

Education Spillovers and Labor Productivity Convergence In Yogyakarta Special Region and Central Java

Joko Susanto*, Didit Welly Udjiyanto

Faculty of Economics and Business, UPN "Veteran" Yogyakarta

*Corresponding author: jk.susanto68@gmail.com

Abstract

This study aims to identify the possibility of the occurrence of education spillover and the convergence of labor productivity in the Yogyakarta Special Region and Central Java. The research data includes the expected year of schooling, GRDP per capita, the number of senior high school, poverty rate, and labor productivity published by the Central Bureau of Statistics (BPS). The data were analyzed by the spatial regression models and the coefficient of variation. The results indicate that there is an education spillover. The expected years of schooling in a region/city is not only influenced by causal factors in this area but also influenced by the expected years of schooling in the surrounding area. Education spillover encourages an increase in labor productivity in the lagging region faster than advanced ones so that they are capable of catching up. Therefore, education spillover promotes convergence in labor productivity.

Keywords: education, spillovers, labor, productivity, Convergence

Introduction

Besides infrastructure and capital, the progress of a region is also determined by human capital. Human capital refers to the qualitative dimension of human resources, such as expertise and skills, which will affect labor productivity. Human capital is a production factor that can regulate other production factors. In the long run, economic growth no longer relies on physical input but shifts to human capital (Di Liberto, 2008), including innovation and education (Pelinescu, 2015). Human capital and physical capital are inputs that complement each other (Pablo-Romero & Gómez-Calero, 2013).

The government always strives to improve the quality of human capital, especially education. Investment in education is an activity that can increase the value of human capital. The outcome obtained from educational investments includes increasing skills labor. Education, as a critical component of human capital formation, is recognized as being vital in increasing the productive capacity of people. Education at the higher levels contributes directly to economic growth by making individual labors more productive and leading to the creation of knowledge, ideas, and technological innovation (Jelilov, Aleshinloye, & Önder, 2016).

States can increase the strength of their economies and their ability to grow and attract high-wage employers by investing in education and increasing the number of well-educated workers (Berger & Fisher, 2013). More educated and more likely to be successful in the job market. Improving the education sector affects economic growth by increasing labor productivity and production capacity. The performance of a country is closely related to the effectiveness of the education system. Besides contributing positively to the social, cultural, and political fields, an effective education system increases competitiveness and contributes to economic growth (Mercan & Sezer, 2014).

Some recent studies emphasize the long-run relationship between output and education. For instance, (Kosfeld & Lauridsen, 2004) state that employed people with at least secondary education increase both GDP per employed and GDP per capita in 180 German labor market. Similarly, (Bronzini & Piselli, 2009) show a positive long-run relationship between average employee schooling years and both labor productivity and output in Italy. Moreover, (Karnik & Lalvani, 2012) conclude that the gross enrollment ratio exhibits a strong positive effect on GDP per capita in 19 Indian States, and the contribution of education to growth is more significant than that of physical capital.

Based on the idea that education has a positive impact on economic growth, the government seeks to increase the years of schooling through compulsory education programs. The years of schooling is influenced by various factors, both socio-economic factors such as income per capita, poverty level, number of family members, and education of the head of the household. The income per capita is a macro indicator of the level of community welfare that reflects the economic capacity of the community, one of which is to finance education. Thus an increase in income per capita will increase school participation. This result is in line with the study of (Sanchez & Sbrana, 2010) and (Zhao & Glewwe, 2010) which states that increasing community welfare will increase school participation. Conversely, the family's economic inability to support the cost of education often has an impact on the high dropout rate. Communities with weak economies have obstacles to accessing education services. In many lagging regions, there are rarely found the good schools; therefore limits the ability of residents to access education.

Other factors that influence the years of schooling in a region are cultural and social status (Glewwe, 2002). Cultural and social status is dynamic as a result of the process of social interaction. Social interaction arises because members of the community are interconnected and need each other. Social interaction is a reciprocal relationship and response between individuals, between groups or between individuals and groups. Social interaction greatly influences the lifestyle of community members and determines the performance to be achieved. The pattern of people's lives will change along with the entry of new ideas as a result of social interaction.

The economy in Yogyakarta Special Region and Central Java tends to be integrated and grow together in line with the interaction between citizens in these areas. This integration is supported by the existence of local streets that connect some cities in both provinces. The form of interaction includes some activities such as population migration, investment flows, and inter-city trade. Inter-city interaction is also supported by the presence of many prominent universities in Yogyakarta with hundreds of thousands of students. The existence of several excellent universities has encouraged population migration to the Yogyakarta Special Region for studying.

The new thoughts that emerged in educational centers easily spread to various regions. Interaction between residents in Yogyakarta Special Region and Central Java caused changes in the life and thinking patterns of the population. Communities far away from education centers realize the importance of education to achieve the welfare of their regions. The change in public attitudes refers to an increase in expected years of schooling, which shows the length of school expected by children at a certain age in the future. Regions that far away from the city center have begun to see the importance of the education quality by including school-age children to pursue higher education. It means that there is some education spillover indicated by an increase in expected years of schooling for school-age residents who have been far away from the city center.

By taking a higher level of education, the community hopes to obtain higher skills. Higher skills are the driving factors for achieving an increase in labor productivity. This condition is reinforced by the support of the provincial and region/city governments in the development of educational infrastructure. Educational progress directly contributes to the quality of human resources. Indeed, education is closely related to economic activity. The development of educational infrastructure in lagging areas will be able to produce productive regions that will be able to catch up from advanced ones (Barro & Martin, 2004).

Therefore, improvement of educational infrastructure supports the convergence of labor productivity indicated by decreasing the disparity of labor productivity.

The economies of the Yogyakarta Special Region and Central Java economies are integrated and grow simultaneously. Economic integration between regions/cities in Central Java is supported by the existence of transportation routes that connect some cities in these areas. The presence of good infrastructure supports various economic activities between these areas, such as the movement of labors (commuters) and trade in goods and services between regions. Interactions between regions in Yogyakarta Special Region and Central Java were also supported by the presence of several prominent universities in Yogyakarta, Semarang, Solo, and Purwokerto. The existence of several excellent universities has encouraged population migration to several cities

in Yogyakarta and Central Java to study. This migration encourages interaction between residents in two or more regions that are geographically close.

Inter-population interaction not only allows the transfer of knowledge and skills between residents but also encourages the dissemination of new ideas from educational centers to the surrounding area. Social interaction is a crucial element in the process of knowledge spillovers (Noorderhaven & Harzing, 2009). Spatially, social interaction will form a horizontal network as a means to share and disseminate knowledge. The effectiveness of knowledge transfer requires cultural harmony (Lucas, 2010). Social interaction can encourage cultural balance while reducing cultural distance, which has hindered knowledge transfer (Ambos & Ambos, 2009).

Social interaction led to a rapid spread of the urban community attitude to the surrounding areas. Areas that have been far away from the city center have begun to see the importance of higher education levels. Thus social interactions encourage education spillovers, which are marked by the addition of expected years of schooling for school-age residents who have been far away from the city center.

Most of the great educational institutions are still in urban areas. This condition creates an educational inequality between the regions and the urban areas (Bustomi, 2012). The average Gini education index in the regencies area is higher than that in the municipality. The low education expenditure from households for financing education is one of the causes of the problem of education inequality. Differences in economic status are one of the factors that lead to educational inequality (Maozhong & Shen Hua, 2011). The government seeks to increase school participation, especially for the weak economic community through improving education infrastructure. This effort was realized mainly in the construction of new schools in several lagging regions so that the goal of equitable distribution of education could be achieved.

The development of educational infrastructure in the lagging region provides a multiplier effect so that this region can catch up with advanced ones. The education level is closely related to labor productivity. The higher the education level, the higher the productivity of labors. This development of educational infrastructure encourages labor productivity in the lagging region to grow faster than the productivity of advanced regional labors. The productivity of labors in the lagging region can catch up (Barro & Martin, 2004) productivity of labors in developed regions. Thus there has been a convergence of labor productivity, which is characterized by a decrease in the disparity in labor productivity between regions.

Research Method

This study uses data from the Central Bureau of Statistics (BPS) of the Yogyakarta Special Region and Central Java and other relevant publications. The data includes the expected year of schooling, GRDP per capita, the number of senior high schools, the poverty rate, and labor productivity. GRDP per capita is calculated by dividing the DRDP based on constant prices in 2010 with the mid-year population. The labors productivity is measured with GRDP based on constant 2010 prices divided by the number of working age population. The scope of the research area in Yogyakarta Special Region and Central Java in 2007-2017. The data published in 2017 is the latest publication. However, the labor productivity includes data for the 2014-2018 period in order to describe the progress of labor productivity disparities between regions in recent years. Labor productivity data for 2018 are estimated based on the interpolation method from the previous year's data.

This study covers expected year of schooling in all regencies and cities in Yogyakarta Special Region and Central Java and the variables that influence it in 2007-2017. Therefore, the research data is in the form of panel data.

Linear regression models on panel data that have interactions between spatial units will have a spatial lag variable on the dependent variable or on an error that is usually called the Spatial Autoregressive Model (SAR) and the Spatial Error Model (SEM). The focus on the Spatial Autoregression Model relates to spatial correlations on the dependent variable, while the Spatial

Error Model focuses on the residual. This study uses the Lagrange Multiplier test to find out the effects of spatial interactions.

The Spatial Autoregression Model is expressed in the following equations.

$$y_{it} = \delta \sum_{j=1}^N w_{ij} y_{jt} + x'_{it} \beta + u_i + \varepsilon_{it} \quad (1)$$

Meanwhile, the Spatial Error Model is outlined in the following equation.

$$y_{it} = x'_{it} \beta + \mu_i + \phi_{it}; \quad (2a)$$

$$\phi_{it} = \rho \sum_{j=1}^N w_{ij} \phi_{jt} + \varepsilon_{it} \quad (2b)$$

Respectively, Y is the expected year of schooling. The W_{ij} is a spatial weighting matrix based on spatial proximity between one region/city and another region/city. Meanwhile, X_1 is GRDP per capita. Hereafter, X_2 is a number senior high school, and X_3 is the poverty rate.

In the autoregressive model, the neighboring relationship between the locations expressed in the spatial weighting matrix W , with its elements W_{ij} is a spatial weight between areal units i and j . The locations that closed to the research site were given a substantial weighting, while the far away one has given a small weighting.

Furthermore, the spatial weighting matrix specified above is normalized first. The method used to normalize the spatial weighting matrix is the row normalization method. So that the elements in the normalized spatial weighting matrix row are spatial influences on a cross-section unit that comes from all other cross-section units, while the elements in the normalized spatial weighting matrix column are spatial influences of a cross-unit individual section to all other cross-section units.

Furthermore, to analyze labor productivity convergence, this study uses the sigma convergence method. This method measures the level of dispersion of labor productivity. The disparity in labor productivity between regions is measured by calculating the coefficient of variation of GRDP per working-age population. If in a certain year variation coefficient is smaller than the previous year's variation coefficient, then sigma convergence occurs. Conversely, if the coefficient of a specific year variation is higher than that in the previous year, then sigma convergence does not occur. The formula for estimating the coefficient of variation for each year is formulated in the following equation.

$$CV = \frac{\sqrt{\sum (y_i - \bar{y})^2 f_i / n}}{\bar{y}} \quad (3)$$

Respectively, CV is the coefficient of variation, y_i is the labor productivity in the region i , \bar{y} is the average of labors productivity in all regions, f_i is the population of region i , and n is the population of the entire region.

Results and Discussion

The long-term expected of years schooling are very long is occurred many urban areas such as Solo, Salatiga, Semarang, Magelang, Pekalongan, Yogyakarta, and several districts such as Sukoharjo, Sleman, Bantul, and Kulonprogo. Meanwhile, regions/cities with long expected years of schooling include Banyumas, Purworejo, Magelang, Semarang, Boyolali, Klaten, Karanganyar, Kudus, Demak, and Tegal City. Moreover, the regions/cities with medium expected years of schooling cover Cilacap, Purbalingga, Kebumen, Kendal, Temanggung, Rembang, Pati, Jepara, Gunungkidul, and Sragen Regencies. Furthermore, short expected years of schooling include Blora, Grobogan, Wonogiri, Wonosobo, Banjarnegara, Pemalang, Batang, Pekalongan, Tegal, and Brebes (Figure 1).

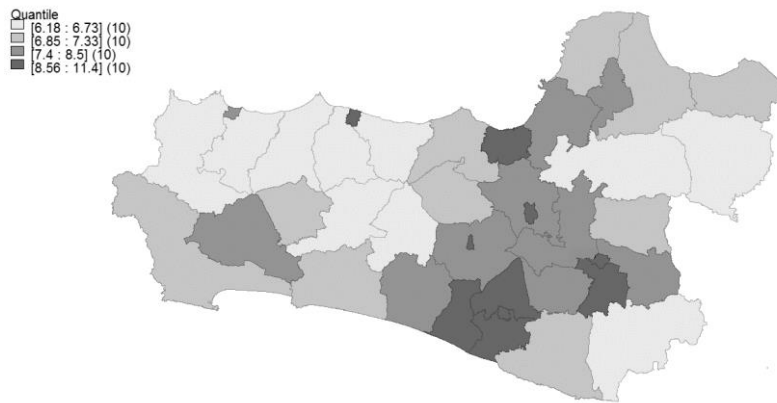


Figure 1. Expected Years of Schooling in Yogyakarta Special Region and Central Java by Regency/City

Furthermore, based on the results of the Scatter Plot Frame of the average of expected years of schooling that shows the cluster pattern, then the used weighting matrix is Quinn Continuity with the provisions valued at 1 for areas that have direct borders and value 0 for areas that have no direct borders. It means that the weighting variable is determined based on the Quinn Continuity method.

Before estimating the parameters of the spatial panel data model, we will first test whether there is a spatial interaction effect using the Lagrange multiplier test. In the Lagrange Multiplier test, there are two tests to be performed, namely the test of the SAR coefficient and the SEM coefficient. The value of χ^2 is 18.56 for the SAR model. The χ^2 value is statistically significant (Table 1). Meanwhile, the χ^2 value on the SEM model is not significant. It means that based on the SAR model, there is a spatial lag dependency, so it needs to be continued in the formation of the intended model. Furthermore, the analysis is carried out based on the results of the estimated SAR model.

Table 1. Lagrange Test Result

Model	LM Value	χ^2 (5%)
SAR	18.56 *	4.321
SEM	0.13	4.321

* significant at $\alpha=5\%$

The estimation results of the Spatial Autoregressive model show that all regression coefficients are significant. Meanwhile, the coefficient of determination (R^2) in the Spatial Autoregressive model is 0.7885 and it shows that 78.75 percent of the variation in expected years of schooling can be explained by variations in explanatory variables, while the remaining 21.25 is explained by residuals (Table 2).

Table 2. Estimated Results of SAR Models

Variable	Coefficient	Std. Error
Constant	-15.745	12.464
W_Expected Year of Schooling	0.176 *	0.096
GDRP per Capita	0.011 *	0.0001
Number of Senior High School	0.282 *	0.123
Poverty Rat	-0.071*	0.028

Dependent variable : Expected Year of Schooling

* significant at $\alpha=5\%$

The very long in expected years of schooling is occurred in several cities Central Java and some regencies in Yogyakarta Special Region except for Gunungkidul Regency. Indeed, the education performance in Yogyakarta Special Region is superior to the education performance in Central Java. The title of Yogyakarta as a center of education encourages the Yogyakarta community to realize the importance of education. On average, the expected years of schooling in Yogyakarta Special Region are higher than that in Central Java. The educational infrastructure in Yogyakarta Special Region is also better than that in Central Java. Some junior high school who graduates in Central Java chose to continue their studies in several senior high schools in Yogyakarta Special Region. Meanwhile, the medium expected years of schooling in Gunungkidul is occurred due to the poverty rate. Some junior high school who graduates in Gunungkidul chose not to continue their studies. They tend to enter the labor market to find income for supporting their family's income.

The GRDP per capita regression coefficient is positive, an increase in GRDP per capita by 1 million rupiahs per person was followed by an increase in expected years of schooling by 0.011 years. GRDP per capita can reflect the ability of the community to finance education. Therefore, an increase in GRDP per capita was followed by an increase in the education level. This result supports the findings of (Khairunnisa, Hartoyo, & Anggraeni, 2015) that GRDP per capita positively influences the junior secondary enrollment rate.

The number of senior high schools has positively influenced the expected years of schooling. An increase in the number of senior high schools by 1 unit, followed by an increase in expected years of schooling by 0.282 years. A school is a form of place used in the continuity of education programs. The government provides a sufficient number of school buildings to accommodate students need as much as the school. The construction of a new senior high school building increases the school capacity and then accommodate the additional students. It means that there is a broader opportunity for juniors high school graduates to continue their education so that longer in expected years of schooling also increased. Providing access to education can lead to an increase in education participation.

Meanwhile, the poverty rate has a negative influence on the expected years of schooling. An increase in the poverty rate of 1 percent will reduce the school's longevity by 0.071. The poor society faces limitations in accessing education. Poverty has caused many children in school-age not to get an education. The inability of a family's income to support the cost of education has an impact on the high dropout rate. Although the government has provided various types of facilities in the education sector, poverty causes school-age residents to enter the labor market. This finding supports the results of the research done by (Suryadarma & Suryahadi, 2009) and (Granado, Fengler, Ragatz, & Yavuz, 2007) which state that poverty is a barrier to education participation. Children tend to left the school in order to earn some money where "welfare" would depend on the family (Mihai, Titan, & Todose, 2015).

Furthermore, the $Y_{\text{expected years school}}$ (in SAR) is significant. Therefore, the distribution of education has occurred. The expected years of schooling in a region/city is not only influenced by some independent variables in these areas but also influenced by the expected years of schooling in the surrounding area. The value of the Lambda coefficient of 0.176 indicates that the value of the expected school year will influence 0.176 schoolings in the neighboring region. The social interaction between the community in the education center and the surrounding communities led to a rapid spread of the importance of higher school level. This social interaction led to the occurrence of education spillovers in Yogyakarta and Central Java, which were marked by an increase of expected years of schooling especially for school-age residents who had been far away from the city center.

The occurrence of education spillover has an impact on increasing labor productivity in the lagging region. The development of educational infrastructure in the lagging region has a multiplier effect on the economy of this region. The development of educational infrastructure can encourage an increase in labor productivity in the lagging region faster than that in the developed regions so that the lagging region can catch up. It means that convergence in labor productivity occurs.

A convergence of labor productivity can be traced by a decreasing in the dispersion of labor productivity between regions/cities. The progress of this dispersion is obtained by calculating the

coefficient of variation from labor productivity from year to year. The convergence of labor productivity is occurred when the dispersion of labors productivity tend to decreases over time, as indicated by a decrease in the variation coefficient of labor productivity (Figure 2). In 2014, the coefficient of variation in labor productivity between regions in Yogyakarta Special Region and Central Java was 0.204. This value continued to decline to 0.185 in 2017 and subsequently fell again to 0.178 in 2018.

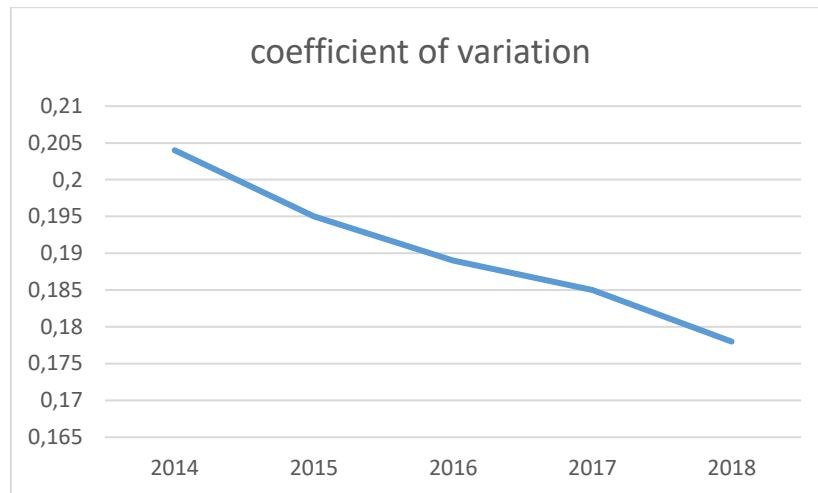


Figure 2. Coefficient Variation of Labor Productivity

Conclusion

This social interaction led to an occurrence of education spillovers in Yogyakarta Special Region and Central Java, which were marked by an increase of expected years of schooling for school-age residents who had been far away from the city center. Expected years of schooling in a region/city is not only influenced by the independent variables in this region but also influenced by the expected years of schooling in the surrounding area. Education spillover has an impact on increasing labor productivity in the lagging region. The development of educational infrastructure can encourage an increase in labor productivity in the lagging region faster than that in the developed regions. It means that convergence in labor productivity has occurred. The dispersion of labor productivity between regions in Yogyakarta Special Region and Central Java always declined from year to year.

To accelerate decline the disparities in labor productivity, the government needs to develop a more equitable education infrastructure and ensure easy access to formal education, especially in the lagging region. Furthermore, the government needs to identify the quality of educational infrastructure so that it is easier to determine the distribution of the education budget that is more appropriate for each region. Moreover, the regency/city government and the provincial government should synergize each other, especially in the formulation of economic policies to avoid overlapping policies.

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