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Foreign Direct Investment and Labour Market Dynamics in a Developing Country: Evidence from Indonesian Plant-Level Data[§]

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Abstract: *This study examines the impact of inward foreign direct investment on the wages and employment of skilled and unskilled workers in Indonesian manufacturing plants. Entry of multinational enterprises affects local labour markets through spillovers as well as labour and product market competition. Our results show that spillovers increase the labour demand of local plants for unskilled workers, but increased wages due to severe labour market competition reduce the demand for skilled workers. We also find that product market competition causes resource reallocation from low- to high-productivity plants. Thus, attracting inward foreign direct investment effectively enhances aggregate productivity growth, but may retard the transition to skill-intensive production in Indonesian manufacturing.*

***Keywords*:** foreign direct investment, resource reallocation, skill intensity

***JEL Classification*:** F23; J24; O14

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1. Introduction

Foreign direct investment (FDI) introduces advanced and capital-intensive technology to developing countries, creating a considerable amount of employment opportunities. Empirical evidence suggests that foreign acquisition of local firms increases productivity, employment, and wages of the acquired firms (Arnold and Javorcik, 2009). Moreover, advanced technology introduced into those firms spills over to other local firms, improving their productivity and wages as well. For example, Blalock and Gertler (2008) find technology transfer from downstream multinational enterprises (MNEs) to upstream local Indonesian suppliers. Considering the industrial development policy for local small and medium-sized enterprises, attracting MNEs, therefore, becomes an important strategy for governments in developing nations.

Spillover benefits to local firms' wages and productivity are attracting much attention from policy makers and academics (e.g. Todo and Miyamoto, 2006; Lipsey and Sjöholm, 2004; Javorcik, 2004). In contrast, prior literature has scarcely studied the impact of FDI on labour demand of local firms through other channels (Hale and Xu, 2016). Theoretically, in addition to spillovers, inward FDI affects employment in local firms by intensifying competition in labour and product markets.

First, because of their size, the entry of MNEs shifts the labour demand curve to the right, increasing the equilibrium wages and reducing local firms' labour demand along their demand curve. In particular, capital-intensive production by MNEs increases demand for skilled workers. Thus, combined with their inelastic supply of skilled workers, inward FDI should intensify competition for skilled workers in developing countries.

Second, in the face of severe competition in the product market against highly productive MNEs, local firms are forced to reduce production. This reduction shifts their labour demand curve to the left and decreases employment. The firm heterogeneity literature (e.g. Melitz, 2003) further argues that the extent to which production and employment in local firms declines is determined by their productivity: low-productivity firms lose more market share than high-productivity counterparts. Stated differently, inward FDI causes resource reallocation from low- to high-productivity firms.

The entry of MNEs affects wages and employment in local firms through at least three channels: spillovers, competition in labour markets, and competition in product markets. As each channel has a different impact on wages and employment, which channel dominates significantly alters the resulting impact of FDI on local firms. Therefore, identifying the overall impact of inward FDI on both wages and employment is essential to evaluate FDI attraction policies accurately.

Employing microdata from Indonesia, we individually evaluate the impact of inward FDI on the wages and employment of skilled and unskilled workers in local firms. We observe that the entry of MNEs results in an increase in wages for both skilled and unskilled workers. However, we also find a reduction in employment, particularly of skilled workers, in most local firms. Moreover, employment tends to decline more in low-productivity firms than in their high-productivity counterparts. Our results, which are consistent with competition effects in the labour and product markets, indicate that channels other than spillovers should be considered when evaluating the effectiveness of FDI attraction policies.

This study has implications for at least two areas of research. The first area is those studies that examine the micro-dynamic aspects of industrial development in a globalising economy. Besides spillover effects, recent firm-level studies emphasise the role of resource reallocation from low- to high-productivity firms in industry-level economic growth (Baily, Hulten, and Campbell, 1992; Griliches and Regev, 1995; Foster, Haltiwanger, and Krizan, 2001). For instance, Pavcnik (2002) concludes that resource reallocation mostly explains aggregate productivity growth in Chilean manufacturing during the trade liberalisation period. Employing firm-level data from 30 developed and developing countries, Alfaro and Chen (2018) also find that resource reallocation contributes substantially to aggregate productivity gains due to inward FDI. Applying our results to their decomposition, we confirm that aggregate productivity growth caused by inward FDI into Indonesian manufacturing is mostly due to a reduction in employment share among low-productivity firms.

Our study also contributes to the literature on the ‘middle-income trap.’ In general, developing countries with an abundant supply of unskilled workers attract MNEs engaging in unskilled-intensive production like assembling. Entry of such firms increases demand for unskilled workers and raises their wages. In middle-income

countries, however, unskilled-worker intensive output expansion is inadequate to maintain economic growth. Failing to make the transition to knowledge-intensive production may mire a country in the middle-income trap (Gill and Kharas, 2007; Nguyen et al., 2015).

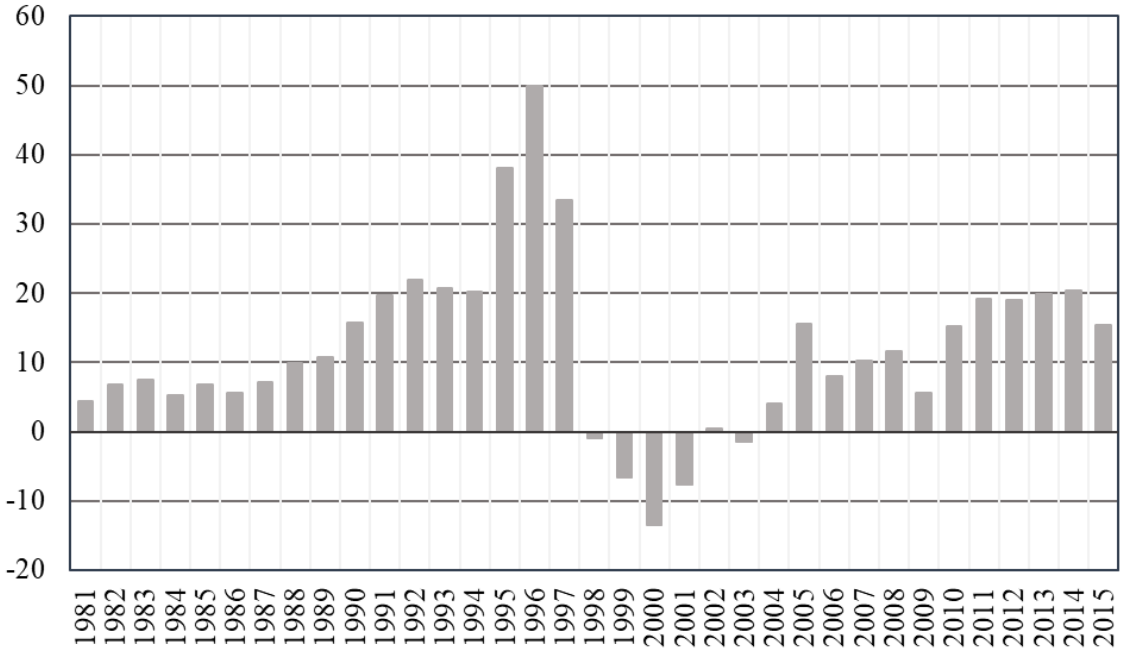
By classifying workers as either skilled or unskilled, this study considers the impact of inward FDI on local firms' labour demand for skilled and unskilled workers, individually. We observe that the entry of MNEs increases the relative wages of skilled workers, inducing local firms to replace skilled workers with unskilled ones. In other words, if the supply of skilled workers is inadequate, attracting MNEs may retard the transition to skill-intensive production in Indonesian manufacturing.

2. Inward Foreign Direct Investment into Indonesia

Traditionally, Indonesia's economy was based on agriculture and mining. It became a lower middle-income country in 1979, but a sharp decline in oil prices in the early 1980s drove the government to diversify its economic structure. It adopted export-oriented industrialisation and has implemented a number of FDI attraction policies for that purpose.

Figure 1 presents the annual flow of inward FDI into Indonesia. Except for the period of the Asian financial crisis and subsequent political turmoil during 1998–2004, an upward trend of inward FDI into Indonesia is observable. For Indonesia to become an upper middle-income country, it is key to determine whether the attracted MNEs contribute to the development of industry within the nation. To do this, we split our sample (2001–2010) into two sub-periods (2001–2005 and 2006–2010) and examine how the jump in inward FDI between these two periods has affected the employment dynamics of local firms in Indonesia.

Figure 1: Net Inflow of Inward Foreign Direct Investment into Indonesia
($ billion)



Note: Figures are deflated by a gross domestic product deflator.
Source: World Bank, World Development Indicators.

Table 1 compares the basic characteristics of MNEs and local firms, obtained from the Annual Survey of Medium and Large Manufacturing Establishment.[1] As in other countries, MNEs in Indonesia tend to employ more workers, pay higher wages for both production and non-production workers, be more skill intensive, and have higher export intensity than local firms. These findings are robust to the inclusion of additional controls (Rows 3–5).

Column 1 shows that the average number of workers in MNEs is four times greater than in local firms, implying that, even if there are fewer MNEs than local firms, their entry should have a considerable impact on the local labour market. Moreover, Column 2 shows that MNEs pay higher wages on average than do local firms.

Next, we classify workers into production and non-production workers. Non-production workers are those who engage in non-manual work, such as factory supervision, administration, logistics, and research and development. Columns 3 and 4 indicate that average wages for both types of workers are higher in MNEs than in local firms.

[1] The data sources are explained in more detail in section 4.

A comparison of Columns 3 and 4 also shows that wages for non-production workers are twice as high as those for production workers, both in MNEs and local firms. In addition, non-production workers generally have a higher level of education than do production workers.[2] Based on these findings, we regard production workers as unskilled, and non-production workers as skilled.[3]

Given the definitions of skilled and unskilled workers, Column 5 shows that MNEs, on average, have higher skill intensity (share of skilled workers to total workers) than do local firms, probably due to the capital-intensive technology employed by MNEs and the complementarity between capital and skilled workers. We examine how the entry of skill-intensive MNEs affects labour market competition, particularly for skilled workers. As discussed in the Introduction, this should have important implications for Indonesia and other countries suffering from the middle-income trap.

Finally, Column 6 compares export intensity between MNEs and local firms. Prior literature argues that MNEs invest in developing countries to carry out relatively unskilled-intensive parts of their production processes like assembling, and their products are mostly exported to third countries. According to Column 6, this argument is partially supported in our case: MNEs are much more export-oriented than are local firms. However, since the majority of their production is still destined for sale in the domestic market, the entry of MNEs is expected to have a pro-competitive effect in the local product market.

These findings suggest that inward FDI has a non-negligible impact on local labour and product markets in Indonesia. Furthermore, MNEs' skill-intensive production could affect labour market competition for skilled and unskilled workers differently. In the next section, we explain how we quantify the impact of inward FDI on the employment dynamics of local Indonesian firms.

[2] Of non-production workers, 9.5% of have completed university and 65.5% have completed high school. Of production workers, only 0.5% have completed university and 41.0% have completed high school.

[3] The classification based on occupation is common in the international trade literature. See, for example, Bernard and Jensen (1997) and Amiti and Cameron (2012). An exception is Kasahara, Liang, and Rodriguez (2016), who argue that, in addition to occupation, years of education should be considered when classifying workers as either skilled or unskilled.

Table 1: Characteristics of Multinational Enterprises and Local Plants in Indonesia

		(1) Number of workers	(2) Wages for all workers (Rp'000)	(3) Wages for production workers (Rp'000)	(4) Wages for non-production workers (Rp'000)	(5) Skill intensity	(6) Export ratio
Simple average							
1)	Local plants	131.0	10,448	9,732	18,080	14.0%	10.5 %
2)	MNEs	541.7	19,670	17,092	33,576	20.1%	39.3 %
Regression coefficients on MNE dummy							
3)	Industry FE	1.270***	0.440***	0.352***	0.456***	0.0380***	0.287***
4)	Industry and island FE	1.266***	0.439***	0.352***	0.454***	0.0383***	0.288***
5)	Industry and island FE and size control		0.241***	0.172***	0.268***	0.0197***	0.199***

FE = fixed effect, MNE = multinational enterprise.
Note: Multinational enterprises are defined as plants whose foreign capital share is greater than 20%. *** represents the statistical significance at 1%. Rows 3–5 are obtained by regressing plant-level variables in (1)–(6) on fixed effects and the logged number of workers in the corresponding plant. We take the log of the number of workers and wages when these variables are used as dependent variables.
Source: Annual Survey of Medium and Large Manufacturing Establishment, 2006 (*Badan Pusat Statistik* [BPS]).

3. Conceptual and Analytical Frameworks

3.1. Conceptual Framework

Consider the following conditional labour demand functions for skilled (L^S_{irt}) and unskilled workers (L^U_{irt}) for plant i in region r at period t. Note that i refers to a plant, not a firm here to be consistent with our dataset, in which production and cost information is provided at the plant level.[4]

$$(1) \quad L^S_{irt} = L^S\left(w^S_{rt}, w^U_{rt}, K_{irt}\ Q(\omega_{irt})\right) \text{ and}$$

$$(2) \quad L^U_{irt} = L^U\left(w^S_{rt}, w^U_{rt}, K_{irt}, Q(\omega_{irt})\right),$$

[4] Because most firms in Indonesia are single-plant firms (Kasahara, Liang, and Rodriguez, 2016), this distinction is not critical in this study.

where, w_{rt}^{S} is local wages for skilled workers and w_{rt}^{U} is local wages for unskilled workers in region r at period t ($t = 1$ for 2001–2005 and $t = 2$ for 2006–2010), K_{irt} represents capital stock, and Q is plant i's output, the level of which depends on its productivity (ω_{irt}) (Melitz, 2003). Equations (1) and (2) indicate that there are at least three channels through which the entry of MNEs affects plant i's demand for skilled and unskilled workers: spillover effects and labour and product market competition.

Spillover Effects

Technological spillovers from MNEs improve the productivity of local plants. If local plants face the downward-sloping demand curve for their goods, productivity enhancement allows them to increase production by lowering prices. This causes the outward shift of their labour demand curve, resulting in a rise in the equilibrium wages and labour demand:[5]

$$\partial \Delta w_{rt}^{h} / \partial \Delta MNE_{rt} > 0 \ \ and \ \ \partial \Delta L_{irt}^{h} / \partial \Delta MNE_{rt} > 0, \ \ h = S, U,$$

where, MNE_{rt} represents the number of MNEs in region r and Δ measures the changes from $t = 1$ to $t = 2$ (i.e. the net increase in the number of MNEs). The number of MNEs, not their output or employment share, is used here because the latter is the outcome of product or labour market competition and its use causes the simultaneity problem in the estimation (see subsection 3.2 below for the identification issue).

Labour Market Competition

The entry of MNEs increases the labour demand for both skilled and unskilled workers in local labour markets, raising the equilibrium wage. Local plants reduce the labour demand for both types of workers along the demand curves (1) and (2):

$$\partial \Delta w_{rt}^{h} / \partial \Delta MNE_{rt} > 0 \ \ and \ \ \partial \Delta L_{irt}^{h} / \partial \Delta MNE_{rt} < 0, \ \ h = S, U.$$

As shown in section 2, MNEs tend to be more skill intensive than local plants. Thus, their entry will considerably increase the labour demand for skilled workers in the

[5] Technological spillovers can have negative effects on employment in local firms. If spillovers induce local firms to adopt capital-intensive technology, the invested capital may replace unskilled workers. When this substitution effect exceeds the production-expansion effect, the labour demand of local firms for unskilled workers decreases in response to inward FDI.

host economy. Combined with the inelastic supply of skilled workers in developing countries, the entry of MNEs raises the wages of skilled workers relative to those of unskilled ones, thus decreasing local plants' relative demand for the former:

$$\partial\Delta(w_{rt}^{S}/w_{rt}^{U})/\partial\Delta MNE_{rt} > 0 \;\; and \;\; \partial\Delta\left(L_{irt}^{S}/L_{irt}^{U}\right)/\partial\Delta MNE_{rt} < 0.$$

The extent to which the relative wages of skilled workers affect the relative demand for them depends on substitutability between skilled and unskilled workers. Given the complementarity between capital and skilled workers, substitutability is expected to be low for plants with a high capital–labour (KL) ratio ($KL_{irt} \equiv K_{irt}/\left(L_{irt}^{S} + L_{irt}^{U}\right)$). Thus, the following relationship holds:

$$\partial\left(\partial\Delta\left(L_{irt}^{S}/L_{irt}^{U}\right)/\partial\Delta MNE_{rt}\right)/\partial KL_{irt} > 0.$$

Product Market Competition

In the face of fierce competition in the product market against MNEs, local plants reduce production and shift their labour demand curve to the left. Therefore, both the equilibrium wages and the number of employees in local plants decline:[6]

$$\partial\Delta w_{rt}^{h}/\partial\Delta MNE_{rt} < 0 \;\; and \;\; \partial\Delta L_{irt}^{h}/\partial\Delta MNE_{rt} < 0, \;\; h = S, U.$$

Melitz (2003) shows that, as competition becomes severer, low-productivity firms reduce production more than do their high-productivity counterparts, implying that the decline in employment is more pronounced for the former:

$$\partial\left(\partial\Delta L_{irt}^{h}/\partial\Delta MNE_{rt}\right)/\partial\omega_{irt} > 0, \;\; h = S, U.$$

The three channels mentioned above have different implications for wages and labour demand. Depending on which channel has the dominant impact, the impact of FDI attraction policies on labour market differs substantially. Stated differently, a policy evaluation requires an empirical assessment of the overall impact on both wages and

[6] It can be argued that this relationship is reversed. For example, by evaluating the local multiplier effect by Moretti (2010), Toews and Vezina (2018) find that higher wages from MNEs in Mozambique allow residents to spend more in the local product market, which then encourages local firms to expand production and employment. If this multiplier effect dominates the competition effects, then inward FDI increases employment in local plants.

employment. Although it is difficult to identify precisely which entry channel for MNEs affects the local labour market the most, evaluating the overall impact allows us to disentangle the impact of each channel indirectly.[7]

The above discussion assumes that technology spillovers are localised, and that labour and product markets are regionally segmented. Previous studies provide partial support for this. Amiti and Cameron (2007) describe some frictions in labour mobility between regions resulting from residents' strong ties to the land in Indonesia. Furthermore, since the interregional transportation infrastructure within and between islands is underdeveloped, the flow of goods and knowledge is highly localised (Amiti and Cameron, 2007; Blalock and Gertler, 2008).

3.2. Empirical Framework—Base Model

We first examine how the entry of MNE affects local wages and the productivity of local plants by estimating the following equation:

$$(3) \quad \Delta \ln W_{ijrt} = \gamma_0 + \gamma_1 \Delta MNE_{rt} + \gamma_2 X_{rt-1} + \gamma_3 \ln W_{ijrt-1} + \delta_R + \delta_j + \varepsilon_{ijrt},$$

where W_{ijrt} denotes wages for skilled workers (w^S_{ijrt}), unskilled workers (w^U_{ijrt}), or both types of workers, the wage ratio between skilled and unskilled workers (w^S_{irt}/w^U_{irt}), or productivity (ω_{irt}) of plant i in industry j and region r at period t. X_{rt-1} represents regional characteristics such as the gross domestic product share of the mining and quarrying sector, remoteness, and the average length of education (in years) received by local residents aged 25 and older at period $t-1$.[8] δ_R is the island fixed effect, δ_j is the industry fixed effect, and ε_{ijrt} is the disturbances.[9]

Since we use plant-level wages in Equation (3), it may be argued that the change in wages reflects the skill upgrading of both skilled and unskilled workers within a plant. For instance, to be competitive against MNEs, inward FDI may induce local plants to employ workers with higher levels of education. To consider this, we include the changes in the share of university and high school graduates among skilled and unskilled workers,

[7] For instance, it is difficult to distinguish between spillover effects and the local multiplier effect as they have very similar impacts on wages and employment.
[8] The remoteness index measures the average distance from the capital of r-th region to all other regional capitals (Combes et al., 2008).
[9] See section 4 for the definition of region.

respectively. However, because this detailed information is only available in 1996 and 2006, only plants that existed in both years can be the subjects of this robustness check.

We next investigate the impact of inward FDI on employment in local plants:

$$\begin{aligned}(4)\quad \Delta \ln L_{ijrt} &= \beta_0 + \beta_1 \Delta MNE_{rt} + \beta_2 \Delta MNE_{rt} \cdot Z_{ijrt-1} \\ &+ \beta_3 X_{rt-1} + \beta_4 \ln L_{ijrt-1} + \delta_R + \delta_j + \varepsilon_{ijrt},\end{aligned}$$

where L_{ijrt} is the number of skilled workers (L^S_{ijrt}) or unskilled workers (L^U_{ijrt}), the total number of workers ($L^S_{ijrt} + L^U_{ijrt}$), or the employment ratio between skilled and unskilled workers (L^S_{ijrt}/L^U_{ijrt}) of plant i in industry j and region r at period t. To consider resource reallocation from low- to high-productivity plants and complementarity between capital and skilled workers, we introduce interaction terms between the entry of MNEs (ΔMNE_{rt}) and plant characteristics (Z_{ijrt-1}), such as productivity (ω_{ijrt-1}) and the capital–labour ratio (KL_{ijrt-1}) of plant i at period $t-1$. Due to the introduction of plant-level characteristics, the overall impact of ΔMNE_{rt} on employment varies across plants. Thus, we evaluate its marginal effects for each plant:

$$(5)\quad \frac{\partial \ln \Delta L_{ijrt}}{\partial \Delta MNE_{rt}} = \beta_1 + \beta_2 Z_{ijrt-1},$$

To identify spillover effects, previous studies estimate Equation (3) with wages or productivity as a regressand. They interpret $\gamma_1 > 0$ as support for spillover effects. However, the discussion in the previous subsection argues that $\gamma_1 > 0$ can be observed even in the case where the entry of MNEs intensifies labour market competition. Thus, unless $\gamma_1 < 0$, that is, unless product market competition has a dominant impact on local wages, we cannot conclude which channel—spillovers or labour market competition—dominates from Equation (3) alone.

In Equation (4), on the other hand, we expect $\partial \Delta \ln L_{ijrt}/\partial \Delta MNE_{rt} > 0$ (< 0)—the marginal effects obtained from Equation (5) – if spillover effects dominate (or are dominated by) competition effects in labour and product markets. Hence, by estimating both Equations (3) and (4), we can observe the relative impact of each channel on the local labour market.

However, the coefficients on ΔMNE_{rt} in Equations (3) and (4) may suffer from the simultaneity bias. Because MNEs invest in regions where they expect strong economic growth, ΔMNE_{rt}, $\Delta \ln W_{ijrt}$, and $\Delta \ln L_{ijrt}$ are likely correlated if local wage growth or employment growth in local plants reflects the current economic situation of the region. To address the endogeneity issue, we use the past population as an instrument.[10] The underlying assumption here is that foreign-affiliated firms are attracted to regions with a large market size (Head and Mayer, 2004). In other words, the net increase in the number of MNEs (ΔMNE_{rt}) should be large in those regions. Regional population in the past can predict the current market size of the region, but is not likely to be correlated with the current business shocks in that region affecting MNEs' location decisions (Combes et al., 2008).

Beyond their impact on individual plants, spillovers and competition effects have implications for the local economy. Spillovers have been considered as key for improving regional productivity, but recent firm-level studies emphasise the role of resource reallocation, namely, competition in product market. We apply our results to quantify the contributions of each factor to regional productivity growth in Indonesia.

Following Foster, Haltiwanger, and Krizan (2001), we define aggregate productivity (Ω_{jrt}) as the weighted average of plant-level productivity:

$$\ln \Omega_{jrt} \equiv \sum_i S_{ijrt} \ln \omega_{ijrt},$$

where S_{ijrt} is the share of employment in plant i in total employment in industry j and region r. Then, aggregate productivity growth can be decomposed into three components:[11]

$$\Delta \ln \Omega_{jrt} = \sum_i S_{ijrt} \Delta \ln \omega_{ijrt} + \sum_i \Delta S_{ijrt} \left(\ln \omega_{ijrt-1} - \ln \Omega_{jrt-1} \right) + \sum_i \Delta S_{ijrt} \Delta \ln \omega_{ijrt}. \quad (6)$$

The first term in Equation (6) is the weighted average of productivity growth of individual plants. This measures the contribution of spillovers. The second term, the changes in

[10] Past population is often used as an instrument in urban economics literature. See, for example, Ciccone and Hall (1996).
[11] The contributions from entering and exiting plants are not considered here. As our plant-level dataset is restricted to those with 20 employees or more, it is not easy to identify the entry and exit of plants.

employment share weighted by the mean deviation of initial productivity, increases if low-productivity plants reduce their market share more than do their high-productivity counterparts from $t-1$ to t. The latter term is the cross term, indicating whether or not plants experiencing productivity growth increase their market share. By substituting $\Delta \ln \omega_{ijrt}$ and ΔS_{ijrt} in Equation (6) with the predicted values from Equations (3) and (4), respectively, we can quantify the relative contributions of spillovers and resource reallocation to aggregate productivity growth.

3.3. Empirical Framework—Extension

Thus far, we have not considered industry differences. For instance, ΔMNE_{rt} in Equation (4) counts the net entry of any foreign-affiliated plants regardless of industry. However, if MNEs produce goods similar to those produced by local plants, competition in the product market may become much more severe. In contrast, if MNEs source their intermediate goods from local plants, their entry may expand the size of the local product market. Hence, by grouping MNEs according to their primary products, we can further disentangle the impact of FDI.

A useful classification here is to group industries according to their stage in the production process. Using an input–output table, Javorcik (2004) divides industries into horizontal and vertical types. Blalock and Gertler (2008) employ the same classification and find that vertical FDI (i.e. FDI into the downstream sector) has positive spillover effects on local firms, whereas horizontal FDI does not. Following Javorcik (2004), we construct the horizontal and backward linkage measures, as follows:

$$(7) \quad \Delta Hztl_{jrt} = \Delta MNE_{jrt},$$

$$(8) \quad \Delta Bwd_{jrt} = \sum_{k \neq j} \alpha_{jk} \Delta MNE_{krt}.$$

where α_{jk} is the share of sales to sector k in total sales in industry j.[12]

We replace these measures with ΔMNE_{rt} in Equation (4). However, it is difficult to find appropriate instruments for ΔBwd_{jrt}. Hence, we first predict ΔMNE_{jrt} using the past population and an additional instrument that captures the industry variation in inward

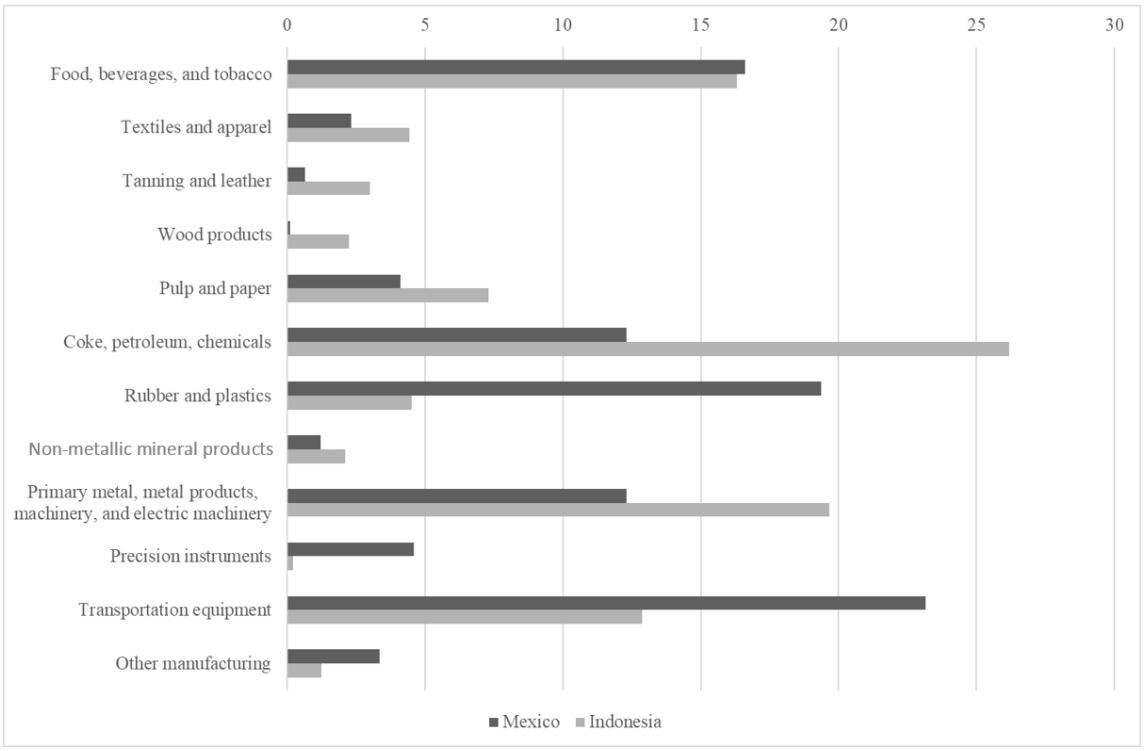
[12] We aggregate the Indonesian input–output table in 2000 according to the 3-digit International Standard Industrial Classification (ISIC) Revision 3 industry code.

FDI into Indonesia but is not correlated with industry-specific shocks in Indonesia. Then, we replace ΔMNE_{krt} in Equations (7) and (8) with its predicted value $\Delta\widehat{MNE}_{krt}$.

As an additional instrument, we use the industry-wise inward FDI flows into Mexico. Mexico and Indonesia are in a similar position within the production network in North America and in East Asia, respectively. However, as they are geographically distant from each other, business shocks specific to Indonesia are not likely to transmit to Mexico (Jordaan, 2011). Figure 2 presents the industry distribution of inward FDI into Mexico and Indonesia. Both countries attract similar types of inward FDI such as food, chemicals, primary metal, machinery, and transport equipment.

Figure 2: Inward Foreign Direct Investment into Indonesia and Mexico by Industry

(%)



Note: Figures are the net inflow of inward foreign direct investment for Mexico and the gross inflow for Indonesia.

Source: Secretariat of Economy of Mexico, Quarterly Flow of Direct Foreign Investment by Investment Type; Indonesian Investment Coordinating Board.

4. Data and Variable Construction

The primary data source is the *Annual Survey of Medium and Large Manufacturing Establishment* from 2001 to 2010, published by Statistics Indonesia (*Badan Pusat Statistik* [BPS]). Its microdata are only available for plants with 20 or more employees. This dataset contains production and cost information at the plant level, including the total value of production, the number of production and non-production workers, the book value of fixed capital assets, material and energy inputs, and labour costs by each type of workers. Plant-level wages are obtained by dividing labour costs adjusted by the consumer price index with the number of workers.

This dataset also reports the plant's location, industry classification for its main product, and share of foreign capital. Regarding the definition of region, we use each province as a geographical unit following Blalock and Gertler (2008). Indonesia consists of thousands of islands, but most of its economic activities are concentrated in two islands: Java and Sumatra. To ensure that enough observations are obtained in remote areas, provinces outside Java and Sumatra are aggregated at the island or archipelago level.[13] This yields 15 regions in total. Next, industry is defined based on the 3-digit International Standard Industrial Classification (ISIC) Revision 3 classification.[14] Lastly, following Blalock and Gertler (2009), we define MNEs as plants whose foreign capital share is greater than 20%.[15]

Productivity (ω_{ijrt}) is obtained by estimating the following production function for each 2-digit ISIC industry:

$$(9) \quad \ln Y_{ijrt} = \beta_S \ln L^S_{ijrt} + \beta_U \ln L^U_{ijrt} + \beta_K \ln K_{ijrt} + \ln \omega_{ijrt},$$

where Y_{ijrt} is value added, which is obtained by subtracting intermediate consumption—material, electricity, and energy—from revenue. The obtained value added is deflated by the wholesale price index. Initial capital stock is proxied by fixed tangible

[13] These islands or archipelagos are the Lesser Sunda Islands, Kalimantan, Sulawesi, and the Maluku Islands, and Western New Guinea.
[14] Some plants switch from one industry to another during sample periods; the overall switching rate is around 5%. Although industry-switching behavior is an interesting issue, we assign to each plant the industry classification to which a plant belongs most frequently during our sample periods.
[15] According to Blalock and Gertler (2009), the obtained samples of foreign-affiliated plants under this definition are mostly equivalent to those doing business under foreign capital investment licenses in Indonesia.

asset deflated by the price index for gross fixed capital formation in Indonesia's System of National Accounts. Capital stock in the following years is constructed by the perpetual inventory method assuming a depreciation rate of 9% (Brandt, Biesebroeck, and Zhang, 2012). Finally, we exclude as outliers plants whose revenue, number of workers, intermediate inputs, capital stock, or wages lie in the top or bottom 1% in each industry.

Ackerberg, Caves, and Frazer (2015) extend the work of Olley and Pakes (1996) and Levinsohn and Petrin (2003) to address the simultaneity bias between unobserved ω_{ijrt} and inputs and potential collinearity in the first stage of the Levinsohn and Petrin estimator.[16] Following Ackerberg, Caves, and Frazer, we obtain two types of productivity using material or investment as a proxy for unobserved productivity. In the following, we present results that employ productivity obtained by using material as a proxy. We confirm the robustness of our results by using the other productivity measure. Finally, since the obtained productivity is not comparable across industries, we take the deviation from the average productivity for each industry-region pair.

Our sample period is divided into two sub-periods: 2001–2005 and 2006–2010; all plant-level variables in this study are averaged over each sub-period. To deal with outliers, plants are excluded if their growth rates in workers, wages, or productivity from $t = 1$ to $t = 2$ are in the top or bottom 1% of the distribution for each industry. We also exclude industry-region pairs in which the number of plants is fewer than 10 in each sub-period to assure adequate competition in the labour and product markets.

The data sources for industry or regional-level variables are as follows. Past regional population is taken from the first and second *Population Census* in 1961 and 1971 published by BPS. The gross domestic product share of the mining and quarrying sectors by region is obtained from *Gross Regional Domestic Product of Provinces in Indonesia By Industrial Origin* published by BPS. Average years of education by region in 2005 comes from the *Human Development Report* by BPS. Finally, the net inflow of inward FDI into Mexico from 2006 to 2010 is taken from the *Quarterly Flow of Direct Foreign Investment by Investment Type* published by the Secretariat of Economy of Mexico.

[16] We use the Stata code used in De Loecker and Warzynski (2012) for the production function estimation.

5. Results

This section presents the estimation results. First, we evaluate the effects of inward FDI on the growth rate of local wages for all, skilled, and unskilled workers (Equation 3). The results are presented in Table 2. Column 1 shows that local wages rise as the number of MNEs increases. In Columns 2 and 3, we examine the impact on local wages for skilled and unskilled workers individually. The results indicate that wages grow faster for skilled workers than for unskilled workers, raising the relative wages of skilled to unskilled workers (Column 4).

In Columns 5–8, we check whether the results in Columns 1–4 reflect the skill upgrading of individual workers in each plant. Adding changes in the share of university and high school graduates among skilled and unskilled workers does not significantly change the coefficients on ΔMNE_{rt}. This suggests that the entry of MNEs increases local wages for both skilled and unskilled workers. Finally, Column 9 in Table 2 examines the effect of inward FDI on productivity growth in local plants. A positive and statistically significant sign on ΔMNE_{rt} implies that local plants receive spillover benefits from MNEs. Thus, we can conclude that competition in the product market has a negligible impact on local wages, but we cannot conclude which – spillovers or competition in labour market – has the dominant impact.

Table 2: Entry of Multinational Enterprises and Changes in Wages and Productivity of Local Plants

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Changes in real wages for			Changes in skilled–unskilled wage ratio	Changes in real wages for			Changes in skilled–unskilled wage ratio	Changes in TFP
Variable	Total workers	Unskilled workers	Skilled workers		Total workers	Unskilled workers	Skilled workers		
ΔMNE_{rt}	0.000300***	0.000214***	0.000621***	0.000407***	0.000304***	0.000209***	0.000543***	0.000335***	0.000159*
	(7.52e-05)	(8.14e-05)	(0.000117)	(0.000122)	(7.58e-05)	(7.53e-05)	(0.000106)	(9.59e-05)	(8.30e-05)
Changes in share of workers by education	No	No	No	No	Yes	Yes	Yes	Yes	N/A
Kleibergen-Paap F	151.8	151.8	151.8	151.8	116.2	116.2	116.2	116.2	153.2
Hansen J	0.0150	0.0201	0.0119	0.856	0.102	0.133	0.0403	0.0566	0.0335
Observations	8,095	8,095	8,095	8,095	4,288	4,288	4,288	4,288	8,095

TFP = total factor productivity.

Note: Standard errors clustered at the industry-region level are in parentheses. ***, **, and * represent the statistical significance at 1%, 5%, and 10%, respectively. Regional control variables, lagged wages or productivity, and industry and island fixed effects are included in all specifications.

Source: Authors' own calculation.

Table 3 shows the estimation results of Equation (4). Overall, the entry of MNEs has a statistically significant impact on employment in local plants. Since its impact differs across firms depending on their productivity and capital–labour ratio, the marginal effects for each plant are evaluated according to Equation (5). The bottom of Table 3 shows that total employment increases in 56% of plants if there is a rise in inward FDI.

However, there is a sharp contrast between skilled and unskilled workers. In response to the entry of MNEs, the number of unskilled workers increased in 68% of local plants, while skilled employment declined in 62% of the plants. These findings imply that both types of employment increase in local plants benefiting from spillovers. However, the entry of MNEs also intensifies competition in the labour market. Due to the inelastic supply of skilled workers, their relative wages rise (Column 4 of Table 2). Therefore, local plants expand production mostly by employing unskilled workers. Indeed, Column (4) of Table 3 shows that skill intensity declines in 89% of local plants.

We also note that labour-intensive plants (i.e. those with a low capital–labour ratio) are more likely to reduce skill intensity. In other words, substitutability between skilled and unskilled workers is low for capital-intensive plants, indicating complementarity between capital and skilled workers.

Table 3: Entry of Multinational Enterprises and Changes in Employment in Local Plants

	(1)	(2)	(3)	(4)
	Changes in the number of			Changes in the ratio
Variable	Total workers	Unskilled workers	Skilled workers	of skilled to unskilled workers
ΔMNE_{rt}	-0.00169***	-0.00129***	-0.00345***	-0.00216***
	(0.000496)	(0.000477)	(0.000816)	(0.000586)
$\Delta MNE_{rt} \times \ln \omega_{ijrt-1}$	0.000442***	0.000419***	0.000595***	0.000176
	(8.92e-05)	(0.000111)	(0.000141)	(0.000181)
$\Delta MNE_{rt} \times \ln KL_{ijrt-1}$	0.000188***	0.000156***	0.000349***	0.000193***
	(5.13e-05)	(4.90e-05)	(8.45e-05)	(5.99e-05)
Kleibergen-Paap F	17.45	17.45	17.45	17.45
Hansen J	0.0972	0.191	0.422	0.520
Observations	8,095	8,095	8,095	8,095
# of obs with positive marginal effects w.r.t. ΔMNE_{rt}	4496 (56%)	5541 (68%)	3062 (38%)	904 (11%)

obs = observations, TFP = total factor productivity, w.r.t. = with respect to.
Note: Standard errors clustered at the industry-region level are in parentheses. ***, **, and * represent the statistical significance at 1%, 5%, and 10%, respectively. Regional control variables, lagged employment, and industry and island fixed effects are included in all specifications.
Source: Authors' own calculation.

In Table 4, we classify inward FDI as either horizontal and vertical (downstream).[17] Since correlation between interaction terms is very high, we examine the impacts of horizontal and vertical FDI separately. The estimation results show that both horizontal and vertical FDI have statistically significant impacts on employment in local plants.

Comparing the marginal effects between horizontal and vertical FDI shows that the former increases unskilled employment in local plants while the latter reduces both skilled and unskilled employment. One explanation for this is that horizontal FDI causes positive spillover effects but vertical FDI does not (see Column 9 in Table 4).[18] Although both horizontal and vertical FDI intensify labour market competition in the host economy, the positive spillover effects in the former outweigh the negative competition effects on employment. However, regardless of the type of FDI, inward FDI lowers the skill intensity of local plants (see Columns 7 and 8).

So far, we have seen that inward FDI significantly affects wages and employment in local plants. We also find that its impact is heterogeneous across plants. For example, Table 3 shows that the number of unskilled workers decreases in 32% of local plants while skilled employment increases in 38% of these plants. This heterogeneity is partly explained by productivity differences. A positive sign on the interaction between ΔMNE_{rt} and productivity in Table 3 indicates that, if local plants face severe competition against MNEs in the product market, employment decreases in low-productivity plants more than in their high-productivity counterparts. Recent studies show that such a reallocation of resources contributes significantly to productivity growth at the regional and national levels.

[17] The results of the first stage estimation are presented in Table A1.
[18] This is not consistent with Blalock and Gertler (2008), who find positive spillovers from vertical FDI. The difference between this study and theirs is that we examine the spillover impact on productivity growth while they evaluate the impact on productivity level.

Table 4: Entry of Multinational Enterprises and Changes in Employment in Local Plants: Horizontal vs. Vertical Foreign Direct Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Changes in the number of						Changes in the ratio of skilled to unskilled workers		Changes in TFP
Variable	Total workers		Unskilled workers		Skilled workers				
$\Delta Hztl_{jrt}$	0.00155		0.0261		-0.108^{***}		-0.134^{***}		0.0697^{**}
	(0.0224)		(0.0232)		(0.0359)		(0.0384)		(0.0301)
$\Delta Hztl_{jrt} \times \ln \omega_{ijrt-1}$	0.0119^{***}		0.0113^{***}		0.0147^{***}		0.00345		
	(0.00190)		(0.00215)		(0.00286)		(0.00364)		
$\Delta Hztl_{jrt} \times \ln KL_{ijrt-1}$	0.00369^{***}		0.00302^{**}		0.00775^{***}		0.00473^{***}		
	(0.00111)		(0.00124)		(0.00159)		(0.00183)		
ΔBwd_{jrt}		-0.134^{***}		-0.116^{**}		-0.232^{***}		−0.115	−0.0261
		(0.0509)		(0.0553)		(0.0826)		(0.0874)	(0.0622)
$\Delta Bwd_{jrt} \times \ln \omega_{ijrt-1}$		0.0251^{***}		0.0192^{***}		0.0456^{***}		0.0264^{**}	
		(0.00701)		(0.00724)		(0.0108)		(0.0118)	
$\Delta Bwd_{jrt} \times \ln KL_{ijrt-1}$		0.0130^{***}		0.0114^{***}		0.0200^{***}		0.00854	
		(0.00412)		(0.00434)		(0.00611)		(0.00613)	
Observations	8,095	8,095	8,095	8,095	8,095	8,095	8,095	8,095	8,095
# of obs with positive marginal effects w.r.t. ΔMNE_{rt}	8077 (100%)	2349 (29%)	8095 (100%)	2496 (31%)	130 (2%)	1039 (13%)	0 (0%)	433 (5%)	

obs = observations, TFP = total factor productivity, w.r.t. = with respect to.

Note: Bootstrapped standard errors (200 repetitions) are in parentheses. ***, **, and * represent the statistical significance at 1%, 5%, and 10%, respectively. Regional control variables, lagged employment or productivity, and industry and island fixed effects are included in all specifications.

Source: Authors' own calculation.

To evaluate the relative contributions of spillovers and resource reallocation to regional productivity growth, we re-estimate Equation (4) by replacing the number of workers (L_{ijrt}) with its share (S_{ijrt}). A plant's market share is obtained by dividing the number of workers in a plant with the total number of workers in the industry to which the plant belongs and the region in which it is located. Table 5 presents the estimation results. We obtain qualitatively similar results as in Table 3.

Table 5: Entry of Multinational Enterprises and Changes in Employment Share in Local Plants

	(1)	(2)	(3)
	Changes in the share of		
Variable	Total workers	Unskilled workers	Skilled workers
ΔMNE_{rt}	-0.00242***	-0.00202***	-0.00414***
	(0.000530)	(0.000497)	(0.000851)
$\Delta MNE_{rt} \times \ln \omega_{ijrt-1}$	0.000457***	0.000433***	0.000612***
	(9.14e-05)	(0.000113)	(0.000141)
$\Delta MNE_{rt} \times \ln KL_{ijrt-1}$	0.000211***	0.000179***	0.000373***
	(5.51e-05)	(5.25e-05)	(8.97e-05)
Kleibergen-Paap F	17.37	17.37	17.37
Hansen J	0.368	0.315	0.277
Observations	8,095	8,095	8,095
# of obs with positive marginal effects w.r.t. ΔMNE_{rt}	1076 (13%)	1366 (17%)	1262 (16%)

obs = observations, w.r.t. = with respect to.
Note: Standard errors clustered at the industry-region level are in parentheses. ***, **, and * represent the statistical significance at 1%, 5%, and 10%, respectively. Regional control variables, lagged employment share, and industry and island fixed effects are included in all specifications.
Source: Authors' own calculations.

By applying the results in Column 9 of Table 2 and Column 1 of Table 5 to Equation (6), we decompose aggregate productivity growth in each industry-region pair into spillover effects, resource reallocation, and the cross effects. On average, a 100% increase in ΔMNE_{rt} raises aggregate productivity by 1.024%. Spillover effects, resource reallocation, and the cross effects explain 36.3, 64.0, and -0.5% of the increase, respectively. Thus, aggregate productivity growth is mostly due to resource reallocation between high- and low-productivity plants.

6. Summary and Policy Implications

This study examines the impact of inward FDI on the wages and employment of skilled and unskilled workers in Indonesian manufacturing plants. Since MNEs bring advanced technology and create considerable job opportunities in the host economy, attracting MNEs is an important development strategy for developing countries. Moreover, inward FDI significantly contributes to the development of local small and medium-sized enterprises through technology spillovers. Previous studies have thus mainly focused on identifying spillover effects on the productivity and wages of local firms. However, due to their size and productivity, the entry of MNEs should intensify competition in local labour and product markets. If the competition effects outweigh the spillover benefits in those markets, local wages increase and production in local firms declines, resulting in a decline in their labour demand. Thus, whether or not inward FDI contributes to the creation of employment by local firms must be evaluated empirically.

Employing microdata from Indonesia, we individually evaluate the impact of inward FDI on the wages and employment of skilled and unskilled workers in local firms. We observe that the entry of MNEs increases local wages for both skilled and unskilled workers. With regard to employment, demand for unskilled workers increases in most local plants while demand for skilled workers decreases. These results suggest that although spillover effects increase the labour demand of local plants, severe labour market competition, along with an inelastic supply of skilled workers, lowers demand for skilled workers. This is also confirmed when we consider industry differences. Finally, we find that the entry of MNEs causes resource reallocation from low- to high-productivity local plants. Stated differently, employment tends to decrease in low-productivity firms more than in their high-productivity counterparts. A productivity decomposition shows that resource reallocation contributes considerably to regional productivity growth.

In sum, attracting inward FDI effectively enhances aggregate productivity growth, and resource reallocation across local firms should be encouraged to maximise these benefits. However, an inadequate supply of skilled workers can be a bottleneck to the expansion of production as it cancels out spillover benefits. Moreover, the increased relative wages of skilled workers discourage local firms from adopting skill-intensive production. This may reduce the innovation potential of the country and may hamper economic growth in the long run.

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Appendix

Table A1: Determinants of Multinational Enterprises Entry by Industry and Region

Variable	ΔMNE_{rt}
$\ln(Population\ in\ 1961)_r$	0.354**
	(0.168)
$\ln(FDI\ into\ Mexico)_j \times \ln(Population\ in\ 1961)_r$	0.0661**
	(0.0272)
F-statistic	11.12
R-squared	0.149
Observations	795

Note: Robust standard errors in parentheses. ***, **, and * represent the statistical significance at 1%, 5%, and 10%, respectively. Industry and island fixed effects are included.
Source: Authors' own calculation.

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