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FOREIGN DIRECT INVESTMENT AND WAGE SPILLOVERS IN THE INDONESIAN MANUFACTURING INDUSTRY

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ABSTRACT

We examine whether Foreign Direct Investment (FDI) influences wage spillover in the manufacturing sector in Indonesia from the perspective of three recipients (dimensions): industry, province, and technology intensity. Annual data of Indonesian manufacturing firms from 2011 to 2015 is employed. Using the Fixed Effect Model, we found the spatial (province) dimension to matter the most as it consistently indicates that inward FDI depresses wages in the recipient province. When we split the observation based on firm size, FDI inflows within the technology intensive subsectors were found to discourage wages. Only FDI inflows within the host industries support higher salaries for smaller domestic firms and gains in labour productivity. The coordination between central and local governments remains essential to ensure that local companies are sufficiently competitive with foreign companies.

Keywords: FDI; Wage Spillover; Manufacturing industry; Indonesia.
JEL Classifications: J31; F23; L60.

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I. INTRODUCTION

The debate on whether incoming FDI benefits the host country has attracted substantial attention, resulting in a plethora of studies. FDI may affect the host economy by increasing labour demand, enhancing international markets, and escalating production capacity (Li and Tanna, 2018; Ni *et al*., 2017). Most of the recent studies in Indonesia have studied FDI spillovers from the perspective of productivity and efficiency gains of firms through which incoming foreign companies might motivate (positive spillover) or, conversely, demotivate (negative spillover) local companies (see Sari *et al*., 2016; Sari, 2019; Suyanto *et al*., 2014). However, little is discussed about the impact of such spillovers (presence of multinational enterprises, henceforth MNEs) on the markets for capital and labor resources, specifically wages.

The hypothesis of this paper is motivated by a theoretical argument which postulates that FDI spillovers might not only affect productivity and efficiency, but also have implications in the market for production factors. Krugman *et al*. (2018) proposed that incoming FDI, commonly via MNEs, influences the market for factors of production by inducing income distribution effects. International companies are likely to attract high-skilled workers as MNEs possess advanced technological levels, higher capital intensity, more advanced management systems, and often offer higher wages than local firms (Chen *et al*., 2011; Javorcik *et al*., 2012). Consequently, FDI may widen the wage gap between foreign and domestic firms in the host country, leading to worse-off local companies losing skilled workers or increasing labor costs. A widening inequality gap might occur if local companies lack competitiveness or are unable to attract talent. Chen *et al*. (2011) argued that the competition between foreign companies and local firms enables labour demand to increase, obliging local companies to raise wages to attract high-skilled labour in a race to narrow the wage gap with foreign companies.

To test our hypothesis, we employ a panel dataset of *Statistik Industri* of Indonesia covering the 2011-2015 period. We employ a fixed-effect model to test whether wage gaps are related to FDI spillovers across sectors, tech groups, and provinces. We use the proxy of Javorcik's (2004) horizontal spillovers that estimates the share of firm's output produced by foreign firms. As studies using the horizontal spillover measure may suffer from cross-sectional dependence (Baltagi and Pesaran, 2007), we use the standard error of Driscoll and Kraay (1998). Hypothetically, output growth is linked to increased demand for workers, while increases in the market share of foreign-owned firms indicate a higher demand for skilled workers. A larger growth in the market share of foreign firms means higher demand for skilled workers, which is linked to wage gaps, in line with the predictions in Indonesia (Javorcik *et al*., 2012; Sjöholm and Lipsey, 2006; Lee and Wie, 2015). We classify firms according to the OECD (2011) guidelines to account for heterogeneity in technological diffusion effects across different sectors (Table A2). Our approach differs from Chen *et al*. (2011): they used capital-ownership, such as foreign-owned and government-owned capital, to capture FDI spillover.

The results of our study reveal that only horizontal spillover within the host province significantly affects wages. When we split the data sample based on firm size, most of the spillover dimensions show negative effects from FDI inflows, so we conclude that incoming foreign investment does not stimulate higher wages

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in domestic firms. These findings are robust for our sub-sample (domestic firms, wage-gap group, and Java & Sumatra regions).

As a robustness test, we have applied three different strategies. First, to capture the effect of FDI spillover on domestic companies, we provide estimates for all firms and only for domestic firms. By removing foreign companies, we remove the possibility of accruing effects captured by MNE to domestic ones, as suggested by Sjöholm and Lipsey (2006). Second, we group firms based on the wage gap between foreign and domestic firms. The Low-gap group consists of firms with wages below the sectoral average wage gap of 50%. Meanwhile, the high-gap group consists of firms paying wages above the average wage gap. Third, we test the effects for firms located on the Java and Sumatra Islands, referred to by Tomohara and Takii (2011), who found FDI spillover within those Islands in Indonesia.

Prior studies have identified that foreign firms offer wage premia (Lipsey and Sjöholm, 2004; Sjöholm and Lipsey, 2006). Tomohara and Takii (2011) found wage inequality due to increasing FDI inflows in Indonesia, Lee and Wie (2015) examined the source of wage inequality in Indonesia by looking into the effects of FDI on technological progress and workers' education, finding that FDI increased demand for high-skilled workers. Higher inflows of FDI led to wage inequality as demand for skilled labour was more pronounced than for low-skilled workers. Previous studies in Indonesia identified that MNE pays higher wages than domestic firms (Wage gap). However, little is said on whether the presence of MNE leads to an increase in wages in the labor market in the host province, recipient industry, or technologically related sub-sectors. Meanwhile, similar to the evidence found in other countries in Southeast Asia (Nguyen, 2019), Chen *et al*. (2011) found evidence of negative FDI spillover in wages for domestic firms in China, suggesting that FDI discourages wage growth in local firms. In Vietnam, Nguyen *et al*. (2019) demonstrated that FDI inflows put downward pressure on the wage rates of domestic firms via spillover effects and cut-off capability, finding that a 1 percent increase in foreign capital leads to a 2.03 percent drop in wages for domestic firms. Chen *et al*. (2011), Nguyen (2019), and Nguyen *et al*. (2019) all found that industry-specific and firm-specific characteristics explain substantial differences in the impact of FDI on wages in some Asian countries. Similarly, in an Italian case (Pittiglio *et al*., 2014), technological differences between domestic and foreign companies were found to be too large, suggesting that firm-specific and industry-specific characteristics need to be considered when estimating spillover effects from FDI in wages, In the context of Indonesia, earlier studies (e.g., Lee and Wie, 2015) generally missed examining the effects of foreign investment at industry-specific level or across groups of tech-related firms. We aim to fill that empirical gap. Additionally, we group firms according to size to distinguish the impact of FDI within firm size groups, a novel approach in the literature.

This study contributes to the literature in several ways. First, we capture the effects of FDI spillover in wages across different sectors, technology intensity levels, and locations. Studies such as Chen *et al*. (2011) mainly focus on horizontal spillovers within the industry and province, but not on the possible effects within groups of similar technology intensity. Theoretically, FDI may impact high and low technology intensity sectors differently. The technology diffusion driven by FDI is greater in the high technology sectors than in the low-technology ones as

high-tech firms rely on innovation, research, and development (Keller, 2010). In this sense, the proportion of skilled workers hired in high technology subsectors is larger than in labor-intensive (low-tech) firms. Secondly, in theoretical arguments, there is a different effect of inward FDI on the wages paid by domestic firms. As large firms can employ more sophisticated technology (Charoenrat *et al*., 2013; Ciani *et al*., 2020; Toma, 2020), they may compete with foreign firms in wage bargaining in the labour market for high-skill workers. Hence, we differentiate the impacts of spillover effects in firms according to the size, which is important in assessing policies about foreign direct investment and liberalization of markets

The case of Indonesia is intriguing, as incoming FDI into the manufacturing sector has increased progressively since the 1980s, when trade and industrial policies provided stronger incentives for investment (Pangestu *et al*., 2015). From the mid-1980s to 2019, FDI expanded more than 90 fold to reach nearly US$25 billion in 2019 (Suyanto *et al*., 2021). This progressive growth of FDI in Indonesia may contribute to wage inequality between local and foreign companies. Javorcik *et al*. (2012) revealed that foreign firms offered, on average, a 39% higher level of wages for their workers in 1990-2009 in Indonesia. However, as there is high heterogeneity among Indonesian manufacturing firms (e.g., level of technology, location, and size), domestic firms in each subsector may respond differently to the inward FDI regarding their wage levels. However, this potential heterogeneity in FDI impacts on wages has not been observed across technology groups in earlier studies on FDI in Indonesia.

The following section explains the data, methodology, and econometric specifications of spillover measurements. Section III presents the findings of this study and offers further discussion. Finally, the conclusion and policy implications are provided in Section IV.

II. DATA AND METHODOLOGY

A. Data and Variables

This study uses annual firm-level data spanning from 2011 to 2015, sourced from the Large and Medium Industrial Survey by Statistics Indonesia, representing more than 74% of the population. We use an unbalanced panel dataset. To categorize firms by size, we refer to the definition of Statistics Indonesia, classifying a firm as a large firm if it has more than 99 workers; otherwise, the firm is classified as a medium-size firm. However, we also used an output-based measure for firm size, the ratio of a firm's output (in Rupiah) to the total output in the subsector (in Rupiah), to provide estimates based on firm size quartiles.

This study uses the proxy of labour cost per worker as a proxy of wages. Labour cost refers to the cost of both production and non-production workers in Rupiah. Meanwhile, we follow Javorcik (2004) in using horizontal spillovers as the measure indicating the foreign share of production (output) on a specific dimension. This study distinguishes the horizontal spillover in different dimensions: within the industry (two-digits subsector of the Indonesia Standard Industrial Classification or *KBLI*), the province, and technology intensity (OECD, 2011). The general formula is specified below:

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$$HSpill_{jt} = \frac{\Sigma_{i\epsilon j} FSh_{it} * Y_{it}}{\Sigma_{i\epsilon j} Y_{it}} \quad (1)$$

where i denotes the firm, and j indicates the subsector/province/technology intensity. *HSpill* represent the horizontal spillover effect, *FSh* is the share of a firm's foreign capital ownership, Y_{it} is the total output in the manufacturing sector. Control variables are considered, such as the dummy of foreign-capital ownership (*FOR*) and the interaction between *FOR* and *FSh*. The control of *FOR* is referred to in earlier studies (Arnold and Javorcik, 2009; Esquivias and Harianto, 2020; Javorcik *et al*., 2012) that argue that foreign firms are more likely to offer a higher wage. There are several thresholds of *FOR*. This study uses 10% as a threshold, which is referred to the 2009 OECD study and Javorcik *et al*. (2012). Meanwhile, the interaction between *FOR* and *FSh* refers to the study by Sari *et al*. (2016). The coefficient of this interaction variable will reflect the impact of higher percentages of foreign ownership on firms' wage levels.

Other control variables included are imported material intensity, firm size, market concentration, and labour productivity, referred to in some prior studies (Chen *et al*., 2011; Pittiglio *et al*., 2014). We expect firms employing imported raw materials or having a larger share of the market (proxy by the Herfindahl-Hirschman Index - HHI) to demand higher skills in workers. The resource-based theory explains that firms may create a comparative advantage on production cost, product, or service. In that logic, imports may be expected to help firms' lower production costs, improve product quality or diversification, or help deliver better service (shorten the delivery time, production, guarantee, or so on). Similarly, maintaining market power requires employing more efficient resources. Labour productivity might affect positively to the wage level as more productive labour is stimulated by higher wages. Table 1 summarizes the description of these variables.

Table 1.
Variable Description

This table provides a detailed description of the variables considered in this study.

Variable	Proxy
Wage	Labour cost (in Rupiah) per worker (labour cost includes salary, overtime wage, bonus in cash, insurance, and accident allowance).
Horizontal Spillover	Share of outputs (in Rupiah) of the foreign-owned company. Horizontal spillover is computed per subsector (23 groups), province (32 regions), and technology intensity groups (High, Medium High, Medium Low, and Low Technology)
FOR	Dummy of a foreign company (1 if a firm possesses more than 10% share of foreign capital, 0 if otherwise).
Import	Imported material intensity measured by the ratio of imported material (in Rupiah) to the total material (in Rupiah).
Firm Size	Number of labour: 1 (large firm) if the firm has more than 99 workers, 0 otherwise (medium firm).
Foreign Share	The share of firm foreign capital ownership.
Market Concentration	Herfindahl-Hirschman Index (HHI) is measured by squaring the market share of each firm competing in a subsector and then summing the resulting numbers.
Labour Productivity	Value added per labour (Value added equals total sales minus expenditures for energy and raw materials inputs).

There might be a biased analysis if the monetary-value variables such as labour cost, total output, imported materials, and value added are directly used. Therefore, this study adjusts monetary variables by the price index to make the data constant. This study uses the deflating approach with the Wholesale Price Indices of Indonesia of 2010 as the base year.

B. Methodology

This study arranges several specifications to capture the wage spillovers in such ways: within the industry, within the province, and within technology intensity. The specifications (2-6) are set as follow:

$$w_{it} = \beta_0 + \beta_1 HSpill_Ind_{j,t} + \beta_2 HSpill_Prov_{k,t} + \beta_3 HSpill_Tech_{l,t} + \mu_i + u_{it} \quad (2)$$

$$w_{it} = \beta_0 + \beta_1 HSpill_Ind_{j,t} + \sum_{m=1}^{M} Zm_{it} + \mu_i + u_{it} \quad (3)$$

$$w_{it} = \beta_0 + \beta_1 HSpill_Prov_{k,t} + \sum_{m=1}^{M} Zm_{it} + \mu_i + u_{it} \quad (4)$$

$$w_{it} = \beta_0 + \beta_1 HSpill_Tech_{l,t} + \sum_{m=1}^{M} Zm_{it} + \mu_i + u_{it} \quad (5)$$

$$w_{it} = \beta_0 + \beta_1 HSpill_Ind_{j,t} + \beta_2 HSpill_Prov_{k,t} + \beta_3 HSpill_Tech_{l,t} + \sum_{m=1}^{M} Zm_{it} + \mu_i + u_{it} \quad (6)$$

where w_{it} is the natural logarithm of labour cost per worker, $HSpill_Ind_{j,t}$ is the horizontal spillover of subsector j in period t, $HSpill_Prov_{k,t}$ is the horizontal spillover of province k in period t, $HSpill_Tech_{l,t}$ is the horizontal spillover of technology intensity group l in period t. Zm_{it} is a set of control variables and consists of the dummy of foreign-owned company, the interaction of FOR and foreign share, imported material intensity, firm size (labour-based), market concentration, and labour productivity. μ_i is an unobserved individual effect that is time-invariant. u_{it} is the idiosyncratic error.

The least-squares estimators of β_j are biased and inconsistent when introducing individual heterogeneity, μ_i, that is correlated with all independent variables. In addition, that may be consistent, albeit inefficient, when μ_i is uncorrelated with all regressors. Fixed Effect Model (FEM) estimates the coefficient of each variable for the first case and Random Effect Model (REM) for the latter one. In other words, the critical issue of determining whether FEM or REM is employed is dependent on whether we can reasonably believe that μ_i is correlated with all regressors (Wooldridge, 2016). According to the data structure, which has numerous individual units (N) and a short period of time (T), it is reasonable that μ_i has a separate intercept for each cross-sectional unit. In that case, FEM is plausibly employed. Moreover, when it comes to policy analysis utilizing aggregate data, FEM generally outperforms REM (Wooldridge, 2016).

The premises of serially uncorrelated errors and homoscedasticity are critical for executing inference using the FEM and REM approach to panel data models. Moreover, it is necessary to check classical assumptions consisting of non-autocorrelation, non-multicollinearity, normality, and homoscedasticity tests. We

can rely on asymptotic approximations that require large N and small T in the absence of normality assumptions (Wooldridge, 2016).

The model with spillover and spatial effects may cause cross-sectional dependence (Baltagi and Pesaran, 2007). Cross-sectional dependence may also stem from unobserved common factors. When unobserved factors lead to cross-sectional dependency, the standard FE and RE estimators will be biased and inconsistent (De Hoyos and Sarafidis, 2006)[1]. In this regard, it is essential to use an alternative estimator for the model with cross-sectional dependency. As our model accommodates the spillovers effect, cross-sectional dependence is likely to occur. In this regard, we employ an FE estimator using Driscoll and Kraay (1998) standard errors, proven as having well-calibrated results when cross-sectional dependence exists (Hoechle, 2007).

III. RESULTS AND DISCUSSION

The analysis starts by looking at the descriptive statistics in Table 2. According to Table 2, the average wage of a worker in the manufacturing sector was Rp 15.4 million a year. However, when looking into wages across groups of firms, substantial differences emerge (Figure 1). Large firms can pay 55% higher salaries and MNEs 97% higher wages compared to an average domestic firm. Differences across sectors and technology intensity are also important (see Figure 1-3). The average values of horizontal spillovers for each dimension (industry, province, and technology) are respectively 28.35%, 29.62%, and 29.56%. Within our dataset, approximately 8.9% of firms are foreign-owned companies, with about 7.72% of foreign capital ownership. Imported material intensity has an average of 7.5%, although in specific sectors the share of imports increases. The HHI index has an average of 586, suggesting a generally competitive environment. However, at some sub-sectors the HHI index can increase to moderate or high levels of market concentration.

[1] There are several tests to identify cross-sectional dependence: Pesaran's CD test of (Pesaran, 2004), Friedman's test of (Friedman, 1937), Frees test of (Frees, 1995). However, due to limited availability of the software needed to examine cross-sectional dependency for our large dataset, we assume that cross-sectional dependency exists.

Table 2.
Descriptive Statistics

This table summarises descriptive statistics. We report mean, maximum, minimum, and Standard Deviation (SD) of main variables used in the study. All variables are defined in Table 2.

Variable	Observation	Unit	Mean	Std. Dev.	Min	Max
Wage	67194	Million Rupiah	3.832	20.516	0	1446.632
Horizontal Spillover within industry	67194	Percentage	28.359	14.336	0.329	90.63
Horizontal Spillover within province	67194	Percentage	29.625	16.953	0	93.399
Horizontal Spillover within technology	67194	Percentage	29.568	9.192	18.234	73.842
Foreign Companies	67194	Dummy	0.089	0.285	0	1
Foreign Share	67194	Percentage	7.72	25.53	0	100
Imported Material Intensity	67194	Percentage	7.503	22.678	0	100
Firm Size	67194	Dummy	0.283	0.451	0	1
Market Concentration (HHI)	67194	Ratio	586.042	852.752	101.562	4962.318
Labour Productivity (LabProd)	67194	Ratio	17.163	1.375	9.597	26.732

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Figure 1.
Wage Premia

This figure illustrates the different magnitude of wages between each category: 1) technology intensity consisting of High Technology (HT), Medium High Technology (MHT), Medium Low Technology (MLT), and Low Technology (LT); 2) capital ownership, consisting of foreign company (FOR) and domestic company (Domestic); 3) Importer vs. non-importer firms; 4) Large vs. Medium firms.

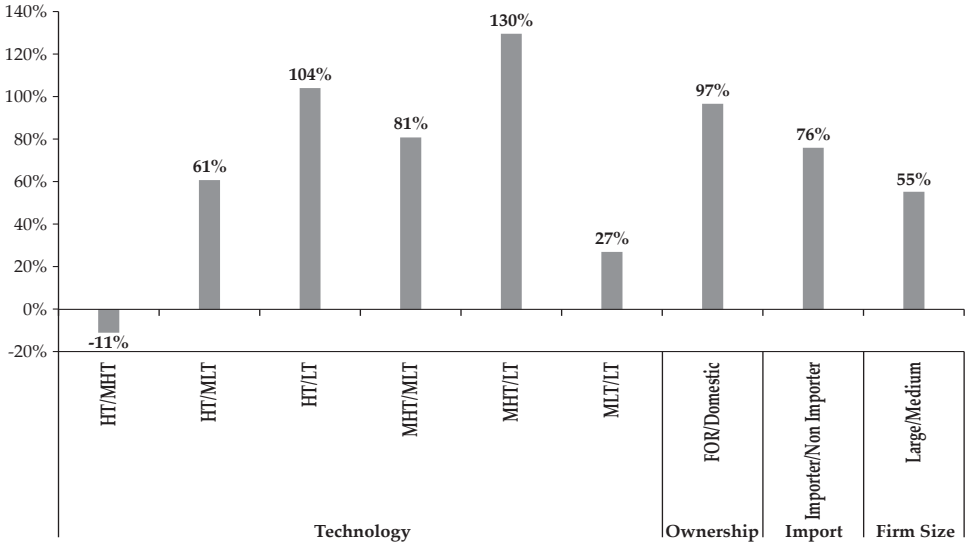


Figure 2.
Employment Premia

This figure illustrates the different magnitudes of employed production workers between each category: 1) technology intensity, consisting of High Technology (HT), Medium High Technology (MHT), Medium Low Technology (MLT), and Low Technology (LT); 2) capital ownership, consisting of foreign company (FOR) and domestic company (Domestic); 3) Importer vs. non-importer firms; 4) Large vs. Medium firms.

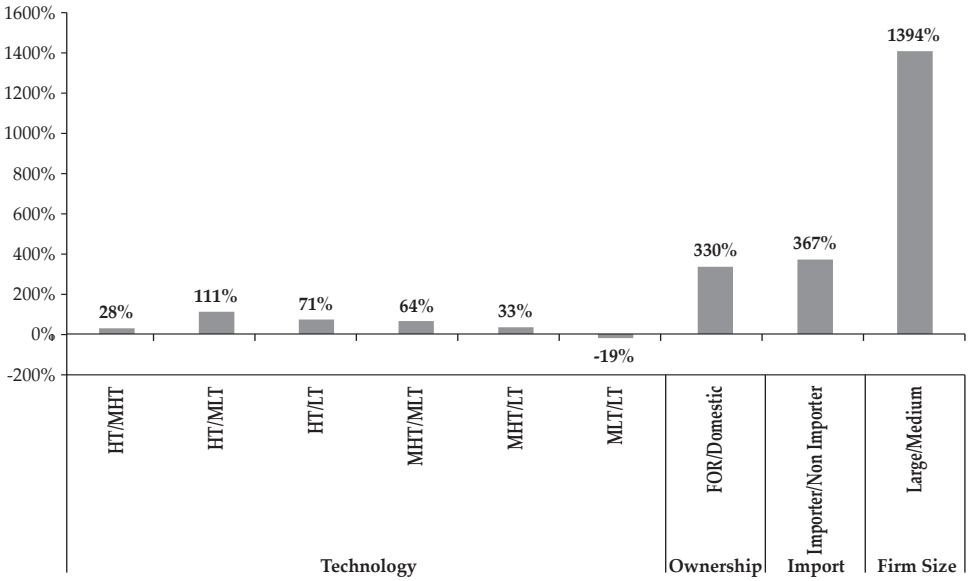


Figure 3.
Employment Premia

This figure illustrates the different magnitude of the wages gap between foreign and domestic firms differentiated by three quartiles of firm size.

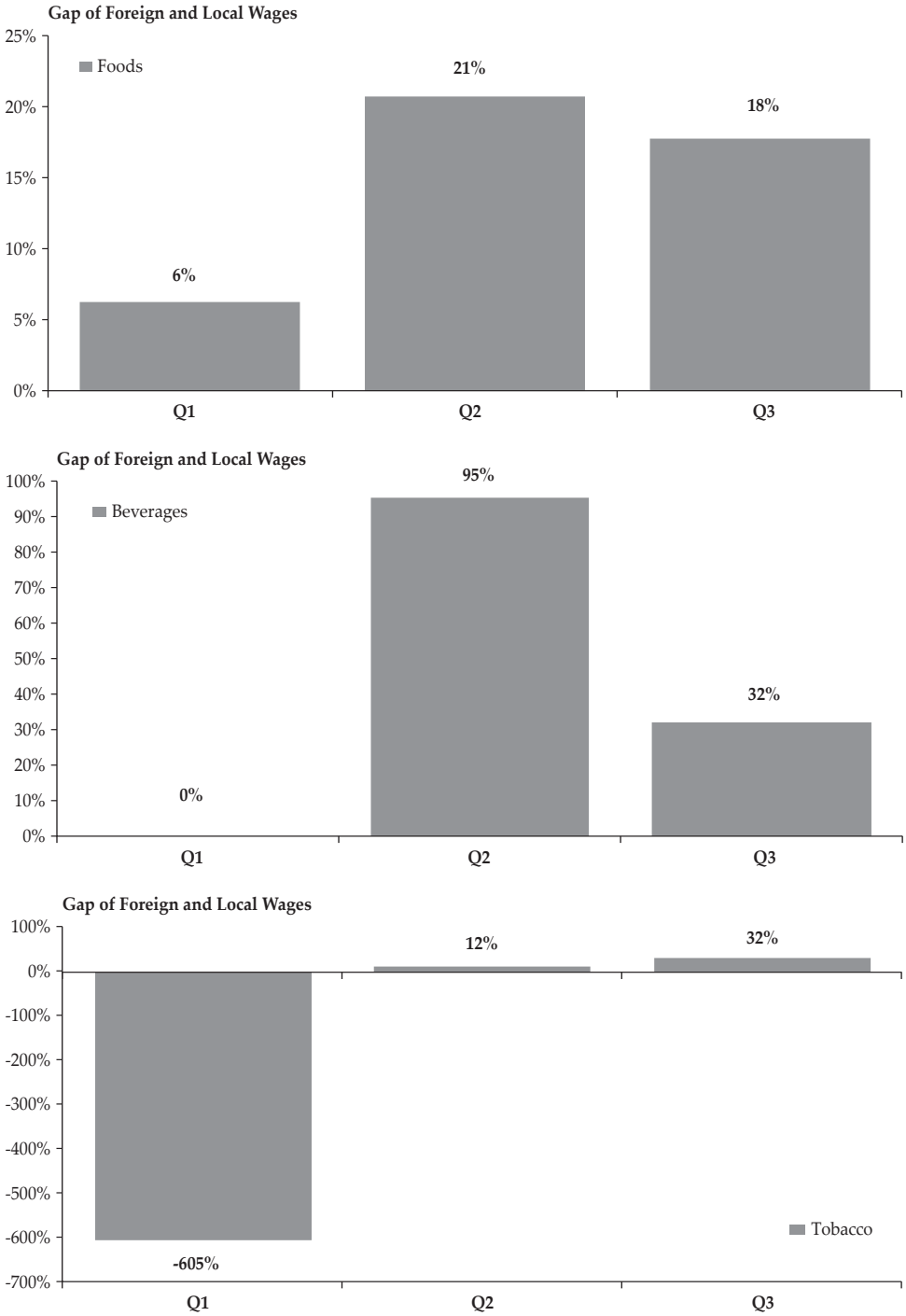
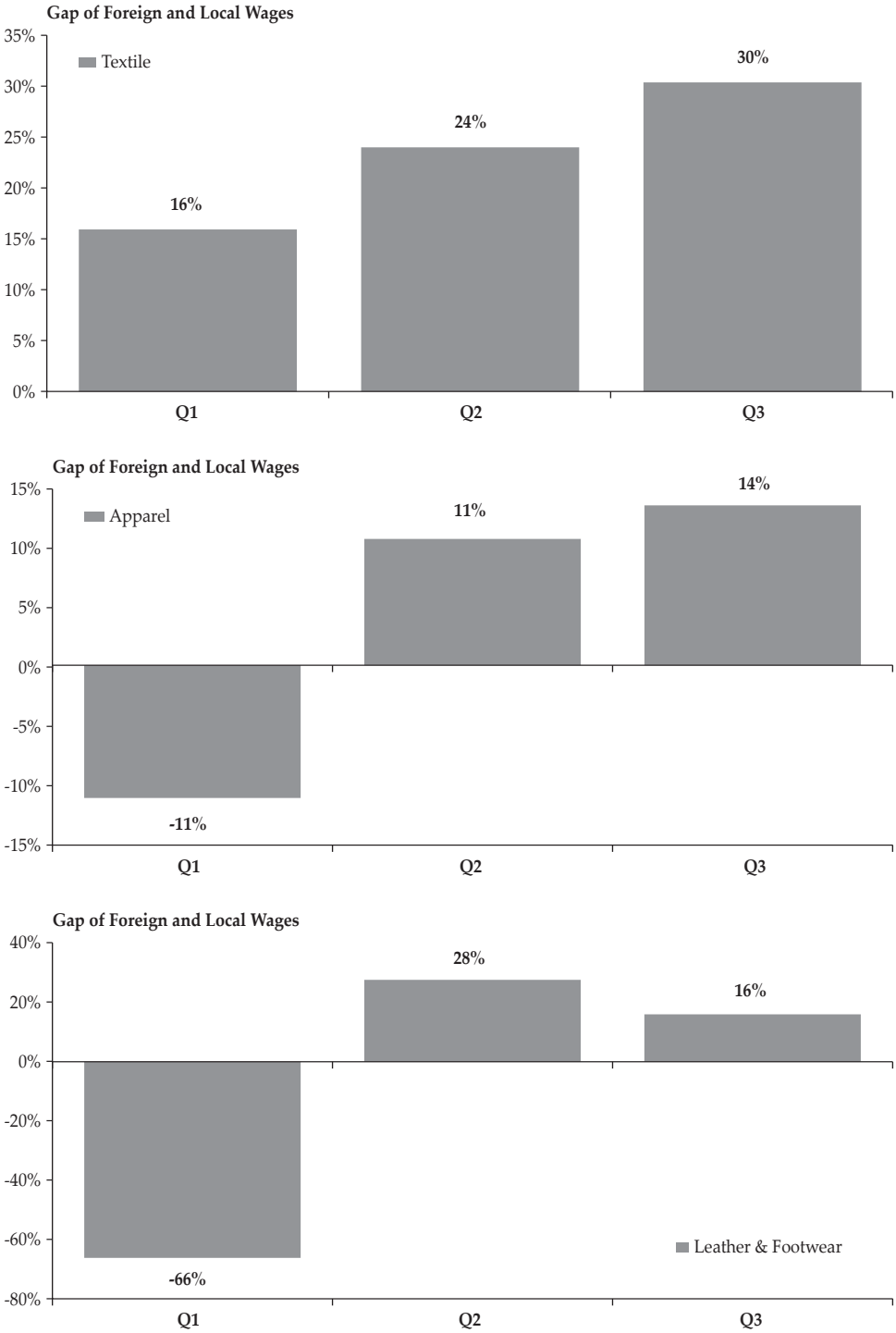


Figure 3.
Employment Premia (Continued)



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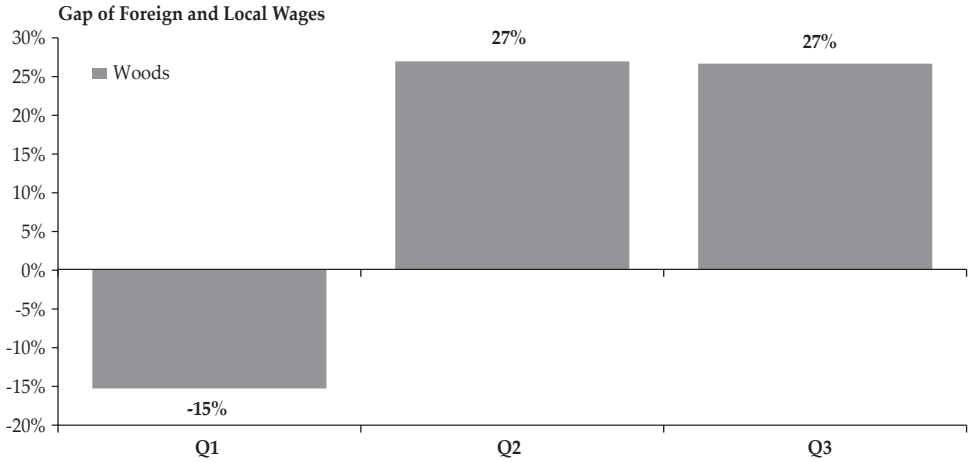

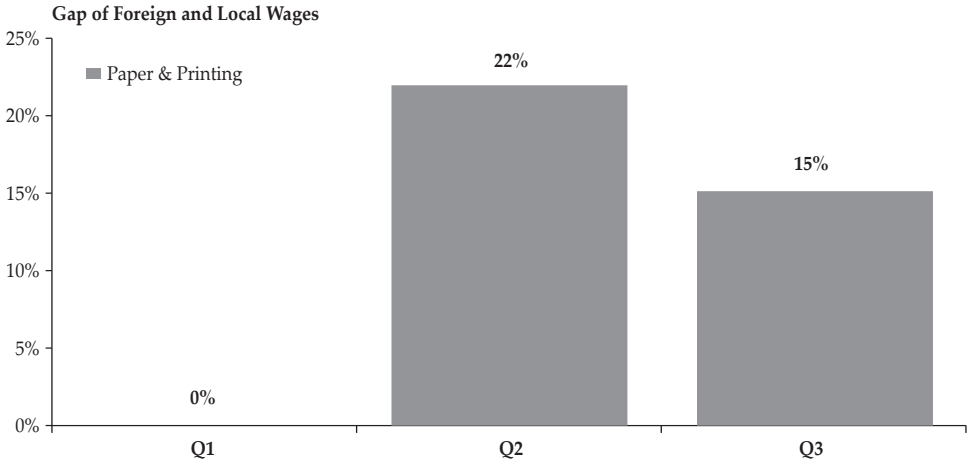

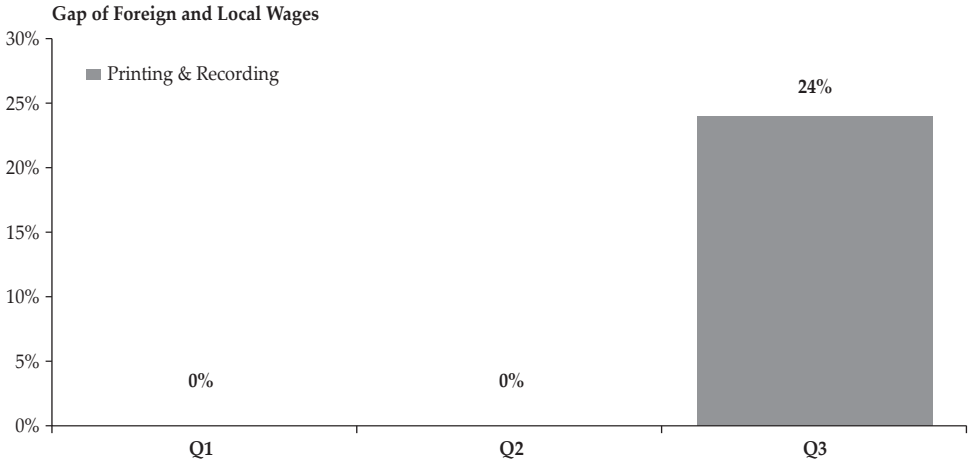

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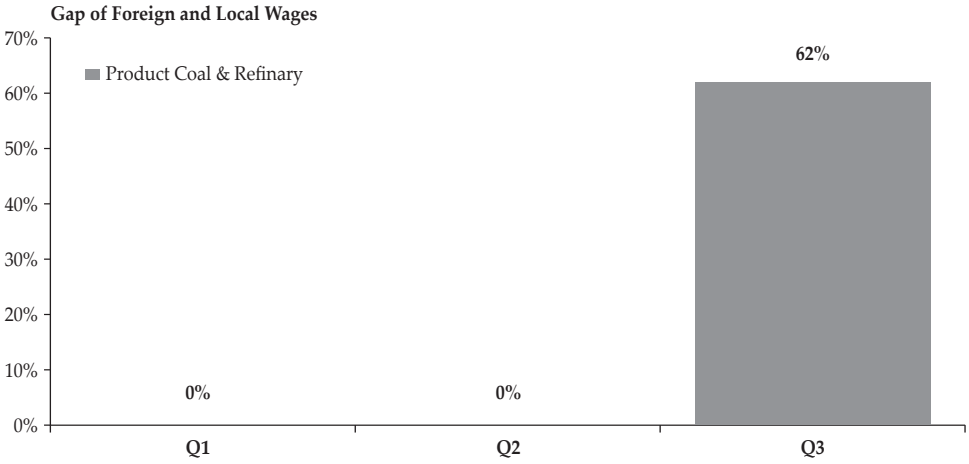

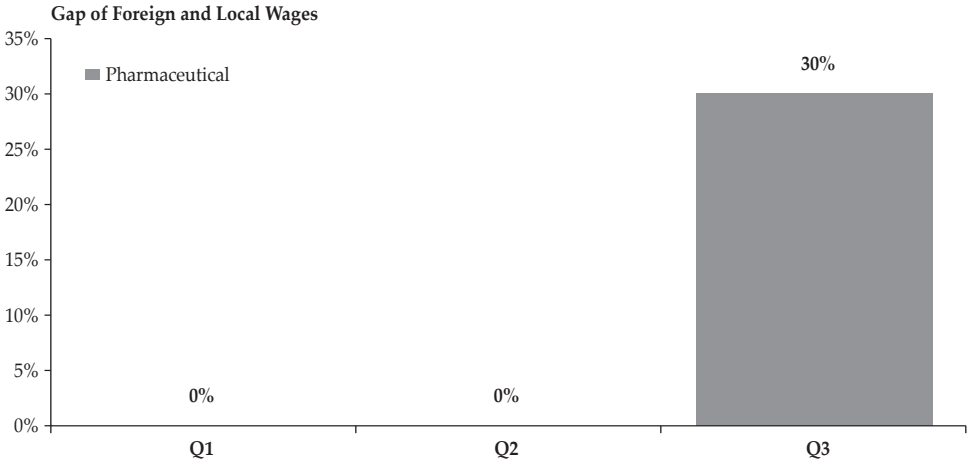

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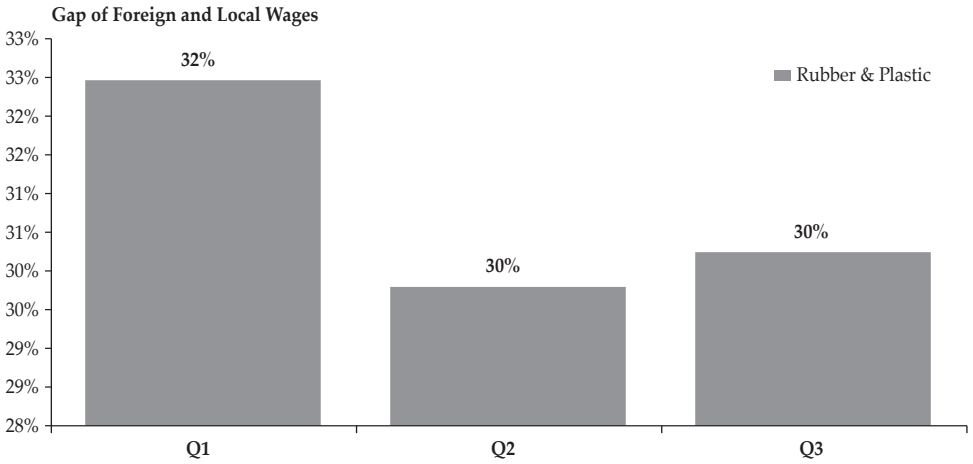

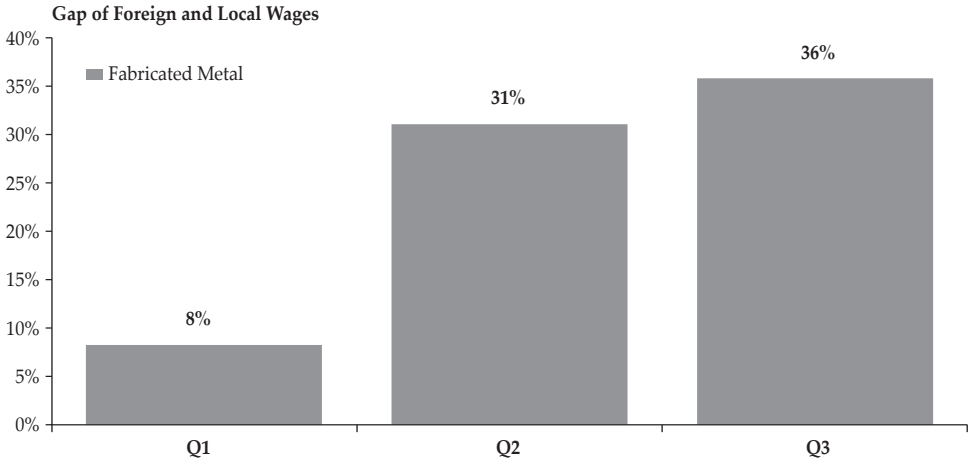

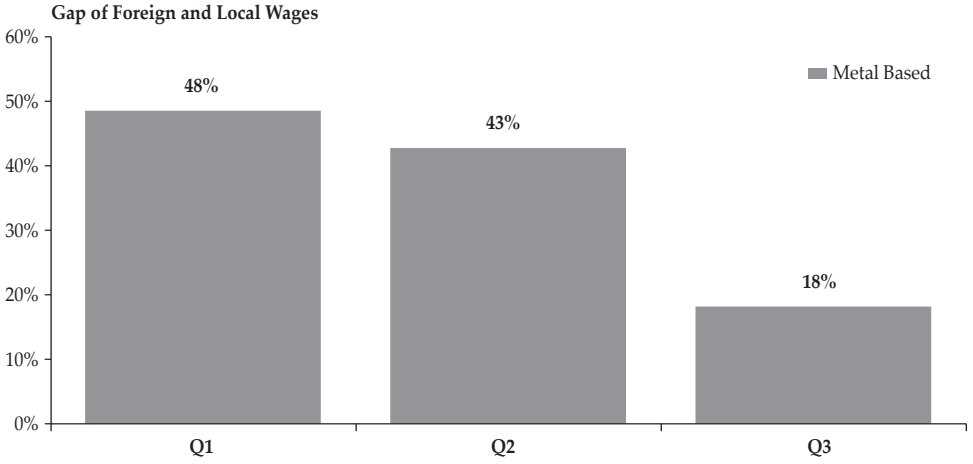

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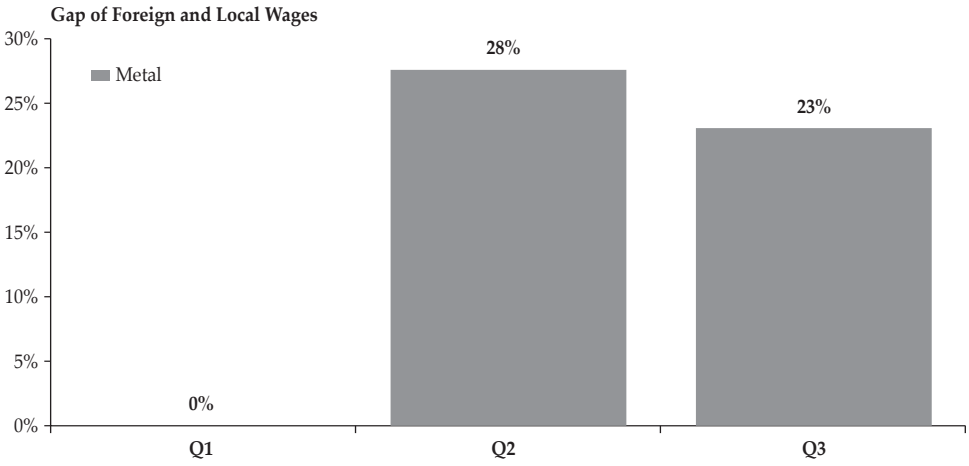

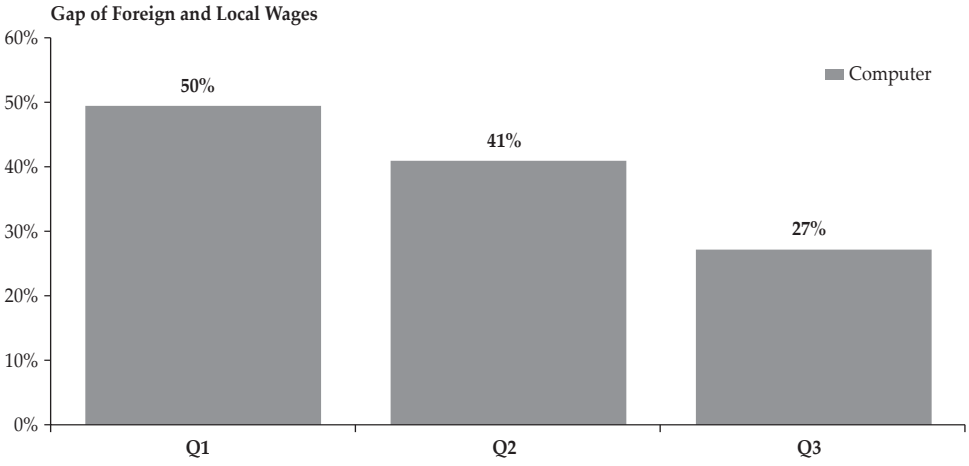

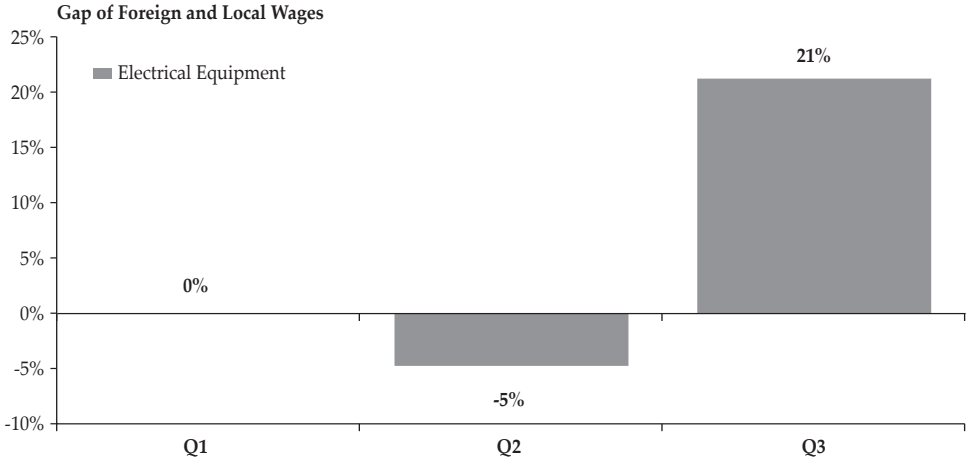

Figure 3.
Employment Premia (Continued)

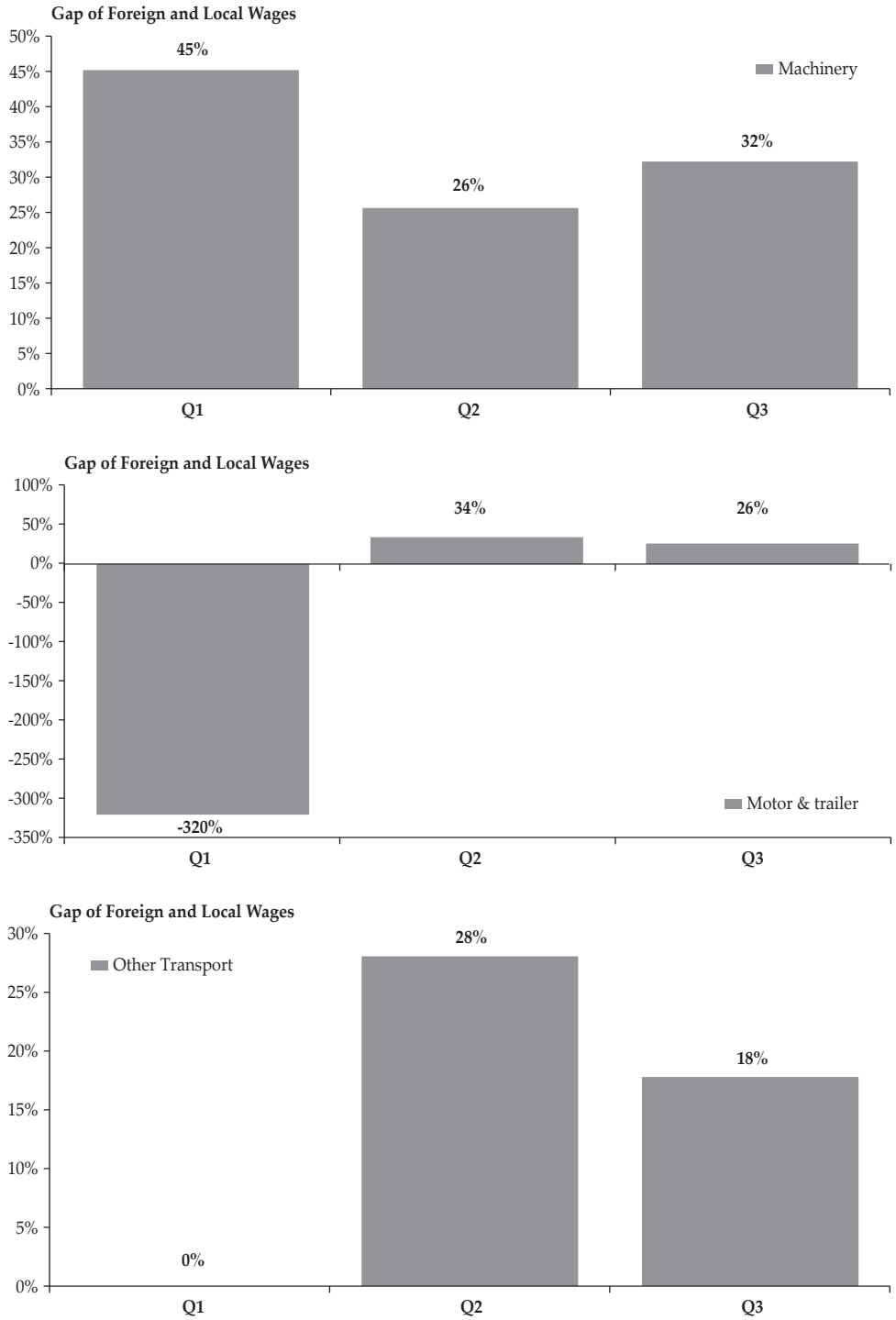

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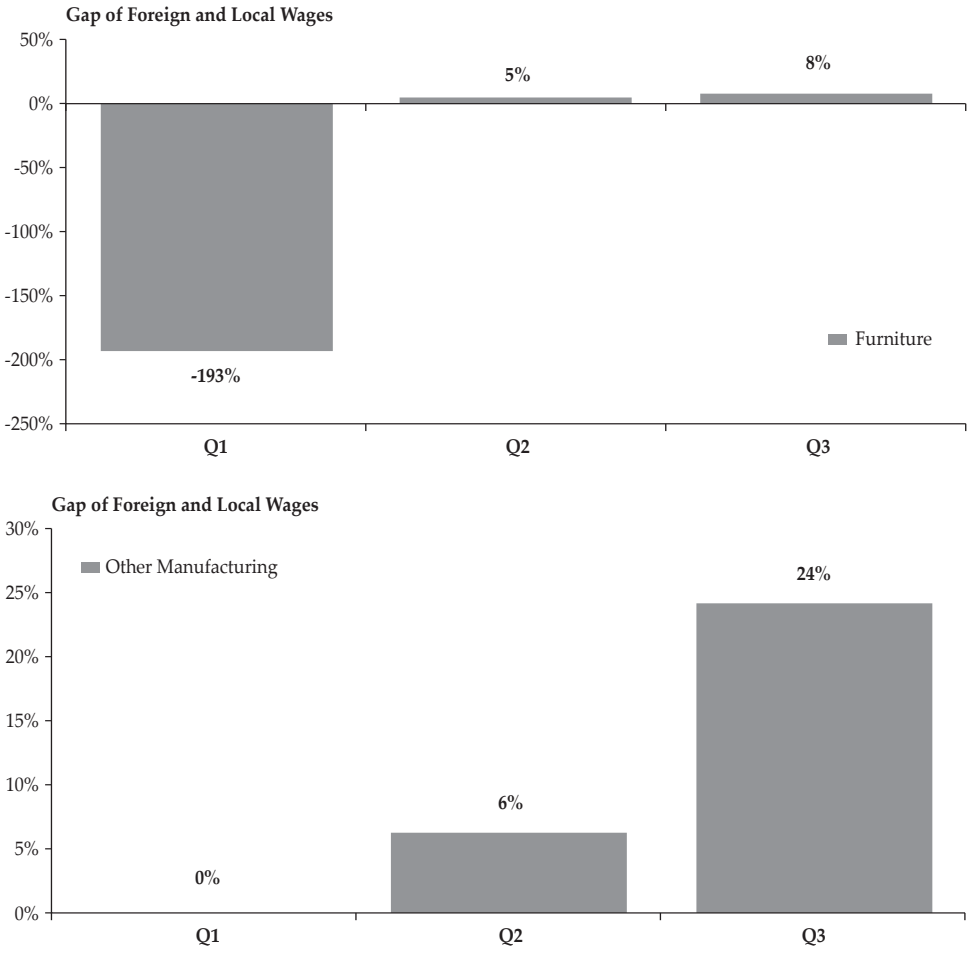
Figure 3.
Employment Premia (Continued)



Furthermore, this section discusses our main findings obtained by estimating equations (2-6). First, we estimate the three basic models, namely Pooled OLS, Fixed Effect Model (FEM), and Random Effect Model (REM) from Equation (6), employing standard panel estimators (see Table 3). Three models are proposed. However, we do not refer to POLS as heterogeneity effect is ignored in this model. Hence, either FEM or REM are preferred and selected using Hausman test. The result suggests that the FEM is the most suitable model to be employed (Table 4). Table 5 reports the estimate of the fixed-effect model. Table A3 reports the multicollinearity test and Table A4 displays the correlation matrix. We apply the Driscoll-Kraay standard errors to accommodate models with cross-sectional dependency. Comparing the FEM estimates of Tables 4 and 5, the magnitude and sign of the coefficients are similar, although the significance varies.

Table 3.
Regression Results of Three Basic Models

This table reports the estimates of Pooled Ordinary Least Square (POLS), Fixed Effect Model (FEM), and Random Effect Model (REM). In this result, robust standard errors have not been employed to identify a suitable specification using *F*-test and Hausman test. POLS = Pooled OLS, FEM = Fixed Effect Model, REM: Random Effect Model; Standard errors are in parentheses. ***, **. * : significances at alpha 1%, 5%, and 10%.

	POLS	**FEM**	**REM**
HSpill_Ind	0.001***	0.005***	0.001***
	(0.000)	(0.001)	(0.000)
HSpill_Provi	-0.002***	-0.026***	-0.004***
	(0.000)	(0.001)	(0.000)
HSpill_Tech	0.008***	-0.005***	0.007***
	(0.001)	(0.001)	(0.001)
FOR	0.230***	0.249	0.230***
	(0.061)	(0.171)	(0.071)
FOR×Foreign Share	-0.103	-0.179	-0.083
	(0.068)	(0.194)	(0.079)
Imported Materials	0.115***	-0.273***	0.102***
	(0.022)	(0.061)	(0.026)
Firm Size	0.196***	0.145***	0.200***
	(0.011)	(0.034)	(0.013)
HHI	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
LabProd	0.402***	0.405***	0.414***
	(0.004)	(0.006)	(0.004)
Constant	8.887***	9.934***	8.788***
	(0.060)	(0.111)	(0.066)
Observations	67194	67194	67194
R^2 (Within)	0.22	0.12	0.09

Table 4.
Hausman Test

This table reports the result of the Hausman test for selecting a suitable model.

Hausman Test	
Chi-square test value	1655.84
p-value	0.000

To capture the impact of FDI spillover on domestic companies, we estimate Horizontal Spillover separately for All firms (including foreign companies) and only Domestic Firms (excluding foreign firms). We compare the impact of FDI on domestic firms, splitting the results associated with foreign companies within the same sector and the same province following (Nguyen, 2019; Suyanto and Salim, 2011). For instance, the coefficient FOR is excluded when estimating effects for Domestic firms as no foreign firms are included in the sample (Table 5-6).

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Table 5.
Regression Results of Wage Spillovers

This table reports the estimates using FEM. Model 1-5 refers to equations (2)-(6). The column of All Firms refers to all observations (both foreign and local firms), while the Domestic Firms column only includes observation for local firms. In this result, robust standard errors are employed. Driscoll-Kraay standard errors are in parentheses. ***, **. * : significances at alpha 1%, 5%, and 10%.

	Model 1		Model 2		Model 3		Model 4		Model 5	
	All Firms	Domestic Firms	All Firms	Domestic Firms	All Firms	Domestic Firms	All Firms	Domestic Firms	All Firms	Domestic Firms
$HSpill_{Ind}$	0.003	0.005	0.004	0.005					0.005	0.007
	(0.005)	(0.006)	(0.006)	(0.007)					(0.006)	(0.006)
$HSpill_{Provi}$	-0.029***	-0.033***			-0.026***	-0.029***			-0.026***	-0.029***
	(0.008)	(0.008)			(0.006)	(0.006)			(0.006)	(0.005)
$HSpill_{Tech}$	-0.005	-0.005					-0.001	-0.001	-0.005*	-0.005**
	(0.006)	(0.006)					(0.003)	(0.004)	(0.002)	(0.003)
FOR			0.188***	-	0.250***	-	0.185***	-	0.249***	-
			(0.042)		(0.090)		(0.037)		(0.095)	
FOR×FShare			-0.195***	-	-0.181***	-	-0.188***	-	-0.179***	-
			(0.028)		(0.059)		(0.023)		(0.065)	
Imported Materials			-0.325*	-0.503*	-0.274*	-0.421*	-0.326*	-0.502*	-0.273*	-0.422*
			(0.177)	(0.262)	(0.146)	(0.220)	(0.179)	(0.261)	(0.145)	(0.222)
Firm Size			0.167***	0.158***	0.149***	0.127***	0.169***	0.161***	0.145***	0.122***
			(0.051)	(0.055)	(0.045)	(0.044)	(0.056)	(0.060)	(0.041)	(0.040)
HHI			-0.000*	-0.000*	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LabProd			0.417***	0.443***	0.406***	0.429***	0.418***	0.444***	0.405***	0.428***
			(0.105)	(0.114)	(0.094)	(0.101)	(0.105)	(0.115)	(0.092)	(0.100)
Constant	16.945***	16.930***	8.899***	8.422***	9.935***	9.614***	9.019***	8.560***	9.934***	9.594***
	(0.227)	(0.230)	(2.054)	(2.223)	(1.602)	(1.740)	(2.015)	(2.181)	(1.693)	(1.842)
Observation	67194	61191	67194	61191	67194	61191	67194	61191	67194	61191
R^2 (within)	0.036	0.042	0.096	0.102	0.123	0.133	0.095	0.101	0.123	0.134

According to Table 5, Models 1 to 5 reveal findings similar to one another. Horizontal Spillover within the recipient industry (*HSpill_Ind*) has a positive but not significant effect on wages. This result implies that the larger output produced by MNEs has a positive impact on wages in domestic companies within the same subsector. However, the effects are not significant. Meanwhile, Horizontal Spillover within the province (*HSpill_Provi*) reveals a significant, negative trend in the wage rate. The negative spillover impact is more pronounced for Domestic Firms than for the entire sample (All Firms). The result indicates that greater participation by foreign companies negatively influences the wages in domestic firms within the provinces where MNEs work. In this sense, wages for workers in local firms do not increase due to the greater presence of MNEs (inward FDI). Instead, MNEs' larger market share diminishes wage growth within the region where they operate. As the coefficient for foreign firms is positive (FOR), it indicates that workers in MNE earn larger salaries than others. This suggests that the presence of MNE has an impact on wage inequality between domestic firms and MNE. The results are in line with the case of Vietnam (Nguyen, 2019; Nguyen *et al*., 2019) and China (Chen *et al*., 2011), who find that FDI has a negative impact on wages in domestic firms.

Furthermore, the finding is relevant to the arguments of Li *et al*. (2013) and Suyanto *et al*. (2021), who stated that the spillover effects might be geographically clustered, as such agglomeration as occurs with MNEs, crowds out labor costs and augments competitive pressures for workers within the clusters. In this sense, the impact of *HSpill_Provi* is more relevant (negative) than the effect of *HSpill_Ind*. Sjöholm (2017) pointed out that foreign firms in Indonesia generally pay higher wages than domestic ones, either due to lack of knowledge of the local labor market, to avoid labor mobility (in terms of turnover or to avoid tech and knowledge leakages), or as a result of volatility in the demand for labor. In that sense, the practice of paying higher wages to workers within MNEs does not lead to an increase in wages for the entire sector or region, contrary to what was commonly assumed in earlier studies in Indonesia, which argued the case for the crowding out of labor due to MNE (Suyanto *et al*., 2021; Sari *et al*., 2016).

Additionally, we consider whether the technology intensity of firms has an impact on wage premia ($HSpill_{Tech}$). The results of a horizontal spillover within a specific technology intensity group (*HSpill_Tech*) show negative, although insignificant effects for Models 1 to 4. This result signals that the presence of MNE will not crowd out the market for labor within the specific technology intensity group. The relationship between the magnitude of spillover and the technological gap has been theoretically studied in the literature. Wang and Blomström (1992) argued that the extent of the spillovers from FDI increases with the technological gap. By contrast, Cantwell (1989) supported the idea that FDI encourages wages in high-tech firms as companies seek workers with high skills in related sectors rather than workers from unrelated tech areas (e.g., unskilled workers). Our findings contrast with those of Pittiglio *et al*. (2014), who pointed out that effects from incoming FDI are not homogeneously distributed among firms, being highly related to the technological level of firms and less relevant for low tech. We find no evidence of different impacts across tech groups.

Initially, we may expect that when the technology intensity gap between the domestic and foreign firms is large, FDI inflows within high-tech sectors will lead

to higher wages for high-skill workers. Possibly a large tech gap could also lead to lower wages for labor in low-tech sectors (decrease in demand). However, in our findings, no significant effect of Horizontal spillover within technology is detected. These findings suggest that FDI spillovers in wages are not different across technology intensity groups. In this sense, although foreign firms in the pharmaceutical industry (for example) offer higher salaries, it will not significantly affect the wages of local firms in a similar technology group, e.g., the chemical industry.

The dummy variable to identify foreign companies (*FOR*) shows positive and significant magnitude for Models 2-5, strengthening the argument that foreign companies offer relatively higher wage rates than domestic firms. As noted in Figure 1, the wage premia of production workers are 1.96 times larger in foreign firms than in domestically owned enterprises. Similarly, employment premia (all workers included) are 3.49 larger in foreign-owned firms than domestic ones (Figure 2). High-skill workers may benefit from the presence of foreign companies to a larger extent than production workers, as the wage premia suggest, in line with earlier studies in Indonesia (Sjöholm, 2017; Javorcik *et al*., 2012; Lee and Wie, 2015). Higher wages signal that foreign companies may attract the most skilled workers, leading to a workforce migration from domestic companies to foreign ones. However, if ever that effect takes place, it does not crowd out the labor market. A similar effect has been pointed out in earlier studies in Indonesia, where foreign firms and exporters reported greater productivity, allowing them to offer higher wage premia to workers (Arnold and Javorcik, 2009; Esquivias and Harianto, 2020; Javorcik *et al*., 2012). However, we argue that higher wages paid by foreign firms do not crowd out the labor market, as generally presumed in studies in Indonesia.

Studies on other geographies (Beenstock *et al*., 2017) also pointed out polarization on wages for workers in high-skill and capital-intensive sectors compared to labor-intensive industries. We found contrasting impacts in the interaction terms (*FOR×FShare*). This indicates that if foreign ownership is higher, the firm is more likely to offer lower wages than firms with foreign ownership below 10%. This finding signals those wages are not directly associated linearly with the foreign share of the firm. Instead, it may rather be the status of the firms that suggests payments of higher salaries[2]. As noted in Sjöholm (2017), MNEs in Indonesia pay higher wages than domestic firms, due to a lack of knowledge of the local labor market, high turnover, to avoid knowledge leakages, among other reasons.

Other control variables show similar findings between Models 2 to 5. A higher intensity of imported material is associated with a lower wage rate for firms. This finding contrasts with our hypothesis that intensifying import activities may require high-skill workers, forcing firms to increase wages. By contrast, the results suggest that imports may substitute for jobs in Indonesia and lead to less pressure for a rise in wages. It is noticeable that the magnitude of the imported

[2] Study of (Sari *et al*., 2016) also found the similar result for the case of firm's productivity. Sari *et al*. (2016) found that for the foreign firms with threshold 10% perform a better productivity, but a larger foreign share in the foreign firm associates to the lower productivity.

material of domestic firms is greater than the share of imports for the sample of All Firms. This indicates that their lower wage rate may be associated with high imports, mainly for domestic firms that may be less efficient. Imports by foreign firms may be related to a higher quality of inputs, increasing the competitiveness of workers and the wage rate (complementary). A plausible reason for this finding is that domestic firms might employ less-skilled workers and utilize imported materials as a way of substituting for skills via imported goods. In earlier studies, domestic firms often displayed lower technical efficiency than large and foreign firms, likely connected to their less efficient workers (Sari *et al*., 2016; Yasin, 2021). In this regard, Yasin (2020) highlighted that domestic companies should instead employ more domestic resources (labor) to increase firm performance as they are more efficient. Nevertheless, hiring skilled workers is related to a higher cost of inputs (e.g., higher wages), requiring domestic firms to increase productivity (e.g., technology capability) to be profitable.

Furthermore, market concentration (HHI) negatively and significantly impacts the wage rate, albeit in a relatively small way. The results indicate that higher concentration in the subsector leads to a decrease in the wage premia. Higher market concentration also refers to the market power of firms, suggesting that firms holding a substantial share of output may maintain dominance over the most efficient resources (high skill labor), an insight pointed out in earlier studies, both in Indonesia (Arnold and Javorcik, 2009; Esquivias and Harianto, 2020; Javorcik *et al*., 2012) and other geographies (Bayraktar-Sağlam and Böke, 2017; Beenstock *et al*., 2017; Pittiglio *et al*., 2014). It may be important to maintain competitive markets to allow wage adjustments and avoid excessive market power to put pressure on wages.

Firm size positively affects the wage rate. This finding is not surprising as we expect larger companies often allocate more sophisticated technology to boost production, employing higher-skilled labour. Larger firms hire more workers, utilize higher capital, and use more advanced technology to achieve higher efficiency and productivity, supporting previous studies that measures the impact of FDI spillovers in wages is the categorization of firm size according to the number of workers (e.g., Wiboonchutikula *et al*., 2016; Widodo *et al*., 2015).

The finding of firm size is strengthened by the impact of labour productivity (*LabProd*) on wages. Labor productivity has a positive impact on wages in Indonesian companies. Increasing the productivity of labour is likely to drive earnings up. The positive link of labor productivity on wages suggests that not only the firm's status (foreign-owned, large, or high tech) that matters to push wages up but also workers' productivity. The welfare of workers may improve as labour becomes more productive, suggesting that policymakers should place more attention to labour productivity programs. The literature points out that labour cost in Indonesia has increased rapidly, although not always accompanied by gains in productivity (Sugiharti *et al*., 2019). Growth in wages expanding due to minimum wage policies rather than based on labor productivity may lead to a decline in competitiveness rather than an improvement on welfare for workers.

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A. Wage Spillovers based on Firm Size Quantiles

Our finding in Table 5 demonstrates that, in general, spillovers from spatial dimensions matter more than sectoral or technological dimensions. In this regard, it is essential to disclose whether the insignificant findings from other dimensions, i.e., within the industry and within technology, are affected by the output-based firm size. Table 6 reports the estimates of effects of FDI spillovers on wages classified in terms of three groups of output-based firm size (Q1 as smallest firms, Q2 as medium firms, and Q3 as largest firms). As we employ a panel data approach, the indicator of firm size is time-variant. In this regard, the groups are based on the average firm size from 2011-2015.

According to Table 6, there are significant changes in the spillover effects when we split the observation based on the firm size. A point to observe is that most firms are domestic among the smallest size group of firms (Q1). Similarly, as noted in Figure 3, the large gaps between the wages of foreign and domestic firms of the same size occur in firms within Q2 and Q3 groups.

We found that positive spillovers within the industry ($HSpill_{Ind}$) occur in the first quantile (Q1) group of firms (smallest size). Meanwhile, the other quantiles reveal a negative magnitude. This result indicates that the presence of MNE may lead to an increase in wages in smaller size firms (Q1). However, that increase in wages is not transmitted to salaries from larger firms in groups Q2 and Q3. The presence of MNE may then raise the wage level in small-size firms (Q1) within the industry while having only a small impact on wages in Q2 and Q3.

In terms of Horizontal Spillover within the province ($HSpill_{Provi}$), we identify a similar effect across quantiles, where incoming FDI leads to a lower wage level in domestic companies than in All Firms. Interestingly, the positive impact that firms within Q1 experience from horizontal spillovers within the industry is canceled out by the adverse effects from horizontal spillover effects within the host province.

Table 6.
Regression Results of Wage Spillovers based on Firm Size Quantiles

This table reports the estimates of effects of FDI spillovers on wages classified by three quantiles of output-based firm size (Q1-Q3). Equation (6) is used in this table. The column of All Firms refers to all observation (both foreign and local firms), while the Domestic Firms column only includes observation with local firms. Driscoll-Kraay Standard errors are in parentheses. ***, **. * : significances at alpha 1%, 5%, and 10%.

	Q1		Q2		Q3	
	All Firms	**Domestic Firms**	**All Firms**	**Domestic Firms**	**All Firms**	**Domestic Firms**
HSpill_Ind	0.043*	0.007	-0.008***	-0.008***	-0.005***	-0.005***
	(0.022)	(0.010)	(0.002)	(0.002)	(0.001)	(0.001)
HSpill_Provi	-0.050***	-0.007*	-0.027***	-0.029***	-0.006***	-0.008***
	(0.007)	(0.004)	(0.006)	(0.005)	(0.002)	(0.002)
HSpill_Tech	-0.052***	-0.006***	0.014***	0.015***	0.000	0.001
	(0.013)	(0.002)	(0.005)	(0.005)	(0.002)	(0.002)
FOR	-0.079	-	0.004	-	0.226***	-
	(0.376)		(0.055)		(0.066)	
FOR×FShare	0.059	-	0.235	-	-0.235***	-
	(0.470)		(0.254)		(0.024)	

Table 6.
Regression Results of Wage Spillovers based on Firm Size Quantiles (Continued)

	Q1		Q2		Q3	
	All Firms	Domestic Firms	All Firms	Domestic Firms	All Firms	Domestic Firms
Imported Materials	-1.436***	-0.478	-0.179*	-0.259*	0.095***	0.093***
	(0.490)	(0.344)	(0.095)	(0.146)	(0.036)	(0.032)
Firm Size	0.337***	0.348**	0.047***	0.028	0.139***	0.145**
	(0.076)	(0.137)	(0.017)	(0.019)	(0.049)	(0.063)
HHI	-0.000**	0.000	0.000	0.000	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LabProd	0.604***	0.560***	0.414***	0.419***	0.250***	0.267***
	(0.132)	(0.161)	(0.104)	(0.107)	(0.047)	(0.048)
Constant	7.542***	6.575**	9.620***	9.574***	12.389***	12.014***
	(2.479)	(3.173)	(1.871)	(1.936)	(0.833)	(0.874)
Observation	22398	22259	22398	21553	22398	17379
R^2 (within)	0.2	0.203	0.154	0.159	0.08	0.09

An intriguing result is revealed by the Horizontal spillover within technology intensity ($HSpill_{_Tech}$). The result shows that Q1 has negative spillovers, while Q2 shows significant positive spillovers. This finding indicates that incoming FDI for small-size firms (Q1) in similar technology intensity might adversely affect wages. By contrast, firms within Q2 (medium-size firms) will experience a rise in salaries derived from horizontal spillovers. As such, competition for workers (revealed by an increase in wages) may be more intense among firms within Q2 than in Q1. For the Q3 group (largest firms), no significant effect is identified. This finding is plausible as large firms have sophisticated technology and enjoy specific market power, which allows them to pay higher wages and even compete with foreign rivals (Ciani *et al*., 2020). In this sense, the wage spillover effect is not related to the presence of foreign firms for Q3. Another consideration for the negative magnitude of spillover effects within the technology group for smaller firms (Q1) suggests that the presence of foreign companies is less relevant for smaller firms than larger ones. Smaller firms might be unlikely to compete for skilled workers once wages in the labour market increase.

The contrasting findings between pooled and size-group observations indicate that FDI spillover effects, notably within the industry and within technology, cannot be generalized. The impact of wage stimulation is not homogeneous across firm size. A robust finding of Horizontal spillover implies that spatial spillovers matter the most amongst all, supporting the finding of Li *et al*. (2013) and Suyanto *et al*. (2021).

The dummy variable employed for foreign-owned companies does not significantly affect wage levels for Q1 and Q2. It means that the wage level between foreign and domestic firms is only significant for the largest size group of the firms (Q3). Furthermore, an intriguing result is shown by the intensity of imported materials. This result indicates that the utilization of imported materials by smaller firms reduces wage levels. Firms might compensate for the imported material costs by substituting them for the cost of labour, as they are produced

more efficiently abroad. As for the largest firms, access to imported intermediate goods helps firms be more competitive, reflected in higher returns for workers. Policymaking then may need to be differently related to inputs for production. At Q1, larger import penetration may indicate a reduction in returns for workers (substitution and possibly a loss in the competitiveness of domestic suppliers), while for Q3, it relates to higher competitiveness.

The effect of firm size is more pronounced in Q1. A large impact of firm size on wages may capture the bargaining power of labor as the size of companies increases. Small firms may have to attract skilled workers by increasing wages. As smaller firms have more flexibility and the ability to develop and adopt new capabilities (Drbevich and Kriauciunas, 2011; Hernández-linares *et al*., 2018), it might allow them to adjust wages in more flexible ways and to a significant magnitude compared to larger firms. This argument supports the finding of Diaz and Sanchez (2008), who postulated that smaller firms have lower complexity and face fewer barriers than large firms in terms of organisational and managerial controls.

B. Robustness Test

This study conducts three approaches to examine the robustness test to compare our findings in Table 6[3]. The first approach is to group firms in each subsector based on size and average wage level (high gap relative to MNE or low gap). The second strategy is to estimate spillover effects for firms within Java – Sumatra Island (largest industrial corridors in Indonesia) and compare the results against all firms. The third approach estimates spillover effects by computing wages based on production workers alone (wages do not include non-production workers). The third approach intends to proxy the possibility of different spillover effects for lower-skilled workers (production labour). However, the results of the sample of including all workers and only-production workers (Appendix, Table A1) are consistent, having only slight differences in magnitude. The results suggest that differences in job positions (production and non-production) do not lead to different spillover effects.

As for the first approach, we cluster firms according to the wage gap between domestic and foreign firms in the sub-sector. The Low-gap group consists of firms that pay 50% or less on average, relative to the wages paid by MNEs. Meanwhile, the high-gap group consists of subsectors with an average wage gap of more than 50% relative to MNEs. The results in Table 7 indicate that the sign of the spillover effects is similar across firms with low or high wage gaps, suggesting that results are consistent. Results in Table 7 support the estimates in Table 6, suggesting that the size of firms matters, adding that the level of wages also matters. We identify that the most consistent effects stem from Horizontal spillover within the host province. Spillover within the industry reinforces the results from Table 6. It suggests that small firms may experience an increase in wages while large firms may, by contrast, experience adverse spillover effects in wages. On the other hand, spillovers related to the technology group discourage wages in Q1 (mostly in low-wage firms) and increase wages in Q2 and Q3. Additional variables for foreign ownership (FOR), Firm Size, HHI, labour productivity reveal similar estimates.

[3] We test robustness for Table 6 as the impact of group-size matters in determining spillover effects.

Table 7.
Robustness Test 1: Group Size Findings and Wage Gap Group for All Observations

This table reports the estimates of the robustness test of FDI spillovers on the wages differentiated primary finding in Table 6 and the wage gap group. The wage gap group is determined by the wage gap between foreign and domestic firms in each subsector. The Low-gap group consists of subsectors with an average wage gap of less than 50%, while the high-gap group consists of subsectors with more than 50%. Driscoll-Kraay Standard errors are in parentheses. ***, **, *: significances at alpha 1%, 5%, and 10%.

	Q1			Q2			Q3		
	All	**Low Gap**	**High Gap**	**All**	**Low Gap**	**High Gap**	**All**	**Low Gap**	**High Gap**
HSpill_Ind	0.043*	0.032**	0.046*	-0.008***	-0.001	-0.007**	-0.005***	-0.007**	0.002
	(0.022)	(0.013)	(0.024)	(0.002)	(0.002)	(0.003)	(0.001)	(0.003)	(0.003)
HSpill_Provi	-0.050***	-0.074***	-0.049***	-0.027***	-0.038***	-0.019***	-0.006***	-0.011***	-0.002***
	(0.007)	(0.009)	(0.007)	(0.006)	(0.006)	(0.004)	(0.002)	(0.003)	(0.000)
HSpill_Tech	-0.052**	-0.017***	-0.057***	0.014***	0.031***	0.003	0.000	0.009***	-0.016***
	(0.013)	(0.004)	(0.014)	(0.005)	(0.005)	(0.004)	(0.002)	(0.002)	(0.003)
FOR	-0.079	0.091	-0.024	0.004	0.194*	0.059***	0.226***	0.338**	0.118*
	(0.376)	(0.285)	(0.409)	(0.055)	(0.117)	(0.012)	(0.066)	(0.134)	(0.067)
FOR×FShare	0.059	-0.663	0.064	0.235	-0.018	0.128	-0.235***	-0.353***	-0.122
	(0.470)	(0.524)	(0.499)	(0.254)	(0.180)	(0.208)	(0.024)	(0.076)	(0.086)
Imported Materials	-1.436***	-0.926**	-1.456***	-0.179*	-0.049	-0.276***	0.095***	0.151***	0.009
	(0.490)	(0.398)	(0.530)	(0.095)	(0.134)	(0.093)	(0.036)	(0.056)	(0.048)
Firm Size	0.337***	1.029***	0.311***	0.047***	0.029	0.048	0.139***	0.055**	0.219***
	(0.076)	(0.330)	(0.079)	(0.017)	(0.042)	(0.029)	(0.049)	(0.025)	(0.084)
HHI	-0.000**	0.000	-0.000***	0.000	0.000	-0.000*	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LabProd	0.604***	0.640**	0.600***	0.414***	0.554***	0.350***	0.250***	0.286***	0.215***
	(0.132)	(0.248)	(0.127)	(0.104)	(0.147)	(0.081)	(0.047)	(0.054)	(0.040)
Constant	7.542***	6.05	7.664***	9.620***	6.758**	10.886***	12.389***	11.755***	13.075***
	(2.479)	(4.323)	(2.376)	(1.871)	(2.691)	(1.493)	(0.833)	(0.900)	(0.794)
Observation	22398	1255	21143	22398	8889	13509	22398	11104	11294
R^2 (*Within*)	0.200	0.282	0.200	0.154	0.19	0.154	0.080	0.102	0.077

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Table 8.
Robustness Test 2: Nationwide Panel and Java & Sumatra Islands

This table reports the estimates of the robustness test of FDI spillovers on wages differentiated by Nationwide and Java & Sumatera Islands. Driscoll-Kraay Standard errors are in parentheses. ***, **. * : significances at alpha 1%, 5%, and 10%.

	Q1				Q2				Q3			
	Nationwide		Java & Sumatera		Nationwide		Java & Sumatera		Nationwide		Java & Sumatera	
	All	Domestic	All	Domestic	All	Domestic	All	Domestic	All	Domestic	All	Domestic
HSpill_Ind	0.043*	0.044**	0.053**	0.053**	-0.008***	-0.008***	-0.004***	-0.004***	-0.005***	-0.005***	-0.002***	-0.002***
	(0.022)	(0.022)	(0.026)	(0.026)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
HSpill_Provi	-0.050***	-0.051***	-0.050***	-0.050***	-0.027***	-0.029***	-0.022***	-0.024***	-0.006***	-0.008***	-0.004***	-0.005***
	(0.007)	(0.007)	(0.004)	(0.004)	(0.006)	(0.005)	(0.004)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)
HSpill_Tech	-0.052***	-0.053***	-0.015**	-0.016**	0.014***	0.015***	0.010***	0.010***	0.000	0.001	0.002	0.004*
	(0.013)	(0.013)	(0.007)	(0.007)	(0.005)	(0.005)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
FOR	-0.079	-	0.787	-	0.004	-	0.103**	-	0.226***	-	0.156*	-
	(0.376)		(0.711)		(0.055)		(0.043)		(0.066)		(0.082)	
FOR×FShare	0.059	-	-0.736	-	0.235	-	0.187	-	-0.235***	-	-0.167***	-
	(0.470)		(0.868)		(0.254)		(0.347)		(0.024)		(0.052)	
Imported Materials	-1.436***	-1.464***	-1.651***	-1.660***	-0.179*	-0.259*	-0.193	-0.247	0.095***	0.093***	0.053	0.038
	(0.490)	(0.503)	(0.594)	(0.601)	(0.095)	(0.146)	(0.139)	(0.162)	(0.036)	(0.032)	(0.037)	(0.031)
Firm Size	0.337***	0.311***	0.534***	0.506***	0.047***	0.028	0.167***	0.149***	0.139***	0.145**	0.119**	0.093
	(0.076)	(0.079)	(0.104)	(0.098)	(0.017)	(0.019)	(0.057)	(0.046)	(0.049)	(0.063)	(0.057)	(0.071)
HHI	-0.000**	-0.000**	-0.002***	-0.002***	0.000	0.000	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LabProd	0.604***	0.608***	0.623***	0.625***	0.414***	0.419***	0.529***	0.536***	0.250***	0.267***	0.231***	0.248***
	(0.132)	(0.134)	(0.109)	(0.109)	(0.104)	(0.107)	(0.111)	(0.116)	(0.047)	(0.048)	(0.047)	(0.048)
Constant	7.542***	7.498***	6.671***	6.663***	9.620***	9.574***	7.568***	7.502***	12.389***	12.014***	12.582***	12.191***
	(2.479)	(2.502)	(2.377)	(2.369)	(1.871)	(1.936)	(1.969)	(2.046)	(0.833)	(0.874)	(0.869)	(0.910)
Observation	22398	22259	20502	20359	22398	21553	20502	19647	22398	17379	20502	15944
R^2 *(Within)*	0.2	0.203	0.26	0.262	0.154	0.159	0.13	0.134	0.08	0.09	0.067	0.076

For the second approach to examine robustness, we focus on firms located in Java and on Sumatra Island. This approach was referred to by Tomohara and Takii (2011), who demonstrated that FDI spillover to the workers mainly benefits the manufacturing sector in those islands. As Java & Sumatra panel data is employed, we calculate new Horizontal Spillovers for all dimensions (within the industry, within the province, and within technology), firm size, and market concentration (HHI). The observation of Java & Sumatra represents approximately 91% of the nationwide sample. According to Table 8 (Column Java – Sumatra), we identify that Horizontal Spillovers for all dimensions reveal robust estimates for each group of size, shown by the relatively similar sign and magnitude of the coefficient compared to Table 6. In this regard, we argue that the findings of Tomohara and Takii (2011) remain relevant, as most significant results from FDI spillovers accrue to firms in Java – Sumatra.

IV. CONCLUSION

In this study, we estimate the impact of foreign direct investment spillover effects on wages for the manufacturing sector in Indonesia, covering the 2011 to 2015 period. We employ fixed effects with standard errors from Driscoll and Kraay (1998) to handle possible cross-sectional dependence. Earlier studies have identified positive spillovers from FDI on technical efficiency and productivity. However, little has been said about the impact of FDI inflows on the labor market in Indonesia. Our results demonstrate the effect of inward FDI on wages through horizontal spillover effects in three different dimensions: FDI effects within the industry, within the province, and within technology intensity. We estimate results for pooled samples (all firms), companies according to size, clusters of firms according to average wage level, and firms according to location (Java and Sumatra Island).

The results suggest that when the observations are pooled together, only horizontal spillover effects within the province are negative and statistically significant, suggesting that FDI inflows may harm the wage rate in the host province. However, when firms are grouped according to size, the impact of spillovers from all three dimension (spatial, industry, and technology) are statistically significant. Horizontal spillover within technology (FDI inflow into similar technology intensity sub-sectors) reveals a negative effect on the wage level only for the group of smallest firms. However, large firms do not capture this impact, implying that the distortion from foreign companies mainly affects wages within small-sized firms. As smaller firms might not utilize high technology and often have simple managerial systems, they are unlikely to compete for skilled workers once wages increase. As for spillovers within the industry, the effects are positive for smaller firms and negative for medium and large ones, suggesting that FDI in a specific recipient industry leads to higher wages for smaller firms and negative (albeit relatively low impact) for large firms.

The most consistent finding is that of within-province industry spillover, implying that the geographical dimension matters the most in the utilisation of inward FDI. The coordination between central and local governments remains essential to ensure that local companies are sufficiently competitive with foreign

companies. Simultaneously, research and development activities might also be intensified for local companies to accommodate those high skilled workers in improving firms' productivity. Both these strategies, ultimately, aim to avoid high-skilled workers' migration to foreign companies.

We also find evidence of foreign firms paying significantly higher wages. Furthermore, we find that imported materials tend to lower the wage level for smaller firms and increase it for large ones. This suggests that larger imports harm wages for Indonesian workers in smaller firms, although it raises wage levels in large firms. We conclude that although FDI spillovers have important impacts on wages in Indonesia, they do not lead to an overall crowding-out effect as often assumed in earlier studies. We find that labour productivity positively impacts wages, suggesting that productivity improvements could help promote welfare gains (raise in wages) without sacrificing industrial competitiveness. Finally, although our study has addressed robust findings of the impact of spillover on wages, our model did not accommodate the dynamic behavior of spillover towards wages, such as the lag at which the FDI spillover might affect the domestic wage level. In this regard, future studies may find examining the effect of FDI spillover in a dynamic model an attractive research endeavor.

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APPENDIX

Table A1.
Regression Results of Wage Spillovers from Production Workers

This table reports the estimates using FEM only for production workers. Model 1-5 refers to equations (2)-(6). The column of All Firms refers to all observations (both foreign and local firms), while the Domestic Firms column only includes observation for local firms. In this result, robust standard errors are employed. Driscoll-Kraay Standard errors are in parentheses. ***, **. * : significances at alpha 1%, 5%, and 10%.

	Q1				Q2				Q3			
	All Observations		Production Worker		All Observations		Production Worker		All Observations Production		Worker	
	All	Domestic Firms	All	Domestic Firms	All	Domestic Firms	All	Domestic Firms	All	Domestic Firms	All	Domestic
HSpill_Ind	0.043*	0.007	0.043*	0.043**	-0.008***	-0.008***	-0.008***	-0.009***	-0.005***	-0.005***	-0.005***	-0.005***
	(0.022)	(0.010)	(0.022)	(0.022)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
HSpill_Provi	-0.050***	-0.007*	-0.050***	-0.051***	-0.027***	-0.029***	-0.027***	-0.029***	-0.006***	-0.008***	-0.006***	-0.007***
	(0.007)	(0.004)	(0.007)	(0.007)	(0.006)	(0.005)	(0.006)	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)
HSpill_Tech	-0.052***	-0.006***	-0.052***	-0.052***	0.014***	0.015***	0.015***	0.016***	0.000	0.001	0.001	0.002
	(0.013)	(0.002)	(0.013)	(0.013)	(0.005)	(0.005)	(0.005)	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)
FOR	-0.079	-	0.015	-	0.004	-	0.023	-	0.226***	-	0.307***	-
	(0.376)		(0.348)		(0.055)		(0.060)		(0.066)		(0.092)	
FOR×FShare	0.059	-	-0.04	-	0.235	-	0.242	-	-0.235***	-	-0.289***	-
	(0.470)		(0.443)		(0.254)		(0.195)		(0.024)		(0.042)	
Imported Materials	-1.436***	-0.478	-1.443***	-1.472***	-0.179*	-0.259*	-0.184**	-0.270**	0.095***	0.093***	0.105***	0.109***
	(0.490)	(0.344)	(0.480)	(0.494)	(0.095)	(0.146)	(0.080)	(0.129)	(0.036)	(0.032)	(0.035)	(0.029)
Firm Size	0.337***	0.348**	0.350***	0.324***	0.047***	0.028	0.036	0.014	0.139***	0.145**	0.153***	0.152**
	(0.076)	(0.137)	(0.077)	(0.079)	(0.017)	(0.019)	(0.022)	(0.023)	(0.049)	(0.063)	(0.047)	(0.063)
HHI	-0.000**	0.000	-0.000**	-0.000**	0.000	0.000	0.000	0.000	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LabProd	0.604***	0.560***	0.610***	0.614***	0.414***	0.419***	0.422***	0.425***	0.250***	0.267***	0.257***	0.274***
	(0.132)	(0.161)	(0.130)	(0.132)	(0.104)	(0.107)	(0.105)	(0.108)	(0.047)	(0.048)	(0.048)	(0.049)
Constant	7.542***	6.575**	0.425	0.383	9.620***	9.574***	2.454	2.431	12.389***	12.014***	5.138***	4.768***
	(2.479)	(3.173)	(2.456)	(2.480)	(1.871)	(1.936)	(1.902)	(1.969)	(0.833)	(0.874)	(0.875)	(0.923)
Observation	22398	22259	22395	22256	22398	21553	22392	21547	22398	17379	22390	17372
R^2 (within)	0.2	0.203	0.203	0.205	0.154	0.159	0.157	0.162	0.08	0.09	0.08	0.09

Table A2.
Technology Intensity Classification

This table presents the classification of technology intensity based on Organization for Economic Co-operation and Development (OECD) consisting of High Technology (HT), Medium High Technology (MHT), Medium Low Technology (MLT), and Low Technology (LT). Source: (OECD, 2011).

High Technology		Medium-High Technology		Medium-Low Technology		Low Technology	
Code	**Subsector**	**Code**	**Subsector**	**Code**	**Subsector**	**Code**	**Subsector**
21	Pharmaceutical Industry	20	Chemical Industry	23	Fabricated Metal Industry	10	Food Industry
26	Computers, Electronics, and Optics Industry	27	Electrical Equipment Industry	24	Metal Base Industry	11	Beverage Industry
		28	Machinery Industry	25	Metals Industry	12	Tobacco Industry
		29	Motor and trailers Industry	22	Rubber and Plastic Industry	13	Textile Industry
		30	Other Transport Equipment Industry	19	Products from Coal and Oil Refinery Industry	14	Apparel Industry
						15	Leather and Footwear Industry
						16	Wood Industry
						17	Paper and Printing Industry
						18	Printing and Recording Media Industry
						31	Furniture Industry
						32	Other Manufacturing Industry

Table A3.
Multicollinearity Test

These tables report the Variance Inflation Factor (VIF) and Matrix of Correlation to diagnose multicollinearity assumption.

	Variance Inflation Factor (VIF)	**1/VIF**
HSpill_Ind	1.5	0.6
HSpill_Tech	1.5	0.6
Import	1.2	0.8
FOR	14.8	0.06
FOR×Fsh	14.7	0.06
Market Concentration (HHI)	1.1	0.9
HSpill_Prov	1.0	1.0
Firm Size	1.1	0.8
Labour Productivity	1.2	0.8
Mean VIF	4.2	-

Table A4.
Matrix of Correlation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) *w*	1.0									
(2) *HSpill_Ind*	0.1	1.0								
(3) *HSpill_Prov*	0.1	0.1	1.0							
(4) *HSpill_Tech*	0.2	0.5	0.1	1.0						
(5) *FOR*	0.2	0.2	0.2	0.2	1.0					
(6) *FOR×Fsh*	0.2	0.2	0.2	0.2	1.0	1.0				
(7) *Import*	0.2	0.2	0.1	0.2	0.4	0.4	1.0			
(8) *Firm Size*	0.2	0.1	0.1	0.1	0.3	0.3	0.3	1.0		
(9) *HHI*	-0.1	-0.2	0.0	0.1	0.0	0.0	0.0	0.0	1.0	
(10) *LabProd*	0.5	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.0	1.0

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