Do Growth Spillovers Matter?

Joko Susanto¹*, Didit Welly Udjianto²

¹,²UPN Veteran Yogyakarta, Indonesia
Email: ¹jksusanto.68@gmail.com, ²diditwelly@upnyk.ac.id

*Corresponding author

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Abstract

Although the Yogyakarta Special Region and Central Java are two independent provinces with different regulations, these economies were integrated as a unity that interacts with each other, so this study examined whether the growth spillovers between regencies/cities occurred in these provinces. The data included economic growth, education, working-age population, and asphalted road published by the Central Bureau of Statistics for 2001-2018. This study used a regression analysis based on the Dynamic Ordinary Least Square (DOLS) model. The results showed that there were growth spillovers. The economic growth of a regency/city was positively influenced by economic growth in its surrounding regions. A particular regency/city obtained benefit from economic growth occurred in its surrounding. Meanwhile, an increase in the working-age population and the asphalted road positively affects economic growth. However, the increase in education did not affect economic growth. Therefore, the local government needs to improve connectivity between regions by building road networks and enhancing intergovernmental cooperation.

Keywords:
growth, spillovers, connectivity.

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Introduction

Economic growth is a reliable indicator of regional development. It shows an increase in the long-term capacity of the economy to provide various goods and services. The local government is always aiming at a specific economic growth rate to increase people’s welfare. An increase in output can be achieved by using new technology or using more input. New technology enables enterprises to use the best technologies to increase productivity and reduce costs (Çalıkkan, 2015). The replacing technology is done by dismantling old machines and installing new ones.

Companies will consider the benefits and costs of replacing technology. The benefits of the new technology include faster production processes and lower production costs. Meanwhile, the cost of replacing technology includes the cost of dismantling old machines and installing new ones. The company will use new machinery if it is considered economically feasible. It means that the new technology may not be accepted if it does not provide significant additional benefits, while the user must bear some costs. Besides, it takes a long time to find a new technology. Therefore, in the short term, companies tend to increase their output by using more inputs. The company must minimize the production cost to sustain its competitiveness. Most of the production cost is the purchase of raw materials (Niewiadomski & Pawlak, 2016), so the firm always searches for lower-priced inputs, including input supplied from other regions. The input movement from other regions needs excellent transportation facilities. Improved road facilities increase transportation efficiency and solve high-cost distribution problems.

Improved transport infrastructure also promotes economic integration between regions (Yu, 2017). Economic integration allowed the interaction of economic actors between regions. The economic integration between regions will take place quickly if this region’s economy and its surroundings complement each other. The integration of some neighboring regions is a first step toward creating an enormous market for trade and investment. Economic integration is believed to stimulate efficiency, productivity, and competitiveness (Ehigiamusoe & Hooi, 2018) through increased interaction between economic agents. The investors and workers from the surrounding area could be involved in the production process. As a result, they receive a fringe benefit in the form of capital rent and wages. Capital rents and wages are components of the Gross Regional Domestic Product (GRDP). Therefore, an increase in capital rents and wages promotes a rise in the GRDP that leads to economic growth.

Furthermore, economic activities tend to be concentrated in specific regions. Economically, this area is a single entity, but, occasionally, administratively, it covers several regencies/cities with different regulations from one another. Efficiency considerations make it necessary for companies to choose the right place. There are three interrelationship elements in the choice of venue: the interaction between economies of scale, transport cost, and customer demand. Considering economies of scale make businesses concentrate their production process in a specific location to serve the entire market. Some economic
sectors such as accommodation, food establishment, construction are mostly located in the sub-urban area (Dubé et al., 2016). Companies tend to build their plants in these areas to minimize transportation costs.

Generally, significant local demand comes from locations around central business districts. People tend to live in these areas due to amenities such as good transportation, excellent telecommunication facilities, and shorten the distance to the business center. The population density in suburban areas is higher than in rural areas. An area around the central business district becomes an exciting county. Some firms prefer to build their plant in this area, with some workers come from the central business district and surrounding areas. Some worker from various regions meets in industrial centers that promote social interaction between workers. The social interaction between educated workers in the central business district and the surrounding areas promotes knowledge spillover.

Educated workers share their experience, knowledge, and skills. Knowledge transfer is likely to occur over relatively short distances, through face-to-face contact with clients or suppliers, or within the local labor market (de Nicola et al., 2019). The economies around the central business districts received positive externalities from human capital working in this venue. Therefore, human capital affects not only particular regions but also the surrounding regions.

Knowledge spillovers promote innovation (Aghion & Jaravel, 2015), resulting in high productivity (Hall, 2011). A spillover effect of knowledge accumulation will be smooth if there is a spatial closeness between regions. Spatial proximity determines how well knowledge spread between workers to facilitate innovation and growth. It overcomes barriers to social interactions such as long-distance and language constraints. Spatial proximity allows workers to move quickly due to low transport costs and linguistic similarity. Spatial closeness encourages interaction between economic actors to allow knowledge to spread across economic sectors.

Furthermore, knowledge spillovers provide additional knowledge to companies. Then, the firms combine it with the knowledge they already have. Spillovers occur in all economic sectors such as agriculture, manufacturing industry, and services. Knowledge spillovers have an impact on increased labor productivity in areas around the business center. Many of the staff who work in the business center come from this place and its surroundings. Social interaction enables skilled workers to share their knowledge, experience, and skills with other workers. Better knowledge of the production process allows workers to work more quickly and efficiently. Social interaction among co-workers can lead to productivity spillover (Cornelissen, 2016) to increase output at fixed inputs to increase labor productivity.

Productivity spillovers promote an increase in output in the region around the growth center. The economic growth occurred in a specific area also stimulates economic growth in the surrounding areas. This process is referred to as growth spillovers. Growth spillover is related to the gap between regions. The magnitude of
the growth spillover decreases with the increasing distance between the two regions (Veneri & Ruiz, 2015).

Spatial closeness allows local demand to play a crucial role in the economic growth of its neighbor. Input-output links contribute to inter-regional spillover, and these effects cannot be ignored. Moreover, the influence of one province on the other may be positive or negative. On the one side, it can expand the market and promote information transfer to its neighbors (positive spillover effects). On the other hand, by improving its competitiveness in the commodity and labor markets (adverse shadow effects), it could empty its neighbors’ economic activity. One region’s positive influence on its neighbor occurred if their characteristics complement each other. If there is a complement characteristic between provinces, a wealthy province’s rapid growth could drag its poor neighbors through capital and technology transfer. The rapid growth of a prosperous province can also push its neighbors by demanding input. High demand for inputs may generate opportunities for suppliers to exploit economies of scale (de Nicola et al., 2019).

Economic growth encourages an improvement in people’s well-being. People’s welfare promotes a rise in market demand. Initially, the demand for goods and services was served by businesses in the local area. However, if these demands continue to grow, the local firms cannot fulfill these needs. Therefore, these needs are supplied by the firm from other regions. This mechanism will continue as long as the input price from surrounding regions is lower than that in the specific region. Also, variations in characteristics between regions mean that the region has a comparative advantage in producing several goods but has a comparative disadvantage in producing other goods. A region depends on the products supplied from its neighbors, and vice versa. Urban areas, for example, do not have significant agricultural land, although the demand for an agricultural product is relatively great due to their large population. Therefore, urban people’s needs for agricultural products rely on supplies from the nearest rural areas.

Moreover, an increase in income in a specific region enhances the increase in demand for tourism products in other regions, in particular tourist destinations. Tourist trips stimulate economic growth in several tourist destinations. The economy of tourist destinations such as Yogyakarta is growing along with the increase in tourist arrivals. Tourist visits to Yogyakarta encourage the development of the trade, hotel, and restaurant sectors. Therefore, the Yogyakarta economy benefits from the economic growth that occurred in its surroundings.

Conversely, some regions will compete with each other if they have similar characteristics. This competition makes a region’s economic growth is accompanied by a deterioration of the neighboring area. It means that this growth does not have a positive impact on its surrounding. Economic growth in a specific region does not impact its surroundings unless it involves economic agents from the surrounding area. This problem arose due to the absence of an input-output relationship between
regions, so the production process in a specific region does not require input from the surrounding area. Moreover, the homogeneous product also makes some regions compete with each other. The similarity of output and input creates a lack of exchange between regions. Therefore, the spatial closeness between regions is not always a positive effect.

Several studies revealed positive growth spillovers (Samake & Yang, 2014; Benos et al., 2015; Seif et al., 2017; Amidi & Majidi, 2020). However, the other research exhibited negative growth spillovers (Arora & Vamvakidis, 2013; Laksono et al., 2018; Amidi et al., 2020). More, Samake & Yang (2014) exhibited that the Low-Income Countries (LICs) received positive growth spillover from Brazil, Russia, India, China, and South Africa (BRICS) through an increase in trade volume, a rise in Foreign Direct Investment (FDI) and technology transfer. Benos et al. (2015) exhibited that spillovers are essential for European regional growth. The regions surrounded by dynamic entities are likely to grow faster than otherwise. Meanwhile, Seif et al. (2017) showed a positive spatial growth spillover between the Middle East and North of Africa (MENA countries). Moreover, Amidi & Majidi (2020) revealed that a country’s economic growth was positively affected by its neighbor and trade partners’ performance.

Conversely, Arora & Vamvakidis (2013) revealed that China’s net export growth contribution is harmful to several large countries in other parts of the world. China’s exports of goods to other countries negatively affect those countries’ net exports. Laksono et al. (2018) showed the negative growth spillovers among regencies/cities in East Java. Developing a regency/city has been detrimental to developing other regencies/cities in East Java due to an absence of synergistic and mutual reinforcing among this province’s regencies/cities. More, Amidi et al. (2020) exhibited negative spillover growth in some Asian countries. An increasing growth rate of the labor force in one country leads to decreased economic growth in other countries.

Several studies revealed growth spillovers with the research object at the regional level, which includes several countries. Also, one study examined growth spillover among regencies/cities in one province with similar regulations. Unlike the several previous studies, this study examines the possibility of growth spillover between regencies/cities in two economically integrated provinces. Although the Yogyakarta Special Region and Central Java are two independent provinces with different regulations, economically, these provinces are a single entity. This linkage is occurred due to the complementarity between the regencies/cities in these provinces. The interaction between regencies and cities in these provinces includes various activities, such as population migration, investment, and trade between regions. This economic integration is facilitated by some roads linking several cities and intergovernmental cooperation. Thus, the economic growth in these regions is the inseparable outcome of the interaction between regions. Whatever occurred in Yogyakarta Special Region had an impact on Central Java, and vice versa. The economic interaction between a specific region and its surroundings makes the region’s economic growth affected by its economic factor and surroundings. Therefore, this research investigates whether the growth spillovers between regencies/cities occurred in these provinces.
Methods

This research used data published by the Central Bureau of Statistics (BPS). This data includes economic growth, education, working-age population, an asphalted road. The study area's scope is all regencies and cities in Yogyakarta Special Region and Central Java for 2001-2018. The selection of the starting point of the research in 2001 when the regional autonomy takes place. Meanwhile, the final point was selected in 2018 because BPS data is the latest data. In this study, economic growth is measured as the percentage rate of increase in the real gross regional domestic product (GRDP). Education is measured by mean years of schooling. The percentage of the population aged 15-64 years reflects the working-age population—moreover, the percentage of the asphalted road as a measure of the asphalted road. Due to the limited data of asphalted roads, the study uses an interpolation technique to estimate the data for specific years.

This study covers the economic growth in all regencies and cities in Yogyakarta Special Region and Central Java for 2001-2018, so it is panel data. Panel data has advantages over time series and cross-section data. Panel data provides more information, variability, degree of freedom and reduces collinearity between variables. Also, panel data is powerful to observe the dynamics of adjustment. Furthermore, the study is performed based on the following spatial regression model.

\[
GROW_{ij} = \alpha_i \sum_{j=1}^{N} w_{ij}GROW_{ij} + \beta_1 EDUC_{ij} + \beta_2 WORK_{ij} + \beta_3 ROAD_{ij} + \delta_i + e_i
\]

Respectively, GROW is economic growth; \(w_{ij}\) is a spatial weighting matrix based on spatial proximity between a specific regency/city and its surroundings, EDUC is education, WORK is the working-age population, and ROAD is asphalted road. The proximity relationship between locations in the autoregressive model is expressed in the spatial weighting matrix \(w\), with the elements \(w_{ij}\) indicating the i-th and j-location relationships’ size. The spillover effect of economic growth can be observed based on the sign of the \(w_{ij}\) coefficient. If \(w_{ij}\) is positive, a specific region grows in line with growth in the surrounding region. Thus, a specific region receives spillovers from economic growth occurred in its surrounding. Moreover, the weighting matrix used is Rook contiguity with the location's provisions adjacent to the location of concern given a weighting of 1, while other locations are given a weight of 0.

Before further analysis is carried out, it must be evaluated whether a set of variables in the model are cointegrated. If cointegration occurred, there is a long-run relationship between the economic variables as desired in economic theory. This study uses the Kao method to test whether a set variable is cointegrated in the model. Moreover, this study used the Dynamic Ordinary Least Square (DOLS) method to estimate the regression model. The DOLS method is superior to the OLS method (Arize et al., 2015).
Results and Discussion

Results

Economic growth occurred in the Yogyakarta Special Region and Central Java varies between regions. Some regencies/cities have high economic growth, but many regencies/cities have low economic growth. This condition is due to each regency/city’s different characteristics, such as human capital, labor productivity, and infrastructure. The rate of economic growth depends on education, working-age population, and infrastructure. Regions with higher education levels, higher working-age population, and excellent infrastructure are experiencing higher economic growth and vice versa.

High economic growth occurred in the regencies of Brebes, Banyumas, Tegal, Purbalingga, Kebumen, Purworejo, Sleman, Sukoharjo, Sragen, Yogyakarta City, Solo City, Tegal City, Salatiga City, and Semarang City. Meanwhile, some regions with moderate economic growth include the regencies of Kulonprogo, Bantul, Magelang, Boyolali, Semarang, Kendal, Rembang, Pati, Jepara, Pekalongan City, and Magelang City. The low economic growth occurred in the Cilacap, Banjarnegara, Pekalongan, Pemalang, Wonosobo, Temanggung, Klaten, Gungkidul, Wonogiri, Karanganyar, Grobogan, Blora, Kudus and Demak Regencies (Figure 1).

Moreover, this study uses descriptive statistics as a way to describe data specifications (Table 1). The highest economic growth rate was 10.840 percent, while the lowest growth rate was 5.032 percent. The highest economic growth of 10.840 percent occurred in Kulonprogo Regency in 2018 and Yogyakarta International Airport’s development. The high value of this airport is the main driver behind the rapid growth of the Kulonprogo Regency. Conversely, the Banjarnegara Regency’s lowest economic growth of 0.070 percent occurred in 2001. Meanwhile, the highest level of education of 11.440 years occurred...
in Yogyakarta City. It is reasonable due to the predicate of Yogyakarta as a student city. Conversely, the lowest education level in the Brebes Regency of 4.840 in 2004 occurred due to the low per capita income in this regency.

### Table 1. Descriptive Statistic

|                   | Growth | Education | Working-Age Population | Asphalted Road |
|-------------------|--------|-----------|------------------------|----------------|
| **Mean**          | 4.852  | 7.583     | 66.962                 | 51.272         |
| **Median**        | 5.032  | 7.260     | 66.776                 | 49.625         |
| **Maximum**       | 10.840 | 11.440    | 79.935                 | 99.160         |
| **Minimum**       | 0.070  | 4.840     | 58.726                 | 10.650         |
| **Standard Deviation** | 1.314  | 1.408     | 3.130                  | 18.344         |

Meanwhile, the area with the highest working-age population was Sleman Regency, with 79.9935 percent in 2018. The region with the smallest working-age population was Pemalang Regency, with 58.726 percent in 2001. Sleman Regency is the young people’s destination who wants to continue their studies. Meanwhile, the Pemalang Regency is a lagging region, so many of its residents go to the other region to seek a job. Moreover, the highest percentage of the asphalted road of 99.160 occurred in Yogyakarta Municipality in 2018. Yogyakarta City has excellent road infrastructure due to its role as the business center in Yogyakarta Special Region. The lowest percentage of the asphalted road of 10.650 occurred in Grobogan Regency in 2001 due to the limited local budget, although this regency has a wide area.

Furthermore, the result of the Kao Cointegration test showed a t-statistic value of -3.229 and statistically significant. It means that there is a long-run relationship between economic variables as desired in economic theory. In a set of variables, there are several linear combinations of these variables, which are stationary. Thus there is a causal relationship in one direction among the variables in the model.

Moreover, both DOLS analysis based on pool and weighted estimation shows similar results. The regression coefficient for both models have the same apparent magnitude, and all have positive signs. The regression coefficient of growth spillovers, working-age population, and asphalted roads are significant in both models. However, the regression coefficient of education is not significant either in the DOLS pool or the DOLS weighted estimation. The coefficients of determination ($R^2$) produced by these two models are the same apparent magnitude. In the pool DOLS estimation model, the amount of 46.9 percent of growth variation can be explained by variations in explanatory variables. Meanwhile, in the DOLS weighted estimation model, variations in all explanatory variables explain 46.5 percent growth variation (Table 2).
Table 2. The Estimation Result

| Number | Variable                  | DOLS (Pooled Estimation)       | DOLS (Weighted Estimation)       |
|--------|---------------------------|---------------------------------|----------------------------------|
|        |                           | 0.323* (0.056)                  | 0.364* (0.009)                   |
| 1      | W_Growth                  |                                 |                                 |
| 2      | Education                 | 0.096 (0.052)                   | 0.032 (0.026)                   |
| 3      | Working-Age Population    | 0.042* (0.005)                  | 0.049* (0.003)                  |
| 4      | Asphalted Road            | 0.017* (0.003)                  | 0.015* (0.001)                  |

R² Observation

0.469 600

0.465 600

Note: * significant at (α=5%)
Numbers in parentheses are Standard Errors
Dependent variable: Growth

Discussion

The coefficient of growth spillovers is positive and significant. It means that a specific region obtains a positive growth spillover from its surrounding regions. For example, Cilacap Regency is bordered by Brebes, Banyumas, and Kebumen Regencies. Thus, the economic growth of the Cilacap Regency, besides being influenced by this regency's resources, is also positively influenced by the economic growth of Brebes, Banyumas, and Kebumen Regencies. The W_GROW coefficient is 0.323 (pool estimation DOLS) and 0.364 (weighted estimation DOLS). It means that the influence of economic growth in Brebes, Banyumas, and Kebumen Regencies on the economic growth of the Cilacap Regency was 0.108 percent (pool estimation DOLS) and 0.121 percent (weighted estimation DOLS).

Increased GRDP of a regency involves inputs from this regency and inputs from its surrounding region. Inter-regional linkages occur due to the complementarity effect as a consequence of various characteristics of each region. These differences promote the emergence of supply and demand from each region that complement each other. Some inputs used in the Cilacap Regency come from Cilacap itself and the surrounding regions. Similarly, the output of Cilacap is partially consumed by the residents of Cilacap itself, while the rest is taken out to meet the demand from the nearby region. Differences in factor endowment give Cilacap Regency a comparative advantage over specific products and sell it to other regions. Simultaneously, Cilacap Regency has a comparative disadvantage in other products and purchases them from nearby areas.

The linkage of Cilacap, Banyumas, and Kebumen is supported by local governments' agreement in Ex Bayumas Residency. Some local government in these regions have agreed to form an institution which coordinates some economic activity such as trade, investment,
and labor. This cooperation is a tool to fulfill the local market demand. Economic agents in these regions cooperate to increase their capacity by sharing information, technology, and other activity for raising economies of scale. If economic agents in a specific regency cannot meet their input demand, they request cooperation with their neighbor regency to supply raw material, labor, and capital. This cooperation creates employment for residents in neighboring regions.

Meanwhile, Cilacap and Brebes’ economic linkage is encouraged by developing large and medium manufacturing industries in Cilacap. These industries need input, especially labor input. Due to the requirement of expertise and skill, the labor need cannot be fulfilled only by Cilacap residents. The residents from neighboring regions, including Brebes, also fulfill this labor need. Some commuters from Brebes promote industrial activities in Cilacap, and they get fringe benefits from this activity.

Besides, a firm always tries to minimize costs by seeking cheap inputs from its region or its surrounding regions. The cost minimization strategy promotes companies in the Brebes, Banyumas, and Kebumen regencies to purchase Cilacap Regency input. Input owners in the Cilacap Regency get the fringe benefit for their contributions to their neighboring regions’ production process. This compensation includes wages, rents, and interest, which form the GRDP based on the expenditure approach. More, income is used to fulfill the needs, and this process is represented in increased consumption—an increase in consumption drive-up the GRDP. Therefore, the Cilacap Regency has received spillovers of economic growth that occurred in its neighboring areas. Conversely, economic growth occurred in Cilacap need some input that comes from this regency and its surrounding. It means that input owners in the Brebes, Banyumas, and Kebumen also get compensation for their contribution to the production activity. These neighboring regions also get benefit from growth spillovers that occurred in Cilacap Regency.

Moreover, the economic growth that occurred in Cilacap Regency promotes a rise in income. An increase in income supports a rise in consumption for primary, secondary, and tertiary products. In line with the comparative advantage principle, a part of the primary needs is supplied from the surrounding regions. This process continues as long as the product price in some neighboring regencies is lower than that in Cilacap Regency. Therefore, economic growth occurred in Cilacap promotes an increase in demand for primary products of its surrounding regions. The increase in demand drives up production, leading to economic growth in the surrounding regions. Conversely, the rise in income occurred in Brebes, Banyumas, and Kebumen promotes an increase in demand for primary products of Cilacap Regency.

Likewise, for the secondary product’s needs, such as industrial manufacturing products, a region relies on other regions’ output. It means that companies from other regions supply the need for industrial products in a specific region. This situation is a result of the unequal distribution of the industrial sector. Different regional characteristics promote some industries tend to build their plants in suburban areas and serve people’s
needs from their location. The increase in demand for a secondary product in a particular area promotes a rise in output in other regions. Therefore, economic growth that occurred in a specific region supports a rise in value-added in other regions.

After primary and secondary needs were fulfilled, the high-income people allocated their income to meet tertiary needs such as tourism. The rich people from Cilacap visited their surrounding areas, such as Banyumas, Kebumen, and Brebes Regencies. A rise in the number of travelers from Cilacap encouraged a rise in consumption in many tourism destinations. They needed food and drink, accommodation, and other needs that promote the emergence of economic activities such as trade, hotels, and restaurants. The economic activity caused an increase in added value, so it encouraged economic growth. Therefore, the area around Cilacap received positive spillover from the economic growth that occurred in Cilacap Regency. The higher the economic growth, the greater the spillover effect received by a specific region. This study's result was consistent with Ho et al. (2013) that grew from one country has a positive spillover effect to its trading partners. This finding was in line with Ahmad & Hall (2017) evidence that growth improvement in a country generated positive spillover effects on neighbors’ economic growth. This result also supported Ahmad (2019) that economic globalization was a significant driver of growth, and when it was spatially modeled, economic globalization had a positive effect on its neighbors. Nevertheless, this results from the contrary to Laksono et al. (2018) that developing a regency/city has detrimental to developing other East Java regions.

Furthermore, the increase in education did not affect economic growth due to the low mean years of schooling. The mean years of schooling in Yogyakarta Special Region and Central Java is only 7.58 years or the equivalent of grade 2 junior high school. It means that mostly the labor force has not graduated from junior high school. Their skills did not meet the requirements to enter the formal sector. Their knowledge did not make enough to take training for operating high-tech machine. Due to inadequate knowledge, the employers and government faced adversity with giving training.

As a consequence of inadequate skill, they were forced to enter the informal sector. Unlike the formal sector, the informal sector is labor-intensive with low capital intensity. Capital intensity determines labor productivity: The higher capital intensity, the higher labor productivity, and vice versa. The low capital intensity in the informal sector leads to low labor productivity and low value-added. A very low value-added did not have a significant effect on economic growth.

There is a link between the education level and the quality of human resources. Qualified human resources indicate a community of expertise (Taty et al., 2017) and then referred to as human capital. Human capital is an element that organizes other resources to generate added value (Blaga & Jozsef, 2014). Human capital is a crucial factor in economic development. Human capital becomes an essential element in achieving sustainable economic development. The quality of human capital is an essential factor
in technical mastery. Technology mastery demonstrates a country’s progress rate and determines its efficiency to increase economic output. Higher human capital allows a faster rate of economic growth.

Recently, the production process tends to a capital intensive method. Considering profit make employers prefer capital intensive than labor-intensive method. The capital intensive method was formulated in the usage of new machines with high technology. However, not all workers could operate the high tech machine. This machine just only could be operated by skilled labor.

Worker expertise was associated with the quality of human resources. Worker’s capability such as knowledge, intelligence, ideas, and skills determines the production process’s efficiency. Human resources tend to have cumulative and long-term effects compared to physical capital. The relationship between capital and skilled labor is the key to realize economic growth. Economic growth is no longer based on natural resources but depends on human capital. Some countries with sufficient human capital have achieved a high standard of living for their citizens, although they did not have adequate natural resources.

Conversely, some countries rich in natural resources, but lack human capital, persist at a low standard of living. Countries with inadequate human capital continue to experience underdevelopment. Without adequate human capital, natural resources and physical capital become insignificant to increase output. Human capital allows a better manufacturing process to maximize productivity through innovation. Skilled labor works faster to obtains a better result. The skilled worker promotes a rise in the manufacturing process’s efficiency, so a rise in output can be realized with fixed input. Therefore, human capital determines the rate of economic growth.

The rate of economic growth is positively associated with advanced education. Advanced education positively affects the quality of human resources. The quality of human resources can be improved in various ways, including education. Education increases knowledge, productivity, and creativity. Educational progress directly contributes to the development of human resources quality. Lagging education has a severe impact on the lagging human resources quality. Local governments need to improve the quality of human resources to create a competitive region. Regional development policies that do not emphasize enhancing human resources quality will make them stay underdeveloped. The local governments must enhance human resources quality in all sectors through personal investment as the central pillar of development. Countries that emphasize enhancing human capital will thrive even though they do not have adequate natural resources. Emphasis on human resources is a foundation for labor productivity improvement. Many production factors, such as land, labor, and physical capital, can experience declining returns, but science and technology can produce innovations to support economic growth. Increased education also promotes technological progress through innovation.

Investment in education is considered to affect an increase in resources to promote
growth positively. Education shape and enhance one’s knowledge so that one can work faster. Higher education leads to higher labor productivity. Since the education quality determines the quality of human resources, the central government has provided the broadest possible access to completing the 9-year compulsory education program. Education is required to promote the sustainability of economic growth. Education broadens people’s knowledge and increases the rationality of thought. Higher knowledge promotes the development of reforms in engineering, economics, and other aspects of life.

One measure of education investment was the mean years of schooling. Low mean years of schooling indicated low education investment. At low education, such as junior high school, changes in the study’s length did not significantly impact graduate quality. It means that the study period’s extension for the junior school period did not impact economic growth. This result supported Hanif & Arshed (2016) that extending primary enrolment would only generate risks for the economy. Their education stills not enough to obtain better jobs. However, this finding was contrary to Pauw et al. (2015) that higher education was needed to support higher growth to create sustainable economic development. This result also differed from Liao et al. (2019), who showed the correlational feedback between education and sustainable economic growth.

Meanwhile, the working-age population (15-64 years of age) positively impacts growth. The increase in economic growth follows a rise in the working-age population. A rise will follow an increase of 1 percent in the working-age population in the economic growth of 0.042 percent (pool estimation DOLS) and 0.049 percent (weighted estimation DOLS). The working-age population is a part of the population that directly participates in the production process. The production process involves interaction among workers, capital, and other inputs to produce an output. There is a specific combination of inputs used in the production process. More physical capital requires more employees, so that results in higher output. The rise in population is not inherently capable of increasing output. The population consists of non-productive age groups (0-14 years of age and 65 years of age and older) and productive age groups (15-64 years of age), and only productive age groups are involved in the production process.

If working-age groups dominate the population in a specific area, therefore this region enjoys a demographic bonus. A demographic bonus will be an advantage if it is filled with qualified workers. The qualified worker will be achieved if the school graduate has the high qualification to operate the high-tech machine and organize the production process. Their expertise and skill are enough to run the production process efficiently. They have a high knowledge to promote innovation in technology, economies, and other aspects. If this condition is met, the demographic bonus promotes an increase in output. The working-age group’s positive impact on economic growth indicates that the labor force has enough skill to create additional value-added. A rise in value-added promotes rapid economic growth. Thus the increase in the working-age population encourages an increase in economic growth.
Furthermore, the demographic bonus will positively impact economic growth if there is an adequate labor demand. Conversely, if the labor demand is not enough to accommodate the job seekers, this condition makes a big problem. This problem arises due to an excess labor supply. If the labor supply is more significant than its demand, most job seekers cannot get the desired job, so they are forced into the unemployment group. Unlike developed countries, so far, Indonesia does not have unemployment benefits. It means that unemployed laborers do not have an income. Meanwhile, he has to fulfill consumption expenditure. Even though the Indonesian Government Issue omnibus law that accommodates unemployment benefit, a limited state budget restricts the government’s ability to fulfill the unemployed resident’s need. Therefore, the central and local government must create an additional labor demand primarily through investment.

The investment shows an additional capital into the economy. The additional capital comes from foreign investment and domestic investment. Besides a low-interest rate, the investor must consider other factors such as political stability, market size, and industrial relation. Generally, Indonesia has high political stability. Also, Indonesia has a large market size due to a large population. However, some investors see that the Indonesian industrial relation does not yet support to achieve the investor's goal. Even though the wage rate in Indonesia is low, but it is accompanied by low labor productivity. It possible that low labor productivity is associated with a low education level of labor. Based on the Central Bureau of Statistics (BPS) data, Indonesian residents mostly have not graduated the junior high school. Therefore, they do not have enough expertise and skill to run the modern machine. Therefore, they are unable to run the production process efficiently. The low labor productivity hinders investment entry.

Labor productivity is an essential factor that determines firm performance (Prosvirikina, 2015). Labor productivity is an indicator that shows how well human resources are managed and used to produce the output. The higher labor productivity is linked to the higher output. Productive workers are inputs that determine economic performance. Generally, a rise in output is realized through the use of advanced production machines. However, not all workers can operate this machinery because it requires specific skills. Only experienced staff can operate sophisticated equipment to produce more output.

So far, low labor productivity is associated with the low mean years of schooling. Therefore, the government needs to extend mean years of schooling by the compulsory education program. The higher education of labor indicated a higher knowledge so that they can accommodate new technology. Besides, the government and employer can easily give training for them to increase their skill. A rise in knowledge and skill lead to an increase in labor productivity. The economic growth will follow an increase in labor productivity. This result is also in line with Thuku et al. (2013) that showed a long-run relationship between population and economy. This study
also supported Rizk (2019) that the working-age population's growth was a dividend and stimulating GDP per capita in both the short and long run. Conversely, this finding runs counter to predictions that population aging would have little effect on productivity (Burtless, 2013).

Furthermore, the percentage of asphalted roads has a positive effect on economic growth. A rise in asphalted roads promotes an increase in economic growth. The rise in asphalted roads by 1 percent contributed to a rise in the economic growth of 0.017 percent (pool estimation DOLS) and 0.015 percent (weighted estimation DOLS). Enhanced road facilities improve transportation efficiency. An efficient transportation system solves the problem of high-cost distribution. The mobility of goods and people can take place quickly and cheaply. Infrastructure plays a significant role in supporting the production process and reduce production costs.

Considering economies of scale makes a company take place in a specific location with excellent infrastructure and concentrate all of its activities just in one venue. The firm does not set up a branch in the other location. The large scale makes the company purchase a cheap input to raise its efficiency. The direct purchase cut shortens the supply chain, so they get cheap input. Also, they get a discount due to a bulk purchase of input. This advantage can be realized if the company does not bear high transportation costs. This cost problem was overcome when the firm was located in an area with good infrastructure. The excellent infrastructure promotes smooth transportation and reduces time travel, so reduce transportation cost. The lower production cost promotes a rise in product competitiveness. It means that firm can sell its product at a lower price without bearing the loss. Therefore, low transportation costs support the firm in serving all customers from a specific location and raising its market share.

Road network is considered a key to realize a region’s regional development (Sreelekha et al., 2016). The construction of road facilities, particularly in disadvantaged regions, accelerates economic activity in this area and enhances connectivity with other regions. Due to poor road infrastructure, some formerly isolated companies can get cheap input, running the production process at a low cost. Lower production costs make firm cheaply produce output. As a consequence of cheap output, the output demand increase leads to a large trade volume. Therefore, road construction rises connectivity between regions and promotes the growing demand for goods and services. Large trade promotes a boost rise in all economic activity. It means that the construction of road infrastructure encourages a rise in economic growth.

Characteristic of each region in Yogyakarta Special Region and Central Java is different from each other. Some regions located on the northern coast of Central Java have a comparative advantage in fisheries’ production. Mostly fishery products come from fishing in the ocean. Meanwhile, several areas have comparative advantages in agricultural products. The vast agricultural land supports the development of crop cultivation. More, some cities have comparative advantages in the service sector due to adequate
infrastructure. The secondary sector is mostly located in the suburban area. Generally, this region has vast land with adequate infrastructure to support the development of the manufacturing sector. Improved asphalted road promotes a rise in trade among regions. An increase in trade drives up people’s income. Thus, the government needs to increase the road’s length and quality, especially in disadvantaged regions, to connect with growth centers.

Improving connectivity between regions, the government has built the South Coast Road linking the Wonogiri, Gunungkidul, Bantul, Kulonprogo, Purworejo, and Kebumen Cilacap Regencies. This road construction is a way to promote developing Southern Central Java and Yogyakarta Special Region and a balancer to the development of roads in the northern part of Central Java. Meanwhile, the Central Road was done to improve Boyolali, Semarang, Magelang, Temanggung, Wonosobo, Banjarnegara, Purbalingga, and Banyumas Regencies. Moreover, road maintenance on the northern coast establishes some regencies/cities in Central Java stretched from Brebes Regency to Rembang Regency. Some highways’ construction was complemented by constructing some toll roads such as the Yogya-Solo, the Yogya-Bowen, and the Yogya Cilacap Toll Road. The construction of toll roads is required to speed up transportation between Yogyakarta and some Central Java cities.

Connectivity between regions will create larger positive effects if it is accompanied by intergovernmental cooperation. Intergovernmental cooperation represents two or more local governments’ arrangement to accomplish a common goal, provide a service, or solve a mutual problem. The economic activity gives result optimum when the production process is run on a large scale, so the firm gets some benefit from economies of scale. So far, some regencies do not have enough economic size to produce output at low costs. Therefore, the economic cooperation between regencies is a way to overcome inefficiency problems due to their small economic size.

This finding was in line with Zhang (2013) that improvements in urban roads and significant local roads had increased the GDP share for China’s manufacturing and service industry. The results also supported Yang et al. (2016) that highways’ construction promoted aggregate productivity growth by facilitating company entry, exit, and reallocation. This result was contrary to Banerjee et al. (2020) that road infrastructure’s construction has no significant economic growth impact.

**Conclusion**

Positive growth spillovers have occurred between regencies/cities of the Yogyakarta Special Region and Central Java. The economic growth of a particular region is positively influenced by growth occurred in its surrounding. The complementary effect encourages inter-regional linkages. Economic growth in a specific region requires some inputs both from this region and the nearby regions. Therefore, the owners of input in the surrounding area receive compensation for their contribution to the production process. This payment includes wages, rent, and interest, which are the components forming GRDP. Economic
growth in a region stimulates a rise in income, so boost a rise in output demand. The increase in output demand in a specific region leads to a rise in economic growth in a region and its surroundings.

Meanwhile, the increase in the working-age population (15-64 years) and road improvement positively impact economic growth. Nevertheless, the rise in the mean years of schooling did not impact economic growth. The mean years of schooling in the Yogyakarta Special Region and Central Java are only 7.58 years or the equivalent to grade 2 junior high school, so most laborers do not have sufficient expertise and skills to drive up economic growth.

The government needs to improve the quality of human resources and increase regional connectivity. An improvement of human resources is made through the 12-year compulsory education program, so the worker graduated from senior high school. They have enough knowledge, expertise, and skill to run the production process efficiently. Meanwhile, the road improvements are primarily aimed at the central and southern of Central Java. Several highways must be developed by several toll roads, such as the Yogya-Solo, the Yogya-Bawen, and the Yogya-Cilacap Toll Road. The construction of several toll roads is required to improve connectivity between cities in the Yogyakarta Special Region and Central Java.

Further, the road construction is accompanied by intergovernmental cooperation. This cooperation promotes economic activity in a large size, so the firm benefits from economies of scale. The production process can produce large value-added to boost economic growth.

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