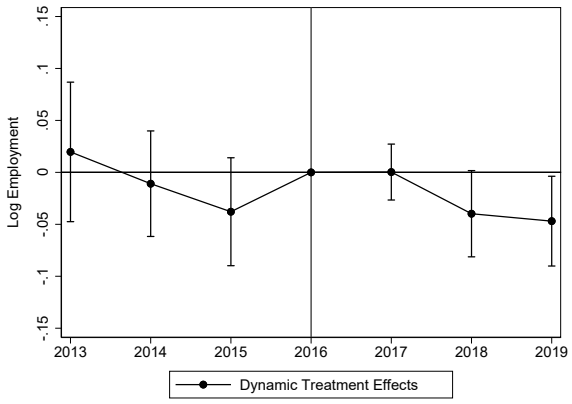
(f) Dynamic Treatments (Other Asia)

Notes: The sample is restricted to the manufacturing sector only. The left figures plot event study analysis results from equation (1). The right figure plots dynamic treatment effects results from equation (3). Coefficients and 95% confidence intervals are illustrated. Standard errors are clustered at the industry level.

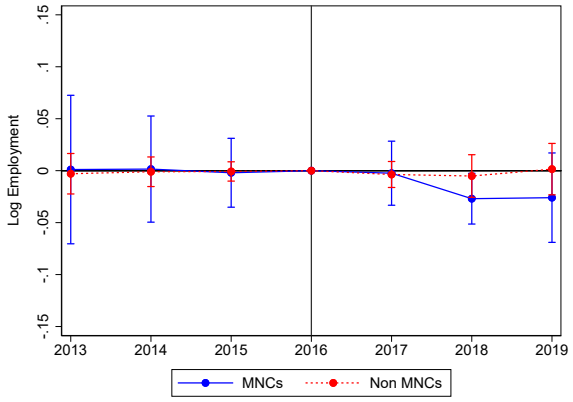
Figure B.4: MNCs and GVCs: Event Study and Dynamic Treatment Effects



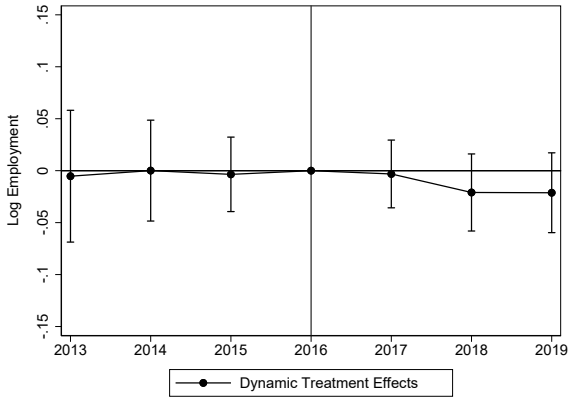
(a) Event Study Coefficients (Japan)



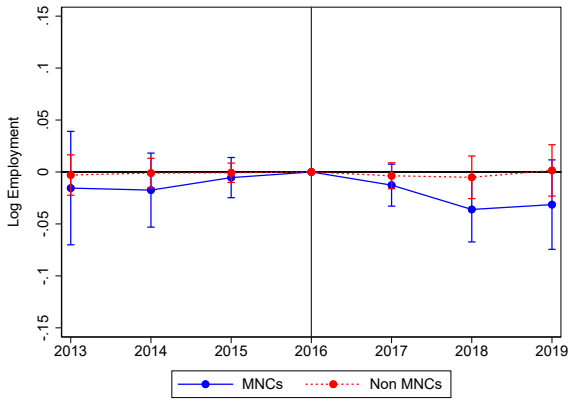
(b) Dynamic Treatments (Japan)



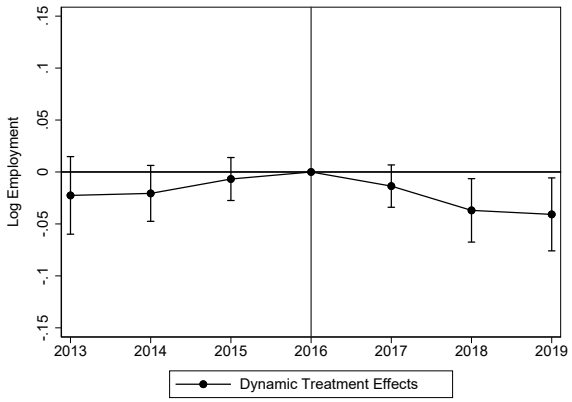
(c) Event Study Coefficients (Europe)



(d) Dynamic Treatments (Europe)



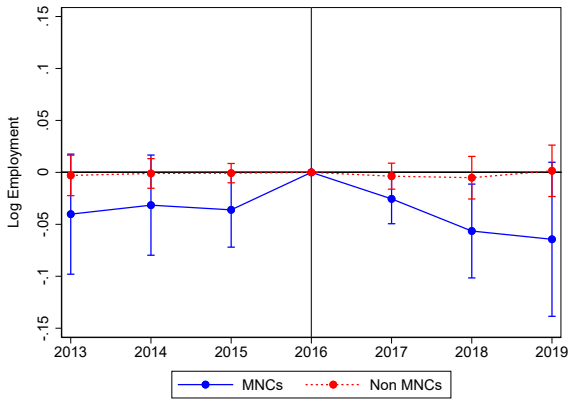
(e) Event Study Coefficients (North America)



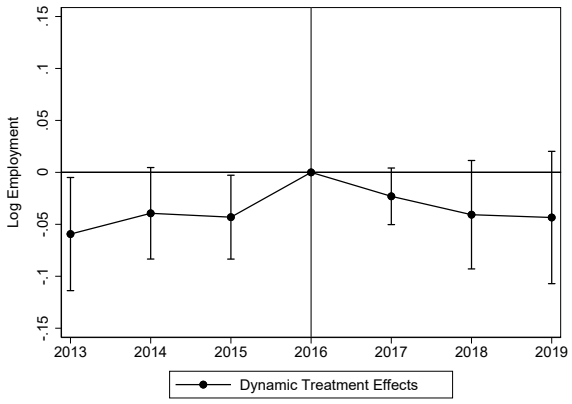
(f) Dynamic Treatments (North America)

Notes: The sample is restricted to the manufacturing sector only. The left figure plots event study analysis results from equation (1). The right figure plots dynamic treatment effects results from equation (3). Coefficients and 95% confidence intervals are illustrated. Standard errors are clustered at the industry level.

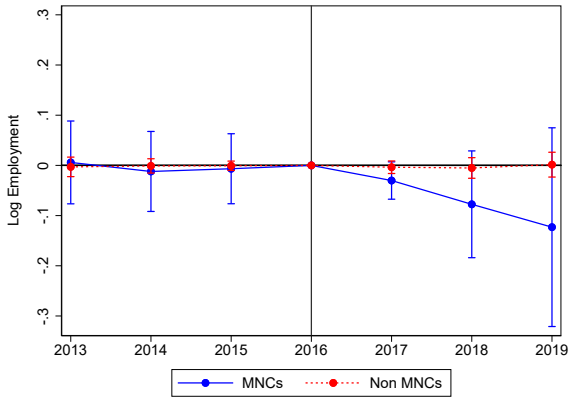
Figure B.5: MNCs and GVCs: Event Study and Dynamic Treatment Effects



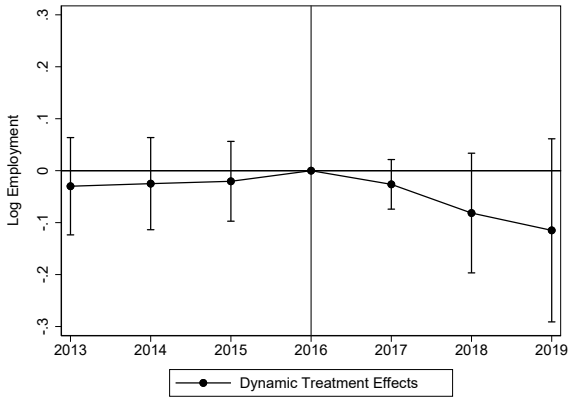
(a) Event Study Coefficients (Latin America)



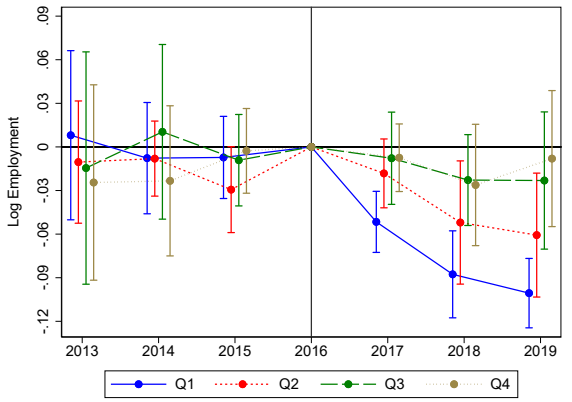
(b) Dynamic Treatments (Latin America)



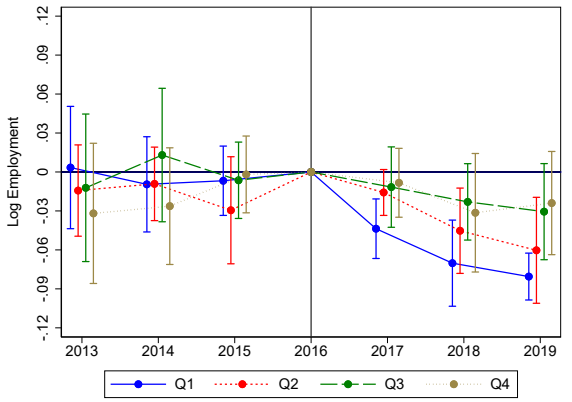
(c) Event Study Coefficients (RoW)



(d) Dynamic Treatments (RoW)



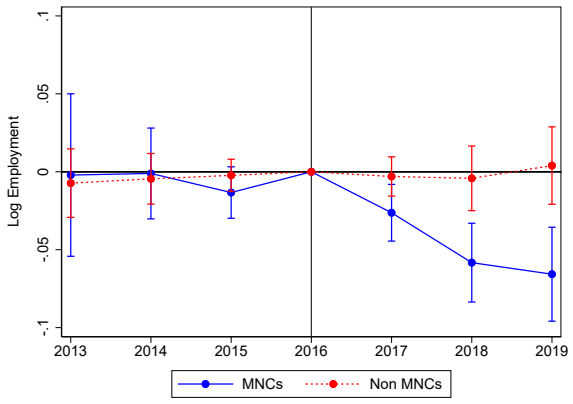
(e) Event Study Coefficients (Wage Group)



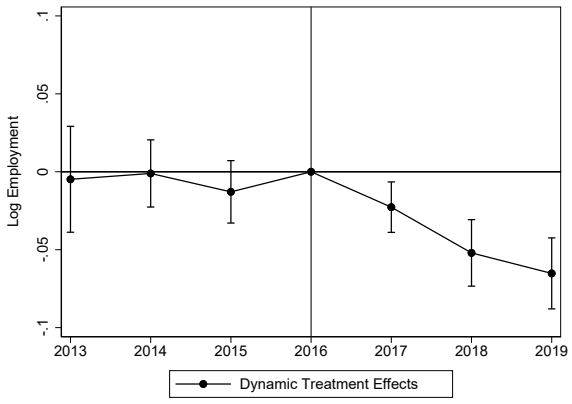
(f) Dynamic Treatments (Wage Group)

Notes: The sample is restricted to the manufacturing sector only. The left figure plots event study analysis results from equation (1). The right figure plots dynamic treatment effects results from equation (3). Q1~Q4 in panel (e) and (f) refer to the quartile group of MNCs according to the level of (weighted) average wages in the countries where their foreign affiliates operate. Coefficients and with 95% confidence intervals are illustrated. Standard errors are clustered at the industry level.

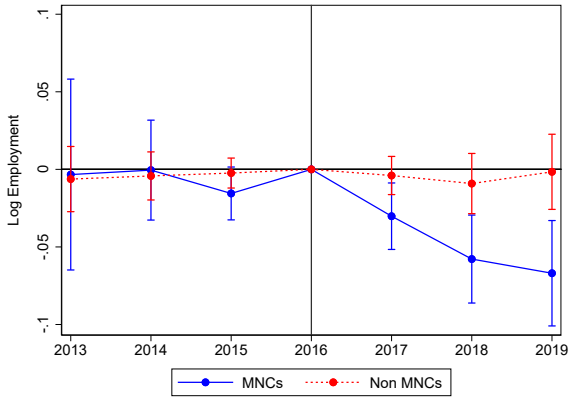
Figure B.6: MNCs and Task: Event Study and Dynamic Treatment Effects



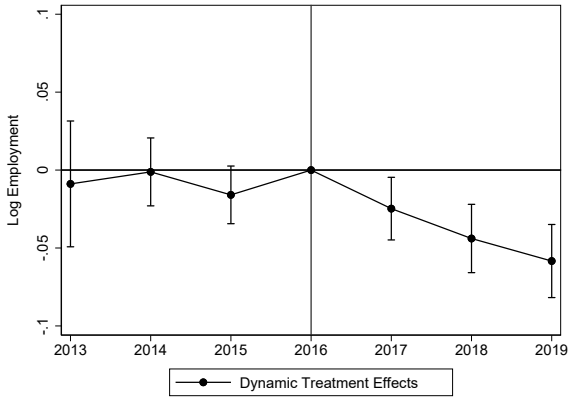
(a) Event Study Coefficients (Same Sector)



(b) Dynamic Treatment Effects (Same Sector)



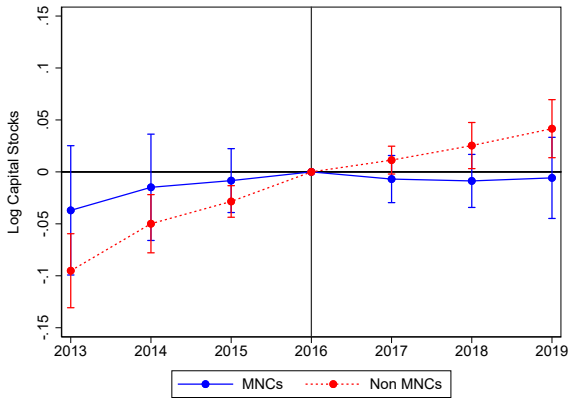
(c) Event Study Coefficients (Same Industry)



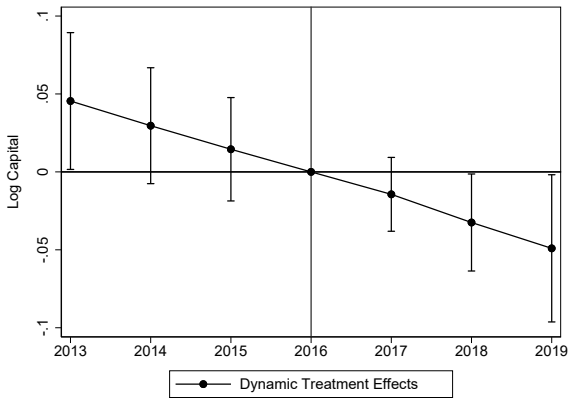
(d) Dynamic Treatments (Same Industry)

Notes: The sample is restricted to the manufacturing sector only. The left figures plot event study analysis results from equation (1) where the dependent variables are the log of employment. The right figures plot dynamic treatment effects results from equation (3). Coefficients and 95% confidence intervals are illustrated. Standard errors are clustered at the industry level.

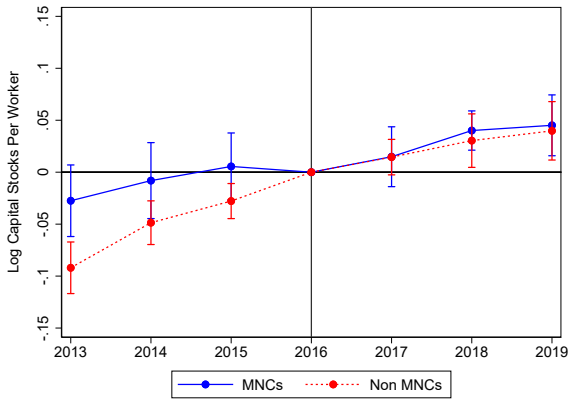
Figure B.7: MNCs and Capital: Event Study and Dynamic Treatment Effects



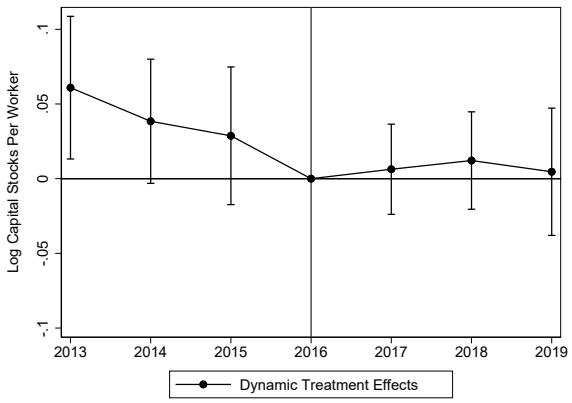
(a) Event Study Coefficients (Capital Stocks)



(b) Dynamic Treatment Effects (Capital Stocks)



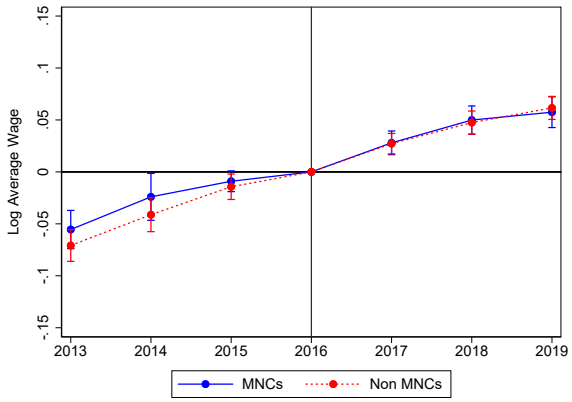
(c) Event Study Coefficients (K / L)



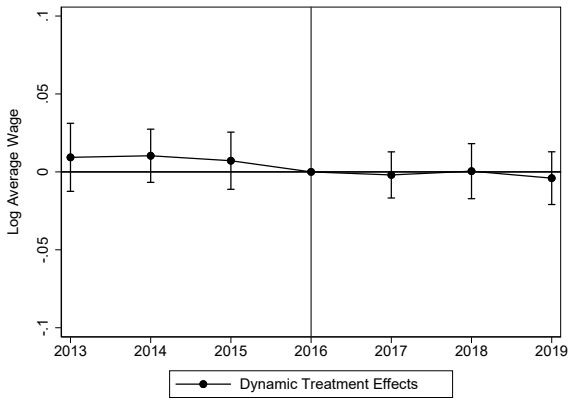
(d) Dynamic Treatments (K / L)

Notes: The sample is restricted to the manufacturing sector only. The left figures plot event study analyses results from equation (1) where the dependent variables are the log of real capital stocks in panel (a), and the log of real capital stocks per worker in panel (c), respectively. The right figures plot dynamic treatment effects results from equation (3) where the dependent variables are the log of real capital stocks in panel (b), and the log of real capital stocks per worker in panel (d), respectively. Coefficients and 95% confidence intervals are illustrated. Standard errors are clustered at the industry level.

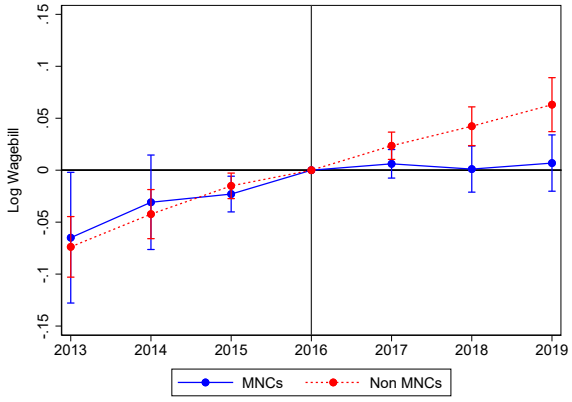
Figure B.8: MNCs and Wage Bill: Event Study and Dynamic Treatment Effects



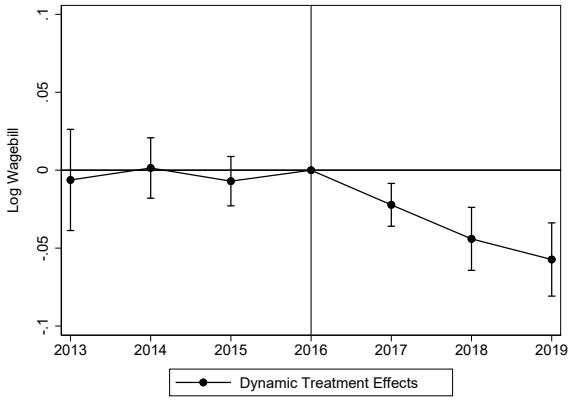
(a) Event Study Coefficients (Average Wage)



(b) Dynamic Treatments (Average Wage)



(c) Event Study Coefficients (Wage Bill)



(d) Dynamic Treatments (Wage Bill)

Notes: The sample is restricted to the manufacturing sector only. The left figures plot event study analyses results from equation (1) where the dependent variables are the log of real average wage in panel (a), and the log of real wage bill worker in panel (c), respectively. The right figures plot dynamic treatment effects results from equation (3) where the dependent variables are the log of real average wage in panel (b), and the log of real wage bill in panel (d), respectively. Coefficients and 95% confidence intervals are illustrated. Standard errors are clustered at the industry level.