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

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Abstract

Inward FDI contributes to employment creation by local firms through externality effects. However, because labor demand of MNEs is biased toward skilled workers, local firms have incentive to replace skilled workers with unskilled ones. Employing microdata from Indonesian manufacturing, this study shows that entry of MNEs causes a decline in skill intensity of local firms. The results further indicate that inward FDI can improve aggregate productivity of the economy by inducing reallocation of workers across local firms. However, due to the lack of skilled workers among local firms, their reallocation does not contribute much to aggregate productivity growth.

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

Foreign direct investment (FDI) introduces advanced technology and capital-intensive production into developing countries. Empirical evidence suggests 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 indirectly contributes to the development of local small and medium enterprises through technology spillovers and demand creation. While empirical evidence of these externality effects on wages and productivity of local firms has accumulated (e.g., Blalock and Gertler 2008; Jovorcik 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 thus, should increase labor demand of local firms. However, because of their size and productivity, entry of multinational enterprises (MNEs) may crowd out 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, facing severe product-market competition against MNEs, local firms decrease their production and employment.

In sum, both externality effects and crowding-out effects in labor market predict wage growth, but they have the opposite impact on employment: if crowding-out effects outweigh (are outweighed by) externality effects, employment declines (increases). Therefore, examining FDI's impact on wages or productivity alone does not allow us to assess its impact on employment in local firms. In other words, whether inward FDI contributes to employment creation 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 Czech Republic and China, respectively. However, they do not consider skill differences between workers. Prior literature argues that 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.

Employing microdata from Indonesia, this study evaluates FDI's impact on wages and employment of skilled and unskilled workers in local firms separately. Our results are consistent with the distributional hypothesis: by enlarging the wage gap between skilled and unskilled workers, inward FDI has the negative (positive) impact on skilled (unskilled) employment for most local firms. Nevertheless, because the increase in unskilled workers more than offsets the reduction in skilled workers, half of the firms increase the total number of workers as in Dinga and Münich (2010) and Karlsson et al. (2009).

This finding has implication for governments in middle-income countries. In general, firms in developing countries engage in unskilled-intensive production. Expansion of that kind of production increases demand for unskilled workers and lifts their wages. In middle-income countries like Indonesia, however, unskilled-intensive output expansion is inadequate to maintain its 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). Our results – inward FDI lowers skill intensity of local firms – suggest that if the supply of skilled workers is inadequate, attracting MNEs will retard the transition of local firms to skill-intensive production. This likely reduces their innovation potential and the long-run productivity growth in Indonesian manufacturing.

Another implication of distributional effects is their impact on industry-level productivity growth. Empirical studies have traditionally focused on the role of externality on innovation and productivity growth. By contrast, recent firm-level studies emphasize the role of resource reallocation (Baily et al. 1992; Grilliches and Regev 1995; Foster et al. 2001). Fierce market competition due to trade liberalization and inward FDI fosters productivity

growth by inducing reallocation of production factors from low- to high-performance firms within industries (Alfaro and Chen 2018; Pavcnik 2002).

However, because of distributional effects, FDI's impact on labor market competition is different between skilled and unskilled workers. This study complements the literature by examining how the level of competition in labor markets affects resource reallocation and productivity growth aggregated at the industry level. For this purpose, we follow Petrin and Levinsohn (2012) in decomposing aggregate productivity growth driven by inward FDI into technical efficiency improvement and reallocation of skilled and unskilled workers. The results confirm more substantial reallocation of skilled workers than unskilled workers, but the lack of skilled workers among local firms partly offset productivity gains from reallocation. Consequently, the reallocation of skilled workers makes a much smaller contribution to aggregate productivity than the reallocation of unskilled workers.

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 empirical methodology. Section 5 describes the data and variable construction. Section 6 presents 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, those 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 includes technology spillovers from MNEs that improve 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. Moreover, spillovers can be

a source of skill-biased technology change (Saito and Gopinath 2011). For example, Blalock and Gertler (2009) find that local firms in Indonesia can enhance spillover benefits from MNEs by increasing their skill intensity. Besides spillovers, demand creation effects, or backward linkage effects, are also categorized into externality effects. 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 crowds 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 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 in labor market for skilled workers. Facing 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

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

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 wages and 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.

Next, to link the firm-level growth rates of skilled and unskilled employment with industry-level productivity growth, we apply a decomposition method developed by Petrin and Levinsohn (2012). 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] Petrin and Levinsohn (2012) argue that if inputs are reallocated from low- to high-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 low- to high-gap firms. As illustrated above, the direction of reallocation is determined according to firm characteristics such as productivity and capital intensity, but these 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 reallocation differs between skilled and unskilled workers.

3. Inward FDI into Indonesia

Traditionally, Indonesian economy was based on agriculture and mining. It became lower middle-income country in 1979, but a sharp decline in oil prices in early 1980s urged the government to diversify its economic structure. The government adopted export-oriented

[2] Kosová (2010) compares the impact of these two on production. Because of crowding-out effects, 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 gaps and deteriorates overall allocative efficiency in the manufacturing sector.

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 the subsequent political turmoil from 1998 to 2004, we observe the upward trend of inward FDI into Indonesia. Therefore, a key for Indonesian economy to become an upper middle-income country is whether the attracted MNEs contribute to industry development in the nation. 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 affects the employment dynamics of local firms.

== Figure 1 ==

Next, Table 1 compares the basic characteristics of MNEs and local firms, obtained from *Annual Survey of Medium and Large Manufacturing Establishment*.[4] 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 total number of workers in MNEs is on average four times greater than local firms, implying that even if the number of MNEs is smaller than local firms, their entry should have a considerable impact on local labor market. Moreover, we find from column (2) that average MNEs pay higher wages than local firms. To see the differences between 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 R&D. Columns (3) and (4) indicate that regardless

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

of the type of workers, average wages are higher in MNEs than in local firms.

However, comparison between columns (3) and (4) 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 production workers.[5] Based on these findings, we regard production and non-production workers as unskilled and skilled ones, respectively.[6] Given the definitions of skilled and unskilled workers, column (5) shows MNEs, on average, have higher skill intensity – share of skilled workers to total employment – than local firms as expected. Hence, entry of MNEs very likely exerts distributional effects in local labor market. 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 process 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 local firms. However, since the majority of their production is still destined for sales in domestic market, we expect that entry of MNEs should have a pro-competitive effect in local product market.

== Table 1 ==

In summary, the above findings suggest that inward FDI should have 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 employment dynamics of local Indonesian firms.

[5] Shares of non-production workers who complete university and high-school are 9.5 and 65.5 percent, respectively. The corresponding shares for production workers are 0.5 and 41.0 percent, respectively.
[6] The classification based on occupation is common in 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 into skilled and unskilled ones.

4. Empirical methodology

4.1 FDI's impact on wages and employment

We first examine how entry of MNE affects market wages and productivity of local firms by estimating the following wage and productivity growth model:

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

where, Δ measures the changes from period $t = 1$ to $t = 2$ ($t = 1$ for 2001-2005 and $t = 2$ for 2006-2010). W_{ijrt} denotes wages for skilled workers (w_{ijrt}^{S}), unskilled workers (w_{ijrt}^{U}), or all workers (w_{ijrt}^{S+U}), the wage ratio between skilled and unskilled workers ($w_{ijrt}^{S}/w_{ijrt}^{U}$), or productivity ($\omega_{ijrt}$) of firm i in industry j and region r at period t.

MNE_{rt} represents the number of MNEs in region r. The number of MNEs, not their output or employment share, is used here because the latter is the outcome of product or labor market competition and its use causes the simultaneity problem in the estimation. See the end of this subsection for the identification issue. Many previous studies also disaggregate MNE_{rt} by industry to isolate, for example, demand creation effects of backward FDI or pro-competitive effects of horizontal FDI. By contrast, because our main interest lies in crowding-out effects in labor market, we do not disaggregate it by industry so that it can capture labor demand from all MNEs regardless of their industry.

H_{rt-1} represents regional characteristics that will affect labor market such as the GDP share of mining and quarrying sector, geographical remoteness, and the average years of education received by local residents aged 25 and older at period $t - 1$.[7] δ_R, δ_j, and ε_{ijrt} are island and industry fixed effects and disturbances, respectively.[8]

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

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

where, L_{ijrt} is the number of skilled workers (L_{ijrt}^{S}) or unskilled workers (L_{ijrt}^{U}), total

[7] Geographical remoteness index measures the average distance from the capital of r-th region to all other regional capitals (Combes et al. 2008).
[8] See Section 5 for the definition of region.

employment ($L^S_{ijrt} + L^U_{ijrt}$), or the employment ratio between skilled and unskilled workers (L^S_{ijrt}/L^U_{ijrt}) of firm i at period t. To allow for the heterogenous impact of FDI on employment across firms, we introduce interaction terms between ΔMNE_{rt} and firm characteristics (Z_{ijrt-1}) such as productivity (ω_{ijrt-1}) and capital-labor (KL) ratio of firm i at period $t-1$.[9]

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

$$(3) \qquad \frac{\partial \ln \Delta L_{ijrt}}{\partial \Delta MNE_{rt}} = \beta_1 + \beta_2 Z_{ijrt-1}.$$

To identify externality effects, previous studies estimate Equation (1) with wages or productivity as a regressand. They interpret $\gamma_1 > 0$ as support for externality effects. However, discussion so far argues that $\gamma_1 > 0$ can be observed even when entry of MNEs intensifies labor market competition. Thus, we cannot conclude which channel – externality effects or crowding-out effects – dominates from Equation (1) alone. In Equation (2), on the other hand, we expect $\partial \Delta \ln L_{ijrt}/\partial \Delta MNE_{rt} > 0\ (< 0)$ if externality effects dominate (are dominated by) crowding-out effects in labor and product markets. Hence, by estimating both Equations (1) and (2), we can compare the relative impact of each channel on local labor market.

Two comments are in order. First, by counting the number of MNEs by region, we implicitly assume that externality effects are localized, and labor and product markets are regionally segmented. Previous studies provide partial support for these assumptions. Amiti and Cameron (2007) describe that there are some frictions in labor mobility between regions as residents' ties to the land are strong in Indonesia. More specifically, 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, because of the underdeveloped inter-region transportation infrastructure within and between islands, the flow of goods and knowledge is highly localized (Amiti and Cameron 2007; Blalock and

[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.

Gertler 2008).

Second, the coefficients on ΔMNE_{rt} in Equations (1) and (2) may suffer from the simultaneity bias. Because MNEs invest in regions where they expect strong economic growth, ΔMNE_{rt} and $\Delta \ln W_{ijrt}$ and $\Delta \ln L_{ijrt}$ are likely correlated if wage and employment growth in local firms reflect the current economic situation of the region. To address the endogeneity issue, we use the past population as an instrument (Ciccone and Hall 1996).

By definition, ΔMNE_{rt} is equivalent to the difference between the number of entry and exit of MNEs. Regional population can predict the number of entry in each region because the latter is the outcome of location decision of individual foreign firms and they are attracted to regions with large market size (Head and Mayer 2004). However, the current population, hence, ΔMNE_{rt} predicted by it, 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) (Van der Eng 2002), the current business shocks do not likely have any effects on the regional distribution of population in the pre-war period. In other words, ΔMNE_{rt} predicted by regional population in the pre-war period is not likely correlated with the current shocks that affect $\Delta \ln W_{ijrt}$ and $\Delta \ln L_{ijrt}$ after controlling for regional and firm characteristics. Following Combes et al. (2008), we use the log of population in multiple years (1920, 1930, 1940) 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

After estimating FDI's impact on employment, we assess the aggregate impact of the reallocation of skilled and unskilled workers on the industry-level productivity growth using productivity growth decomposition developed by Petrin and Levinsohn (2012). First, we define aggregate productivity growth rates (APG_G) from $t = 1$ to $t = 2$ as:

(4) $$APG_G = \sum_i \overline{D}_{ijrt} \Delta \ln VA_{ijrt} - \sum_i \sum_l \overline{D}_{ijrt} \bar{s}^l_{ijrt} \Delta \ln X^l_{ijrt},$$

where, VA_{ijrt} is value-added of firm i at period t and X_{ijrt}^{l} denotes the amount of l-th primary input such as skilled and unskilled workers and capital. $D_{ijrt}\left(= VA_{ijrt}/\sum_i VA_{ijrt}\right)$ represents the Domar weight; $s_{ijrt}^{l}\left(= P_{ijrt}^{l}X_{ijrt}^{l}/VA_{ijrt}\right)$ is the value-added share of l-th input; and $\bar{}$ denotes the average of $t = 1$ and $t = 2$. Note that the Domar weight is obtained by adding up value-added of any firms, including continuing, entering, and exiting local and foreign-affiliated firms. In other words, Equation (4) measures the contribution of continuing local firms to the overall productivity growth in Indonesian manufacturing.[10]

If we consider the following Cobb-Douglas value-added production function:

(5) $$\ln VA_{ijrt} = \beta_S \ln L_{ijrt}^{S} + \beta_U \ln L_{ijrt}^{U} + \beta_K \ln K_{ijrt} + \ln \omega_{ijrt},$$

then, by substituting $\ln VA_{ijrt}$ in Equation (4) with Equation (5), we can rewrite Equation (4) as:

(6) $$APG_G = \sum_i \bar{D}_{ijrt} \Delta \ln \omega_{ijrt} + \sum_i \bar{D}_{ijrt} \sum_l \left(\beta_l - \bar{s}_{ijrt}^{l}\right) \Delta \ln X_{ijrt}^{l},$$

where, β_l is the parameter on l-th input in Equation (5).

By substituting $\Delta \ln \omega_{ijrt}$ and $\Delta \ln X_{ijrt}^{l}$ in the right-hand side of Equation (6) with the forecasted values from Equations (1) and (2), we can quantify the relative contributions of externality effects and resource reallocation to aggregate productivity growth. The first term in Equation (6) is the weighted average of productivity growth of individual firms, arising from externality. The second term represents the contribution of resource reallocation. More specifically, $\beta_l - \bar{s}_{ijrt}^{l}$ 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. If the gap is not zero, aggregate productivity grows by reallocating resources from firms with small gaps to those with large gaps. Stated differently, if inward FDI increases (decreases) the employment growth rates in large- (small-) gap firms, resource reallocation positively contributes to

[10] The contributions of entering and exiting local firms are not examined here. Observations in our dataset are restricted to those with 20 employees or more and thus, it is difficult to precisely identify those firms.

aggregate productivity growth.

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 available only for plants with 20 or more employees. This dataset contains production and cost information at 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 System of National Account in Indonesia. Capital stock in the following years 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 cost adjusted by the consumer price index with the number of workers. We exclude as outliers plants whose revenue, the number of workers, intermediate inputs, capital stock, or wages lie in the top or bottom one percent in each industry.

This dataset also reports plant's location, industry classification for its main product, and the share of foreign capital. With regard to the definition of region, following Blalock and Gertler (2008), we use each province as a geographical unit. Indonesia consists of thousands of islands, but most of its economic activities are concentrated in two islands, Java and Sumatra. To ensure enough observations in remote areas, provinces outside Java and Sumatra islands are aggregated at the island or archipelago level.[11] Thus, we have 15 regions

[11] These islands or archipelagos are Lesser Sunda Islands, Kalimantan, Sulawesi, and Maluku Islands and Western New Guinea.

in total. Next, industry is defined at 3-digit ISIC Revision 3 classification.[12] Lastly, following Blalock and Gertler (2009), we define MNEs as firms whose foreign capital share is greater than 20 percent.[13]

Productivity is obtained by estimating Equation (5) for each 2-digit ISIC industry. Because the obtained productivity is not comparable across industries, we take the deviation from industry average. We estimate production function using a methodology proposed by Ackerberg et al. (2015, hereafter ACF), who extend Olley and Pakes (1996) and Levinsohn and Petrin (2003, hereafter LP) to address the simultaneity bias between unobserved ω_{ijrt} and inputs and potential collinearity in the first stage of the LP estimator.[14] 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.

Our sample period is divided into two sub-periods: 2001-2005 and 2006-2010. Hence, all plant-level variables are averaged over each sub-period. As for productivity, we first estimate Equation (5) 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, wages, or productivity 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 less than 10 in each sub-period to assure adequate competition in labor and product markets. See Table 2 for summary statistics of variables.

== Table 2 ==

The data sources for industry or regional-level variables are as follows. Regional population in the pre-war period is from the first and second *Population Census* in 1920 and

[12] There are some plants that switch from one industry to another during sample periods. 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.
[13] 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.
[14] We use the Stata code used in De Loecker and Warzynski (2012) for the production function estimation.

1930 by the Dutch colonial government and the 1940 population estimates (Boomgaard and Gooszen 1991; Van der Eng 2002). GDP share of 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 *Human Development Report* by BPS.

6. Estimation results

6.1 Wage and employment growth models

This section presents the estimation results. First, we estimate the wage and productivity growth model (Equation 1) to evaluate FDI's impact on the wage growth rates for all, skilled, and unskilled workers and productivity growth. The results are presented in Table 3. Column (1) shows that market wages rise as the number of MNEs increases. In columns (2) and (3), we examine the impact on market wages for skilled and unskilled workers individually. The results indicate that wages grow faster for skilled workers than unskilled ones, raising the relative wages of skilled workers (column 4). Finally, column (5) examines externality effects on productivity growth of local firms. A positive and statistically significant sign on ΔMNE_{rt} implies that local firms receive externality benefits form MNEs.

The last finding indicates that externality certainly contributes to wage growth in columns (1) to (3). A rise in relative wages of skilled workers in column (4) is also consistent with skill-biased technology change. However, these results do not contradict what crowding-out effects under the distributional impact of FDI predict. From the results in Table 3 alone, therefore, we cannot conclude which of externality effects and crowding-out effects have a dominant impact in the local labor market.

== Table 3 ==

Table 4 shows the estimation results of the employment growth model (Equation 2). Overall, entry of MNEs have 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 complementarity between capital and skilled workers.

To ease the interpretation of the results, marginal effects of inward FDI on employment are evaluated for each firm according to Equation (3). The bottom of Table 4 shows that 46 percent of local firms increases total employment. However, there is a sharp contrast between skilled and unskilled workers. In response to a rise in inward FDI, 55 percent of local firms increases the number of unskilled workers (column 2), while 33 percent of firms increases skilled employment (column 3). As a result, the ratio of skilled to unskilled employment rises in only 7 percent of firms (column 4).

The last finding is not consistent with skill-biased technology change. Instead, it indicates that crowding-out effects under the distributional impact of FDI dominate externality effects in labor market for skilled workers. Externality benefits (column 5 in Table 3) encourage local firms to increase both types of employment. However, because of distributional effects, market wages for skilled workers rise more rapidly than for unskilled workers (column 4 in Table 3). Hence, local firms expand their production by using more unskilled workers, lowering the ratio of skilled to unskilled employment (column 4 in Table 4).

== Table 4 ==

6.2 Sources of aggregate productivity growth

Thus far, we have seen that FDI's impact on employment is heterogeneous across firms: low-productivity local firms with the low KL ratio reduce both skilled and unskilled employment more than high-productivity counterparts with the high KL ratio. Stated differently, inward FDI induces a reallocation of workers from the former to the latter. In the following, we forecast to what extent such reallocation improves aggregate productivity growth by

supposing that ΔMNE_{rt} is doubled in each region.

Table 5 presents the results of decomposition. If ΔMNE_{rt} is doubled from $t = 1$ to $t = 2$, local firms operating in both periods can enhance the overall productivity growth rate in Indonesian manufacturing by 0.72 percent. The bottom of Table 5 shows the actual growth rate, that is observed between 2001-2005 and 2006-2010 and is attributed to the same local firms.[15] The forecasted productivity growth rate of 0.72 percent is not negligible when compared to the actual growth rate of 2.72 percent. Externality and reallocation respectively explain 69 percent and 32 percent of the forecasted growth rate. In sum, there is non-negligible contribution from resource reallocation. However, the reallocation of skilled workers only accounts for 12 percent of the forecasted growth rate and the remaining 20 percent is explained by reallocation of unskilled workers.

== Table 5 ==

To find underlying causes, Figure 2 decomposes the reallocation term in Equation (6), i.e., $\left(\beta_l - \bar{s}_{ijrt}^l\right)\Delta \ln X_{ijrt}^l$, into two components: employment growth rates of local firms ($\Delta \ln X_{ijrt}^l$) and the corresponding gaps ($\beta_l - \bar{s}_{ijrt}^l$). Both panels show that the greater the employment growth rates, the larger the gaps. Consequently, inward FDI induces reallocation of both skilled and unskilled employment from small- to large-gap firms. However, the comparison between panels indicates that the slope of the fitted line is flatter for skilled workers than for unskilled ones. In other words, the differences in gaps between expanding and shrinking firms are smaller for skilled workers than for unskilled ones. Consequently, reallocation of skilled workers contributes less to aggregate productivity than unskilled workers as observed in Table 5.

As distributional effects predict, inward FDI causes larger reallocation of skilled workers, having greater dispersion in growth rates, than unskilled ones. On the other hand, the corresponding gaps for skilled workers are mostly concentrated in the positive range.

[15] The contribution of capital to value-added production is included in the actual growth rate because we do not have good data on capital expenditure.

Therefore, even though we observe large reallocation of skilled workers, reallocation from positive-gap firms to other positive-gap firms does not contribute much to aggregate productivity growth. Because positive gaps indicate that the value of marginal product of skilled workers exceeds their wages, we can conclude that the lack of skilled workers among local firms partly offset aggregate productivity gains arising from their reallocation.

== Figure 2 ==

6.3 Robustness checks

Because we use firm-level wages in Equation (1), one may argue that wage growth reflects 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, we include in Equation (1) the changes in the share of university- or high school-graduates in skilled or unskilled workers. Because this information is only available in 1996 and 2006, firms existing in both years are the subjects of this robustness check. In other words, we suppose that the changes from $t = 1$ to $t = 2$ can be proxied by the changes observed between 1996 and 2006.

Table 6 presents the results. Column (1) 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. This finding holds even if we estimate the model individually for skilled and unskilled workers (columns 2 and 3).[16] Therefore, firm-level wage growth certainly reflects skill upgrading of individual workers within firms. Although the size of coefficients on ΔMNE_{rt} becomes smaller, they remain positive and significant even after controlling for workers' educational attainment, confirming externality and crowding-out effects.

== Table 6 ==

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

[16] 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.

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. Because firms in developed countries outsource skill-intensive activities from a developing country's perspective (Feenstra and Hanson 1997), outsourcing increases skill intensity of local firms which produce and export outsourced products. In sum, if transaction with neighboring MNEs increases local firms' opportunities to engage in international trade, parameters on ΔMNE_{rt} in Equation (2) may reflect the effects of international trade on skill upgrading.

To control for the effects of trade on employment growth and skill intensity, we include in Equation (2) 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 (1) to (3) of Table 7 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 importing or exporting opportunities enhance skill intensity of local firms – but the differences are not statistically significant (column 4). Note that 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.

== Table 7 ==

7. Summary and conclusions

Because MNEs bring advanced technology and create considerable job opportunities in the host economy, attracting MNEs becomes an important development strategy in developing countries. Besides such direct impact, inward FDI contributes to the development of local small and medium enterprises through technology spillovers and demand creation. Previous studies, therefore, have focused on the identification of these externality effects on productivity and wages of local firms. However, because of their size and productivity, entry of MNEs should intensify competition in labor and product markets, which leads to crowding-out of local firms from the markets. If crowding-out effects outweigh externality effects, entry of MNEs decreases employment in local firms. Consequently, whether inward FDI contributes to employment creation by local firms needs empirical evaluation.

We address this issue by employing microdata from Indonesia, a country constituting an important part of international production networks of MNEs. However, this study differs from the previous literature by considering distributional effects of inward FDI. More specifically, we examine FDI's impact on skilled and unskilled employment individually. The results stress the importance of distributional effects in characterizing employment growth patterns of local firms: the positive impact of externality on labor demand is more than offset by the negative impact of severe labor market competition for skilled workers. Distributional effects also have implication to productivity growth. By decomposing aggregate productivity growth into technical efficiency gains and reallocation of skilled and unskilled workers, we find a non-negligible contribution from reallocation of unskilled workers, but a relatively minor contribution from reallocation of skilled ones.

In conclusion, the results of this study confirm that attracting inward FDI is effective for development of local firms. Technology spillovers and demand creation effects enhance productivity of local firms, leading to creation of unskilled jobs. However, the inadequate supply of skilled workers can be a bottleneck for effective FDI attraction policies. The lack of skilled workers prevents local firms from expanding their production, limiting the potential

productivity gains from resource reallocation. Furthermore, it discourages local firms from adopting skill-intensive production. This will reduce their innovation potential and may hamper the long-run productivity growth in Indonesian manufacturing.

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Table 1. 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 2. 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 ($\Delta \ln(L_{ijrt}^{S} + L_{ijrt}^{U})$)	-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
Net increase in the number of MNEs (ΔMNE_{rt})	35.893	70.864

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

Table 3. FDI's Impact on Wages and Productivity of Local Firms

	(1)	(2)	(3)	(4)	(5)
	Growth rate of				
Variable	Wages for all workers	Wages for unskilled workers	Wages for skilled workers	Skilled-unskilled wage ratio	TFP
ΔMNE_{rt}	0.000248***	0.000177**	0.000433***	0.000256**	0.000623***
	(5.74e-05)	(6.94e-05)	(0.000101)	(0.000117)	(0.000107)
Kleibergen-Paap F	40.01	40.01	40.01	40.01	40.28
Hansen J	0.00662	0.0104	0.0520	0.475	0.00183
Observations	9,976	9,976	9,976	9,976	9,976

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.

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

	(1)	(2)	(3)	(4)
	Growth rate of			
Variable	Total employment	Unskilled employment	Skilled employment	Ratio of skilled to unskilled employment
ΔMNE_{rt}	-0.00169***	-0.00146***	-0.00278***	-0.00131***
	(0.000405)	(0.000391)	(0.000662)	(0.000490)
$\Delta MNE_{rt} \times \ln \omega_{ijrt-1}$	0.000386***	0.000367***	0.000448***	8.13e-05
	(7.88e-05)	(9.28e-05)	(0.000103)	(0.000140)
$\Delta MNE_{rt} \times \ln KL_{ijrt-1}$	0.000177***	0.000161***	0.000274***	0.000113**
	(4.03e-05)	(3.88e-05)	(6.60e-05)	(4.85e-05)
Kleibergen-Paap F	15.14	15.14	15.14	15.14
Hansen J	0.0813	0.173	0.521	0.937
Observations	9,976	9,976	9,976	9,976
Firms with positive marginal effects w.r.t. ΔMNE_{rt}	4,578 (46%)	5,449 (55%)	3,307 (33%)	700 (7%)

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. Sources of Aggregate Productivity Growth in Indonesian Manufacturing

When ΔMNE_{rt} is doubled in each region	Growth rate	Contribution (%)
Aggregate productivity growth	0.72	
Externality	0.49	69
Reallocation of		
Unskilled workers	0.14	20
Skilled workers	0.09	12
Observed growth from 2001-2005 to 2006-2010	2.72	

Note: Table shows the portion of aggregate productivity growth rates in Indonesian manufacturing attributed to local firms operating in both sub-periods. The values indicate how much productivity grows when ΔMNE_{rt} is doubled in each region. The last row shows the actual productivity growth rate observed between two sub-periods. The contribution of capital to value-added production is included in the observed growth rate.

Table 6. FDI's Impact on Wages, Controlling for Workers' Educational Attainment

	(1)	(2)	(3)	(4)
	Growth rate of			
Variable	Wages for all workers	Wages for unskilled workers	Wages for skilled workers	Skilled-unskilled wage ratio
ΔMNE_{rt}	0.000203***	0.000115**	0.000459***	0.000326***
	(5.32e-05)	(5.48e-05)	(8.42e-05)	(7.72e-05)
Changes in the share of high-school graduates in unskilled workers	0.0696***	0.0558***		0.0424*
	(0.0159)	(0.0168)		(0.0230)
Changes in the share of university graduates in unskilled workers	0.526**	0.928***		-0.862**
	(0.224)	(0.207)		(0.385)
Changes in the share of high-school graduates in skilled workers	-0.0183		0.00864	0.0232
	(0.0120)		(0.0207)	(0.0201)
Changes in the share of university graduates in skilled workers	0.0411*		0.212***	0.185***
	(0.0239)		(0.0411)	(0.0402)
Kleibergen-Paap F	30.81	30.80	30.24	30.81
Hansen J	0.157	0.116	0.144	0.589
Observations	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.

Table 7. FDI's Impact on Employment, Controlling for Trade Effects

	(1)	(2)	(3)	(4)
	Growth rate of			
Variable	Total employment	Unskilled employment	Skilled employment	Ratio of skilled to unskilled employment
ΔMNE_{rt}	-0.00163***	-0.00140***	-0.00276***	-0.00135**
	(0.000481)	(0.000466)	(0.000785)	(0.000615)
$\Delta MNE_{rt} \times \ln \omega_{ijrt-1}$	0.000444***	0.000423***	0.000570***	0.000148
	(9.76e-05)	(0.000120)	(0.000128)	(0.000184)
$\Delta MNE_{rt} \times \ln KL_{ijrt-1}$	0.000173***	0.000156***	0.000275***	0.000119*
	(4.83e-05)	(4.66e-05)	(7.84e-05)	(6.15e-05)
Start importing inputs	0.0778***	0.0775***	0.119***	0.0414
	(0.0212)	(0.0240)	(0.0300)	(0.0357)
Start exporting products	0.0818***	0.0716***	0.117***	0.0456
	(0.0226)	(0.0233)	(0.0367)	(0.0371)
Kleibergen-Paap F	12.97	12.97	12.97	12.97
Hansen J	0.0899	0.195	0.359	0.989
Observations	8,293	8,293	8,293	8,293
Firms with positive marginal effects w.r.t. ΔMNE_{rt}	3,613 (44%)	4,301 (52%)	2,728 (33%)	880 (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.

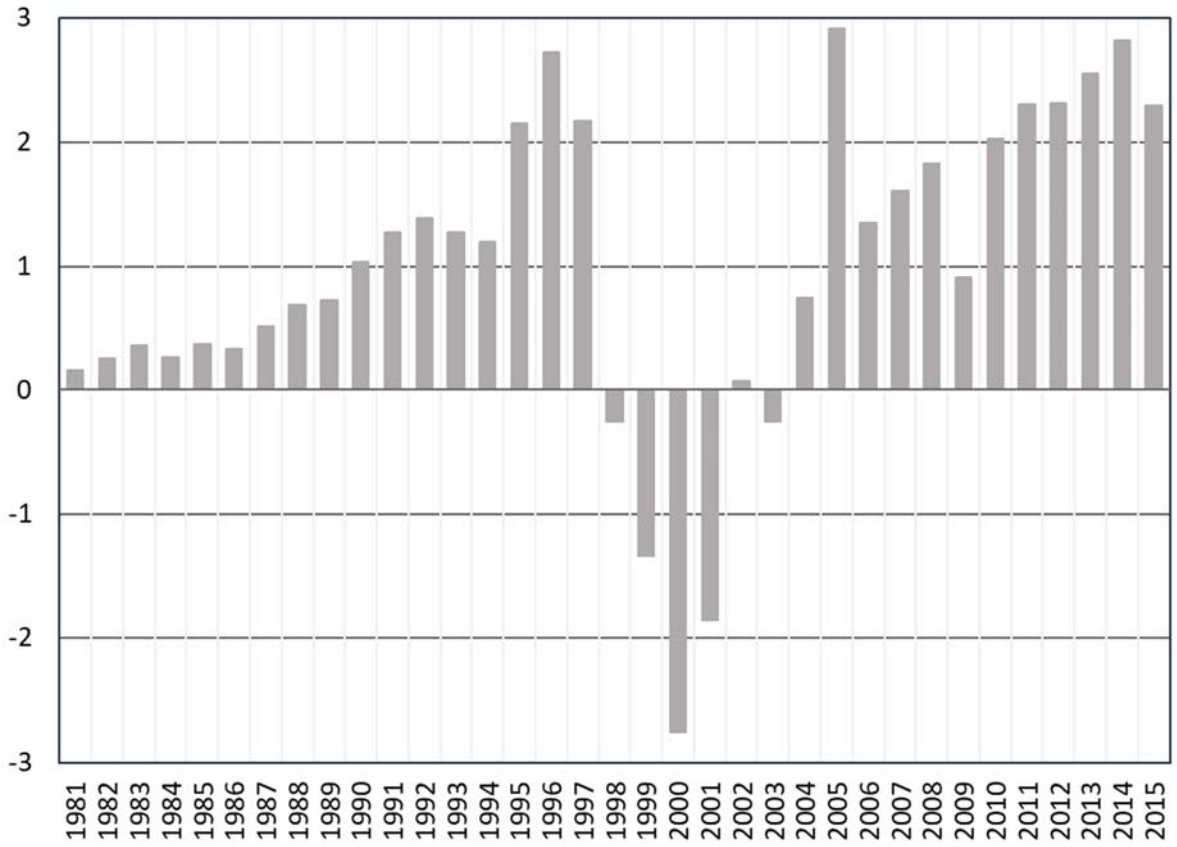

Figure 1. FDI Net Inflows as a Share of GDP in Indonesia

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

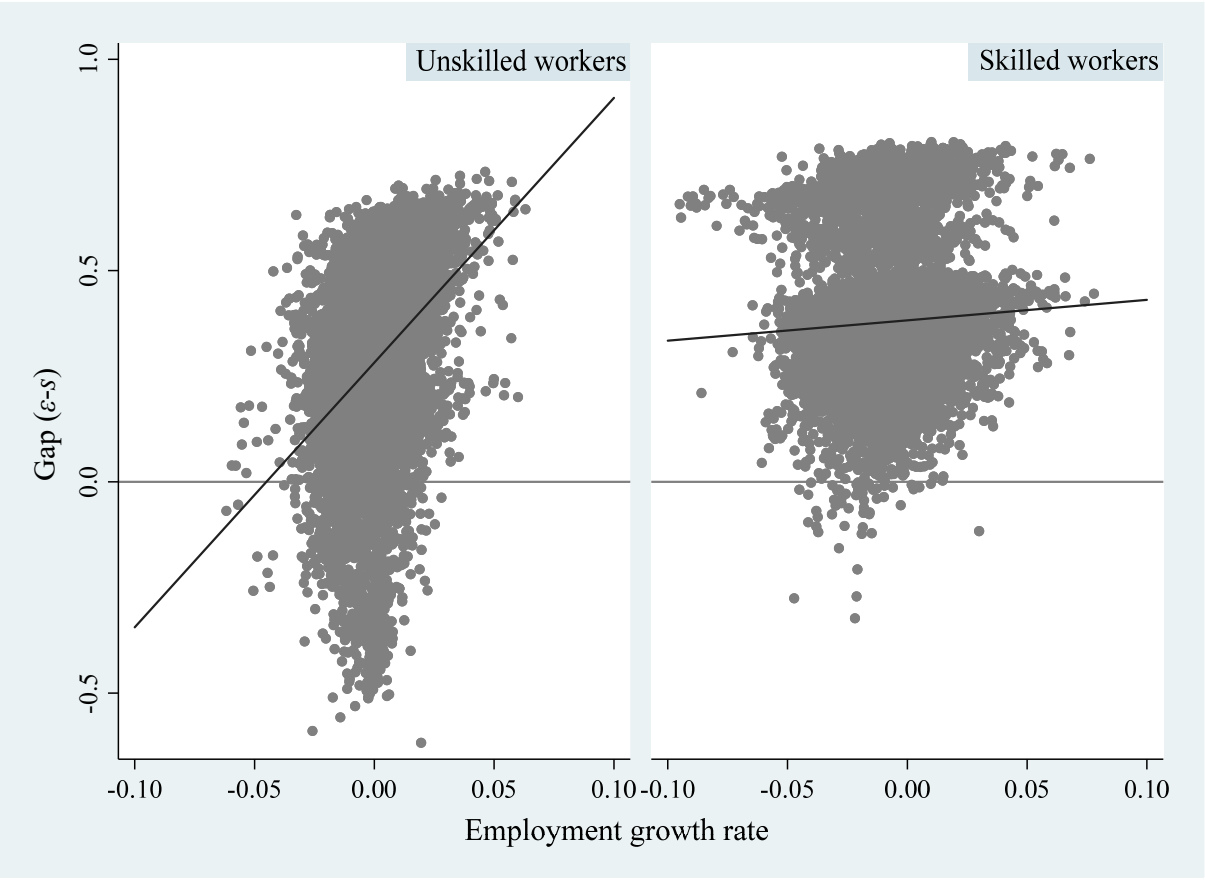

Figure 2. Relationship between Employment Growth Rate and Gap Between Value of Marginal Product and Wage