Do Wage Spillovers Lead to Labor Productivity Spillovers?

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Abstract
This research wants to analyze wage spillovers in Yogyakarta and Central Java, and whether these spillovers induce labor productivity spillovers. This study uses data published by the Central Bureau of Statistics (BPS) and includes wage rate, regency/city minimum wage, capital intensity, education level, growth, and labor productivity. The spatial regression is used in this study. The results show that there is a wage spillover across regencies/municipalities in Yogyakarta and Central Java. The wage rate is not only influenced by the variables in the area but is also by the wage rates in the surrounding area. However, these wage spillovers do not encourage labor productivity spillovers. The labor productivity in a regency/city depends on the availability of physical capital in this area. An expansion in labor productivity in a zone does not affect the increment in labor productivity in the encompassing zone. The physical capital not easily moved between regencies/cities.

Keywords: wage, spillovers, labor, productivity

JEL Classification: J24, J3, J61

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Introduction

Workers also pay attention to fairness aspects in wage determination, besides to the wage rate. The fairness aspect encourages workers to compare their wages with those of other employees for the same job position. Therefore, if there is a substantial difference between the wages rate they receive and the salaries of other employees, then they consider that this wage determination to be unfair. This perception of injustice will be responded to by the lower worker’s effort. Workers will take non-cooperative actions that hinder the achievement of company goals. It means that the worker’s effort is not only determined by the wage rate, but also it is determined by relative wages (Lallemand et al., 2004). Relative wages reflect in the ratio of wages received by workers to the wages of other employees in the same job position. Then, as technology develops, workers can find out relative wages easily. The development of trade unions facilitates interaction among workers so that they can exchange information with each other. Then, the interaction among workers allows them to know the wage rate at other companies in the same region and even the wages rate in the outside area.

The development of trade unions also shows the decentralization of industrial relations that, in turn, prompted an expansion in the bargaining power of trade unions when negotiating with employers. Frequently, an expansion in the bargaining power of workers causes complicated negotiations on the wage rate. In these negotiations, it is frequently tricky for employees and employers to reach a meeting point. To that end, the government seeks to simplify the determination of wages by issuing Government Regulation No. 78 of 2015 on Remuneration. Through this regulation, the Provincial Minimum Wage (UMP) and Regency/City Minimum Wage (UMK) are determined based on a formula taking into account inflation and economic growth. However, the lowest pay permitted by law guidelines applies to a single employee with less than one year of tenure. Meanwhile, for a worker with a year or more of tenure, the wage determination remains to be carried out through negotiations between the trade union and the employer.

In the wage rate determination, the employer wishes that workers are cooperative in order to realize the company’s goals. This interest encourages employers to consider the fairness aspect by taking into account the wage rates of the surrounding area. Therefore, the company’s conditions and the area where the company located but also by the wage rate in the surrounding area do not only determine the wage rate. In other words, there are wage spillovers between a region and the surrounding area.

Furthermore, wage spillovers are also encouraged by spatial integration that covers several regencies/cities. Spatial integration makes several regions interdependent with each other in the form of an economic zone. The establishment of economic zones promotes smooth interactions between economic agents, including interactions among workers. It means that spatial integration encourages wage spillovers via smooth interaction among workers. Spatially, interactions among workers will form a horizontal network as a means to share and to spread knowledge. This interaction not only supports the exchange of information and technology but also encourages the similarity of attitudes among workers. Workers who do not have much information tend to take a position by imitating the attitude of other parties who have more information (Manski, 2000).
The similarity of attitudes among workers causes them to realize the bigger magnitude of their bargaining power to demand higher wages. Therefore, trade unions will support each other to demand workers’ rights, especially demands increased wages. In this situation, an expanded level of an increased degree of social collaboration would prompt a higher readiness to pay (Hilbert & Suessmair, 2015). Besides, social norms formed by social interaction play an essential role in the pricing mechanism in addition to fairness motives (Regner, 2015). It means that the employer must pay a higher wage rate due to an increase in workers’ bargaining power. Workers want their wage rate is not too much different from that in the surrounding area.

The economy of Yogyakarta and Central Java are incorporated and growing untimely. This economic integration is supported by the existence of transportation routes connecting some cities in the region. Moreover, good communication infrastructure also supports the economic integration between the two areas. The good infrastructure promotes many economic activities between areas, for example, the labor mobility among regions (commuting) and business among areas. This migration encourages interaction in the form of cooperation between residents in two or more geographically adjacent regions. This interaction is known as neighborhood effects (Manski, 2000). Social interaction will form a horizontal network among workers as a means for knowledge exchange and information dissemination. Economic agents who are in a group or a network, as a result of economic integration, tend to have similar behavior. The worker’s behavior in a region influences those in the surrounding area. Workers who feel behind information will imitate the behavior of other workers who are considered to better knowledge. It encourages the equality of perceptions and attitudes of workers from various regions who have been equally disadvantaged in negotiations with employers.

The same feeling of some workers strengthens the ties between trade unions. More people join to trade union so that the strength of this organization increases. The bargaining of trade union power is one aspect that employers must pay attention to, especially in wage rate negotiations. The employer has an interest in the continuity of production activities. However, this continuity requires good cooperation between employees and employers. Without good cooperation, the company’s target will not be achieved. The absence of cooperation between employees and employers results in downward of worker’s commitment (Islam, 2001). This situation has the potential to cause strikes. Labor strikes create chaotic production targets set by employers. During the strike, the company cannot produce output, whereas they have usually been bound by an agreement with the buyer to send output according to the order.

Furthermore, workers want fairness in determining wage rates. The element of fairness in wages can be seen, among others, from the low wage disparity. Workers expect the determined wage rate not too far from that in other companies. At the point when the most productive area raises pay rates because of a positive productivity shock, laborers in the lower productivity area may request equal pay increments because of fairness judgment, without coordinating it with a relative productivity increment (Konings & Marcolin, 2014).

The similarity of workers’ attitudes in Yogyakarta and Central Java led to an increase in bargaining power during the wage negotiations. Therefore, in determining the wages rate,
Employers in Yogyakarta do not only take into account internal factors in their company, and economic conditions in this province. However, they will also take into account the wages rate in Central Java Province. It means that the wages rate is not only determined by the company’s internal conditions, but also by the wages rate in the surrounding areas so that wage spillovers have occurred between Yogyakarta and Central Java.

Several researchers analyzed wage spillovers and obtained many results. The study of Neumark et al. (2004) explores the impact specifically on individual wage increases at several points in the payroll cycle and finds evidence of significant spillover effects. Moreover, an experiment by Falk et al. (2006) showed that minimum wages had a significant impact on reservation wages for individuals. They claim that the minimum wage affects the fairness of subjects and that this can lie behind any reported spillover effects. However, Dickens & Manning (2004) provide significant proof that minimum wages were implemented in 1999 and did not show any signs of spillover. The study’s findings of Autor & Salomons (2018) found that minimum wages do not produce significant beneficial spillover effects at higher percentiles of wages. Likewise, Vandekerckhove et al. (2018) indicated no evidence found that the minimum wage spillage is due to the consequences of dis-employment.

Workers’ mobility promotes social interaction among workers (Boldrin & Canova, 2001). Social interaction makes some workers receive skills and experience from the other (Hoi & Pomfret, 2011). Görg et al. (2007) find that laborers who work for and get preparing in outside firms experience more fast development than laborers being prepared distinctly in domestic firms. However, wage increases occurred in foreigners are followed by increases in that in a domestic company. The fairness aspect makes workers demand their wages received is not too different from those in other regions. Social interaction among workers makes a wage increase in a zone is adhered to by an increase in wages in the encompassing zone.

An increase in wages causes an increase in labor costs. The rise in labor costs is a burden for employers, so they will be willing to pay higher wages if worker productivity also increases. The wage rate is closely related to labor productivity (Manning, 2000; Nurfiat & Rustariyuni, 2018). The higher labor productivity, the higher output that can be produced. Moreover, labor productivity is identified with the nature of personnel, innovation, and physical capital stock. The education level of labor and the measure of physical capital significantly affect labor productivity (Farah & Sari, 2014). The technology is a critical factor that determines the output level. The higher output only can be achieved by better technology. The better technology promotes an increase in the effectiveness of production equipment so that the production process enables to create a higher added value (Blaga & Jozsef, 2014). However, the operation of high-tech production equipment requires highly skilled workers. Therefore, the effectiveness of using the production means will increase if the skills of workers also rise.

Furthermore, workers’ skills will improve if they get new production techniques, for example, from other workers. Indeed, the interaction among workers allows workers who have much knowledge to share their knowledge, experience, and skills with others, including workers in the outside area. The transfer of knowledge enables workers to work more effectively and efficiently. They can increase output at a fixed level of input use so that labor
productivity increases. Therefore, an expansion in labor productivity occurred in a locale will be adhered to by a rise in labor productivity in the encompassing zone. This process is known as labor productivity spillovers.

Improved transportation and communication facilities support labor productivity spillovers between regions. Improvements in the transportation sector have led to higher worker mobility among regions. Meanwhile, improvements in communication technology have made it easier for population communication among regions so that residents of other regions can immediately access information that occurs in one area quickly and cheaply. Therefore, improvements in transportation and communication have sped up labors’ productivity spillovers. The interaction among workers enables wages not only spillover but also encourages labor productivity spillover. It means that labor productivity spillovers will follow wage spillovers.

Some researchers have analyzed the possibility of wage spillovers and found many results. Some studies have found wage spillovers (Neumark et al., 2004; Falk et al., 2006), while some other results do not indicate wage spillovers (Dickens & Manning, 2004; Autor & Salomons, 2018; Vandekerckhove et al. 2018). However, so far, researchers have not analyzed whether wage spillovers encourage labor productivity spillovers. Therefore, this study examines the possibility of wage spillovers and whether these spillovers encourage productivity spillovers.

**Methods**

This research uses data published by the Central Bureau Statistics of Yogyakarta and Central Java. The data of wage rate, regency/city minimum wages, labor productivity, economic growth, education level, and capital intensity were utilized in this study. Due to the limited data available, the wages rate is measured by wages in the industrial sector production workers. BPS publications on wage rates are relatively limited and only present wages in the industrial sector, while wage publications in other sectors are rarely found. The wage rate is obtained by processing 2017 Sakernas raw data. Meanwhile, labor productivity is estimated by the proportion of Regional GDP to the population of working age. The selection of the working-age population as a dividing factor is because just the working-age populace is effectively associated with the production process. The education level is estimated by mean years of schooling. The average length of schooling illustrates the average level of education pursued by citizens in their studies. Furthermore, capital intensity is estimated by the ratio of formation in gross domestic fixed capital to the total working-age population. The formation of gross domestic fixed capital illustrates the amount of investment available to increase the number of production means. Capital is a complement to human resources in production activities.

The scope of the research area for the analysis of wage spillovers is all areas in Yogyakarta and Central Java in 2017. Meanwhile, for analysis of labor productivity spillovers, the study uses 2018 data. It is based on the consideration that the impact of wage spillovers that occurred in 2017 only feels at least one year after the event. In the case of 2018, labor productivity data
not available in several regencies/cities, then labor productivity in several areas is estimated by the interpolation method.

In the case of wage spillovers, the analysis is conducted based on cross-section data in 2017. However, it is different from some previous research, in the case of productivity spillovers built based on the dynamic model approach. For worker productivity variables, as the dependent variable, the 2018 data is used, while the independent variables use the 2017 data. It is due to the consideration that in economics, the impact of changing explanatory variables on the experimental variable is rarely instantaneous. Very often, the dependent variable reacts to the independent variable with a lag time. For that reason, paying attention to the lag does the regression analysis. The analysis of wage spillovers and labor productivity spillovers are done through spatial regression analysis. The spatial regression analysis is a regression analysis to obtain observational information that is influenced by the effect of space or location. The spacing effect is presented in the form of location coordinates (longitude, latitude) and weighting. One of the spatial influences is spatial autocorrelation. Spatial autocorrelation is asserted through weighting as a matrix that portrays the relationship closeness among observations, and after that, otherwise called the spatial weight matrix. If there are three regions on a map, the spatial weighting matrix \( W \) can be obtained based on the distance from the neighborhood information that indicates the distance between one and another region.

Furthermore, the analysis of wage spillovers and labor productivity spillovers is carried out based on the following spatial regression models.

\[
Wage_i = a_i W age_i + b_1 Growth_i + b_2 Educ_i + b_3 Minwage_i + d_i + e_i \quad (1)
\]

\[
Pduct_i = \gamma Pduct_i + \phi_1 Minwage_i + \phi_2 Educ_i + \phi_3 Capitn_i + \eta_i + u_i \quad (2)
\]

In the equations above, the wage is the wage rate, \( W_{ij} \) is a spatial weighting matrix which reflexes in view of spatial closeness among regencies/cities. Respectively, \( Pduct \) symbolizes worker productivity, \( Educ \) is the level of education, \( Capitn \) is the intensity of capital. The \( Growth \) and \( Minwage \) respectively symbolize economic growth and regency/city minimum wages. The existence of a neighboring among locations is shown in the spatial weighting matrix. Areas that are near the position observed are given a noteworthy weighting, while those distant are given a slight weighting.

**Results and Discussion**

**Results**

The outcome of the Scatter Plot Frame shows that the labor productivity indicates cluster patterns, the appropriate weighting matrix used is Quinn continuity with the arrangements of 1 = for territories that fringe legitimately and 0 = for regions that do not outskirt straightforwardly. Hence, the weighting variable is assigned in view of the Quinn continuity method.

The research data are vulnerable to the appearance of diversity between locations and spatial autocorrelation. To detect spatial autocorrelation, the Moran Index is used, which is a measure of the correlation between observations that are close together. The calculation
result using Geoda software shows the Moran’s statistical value of the variable wages of 2.960, which shows the existence of spatial autocorrelation. This result is reinforced by the statistical value of the Lagrange Multiplier (lag) test of 9.727 with a p-value of 0.002, which means that there is spatial autocorrelation. Likewise, the LM Robust value (lag) of 8.809 indicates spatial autocorrelation.

Further, in view of the consequences of the quantile examination, it tends to be seen that very high pay rates occur in the regions of Brebes, Kendal, Demak, Gobogan, Semarang, Sragen, Sleman, Salatiga City, Semarang, and Yogyakarta. Meanwhile, regencies/cities with high wages rates include the regions of Cilacap, Kulonprogo, Bantul, Klaten, Gunungkidul, Wonogiri, Karanganyar, Sukoharjo, Boyolali, and Rembang. The regencies/cities with moderate wage rates include Blora, Kudus, Jepara, Purworejo, Magelang, Temanggung, Batang, and several cities such as Solo, Magelang, and Tegal. Further, low wage rates occur in Pati, Wonosobo, Kebumen, Banyumas, Purbalingga, Banjarnegara, Tegal, Pekalongan, Pemalang, and Pekalongan City (Figure 1).

By utilizing the spatial regression model, there are two potential outcomes models, in particular, the Spatial Autoregressive Model and the Spatial Error Model. The Spatial Autoregressive Model binds together a straightforward relapse model with spatial lag in the experimental variable applying a cross-section. The superiority of this model is that this model is appropriate for use in spatial patterns with a local approach. In the interim, the Spatial Error Model was incorporated by considering the spatial effect on errors.

The estimation outcomes of Spatial Autoregressive and the Spatial Error Models are indistinguishable. In the Spatial Autoregressive Model, the Wage_spillovers coefficient is significant, so is the LAMBDA coefficient in the Spatial Error model. The regression coefficient of growth is significant for both the Spatial Autoregressive and Spatial Error
Models. Besides, the regression coefficient of regency/city minimum wage is notable in both the Spatial Autoregressive and the Spatial Error Models. Simultaneously, the regression coefficient of the education level is not notable in both for the Spatial Autoregressive and the Spatial Error Models (See Table 1).

Furthermore, the results of estimated labor productivity spillovers also show spatial autocorrelation. LM Robust value (lag) of 6.746 with p-value < 0.005 indicates the existence of spatial autocorrelation. Likewise, the significant statistical value of the Lagrange Multiplier (SARMA) test indicates the presence of spatial autocorrelation. This result is strengthened by the Robust LM (Error) value of 4.810 with a p-value of 0.028, which means that there is spatial autocorrelation.

| Table 1. Results of Estimated Spatial Regression of the Wage Spillovers |
|---------------------------------------------------------------|
| **Spatial Autoregressive Model** | **Spatial Error Model** |
| Coefficient | Prob. | Coefficient | Prob. |
| W_SPILOVER | 0.521* | 0.001 | - |
| CONSTANT | -704.621 | 0.068 | -137.524 | 0.767 |
| GROWTH | 77.631* | 0.043 | 82.517* | 0.032 |
| EDUCATION | 21.071 | 0.324 | 12.295 | 0.624 |
| MIN WAGE | 505.950* | 0.011 | 617.122* | 0.014 |
| LAMBDA | - | - | 0.546* | 0.000 |
| R-square | 0.517 | 0.498 |
| Schwarz Criterion | 549.296 | 547.464 |

Note: * significant at α = 5%

Generally, high labor productivity is happened in the industrial and service sectors, while the economic sector with low labor productivity is the agricultural and the informal sector. The industrial and service sectors require workers with specific expertise and skills. Expertise workers can only do production processes in the industrial and service sectors. Workers with minimum skills cannot enter the industrial or service sectors. Meanwhile, the agricultural sector tends to be a sector that accommodates job seekers with various skills, even for workers with minimum skills. Job seekers who are not absorbed in the industrial and service sectors will enter the agricultural sector. The number of agricultural sector workers is enormous, while the area of agricultural land tends to decrease from year to year due to the conversion of land from agricultural land to non-agricultural land.

Meanwhile, the informal sector also accommodates an abundance of labor from other sectors and thus faces the problem of labor surplus. The number of workers is excessive, while the capital is limited so that the production process not to be carried out effectively and efficiently. This condition leads to low labor productivity in the informal sector.

Labor productivity in Yogyakarta and Central Java shows a cluster. Very high labor productivity occurs in regions that have industrial centers such as Kendal, Kudus, and
Cilacap. Meanwhile, other regions such as Solo, Salatiga, Semarang, Magelang, and Tegal have adequate service sectors so that labor productivity is also very high. Meanwhile, regencies/cities with high labor productivity include Banyumas, Batang, Semarang, Boyolali, Sragen, Karanganyar, Sukoharjo, Klaten, Sleman, Blora, Pati, and Pekalongan Regencies. Moreover, labor productivity in the regency, which is dominated by the agricultural sector, is relatively low. Labor productivity is happening in Brebes, Tegal, Purbalingga, Pekalongan, Temanggung, Kebumen, Purworejo, Bantul, Wonogiri, and Rembang Regions. Furthermore, low labor productivity includes Pemalang, Banjarnegara, Wonosobo, Magelang, Kulonprogo, Gunungkidul, Grobogan, Demak, and Jepara Regions (See Figure 2).

Figure 2. Labor Productivity in the Yogyakarta and Central Java by Regency/City

The estimation results of labor productivity spillovers both in view of the Spatial Autoregressive and the Spatial Error Models demonstrate similar outcomes. In the Spatial Autoregressive Models, the coefficient of labor productivity spillovers is not significant. Likewise, the LAMBDA coefficient on the Spatial Error Models is also not prominent. The regression coefficient of regency/city minimum wage both in the Spatial Autoregressive and the Spatial Error Models are insignificant. Moreover, the regression coefficient of education level in the Spatial Autoregressive and the Spatial Error Models are both insignificant. In the interim, in the Spatial Autoregressive Models, the regression coefficient of regency/city minimum wage is noteworthy; however, in the Spatial Error Model, this regression coefficient is not noteworthy. Moreover, the coefficient regression of capital intensity is significant both in Spatial Autoregressive and the Spatial Error Models (See Table 2).
Table 2. Estimation Results of Labor Productivity Spillovers

|                          | Spatial Autoregressive Model | Spatial Error Models |
|--------------------------|-----------------------------|-----------------------|
|                          | Coefficient | Prob. | Coefficient | Prob. |
| PRODUCTIV_SPILOVER       | -0.373      | 0.064 | -           | -     |
| CONSTANT                 | -64.598     | 0.127 | -56.985     | 0.184 |
| MINIMWAGE                | 0.055*      | 0.002 | 0.041       | 0.085 |
| EDUCATION                | 4.711       | 0.124 | 4.219       | 0.162 |
| KAPINTENS                | 0.987*      | 0.000 | 0.948*      | 0.000 |
| LAMBDA                   | -           | -     | -0.099      | 0.658 |
| R-square                 |             |       |             |       |
| Schwarz Criterion        | 0.668       |       | 0.635       |       |

Note: * significant at α = 5%

Because of the outcome of spatial regression analysis, it is necessary to determine a superior model as the basis of analysis. The determination of the superior model is done based on the Schwarz Criterion value. The superior model has a smaller Schwarz Criterion value than the other model. Based on the value of the Schwarz Criterion, the accomplish model is the Spatial Error Model (SEM). Moreover, in the wage spillovers and labor productivity spillovers analysis, the SEM model has a lower Schwarz Criterion value than those in the SAR model (Table 3). For this reason, the discussion of wage spillovers and labor productivity spillovers is carried out based on the Spatial Error Model.

Table 3. Encompassing Model Based on Schwarz Criterion

|                          | Wage Spillovers | Labor Productivity Spillovers |
|--------------------------|-----------------|------------------------------|
|                          | SAR             | SEM                          | SAR             | SEM                          |
| Schwarz Criterion        | 549.296         | 547.464*                    | 360.184         | 359.167*                    |

* Encompass model

Wage Spillovers

In the case of wage spillovers, the regression coefficient of economic growth, regency/city minimum wages, and LAMBDA are significant. Meanwhile, the education level variable is not significant. The coefficient of determination ($R^2$) in the Spatial Error model is 0.498. It means that 49.8 percent of wage rate variations can be explained by variations in independent variables, while variables outside the model explain the remaining 50.2 percent.

The regression coefficient of the education variable, which is not significant, indicates that the education level does not influence the wage rates. It is likely due to using the average length of scholar variables as a proxy for education level variables. The average length of schooling in Yogyakarta and Central Java regions tends to be uniform between one region and another. The average length of schooling in these two provinces does not differ significantly between one regency/city and another. Only a few cities such as Semarang, Salatiga, Solo,
Yogyakarta, and Sleman Regency have an average length of schooling scores far above the average length of schooling in these two provinces. Generally, the average length of schooling in Yogyakarta and Central Java is only 7.8 years. This education level is equivalent to grade 2 junior high school. This level of education is not enough to provide expertise to the population so that the majority of the population works in the agricultural and informal sectors with relatively low wages compared to those in the industrial and service sectors.

The results of this study are different from Mocan (2014), which indicates that increased schooling, in particular for women, has been translated into higher wages. The significant additional allowance about 14 percent per year of education is concentrated among females. It is possible because, in Mocan (2014), the impact of schooling on wage rates for male and female employees has been segregated, while this research has not differentiated wage levels into male and female. Moreover, the Indonesian economy is facing the labor surplus problem, so most Indonesian workers are forced to work excess labor sectors, such as the agricultural and informal sectors. Many industries fail to produce high wages due to low labor productivity. Therefore, a rise in education level has no impact on the growth in salaries. Besides, the results of Duflo (2001) investigated a transition in Indonesia in the 1970s and found that education output grew significantly, just as wages increased by 6.8 to 10.6% each year of schooling.

Meanwhile, the regression coefficient of economic growth is significant, with a value of 82.517. It means that an increase in wages of 82.517 rupiahs will follow a rise in the economic growth of 1 percent. The output is the result of interaction among several inputs in a production process. One of the inputs involved in the production process is labor input. A rise in the output shows an increment in the contribution of employees in the production process, and this condition indicates a rise in labor productivity. The high and low economic growth in an area depends on the high and low labor productivity. Then, the wages rate is determined based on labor productivity. Labor productivity reflects the ability of workers to produce output. The higher labor productivity, the higher the wages rate they receive, and vice versa. Thus workers are entitled to receive higher compensation from an increase in output. One form of remuneration to workers is an increase in wages. This finding supports the results of research Charysa (2013), which states that economic growth influences regional minimum wages. Economic growth shows the increase in output in a certain period. An output increase shows an increase in the labor contribution in the production process so that they get a higher wage.

Further, the regression coefficient of the regency/city minimum wage variable is significant, with a value of 617.122. It shows that an increase in regency/city minimum wages of 1 thousand rupiahs caused an increase in workers’ wages of 617.122 rupiahs. Even though the rule of minimum wage applies to single workers with occupation tenure less than one year, however, a fairness consideration makes a raise in regency/city minimum wage also affects wage increments for other workers with job tenure one year or more.

The fairness aspect is thought to be the cause of general wage increases. In addition to the wages rate received, workers also pay attention to aspects of fairness in wages. Workers compare their wages both with colleagues in the same job position and with other employees.
in the company. Workers realize that the wages rate differs for each different level of work, but they can not accept if there is a too large difference in wages rate between work levels. If the wage gap between levels is enormous, then the worker considers this to be unfair, and vice versa. Workers will give a negative response to the unfair wage determination. Therefore, a raise in the regency/city minimum wage will be followed by an increment of general wages.

This resulting study differs from the findings of Dube et al. (2010) that show the enormous negative elasticity acquired in the conventional determinations was expected for the most part to contrast (regional and local) in employment trends that were not identified with minimum wage policies. This discovery likewise contrasts from the results of Neumark et al. (2006) in Brazil, which expressed that there is no proof that the adjustment in the minimum wage has expanded income at the lower end of the income distribution. It is allegedly due to differences in research objects. This study uses data on individual wage rates, while Dube et al. (2010) examine household income. Most household heads in Brazil earn wages at or close to the minimum wage so that the increase in the minimum wage does not affect the distribution of family income in Brazil.

The discoveries of this investigation are in accordance with the investigation consequences of Gindling & Terrel (2009) in Honduras. They discovered impacts just on the pay of laborers in medium and large firms, where an expansion of 1% in the minimum wage prompted an ascent of 0.29% in the average wage. Simultaneously, the authors found no impacts inferable from the minimum wage on the wage rates in small firms or self-employed workers. They found that a higher minimum wage could make joblessness and move work from large to small firms, which were bound to dismiss the minimum wage. The consequences of the examination additionally fitting with the discoveries of Vázquez et al. (2018), which expresses that an ascent in the minimum wage, on average, drove the time-based compensation rose by somewhere in the range of 1.6% and 2.6% for general worker and somewhere in the range of 1.8% and 3.3% for wage rates.

Furthermore, whether or not wage spillovers occurred can be seen from the significance of the LAMBDA coefficient. In the case of wage spillovers, the LAMBDA regression coefficient is significant, with a value of 0.546, indicating that there are wage spillovers in determining wage rates in Yogyakarta and Central Java. The wage rates in a region are not only influenced by some variables such as economic growth, education level, and regency/city minimum wage in this area but also by the wages rate in the surrounding areas. The results show that the wage rate in each regency/city influences 0.546 times than that of the surrounding regency/city. In the wage determination, fairness considerations encourage employers to consider the wage rates in the surrounding area.

The fairness aspect plays an essential role along with spatial integration between Yogyakarta and Central Java. This spatial unification promotes interaction between trade unions in various regions. Then, trade unions exchange information, which leads to similar attitudes, especially to demand higher wages. The presence of labor unions has a positive impact on firm productivity (Morikawa, 2010). These findings support Driffield & Taylor (2006), which states that wage spillovers do occur, but the multiple of these impacts recommend that inter-regional or inter-sectoral wage spillovers are restricted. There is proof of wage spillovers
for both skilled and unskilled labors, both across areas, ventures, and between the foreign and domestic owned sectors. Moreover, these discoveries are likewise in accordance with the study of Telegdy (2018) that expressed that the spillover affected primarily the wages of laziness, young workers, and the highly educated. The analysis also finds that employers raised the wages of incumbents, rather than newly hired employees, and that bonuses increased more than regular wages.

**Labor Productivity Spillovers**

Moreover, in the case of labor productivity spillovers, the regression coefficient of capital intensity is significant. Meanwhile, the regency/city minimum wage, education level, and LAMBDA are not significant. The coefficient of determination \( R^2 \) in the Spatial Error Model is 0.635. It means that 63.5 percent of labor productivity variation can be explained by variations in independent variables, while variables outside the model explain the remaining 36.5 percent.

The regression coefficient of the education level is not significant indicates that the level of education does not affect labor productivity. It is allegedly due to the use of the average length of school variables as a proxy for education level. The average length of schooling in Yogyakarta and Central Java regions tends to be uniform between one region and another. The average length of schooling in these two provinces does not differ significantly between one regency/city and another. Only a few cities such as Semarang, Salatiga, Solo, Yogyakarta, and Sleman Regency have an average length of schooling scores far above the average length of schooling in these two provinces. This condition causes variations in labor productivity not affected by education factors but by other variables. The average length of schooling in Yogyakarta and Central Java is 7.8 years. Thus the average population these two provinces are educated up to grade 2 in junior high school. This education level is not enough to provide human resources with specific expertise and skills. However, jobs in the industrial and service sectors require specific expertise, which can usually only be fulfilled by senior high school educated job seekers.

Indeed, workers graduating from junior high schools tend to work in the agricultural or informal sectors. The agricultural sector can accommodate a large number of workers, but a limited area makes labor productivity in this sector relatively low. The average area of land that can be cultivated by a farmer decreases as an impact of the conversion of land from agricultural land to non-agricultural land. Higher productivity in the non-agricultural sector has led to land conversion. The relatively small yields of agricultural cultivation have made the community no longer interested in the agricultural sector.

Meanwhile, the informal sector is also ready to ingest an enormous number of laborers. However, labor productivity in this sector is relatively low due to the low capital intensity. The results of this study support the findings of Larbi-Apau & Sarpong (2010), which express that educated labors have a higher extent to receive innovation and elective generation blend for rising effectiveness and efficiency. Higher educational levels have an impact on labor productivity in the poultry industry and ought to be saddled for improved performance in the domestic and global markets.
The regression coefficient of the regency/city minimum wage is not significant. An increment in the regency/city minimum wage is not followed by an increase in labor productivity. Even though regency/city minimum wages increase every year, but the magnitude of the wage increment is relatively small. This increase in wages does not have a notable impact on labor productivity. Enforcement of Government Regulation Number 78 the Year 2015 on Remuneration limit an increase in regency/city minimum wage. Based on this regulation, the determination of the regency/city minimum wage is no longer determined based on the results of negotiations between trade unions and employers, but it based on a formula taking into account inflation and economic growth. Trade unions can no longer negotiate with employers because the minimum wage has been determined based on a standard formula. The enactment of this government regulation results in a smaller increase in regency/city minimum wages than those in the previous period. At the same time, workers continue to face a decline in real wages due to inflation, so that increases in regency/city minimum wages do not encourage increases in labor productivity. A smaller increase in the regency/city minimum wage is seen as insufficient to encourage workers to work more harder. Therefore, an increment in regency/city minimum wages does not have an impact on labor productivity. These findings are different from Riley & Bondibene (2017) that find the relationship between national minimum wage and labor productivity through total factor productivity.

Moreover, the regression coefficient of capital intensity is significant, with a value of 0.950. It means that an increase in labor productivity of 950 thousand per person will follow enhancement in capital intensity of 1 million rupiahs per person. Labor productivity is closely related to capital intensity. The increase in capital intensity shows an increase in the mastery of each worker on capital input so that workers are more flexible in using production facilities. The increase in capital intensity delayed the entry into force of the Law of Diminishing Returns. High and low output depends on the amount of capital as a means of production. An increment in capital demonstrates a raise in production means so that employees can use that easily. As technology advances, the production process does not only depend on human resources but also the availability of production means. An increase in capital allows the production process to be carried out effectively and efficiently so that labor productivity increases. This discovery is in accordance with the results of Yang & Lahr (2008) that the increment of labor productivity for districts and sectors in China principally originates from the diminishing labor input per unit of gross output and changes in value-added of gross output. A wage increase has mixed impact on applicants productivity and motivation (Barigozzi et al., 2018).

Further, regardless of whether labor productivity spillovers happened can be seen from the centrality of the LAMBDA coefficient. In this case, the LAMBDA regression coefficient is not significant. It shows that there are no labor productivity spillovers in Yogyakarta and Central Java. The labor productivity in a zone is not impacted by labor productivity in the encompassing zones. The labor productivity depends on the capital intensity, while the wage rates do not affect.

Moreover, capital intensity depends on the formation of gross domestic fixed capital in each regency/city. Gross domestic fixed capital formation is production unit expenditure
to expand fixed assets. It describes an additional capital good, including procurement, manufacture, purchase of new capital goods from domestic and new or used capital goods from abroad. Thus gross domestic fixed capital formation is an investment made to increase physical capital. As technology advances, the production process relies upon the accessibility of high-tech production equipment. However, physical capital is not easy to move between regencies/cities. Indeed, the immobile of physical capital causes the availability of physical capital in an area that encourages an increase in output in that region but does not affect the output in the surrounding area. The absence of a movement of physical capital causes no spillovers of labor in Yogyakarta and Central Java.

Economic integration caused the economy of Yogyakarta and Central Java regions to be an economic zone. This integration encourages interaction between workers in the two provinces. However, this interaction will only affect the conditions of industrial relations, including the wage rates, but it does not affect physical things. An increase in wages in a regency/city affects the wage rates in the surrounding area, but this interaction is not able to encourage physical capital movement between regencies/cities. Physical investments such as factories and their equipment tend to settle in certain areas. The movement of physical capital requires an enormous cost and takes a long time. Generally, physical capital movement occurs in the long term so that studies using cross-section data do not detect it.

This result contradicts the findings of Stoyanov & Zubanov (2012) that hiring workers from more productive than firms that hired workers from more productive firms experience productivity gains one year after the hiring. The productivity gains associated with hiring from more productive firms are equivalent to 0.35 percent per year for an average firm. They argue that this is the evidence for productivity spillovers from more to less productive. It is because Stoyanov's work uses data from employees at the Danis company level. The organization hired highly skilled workers from outside to promote higher productivity for all employees. The availability of capital leads to productivity spillovers in a business. In the meantime, this study uses data from workers in all economic sectors by analyzing the social interactions and the potential for interregional spillovers of productivity among workers. Limited capital also inhibits the spillover of labor productivity, especially in poor areas.

This finding also contradicts the results of Newman et al. (2015), which states there are productivity gains associated with direct linkages between foreign-owned and domestic firms along the supply chain not captured by commonly used measures of spillovers. It includes evidence of productivity gains through forwarding linkages for domestic firms that receive input from foreign-owned firms. Newman et al. (2015) look at productivity spillovers through interactions between foreign investment firms and domestic firms. The versatility of resources enables productivity spillovers for employees. However, this study analyzes the probability of spillover productivity through social interaction between employees. Low capital mobility in Central Java and Yogyakarta reduces spillovers in workers' productivity.
Conclusion

Spillovers wage that occurred in Yogyakarta and Central Java did not encourage productivity spillovers. Although wage increases in an area have an impact on wage increases in the surrounding area, low mobility of capital hinders productivity spillovers. The nature of physical capital, which is not easy to move between regencies/cities, and this condition causes no spillovers of labor productivity in Yogyakarta and Central Java. The lack of capital regions faces a dilemma an increase in wages that is not accompanied by an increase in productivity.

Furthermore, in the formulation of wage policies, the regency/city and also the government of Yogyakarta and Central Java province need to create synergies in order to produce integrated policies. The integrated policy is needed to eliminate overlapping policies. Regency/city governments and provincial governments need to monitor wage rates in an area so that wage increases occur within reasonable limits, so that surrounding areas do not bear excessive burdens due to wage increases in a particular region. It is because productivity spillovers do not accompany the wage spillover.

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