FDI and Labor Market Dynamics in a Developing Country: Evidence from Indonesian Plant-Level Data[§]

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Abstract

Inward FDI can contribute to the creation of employment by local firms through externality. However, labor-market competition for skilled workers becomes severe due to skill-biased labor demand of MNEs. Employing microdata from Indonesian manufacturing, we find that the entry of MNEs induces local firms to inrease total employment but to decrease skilled workers, reducing their skill intensity. Furthermore, inward FDI can improve industry-level productivity through reallocation of workers across firms, but the reallocation of skilled workers does not contribute much to it. Hence, the supply of skilled workers is key to the sustainable growth of Indonesian manufacturing.

Keyword: FDI, Resource reallocation, Skill intensity
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1. Introduction

The recent debate on globalization has centered around its effect on local labor markets. For example, whether a rise in import penetration reduces local employment, wages, and job security has received much research attention (e.g., Autor et al. 2013). By contrast, multinational enterprises (MNEs) are, in general, supposed to create considerable job opportunities in the host economy and thus, attracting inward foreign direct investment (FDI) becomes an important development strategy for developing nations. Empirical evidence confirms that foreign acquisition of local firms increases productivity, employment, and wages of the acquired firms (Arnold and Javorcik 2009).

Besides such direct impact, inward FDI contributes to the development of local small and medium-sized enterprises indirectly through technology spillovers and demand creation. While empirical evidence of the externality effects on the wages and productivity of local firms has accumulated (e.g., Blalock and Gertler 2008; Javorcik 2004; Lipsey and Sjöholm 2004; Todo and Miyamoto 2006), prior literature has scarcely studied FDI's impact on employment in local firms (Hale and Xu 2016). Theoretically, externality effects have the positive impact on production and are supposed to increase the labor demand of local firms. However, due to their size and productivity, the entry of MNEs may crowd out some local firms from labor and product markets (Kosová 2010). For instance, large labor demand by MNEs increases market wages and induces local firms to reduce their employment. Similarly, in the face of severe product-market competition against MNEs, local firms decrease their production and employment. Although both externality and crowding-out effects in labor market predict wage growth, they have the opposite impact on employment: if crowding-out effects outweigh (are outweighed by) externality effects, employment declines (increases).

In summary, examining FDI's impact on the wages or productivity alone does not

allow us to assess its impact on employment in local firms. Whether or not inward FDI contributes to the creation of employment by local firms needs empirical evaluation. A few studies have examined the net impact of inward FDI on employment in local firms, including Dinga and Münich (2010) and Karlsson et al. (2009), who find the positive impact on employment in the Czech Republic and China, respectively. However, they do not consider skill differences between workers. Because labor demand of MNEs is biased toward skilled workers, inward FDI enlarges wage gaps between skilled and unskilled workers (Goldberg and Pavcnik 2007). Combined with the inelastic supply of skilled workers in developing countries, the distributional impact of FDI implies more intensified labor-market competition for skilled workers than unskilled ones, resulting in a reduction of skill intensity of local firms.

Employing microdata from Indonesia, this study evaluates FDI's impact on employment of skilled and unskilled workers in local firms individually. Overall, our results are consistent with the distributional hypothesis: inward FDI has the positive impact on total employment as in Dinga and Münich (2010) and Karlsson et al. (2009), but its impact differs between skilled and unskilled workers. The entry of MNEs induces local firms to substitute skilled workers with unskilled one by enlarging the wage gap between skilled and unskilled workers. The total number of workers increases because the increase in unskilled workers more than offsets the reduction in skilled ones.

Distinguishing FDI's impact on skilled employment from that on unskilled one yields two implications regarding productivity growth of Indonesian manufacturing. The first implication is on skill intensity and innovation potential of local firms. Increasing the share of skill workers and human capital is key to ensureing smooth knowledge transfer between firms (Saito and Gopinath 2011) and to economic growth of nations (Lucas 1988). For example, Blalock and Gertler (2009) conclude that the capacity of Indonesian firms to absorb externality from MNEs increases along with the increase in the share of workers with an education at or above the junior-college level. By contast, our results – inward FDI lowers skill intensity of local firms – suggest that attracting MNEs will retard the transition of local

firms to knowledge-intensive production. Failing to make the transition may mire countries like Indonesia in the middle-income trap (Gill and Kharas 2007; Nguyen et al. 2015).

Besides externality effects on firm-level productivity growth, recent studies emphasize the role of resource reallocation across firms on industry- or macro-level productivity growth (Baily et al. 1992; Grilliches and Regev 1995; Foster et al. 2001). Fierce market competition due to globalization fosters productivity growth by inducing reallocation of production factors from low- to high-performance firms within industries (Alfaro and Chen 2018; Pavcnik 2002). The second implication is, therefore, on the relative contribution of externality effects and reallocation of skilled and unskilled workers to aggregate productivity growth. More specifically, following Petrin and Levinsohn (2012), we quantify the extent to which an increase in inward FDI rasises industry-level productivity growth and the relative contribution of externality and resource reallocation to it. We find that because the current level of skilled employment is below the optimal level for most of the local firms, there is little room for productivity improvement through the reallocation of skilled workers across local firms. Quantitatively, compared with the reallocation of unskilled workers, the reallocation of skilled ones makes a much smaller contribution to aggregate productivity growth. These two implications suggest that the supply of skilled workers is key to the sustainable growth of Indonesian manufacturing.

The rest of the paper is organized as follows. Section 2 provides a more detailed description of the conceptual framework. Section 3 introduces the basic characteristics of inward FDI into Indonesia. Section 4 discusses the empirical methodology. Section 5 describes the data and variable construction. Section 6 presents the estimation results. Finally, Section 7 concludes with a summary of results and policy implications.

2. Conceptual framework

Previous literature has identified several channels through which inward FDI affects labor market in the host economy. Broadly speaking, the effects can be classified into (i) externality

effects, (ii) crowding-out effects, and (iii) distributional effects (Dinga and Münich 2010). We discuss each of the effects in turn.

Externality effects include technology spillovers from MNEs that improve the productivity of local firms. In the presence of imperfect competition, productivity enhancement allows local firms to increase their production by lowering prices. This raises their labor demand, resulting in a rise in wages and employment. Besides spillovers, demand creation effects, or backward linkage effects, can be categorized into externality effects, too. If MNEs source their intermediate goods from local firms, their entry results in the expansion of local product market. Local firms react to it by increasing their production, which leads to a rise in wages and employment.[1]

On the other hand, because MNEs tend to be larger and more productive than local firms, their entry may crowd out local firms from labor and product markets. A fierce labor market competition increases market wages, reducing employment in local firms. Likewise, a severe product market competition induces local firms to cut down their production, resulting in a decrease in employment. In the latter case, the extent of employment reduction varies depending on productivity of local firms. In general, low-productivity firms likely lose more employment than high-productivity counterparts (Melitz 2003).

Finally, distributional effects refer to the FDI-induced changes in relative wages between skilled and unskilled workers. Goldberg and Pavcnik (2007) indicate that because of the complementarity between capital and skilled workers, the increase in capital inflows into developing countries yields higher demand for skilled workers in those countries. In addition, because MNEs engage in more skill-intensive activities from the developing country's point of view, their labor demand is biased toward skilled workers, enlarging wage inequality between different skill levels (Feenstra and Hanson 1997). By widening the wage gap between skilled and unskilled workers, distributional effects strengthen crowding-out effects

[1] In a similar vein, local multiplier effects (Moretti 2010) are also considered to raise wages and employment. Toews and Vezina (2017) find that higher wages from MNEs in Mozambique allow residents to spend more in the local product markets, encouraging local firms to expand production and employment.

in the labor market for skilled workers. In the face of the absolute and the relative increase in wages for skilled workers, local firms must cut down skilled employment, but the level of substitution between skilled and unskilled workers depends on firm characteristics like capital intensity.

In conclusion, both externality effects and crowding-out effects have the positive impact on market wages, but they have the opposite impact on labor demand.[2] Thus, the assessment of FDI attraction policies depends on which channel dominates. Our first contribution is, therefore, to identify the net impact of inward FDI on employment in local firms. In contrast to previous studies, we consider distributional effects of inward FDI by individually examining its impact on skilled and unskilled employment.

The discussion thus far indicates that FDI's impact on employment likely varies between local firms according to their characteristics such as productivity and capital intensity. In other words, the entry of MNEs causes reallocation of workers across local firms. To link firm-level changes in employment with industry-level productivity growth, we apply a method developed by Petrin and Levinsohn (2012). They argue that in the presence of imperfect competition or frictions in labor market, firms do not necessarily produce at the point where marginal product of labor equals wage, yielding a gap between the value of marginal product and factor price.[3] If inputs are reallocated from negative- to positive-gap firms, aggregate productivity grows even in the absence of technical efficiency gains of individual firms. Thus, a key question here is whether inward FDI induces reallocation of workers from negative- to positive-gap firms. As illustrated above, the direction of reallocation is determined according to productivity and capital intensity, but these firm characteristics and the gaps are in general uncorrelated to one another (Petrin and Levinsohn 2012). The second contribution of this study is to examine whether inward FDI induces reallocation in a way that enhances aggregate productivity growth and whether the extent of

[2] Kosová (2010) compares the impact of these two on production. Because of crowding-out effects, the entry of MNEs induces exit of local firms. After MNEs start their operation, however, local firms increase their production because demand creation effects outweigh crowding-out effects.

[3] For instance, Petrin and Sivadasan (2013) show that enhanced job security in Chile widens the marginal product-input cost gaps and deteriorates overall allocative efficiency in the manufacturing sector.

reallocation differs between skilled and unskilled workers.

3. Inward FDI 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. The government adopted export-oriented industrialization and has implemented a number of FDI attraction policies for this purpose. Currently, Indonesia constitutes an important part of international production networks for MNEs and attracts considerable research attention regarding the impact of international trade and FDI on the performance of local firms (e.g., Amiti and Cameron 2012; Blalock and Gertler 2008; Kasahara et al. 2016; Lipsey and Sjöholm 2004; Takii 2005).

Figure 1 presents FDI net inflows in Indonesia as a share of GDP. 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.[4] Hence, the sustainable growth of Indonesian economy depends on whether the attracted MNEs can contribute to the industrial development. To see 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.

== Figure 1 ==

Next, Table 1 shows the historical trend of the population share of university graduates and per capita GDP in Indonesia and its neighboring countries. Indonesia has steadily increased the supply of university graduates during the estimation period. However, its population share is still low when compared to that of neighboring countries. For example, the Philippines has lower GDP per capita but has higher share of university graduates than Indonesia. On the other hand, factors such as rising quality standards for products have led to

[4] The inflow of FDI is low in 2009 because of the 2008 financial crisis.

a growing demand for skilled workers, especially among large and export-oriented firms (di Gropello et al. 2011). Combined with the supply-side factors, rising demand for skilled workers enlarges the skill gaps – the gap between demand and supply of skilled workers – in Indonesia. For instance, according to a firm-level survey conducted in 2008, most of the employers find it difficult to find workers suitable for director and professional jobs (di Gropello et al. 2011). Alatas and Newhouse (2010) also confirm that despite the increase in the supply of educated workers, the wage premium for those workers shows an upward trend during this period. Because MNEs have larger demand for skilled workers than local firms, their entry must have significantly contributed to the rise in demand for educated workers and thus, to the skill gaps emerging in Indonesia.

== Table 1 ==

Finally, Table 2 compares the basic characteristics of MNEs and local firms, obtained from the *Annual Survey of Medium and Large Manufacturing Establishment*.[5] 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 to 5).

Column (1) shows that the total number of workers in MNEs is on average 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 labor market. Moreover, column (2) shows that MNEs pay higher wages on average than do local firms. To see the wage differences between the types of workers, we classify workers into two types: 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 regardless of the type of workers, average wages are higher in MNEs than in local firms. A further comparison of these two columns

[5] Rigorously, "local plants" is more appropriate expression here because production and cost information are provided at plant level in our dataset. However, since most firms in Indonesia are single-plant firms (Kasahara et al. 2016), this distinction is not so critical.

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.[6] Based on these findings, we regard production workers as unskilled, and non-production workers as skilled, respectively.[7] Given the definitions of skilled and unskilled workers, column (5) shows that MNEs, on average, have higher skill intensity – the share of skilled workers to total employment – than do local firms as expected. Hence, the entry of MNEs very likely exerts distributional effects in local labor market. 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 partly 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.

== Table 2 ==

These findings suggest that inward FDI have a non-negligible impact on local labor and product markets in Indonesia. Furthermore, MNEs' skill-intensive production could affect labor 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.

[6] Information on the composition of workers by educational attainment is available in the 2006 version of our firm-level survey. Of non-production workers, 10.4 percent have completed university and 62.5 percent have completed high school. Of production workers, only 1.1 percent have completed university and 42.2 percent have completed high school.

[7] 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 et al. (2016), who argue that, in addition to occupation, years of education should be considered when classifying workers as either skilled or unskilled.

4. Empirical methodology

4.1 FDI's impact on employment

We examine how the entry of MNEs affects employment and the productivity of local firms by estimating the following model:

$$\Delta \ln Y_{ijrt} = \beta_0 + \beta_1 \Delta MNE_{rt} + \beta_2 \Delta MNE_{rt} \cdot Z_{ijrt-1} + \beta_3 H_{rt-1} + \beta_4 \ln Y_{ijrt-1} + \delta_R + \delta_j + \varepsilon_{ijrt}, \quad (1)$$

where, Δ measures the changes from period $t = 1$ to $t = 2$ ($t = 1$ for 2001-2005 and $t = 2$ for 2006-2010). Y_{ijrt} denotes the number of skilled workers (L^S_{ijrt}) or unskilled workers (L^U_{ijrt}), total employment ($L^S_{ijrt} + L^U_{ijrt}$), the employment ratio between skilled and unskilled workers (L^S_{ijrt}/L^U_{ijrt}), or productivity (ω_{ijrt}) of firm i in industry j and region r at period t. MNE_{rt} is a variable that measures the presence of MNEs in local labor markets. Following previous studies (e.g., Blalock and Gertler 2008), we define MNE_{rt} as the revenue share of MNEs in region r. There are studies that disaggregate MNE_{rt} by industry to isolate, for example, demand creation effects of backward FDI or pro-competitive effects of horizontal FDI on productivity spillovers. By contrast, because our main interest lies in crowding-out effects in labor market, we do not disaggregate it by industry so that we can consider labor demand from all MNEs regardless of their industry affiliation.[8] To allow for the heterogeneous impact of FDI on employment across firms, we introduce interaction terms between ΔMNE_{rt} and firm characteristics (Z_{ijrt-1}) such as the productivity (ω_{ijrt-1}) and capital-labor (KL) ratio of firm i at period $t-1$.[9] H_{rt-1} represents regional control variables that will affect local labor market such as the GDP share of the mining and quarrying sector, geographical remoteness, and the average length of education (in years) received by local residents aged 25 and older at period $t-1$.[10] Finally, δ_R, δ_j, and ε_{ijrt}

[8] It can be argued that inter-sectoral mobility of workers may be lower than intra-sectoral mobility. In this case, inward FDI has different impacts on labor market competition according to the industry affiliation of entering MNEs. However, we cannot examine whether mobility of workers differs between intra and inter sectors because our instrument does not have industry-level variation.

[9] KL ratio is defined as $K_{ijrt-1}/\left(L^S_{ijrt-1} + L^U_{ijrt-1}\right)$, where K_{ijrt-1} denotes capital stock.

[10] Geographical remoteness index measures the average distance from the capital of r-th region to all

are island and industry fixed effects and disturbances, respectively.[11]

Due to the introduction of firm-level characteristics, the overall impact of ΔMNE_{rt} on employment varies across firms. Thus, for each firm, we evaluate its marginal effects:

$$(2) \qquad \frac{\partial \ln \Delta Y_{ijrt}}{\partial \Delta MNE_{rt}} = \beta_1 + \beta_2 Z_{ijrt-1}.$$

We expect $\partial \Delta \ln Y_{ijrt} / \partial \Delta MNE_{rt} > 0 \ (< 0)$ if externality effects dominate (or are dominated by) crowding-out effects in labor and product markets.

Two comments are in order. First, by using the revenue share of MNEs by region, we implicitly assume that externality effects are localized, and that labor and product markets are regionally segmented. Previous studies provide partial support for these assumptions. Amiti and Cameron (2007) describe some frictions in labor mobility between regions resulting from residents' strong ties to the land in Indonesia. Quantitatively, a 10 percent increase in distance between two Indonesian regions leads to a 7 percent reduction in the proportion of people migrating between the regions (Bryan and Morten 2018). Furthermore, since the inter-regional transportation infrastructure within and between islands is underdeveloped, the flow of goods and knowledge is highly localized (Amiti and Cameron 2007; Blalock and Gertler 2008).

Second, the coefficients on ΔMNE_{rt} and its interaction terms in Equation (1) may suffer from the simultaneity bias. Because MNEs invest in regions where they expect strong economic growth, ΔMNE_{rt} and $\Delta \ln Y_{ijrt}$ are likely correlated if employment and productivity growth in local firms reflects the current economic situation of the region. To address the endogeneity issue, we use the past population as an instrument (Ciccone and Hall 1996). In general, revenue share of MNEs in a region will rise as the number of MNEs entering that region increases. Regional population can predict the number of entry in that region because the number of entrants is determined by location decision of individual foreign firms and they tend to be attracted to regions with a large market size (Head and

other regional capitals (Combes et al. 2008). The growth rate of minimum wages in each region is not included because it is not statistically significant. Note that its inclusion does not affect our results.

[11] See Section 5 for the definition of region.

Mayer 2004). However, note that ΔMNE_{rt} predicted by the current population is likely correlated with the current business shocks. By contrast, because of social disorders during the period of the Japanese occupation (1942-1945) and the following Indonesian war of independence (1945-1949), the current business shocks do not likely have any effects on the regional distribution of population in the pre-war period (Van der Eng 2002). In other words, after controlling for local permancent characteristics by including regional and firm control variables as covariates, ΔMNE_{rt} predicted by regional population in the pre-war period is likely to be exogenous to the current business shocks in the region. Following Combes et al. (2008), we use the log of population in multiple years (1920 and 1930) so that they can capture both the past level and the historical growth rates of population in each region.

4.2 FDI's impact on aggregate productivity growth

The entry of MNEs contributes to aggregate productivity growth of Indonesian manufacturing through two channels: externality and reallocation of workers from low- to high-performance firms. To quantify the relative impact of each channel to aggregate productivity growth, we employ a method developed by Petrin and Levinsohn (2012).

First, define aggregate productivity growth rates (APG) from $t = 1$ to $t = 2$ as:

$$APG = \sum_i \bar{D}_{ijrt} \Delta \ln VA_{ijrt} - \sum_i \sum_l \bar{D}_{ijrt} \bar{s}^l_{ijrt} \Delta \ln X^l_{ijrt}, \quad (3)$$

where, VA_{ijrt} is value-added of firm i at period t and X^l_{ijrt} denotes the amount of l-th primary input such as skilled ($l = S$) and unskilled ($l = U$) workers and capital ($l = K$). $D_{ijrt}\left(= VA_{ijrt}/VA_t\right)$ represents the Domar weight; $s^l_{ijrt}\left(= P^l_{ijrt}X^l_{ijrt}/VA_{ijrt}\right)$ is the value-added share of the cost of l-th input; and $\bar{}$ denotes the average of $t = 1$ and $t = 2$. Equation (3) indicates that aggregate productivity growth is obtained as a weighted sum of the Solow residual of individual firms using the share of each firm's value-added in the manufacturing sector's value-added as the weight. Note that the industry-level value-added in the Domar weight (VA_t) is the sum of value-added of any firms – continuing, entering, and exiting local and foreign-affiliated firms – in the manufacturing sector, while i in Equation

(3) refers to continuing local firms only. Because the Solow residual is aggregated over continuing local firms in Equation (3), the obtained productivity growth rate measures the contribution (in levels) of continuing local firms to the overall productivity growth rate in Indonesian manufacturing.[12]

Next, consider the following Cobb-Douglas value-added production function:

$$\ln VA_{ijrt} = \beta_S \ln L^S_{ijrt} + \beta_U \ln L^U_{ijrt} + \beta_K \ln K_{ijrt} + \ln \omega_{ijrt}. \quad (4)$$

Then, by substituting $\ln VA_{ijrt}$ in Equation (3) with Equation (4), we can rewrite Equation (3) as:

$$APG = \sum_i \overline{D}_{ijrt} \Delta \ln \omega_{ijrt} + \sum_i \overline{D}_{ijrt} \sum_l (\beta_l - \bar{s}^l_{ijrt}) \Delta \ln X^l_{ijrt}, \quad (5)$$

where, β_l is the parameter on l-th input in Equation (4). The first term in Equation (5) is the weighted average of productivity growth rates of individual firms. This captures externality effects on aggregate productivity growth. The second term represents the contribution of resource reallocation. $\beta_l - \bar{s}^l_{ijrt}$ in the parenthesis reflects the gap between the value of marginal product of l-th input and its price. The gap is zero under perfect competition but not zero in the presence of imperfect competition or frictions in factor markets. In the latter case, firms with a positive (negative) marginal product-input cost gap can improve productivity by increasing (reducing) their input use. Therefore, reallocation of workers from negative- to positive-gap firms leads to aggregate productivity growth. Suppose, for example, in the face of severe competition with MNEs, every local firm decreases its employment but local firms with a negative gap reduce the employment more than do local firms with a positive gap. Aggregate productivity rises if the overall enhancement in productivity among local firms with a negative gap exceeds the overall decline in productivity among local firms with a positive gap.

Consequently, Equation (5) enables us to quantify the relative contribution of externality effects and resource reallocation to aggregate productivity growth. In so doing, we

[12] Technically, the contribution of entering and exiting local firms can be evaluated by extending Equation (5). However, since observations in our dataset are restricted to those with 20 employees or more, it is difficult to precisely identify those firms. Thus, the contributions from those firms are not examined here.

consider a counterfactual case where every region experiences an increase in ΔMNE_{rt} by its sample mean ($\overline{\Delta MNE_{rt}}$), holding other factors constant. Then, the predicted changes in skilled and unskilled employment and productivity of local firms are:[13]

$$(6) \qquad \Delta \widehat{\ln Y_{ijrt}} = \left(\widehat{\beta_1} + \widehat{\beta_2} Z_{ijrt-1}\right)\overline{\Delta MNE_{rt}},$$

where, Y_{ijrt} denotes L^S_{ijrt}, L^U_{ijrt}, and ω_{ijrt}. By substituting $\Delta \ln \omega_{ijrt}$ and $\Delta \ln X^l_{ijrt}$ in the right-hand side of Equation (5) with Equation (6), we can evaluate how much externality and reallocation of skilled and unskilled workers enhance aggregate productivity in Indonesian manufacturing.

5. 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 is 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, electricity, and energy inputs, and labor costs for each type of workers. Value-added 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 asset deflated by the price index for gross fixed capital formation in Indonesia's System of National Accounts. Capital stock in the following periods is constructed by the perpetual inventory method assuming a depreciation rate of 9 percent (Brandt et al. 2012). Plant-level wages are estimated by dividing labor costs adjusted by the consumer price index with the number of workers. We exclude as outliers plants whose revenue, number of workers, intermediate inputs, capital

[13] The contribution of capital reallocation to aggregate productivity growth is not considered here because we do not have good data to estimate the value-added share of capital expenditure.

stock, or wages lie in the top or bottom one percent in each industry.

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.[14] This yields 15 regions in total. Next, industry is defined based on the 3-digit International Standard Industrial Classification (ISIC) Revision 3.[15] Lastly, following Blalock and Gertler (2009), we define MNEs as firms whose foreign capital share is greater than 20 percent.[16] However, the results essentially do not change if we increase the threshold to 50 percent.

Productivity is obtained by estimating Equation (4) for each 2-digit ISIC industry. We estimate production function using a methodology proposed by Ackerberg et al. (2015, hereafter ACF), who 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.[17] Following ACF, we obtain the 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, but we confirm the robustness of our results to the use of the other measure. Since the obtained productivity is not comparable across industries, we take the deviation from industry average in the estimation.

Our sample period is divided into two sub-periods: 2001-2005 and 2006-2010;[18] all

[14] These islands or archipelagos are the Lesser Sunda Islands, Kalimantan, Sulawesi, and the Maluku Islands and Western New Guinea.
[15] Some plants switch from one industry to another during sample periods; the overall switching rate is around 5 percent. Although industry-switching behavior is an interesting issue, we assign to each plant the industry classification to which a plant belongs most frequently during sample periods.
[16] According to Blalock and Gertler (2009), the samples of foreign affiliated firms obtained under this definition are mostly equivalent to those doing business under the foreign capital investment licenses in Indonesia.
[17] We use the Stata code used in De Loecker and Warzynski (2012) for the production function estimation.
[18] We do not examine the impact of annual changes in MNE_{rt} on annual changes in $\ln Y_{ijrt}$ in the following reasons. First, as Figure 1 shows, we observe a significant jump in inward FDI from the first to

plant-level variables are averaged over each sub-period.[19] As for productivity, we first estimate Equation (4) using annual data and then, the obtained productivity is averaged over each sub-period. To deal with outliers, plants are excluded if their growth rates in workers, productivity, or wages from $t = 1$ to $t = 2$ are in the top or bottom one percent of the distribution for each industry. We also exclude industry-region pairs in which the number of continuing local plants is fewer than 10 in each sub-period to assure adequate competition in the labor and product markets. See Table 3 for summary statistics of variables.

== Table 3 ==

The data sources for regional-level variables are as follows. Regional population in the pre-war period is taken from the first and second *Population Census* in 1920 and 1930 by the Dutch colonial government (Boomgaard and Gooszen 1991). GDP share of the mining and quarrying sector by region is obtained from *Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin* published by BPS. Finally, average years of education by region in 2005 comes from the *Human Development Report* by BPS.

6. Estimation results

6.1 Employment growth model

Table 4 shows the estimation results of the employment growth model (Equation 1). Overall, the entry of MNEs has the negative impact on employment in local firms. However, since the interaction terms are positive and significant, FDI's impact differs across firms depending on their productivity and KL ratio. High-productivity firms can mitigate the negative impact of inward FDI (columns 1 to 3). Furthermore, capital-intensive firms, i.e., those with high KL ratio, are less likely to reduce skill-intensity (column 4). In other words, substitutability between skilled and unskilled workers is low for firms with high KL ratio, indicating the

the second half of 2000s, which provides an interesting case to study the labor market impacts of inward FDI. Second, we set a five-year interval in case reallocation takes significant time. Third, because our instrument has only cross-sectional variation, it cannot account for time-series variation in ΔMNE_{rt}.

[19] To control for the effect of the 2008 financial crisis, we repeated the same estimation by excluding the sample in 2009 and confirmed that the results were essentially the same.

complementarity between capital and skilled workers. Marginal effects of inward FDI on employment for each firm are evaluated according to Equation (2). The bottom of Table 4 shows that total employment increases in 52 percent of local firms. However, there is a sharp contrast between skilled and unskilled workers. In response to a rise in inward FDI, the number of unskilled workers increases in 61 percent of local firms (column 2), while skilled employment increases in 36 percent of the firms (column 3). As a result, the ratio of skilled to unskilled employment rises in only 6 percent of firms (column 4). These results suggest that externality effects from inward FDI contributes to the creation of unskilled employment. However, since crowding-out effects amplified by distributional effects outweigh externality effects for skilled workers, local firms reduce skilled employment and skill intensity.

== Table 4 ==

Next, we consider the role of international trade on skill intensity. This topic has been extensively discussed in the field of international trade. For example, Amiti and Cameron (2012) find that because intermediate inputs production is more skill-intensive when compared with conventional goods production in Indonesia, a reduction in input tariffs induces local firms, especially those importing inputs, to shift their production toward unskilled-intensive goods. As a result, the relative demand for skilled workers declines. In contrast, Kasahara et al. (2016) demonstrate that the use of foreign intermediate goods encourages local Indonesian firms to adopt skill-biased technology, increasing the relative demand for skilled workers. Besides importing intermediate goods, exporting activities can affect the relative demand, too. Firms in developed countries tend to outsource skill-intensive activities from a developing country's perspective (Feenstra and Hanson 1997) and thus, outsourcing increases skill intensity of local firms in developing countries, producing and exporting outsourced products.

To control for the effects of international trade on employment growth and skill intensity, we include in Equation (1) two dummy variables. One takes the value one if firm i starts to import intermediate goods at period $t = 2$ and the other takes the value one if firm i starts to export its products at period $t = 2$. Columns (5) to (7) of Table 4 show that both

variables have the positive impact on skilled and unskilled employment. Hence, local firms starting to import intermediate goods or to export their products tend to have higher employment growth than others. Quantitatively, skilled employment increases more than unskilled employment, implying that both importing and exporting opportunities enhance skill intensity of local firms, but the differences are not statistically significant (column 8). Most importantly, the inclusion of these dummy variables does not affect the statistical significance of parameters on ΔMNE_{rt} and its interactions terms. Moreover, it scarcely changes the number of firms that have positive marginal effects with respect to inward FDI.

6.2 Productivity growth model

Table 5 presents externality effects of inward FDI on productivity of local firms. A positive and statistically significant sign on ΔMNE_{rt} in column (1) implies that local firms receive externality benefits from MNEs. Negative signs on its interaction terms indicate that lower-productivity firms with lower KL ratio can enhance productivity more, suggesting that externality effects enable low-productivity firms to catch up to high-productivity counterparts. The bottom of Table 5 shows that externality effects increase productivity for most of the local firms. In column (2), the employment ratio between skilled and unskilled workers at $t-1$ ($L^S_{ijrt-1}/L^U_{ijrt-1}$) is introduced as an interaction term with ΔMNE_{rt}. A positive and significant sign on the variable indicates that local firms employing relatively more skilled workers tend to have higher capacity to absorb externality from MNEs.[20] This finding stresses the importance for local firms to adopt knowledge-intensive production to maximize externality benefits. However, as columns (4) and (8) of Table 4 show, inward FDI exerts the opposite effect on the employment ratio between skilled and unskilled workers. Consequently, externality effects from MNEs will decrease by the extent to which inward FDI reduces the absorptive capacity of local firms.

== Table 5 ==

[20] These findings – catch-up effects of and absorptive capacity for FDI spillovers – are consistent with Blalock and Gertler (2009).

6.3 Sources of aggregate productivity growth

As Table 4 indicates, FDI's impact on employment is heterogeneous across firms: low-productivity local firms with low KL ratio reduce both skilled and unskilled employment more than high-productivity counterparts with high KL ratio. Stated differently, inward FDI induces reallocation of workers from the former to the latter firms. In addition, the entry of MNEs improves the productivity of local firms through externality effects. In the following, using the results from columns (2) and (3) of Table 4 and column (2) of Table 5 and supposing that every region experiences an increase in ΔMNE_{rt} by its sample mean, we quantify to what extent externality effects and reallocation of workers improve aggregate productivity growth of Indonesian manufacturing.

As explained in the previous section, resource reallocation contributes to aggregate productivity growth if workers are reallocated from firms with a negative marginal product-input cost gap to firms with a positive gap. To examine if such reallocation is observed in our case, Figure 2 decomposes the reallocation term in Equation (5), i.e., $\left(\beta_l - \bar{s}_{ijrt}^l\right)\Delta \ln X_{ijrt}^l$, into two components: the growth rates of skilled and unskilled workers ($\Delta \ln X_{ijrt}^l$) and the corresponding marginal product-input cost gaps ($\beta_l - \bar{s}_{ijrt}^l$). Both panels show that the greater the employment growth rates, the larger the gaps. Consequently, inward FDI likely induces reallocation of both skilled and unskilled employment from small- to large-gap firms. However, a comparison between panels indicates that marginal product-input cost gaps for unskilled workers take both negative and positive values, while the gaps for skilled workers are mostly concentrated in the positive range. This implies that the current level of skilled employment is below the optimal level for most of the local firms and a reduction in skilled workers causes a decrease in productivity for them. Thus, even if reallocation of workers takes place, there should be less room for productivity improvement through the reallocation of skilled workers than through the reallocation of unskilled workers.

== Figure 2 ==

Table 6 presents the quantitative contribution of externality and reallocation effects

to aggregate productivity growth in our counterfactual case (Equation 5). When every region experiences an increase in ΔMNE_{rt} by its sample mean, the industry-level productivity growth rate rises by 0.55 percentage point. Externality and reallocation of workers respectively contribute 0.31 and 0.24 (= 0.16 + 0.08) percentage points to aggregate productivity growth. Overall, reallocation of workers significantly enhances industry-levle productivity. However, as Figure 2 indicates, compared to the reallocation of unskilled workers, the reallocation of skilled worker does not contribute much to productivity growth.

== Table 6 ==

6.4 Extension: wage growth model

Thus far, we have focused on the identification of FDI's impact on employment and productivity of individual local firms and on overall productivity growth of the manufacturing sector. As discussed in the Introduction, examining its impact on the wages does not help us to conclude which of externality effects and crowding-out effects have the dominant impact in the local labor market. However, if inward FDI intensifies competition in local labor markets, especially for skilled workers, we should observe an increase in local wages for both skilled and unskilled workers and the relative wages of skilled workers.

In Table 7, we evaluate FDI's impact on the wage growth rates for all, skilled, and unskilled workers. Column (1) shows that local wages rise as the revenue share 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 ones, raising the relative wages of skilled workers (column 4). These results are consistent with what crowding-out effects predict in the presence of the distributional effects of FDI. However, as firm-level wages are used in Table 7, one may argue that wage growth reflects the skill upgrading, in terms of educational attainment, of workers within firms. For instance, to be competitive against MNEs, local firms may increase the number of workers with the higher level of education. To address this concern, in columns (5) to (8), we include changes in the share of university- or high school-graduates in skilled

or unskilled workers.[21] Column (5) indicates that wages rise as local firms increase the share of university graduates in skilled workers or the share of university- or high-school graduates in unskilled workers.[22] This finding holds even if we estimate the model individually for skilled and unskilled workers (columns 6 and 7). Therefore, firm-level wage growth certainly reflects skill upgrading of individual workers within firms. However, although the size of coefficients on ΔMNE_{rt} becomes smaller, they remain positive and significant even after controlling for workers' educational attainment, providing results consistent with distributional effects.

== Table 7 ==

7. Summary and conclusions

MNEs are expected to bring advanced technology and create considerable job opportunities in the host economy and thus, attracting MNEs becomes an important development strategy for developing countries. Besides such direct impact, technology spillovers from and demand creation by MNEs can contribute to the development of local small and medium-sized enterprises. Previous studies have thus mainly focused on identifying these externality effects on the productivity and wages of local firms. However, due to their size and productivity, the entry of MNEs should intensify competition in labor and product markets, which leads to crowding-out of local firms from the markets. If the crowding-out effects outweigh the externality effects, the entry of MNEs decreases employment in local firms.

Consequently, whether or not inward FDI contributes to the creation of employment by local firms must be evaluated empirically. We address this issue by incorporating distributional effects of inward FDI: by widening the wage gap between skilled and unskilled workers, distributional effects strengthen crowding-out effects in labor market for skilled

[21] Because this information is only available in 1996 and 2006, firms existing in both years are the subjects of this robustness check. The underlying assumption here is that the changes observed between 1996 and 2006 can be used as a proxy for the corresponding changes from $t = 1$ to $t = 2$.
[22] Interestingly, these three types of workers exactly match the definition of skilled workers used by Kasahara et al. (2016) in their study on Indonesian manufacturing.

workers. Indeed, employing microdata from Indonesia, this study highlights the role of distributional effects in characterizing employment growth patterns of local firms. Externality effects induce local firms to expand production, but local firms do so by mostly employing unskilled workers because wages for skilled workers rise more rapidly than wages for unskilled counterparts. As a result, skill intensity of local firms declines.

In conclusion, we confirm the effectiveness of FDI attraction policies on the development of local firms: externality effects can create unskilled jobs by enhancing productivity of local firms and the reallocation of unskilled workers contributes to industry-level productivity growth. However, our results also point out that the skill gaps emerging in Indonesia may limit the effectiveness of the policies. For example, if inward FDI leads to a significant reduction in skill intensity of local firms, their capacity to absorb externality from MNEs will decrease accordingly. Furthermore, even if inward FDI induces reallocation of workers, the reallocation of skilled workers will have limited impact on aggregate productivity growth as long as the level of skilled employment is below the optimal level for most firms. These findings suggest that the steady and adequate supply of skilled workers is key to further growth of Indonesian manufacturing.

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Table 1. Educational Attainment in Indonesia and Neighboring Countries

	2000	2005	2010
Indonesia			
Population share of university graduates	1.8	2.9	5.0
GDP per capita	2144	2524	3122
China			
Population share of university graduates	2.9	2.7	2.4
GDP per capita	1768	2732	4550
Malaysia			
Population share of university graduates	3.1	4.4	5.9
GDP per capita	7007	7974	9041
Philippines			
Population share of university graduates	8.0	7.7	7.2
GDP per capita	1607	1817	2124
Thailand			
Population share of university graduates	4.4	10.4	10.0
GDP per capita	3458	4338	5076
Vietnam			
Population share of university graduates	2.5	3.5	4.6
GDP per capita	765	1018	1318

Unit: Percent and constant 2010 USD.
Source: Barro and Lee (2013).
World Bank, World Development Indicators.

Table 2. Characteristics of MNEs and Local Firms in Indonesia

	(1) Total employment	(2) Wages for all workers	(3) Wages for production workers	(4) Wages for non-production workers	(5) Skill intensity	(6) Export ratio
Simple average						
1) Local firms	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***	3.805***	28.68***
4) Industry & Island FE	1.266***	0.439***	0.352***	0.454***	3.825***	28.83***
5) Industry & Island FE & size control		0.241***	0.172***	0.268***	1.966***	19.90***

Unit: Person, thousand rupiah, and percent.
Note: MNEs are defined as firms whose foreign capital share is greater than 20%. *** represents the statistical significance at 1%. Rows 3) to 5) are obtained by regressing firm-level variables in (1) to (6) on fixed effects and the log of total employment. We take the log of total employment and wages in the regression analyses presented in columns (1) to (4).
Source: BPS, Annual Survey of Medium and Large Manufacturing Establishment, 2006.

Table 3. Summary Statistics

Variable	Mean	Std. deviation
Wage growth rate for all workers ($\Delta \ln w_{ijrt}^{S+U}$)	0.116	0.377
Wage growth rate for unskilled workers ($\Delta \ln w_{ijrt}^{U}$)	0.134	0.417
Wage growth rate for skilled workers ($\Delta \ln w_{ijrt}^{S}$)	0.086	0.653
Growth rate of total employment ($\Delta \ln\left(L_{ijrt}^{S} + L_{ijrt}^{U}\right)$)	-0.045	0.346
Growth rate of unskilled employment ($\Delta \ln L_{ijrt}^{U}$)	-0.070	0.388
Growth rate of skilled employment ($\Delta \ln L_{ijrt}^{S}$)	0.055	0.616
Change in the revenue share of MNEs (ΔMNE_{rt})	0.040	0.179

Sources: BPS, Annual Survey of Medium and Large Manufacturing Establishment, 2001-2010.

Table 4. FDI's Impact on Employment in Local Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Growth rate of							
Variable	Total employment	Unskilled employment	Skilled employment	Ratio of skilled to unskilled employment	Total employment	Unskilled employment	Skilled employment	Ratio of skilled to unskilled employment
ΔMNE_{rt}	-2.414***	-2.078***	-4.061***	-1.983**	-2.357***	-2.018***	-4.055***	-2.037**
	(0.614)	(0.592)	(1.039)	(0.779)	(0.738)	(0.714)	(1.249)	(0.990)
$\Delta MNE_{rt} \times \ln \omega_{ijrt-1}$	0.575***	0.548***	0.671***	0.123	0.671***	0.640***	0.864***	0.224
	(0.120)	(0.141)	(0.169)	(0.218)	(0.150)	(0.183)	(0.215)	(0.292)
$\Delta MNE_{rt} \times \ln KL_{ijrt-1}$	0.262***	0.238***	0.407***	0.169**	0.259***	0.235***	0.415***	0.180*
	(0.0621)	(0.0600)	(0.102)	(0.0741)	(0.0754)	(0.0730)	(0.124)	(0.0967)
Start importing inputs					0.0769***	0.0769***	0.117***	0.0402
					(0.0212)	(0.0240)	(0.0302)	(0.0358)
Start exporting products					0.0818***	0.0710***	0.118***	0.0473
					(0.0226)	(0.0233)	(0.0368)	(0.0372)
Kleibergen-Paap F	13.88	13.88	13.88	13.88	14.56	14.56	14.56	14.56
Hansen J (p-value)	0.0801	0.226	0.239	0.708	0.0837	0.297	0.214	0.547
Observations	9,976	9,976	9,976	9,976	8,293	8,293	8,293	8,293
Firms with positive marginal effects w.r.t. ΔMNE_{rt}	5220	6127	3616	617	4143	4871	3115	902
	52%	61%	36%	6%	50%	59%	38%	11%

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.

Table 5. FDI's Impact on Productivity of Local Firms

	(1)	(2)
Variable	Growth rate of TFP	
ΔMNE_{rt}	3.292***	3.255***
	(0.909)	(0.912)
$\Delta MNE_{rt} \times \ln \omega_{ijrt-1}$	-2.851**	-2.825**
	(1.138)	(1.125)
$\Delta MNE_{rt} \times \ln KL_{ijrt-1}$	-0.200**	-0.212**
	(0.0891)	(0.0891)
$\Delta MNE_{rt} \times L^{S}_{ijrt-1}/L^{U}_{ijrt-1}$		0.618*
		(0.357)
Kleibergen-Paap F	17.06	13.77
Hansen J (p-value)	0.115	0.108
Observations	9,976	9,976
Firms with positive marginal effects w.r.t. ΔMNE_{rt}	7823	7802
	78%	78%

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 productivity, and industry and island fixed effects are included in all specifications.

Table 6. Sources of Aggregate Productivity Growth in Indonesian Manufacturing

If ΔMNE_{rt} increases by its sample mean in each region	Growth rate (%)	Contribution
Aggregate productivity growth	0.55	
Externality	0.31	57%
Reallocation of		
Unskilled workers	0.16	30%
Skilled workers	0.08	14%

Note: Table shows the portion (in levels) of aggregate productivity growth rates in Indonesian manufacturing attributed to local firms operating in both sub-periods. The values indicate how much productivity grows if ΔMNE_{rt} increases by its sample mean in each region, holding other factors constant.

Table 7. FDI's Impact on Wages of Local Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Growth rate of							
Variable	Wages for all workers	Wages for unskilled workers	Wages for skilled workers	Skilled-unskilled wage ratio	Wages for all workers	Wages for unskilled workers	Wages for skilled workers	Skilled-unskilled wage ratio
ΔMNE_{rt}	0.503***	0.403***	0.802***	0.399*	0.373***	0.241***	0.789***	0.519***
	(0.108)	(0.125)	(0.189)	(0.204)	(0.0834)	(0.0857)	(0.136)	(0.117)
Changes in the share of high-school graduates in unskilled workers					0.0704***	0.0561***		0.0438*
					(0.0159)	(0.0168)		(0.0231)
Changes in the share of university graduates in unskilled workers					0.538**	0.936***		-0.846**
					(0.225)	(0.208)		(0.386)
Changes in the share of high-school graduates in skilled workers					-0.0188		0.00773	0.0225
					(0.0120)		(0.0207)	(0.0201)
Changes in the share of university graduates in skilled workers					0.0413*		0.213***	0.185***
					(0.0238)		(0.0410)	(0.0401)
Kleibergen-Paap F	18.15	18.15	18.15	18.15	10.89	10.90	10.80	10.89
Hansen J (p-value)	0.0364	0.00602	0.538	0.155	0.252	0.0742	0.223	0.934
Observations	9,976	9,976	9,976	9,976	5,286	5,286	5,286	5,286

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, and industry and island fixed effects are included in all specifications.

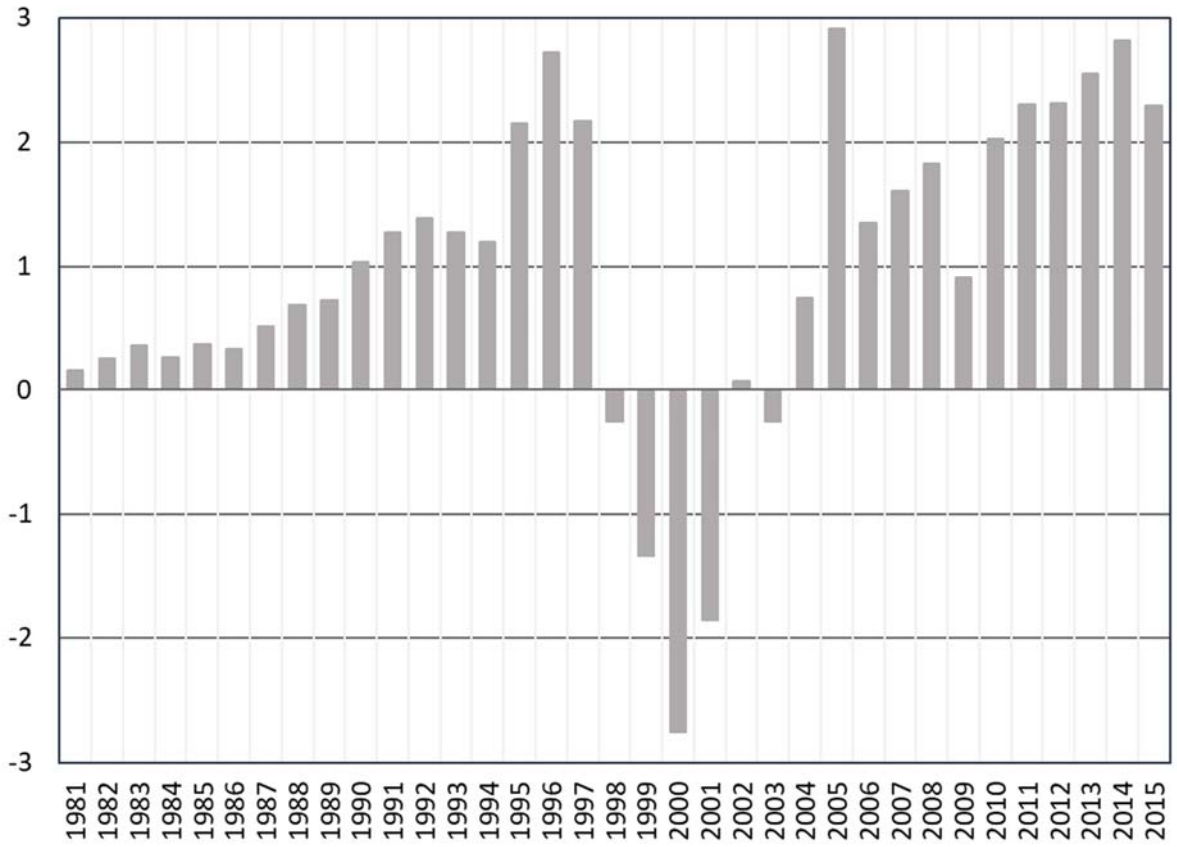

Figure 1. FDI Net Inflows as a Share of GDP in Indonesia

Unit: Percent.
Source: World Bank, World Development Indicators.

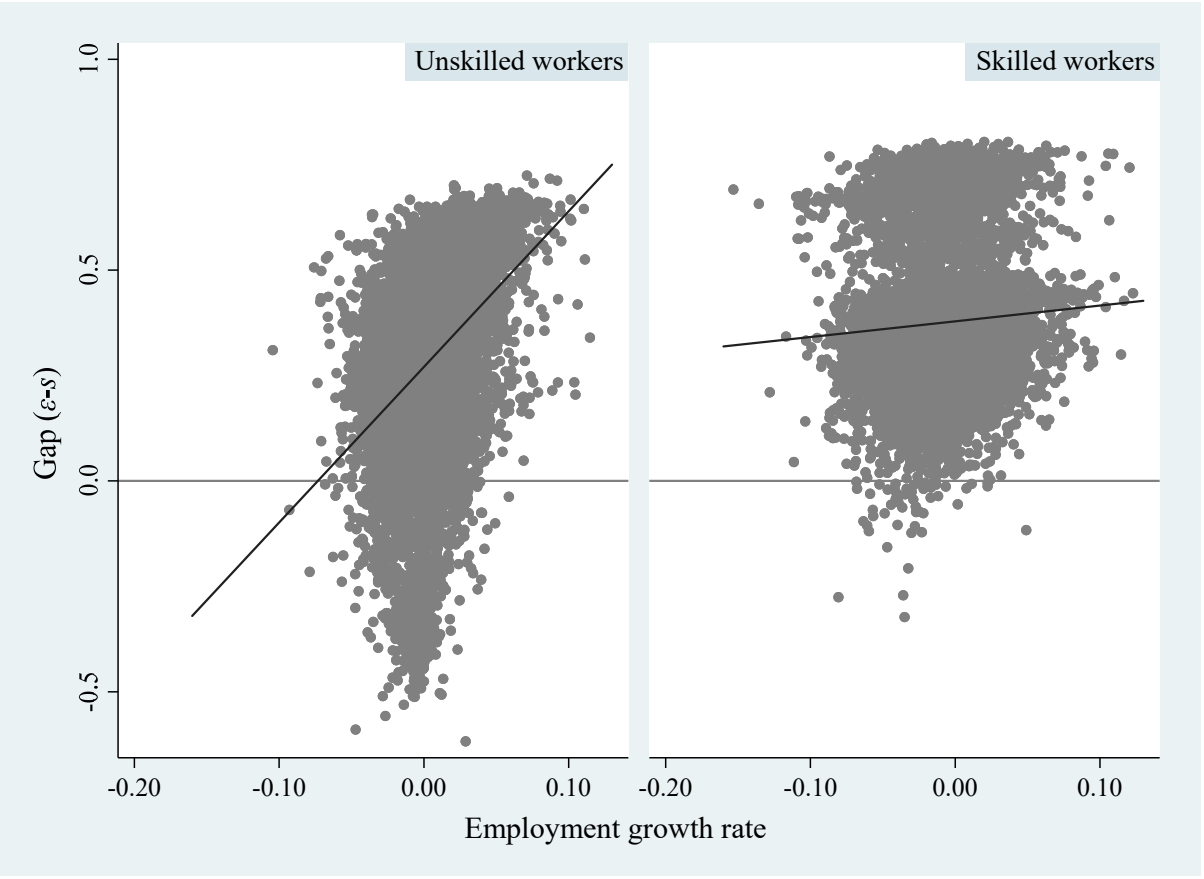

Figure 2. Employment Growth Rate and Marginal Product-Wage Gap