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INDUSTRIES DEVELOPMENT WITH THE INPUT-OUTPUT ANALYSIS: INVESTMENT SIMULATION ON TWO REGENCIES IN INDONESIA[1]

Abstract. The similarity of the industrial structure of the main industries in two neighboring regencies, Wonosobo and Temanggung, Indonesia, is expected to result in equality demand for intermediate and primary inputs. The neighbouring regencies are located in the mountainous area and had similarities in economic structure. The goals of this study were to analyse the economic structure, select 5 main sectors in each district, and compare the impact of the economic investment on the main sectors in order to identify the effectiveness of the investment in the same production sector in the context of its impact on the economy. This research employed independent Input-Output analysis using the 2016 Input-Output Tables of Wonosobo and Temanggung regencies to evaluate the flow of intersectoral transactions and develop a multiplier analysis to determine development strategies which are shock injections applied to each region. This study hypothesises that the increase of sectoral investments increases output which is relatively the same in 5 corresponding industries in both regions. The obtained results showed that the selected main sector included Trade, Other Food and Beverage Industries, Building, and Wood and Wood Materials Industries. The investment on the main industrial sector led to a higher improvement in Temanggung rather than in Wonosobo. By simulating investment policies in two adjoining regencies, the optimally economic impact on each region and the cooperation approach used to carry out development planning can be assessed.

Keywords: economic development planning, input-output analysis, Leontief multiplier, Leontief production function, investment policy simulation, economic structure, inward-outward oriented planning, industrialisation strategy, backward linkage, forward linkage

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ИССЛЕДОВАТЕЛЬСКАЯ СТАТЬЯ

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Анализ межотраслевого баланса развития промышленности: моделирование инвестиций на примере двух округов Индонезии

Аннотация. Предполагается, что можно достичь равенства спроса на промежуточные и первичные факторы производства в двух округах Индонезии — Вонособо и Темангтунг, благодаря сходству отраслевой структура производства. Эти соседствующие округа, располагающиеся в гористой местности, которые характеризуются схожей экономикой. Цели исследования — проанализировать структуру экономики, выбрать 5 основных секторов в каждом округе и сравнить влияние инвестиций на промышленность в каждом секторе для оценки их экономической эффективности. Межотраслевой анализ с применением таблиц «затраты — выпуск» за 2016 г. для округов Вонособо и Темангтунг позволил оценить поток межотраслевых транзакций. Оценка по мультипликаторам помогла определить стратегии развития для каждого региона. Была предложена гипотеза, предполагающая, что увеличение промышленных инвестиций увеличивает объем производства, который близок в 5 соответствующих отраслях обоих регионов. В статье были проанализировано развитие таких выделенных секторов, как торговля, отрасли производства продуктов питания и напитков, строительство, а также производство древесины и древесных материалов. Инвестиции в промышленность оказались более эффективными в Темангтунге, чем в Вонособо. Благодаря моделированию инвестиций в двух соседних округах можно оценить оптимальное экономическое воздействие для каждого региона, а также разработать подход к эффективному сотрудничеству для их дальнейшего развития.

Ключевые слова: планирование экономического развития, межотраслевой анализ, мультипликатор Леонтьева, производственная функция Леонтьева, моделирование инвестиционной политики, экономическая структура, внутреннее и внешнее планирование, стратегия индустриализации, связь с поставщиками, связь с потребителями

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Introduction

From the perspective of economic development planning in Indonesia, the premise underlying this study is that regional economic development planning, which tends to be partial based on each region, has applied regional administrative approaches to produce a direction of economic development. This presumably occurred as a result of the regional government, as an authority with autonomous powers, planning its development concentrating only on its own administrative area. As a consequence, the planning tends to be inward looking, paying more attention to the potential of its local economic resources within its territorial boundaries, while evading outward looking so that the economic potential of the outside areas that possibly can be utilised has not been identified.

The inward-oriented planning — of each regency government — caused negative overlap in the development of major industrial types that are relatively similar in the two regencies, meaning that they cannot optimally support the economic development of each region. As the economic potencies and resources supporting industrial development in each region are similar, regions are supposed to take into account other side's potential opportunities as the competitive advantage for both regencies' benefits. Consequently, disregarding of the outward-oriented planning policy might lead to both regions losing opportunities to generate economic-supporting development.

From the point of view of regional-oriented development theories, such as central place theory (Christaller, 1933), the growth pole theory (Perroux, 1950), circular cumulative causation (Myrdal, 1957), and industrial clusters (Marshall, 1920; Stimson et al., 2006), the centre of growth or industrial gathering in a place has no administrative boundaries. On the contrary, economic development policy strategies apply restriction related to administrative boundaries. As a result, local governments of neighbouring regencies have difficulties in linking and cooperating with one to another in terms of economic development, a state that can improve both regencies' economy.

Discussions about administrative boundary constraints are more pronounced at the inter-country level. The Organisation for Economic Co-operation and Development (OECD, 2009) emphasises that in the context between countries, administrative boundaries need to be simplified. Simplification strategies need to be implemented to reduce regulatory complexity and uncertainty, cut bureaucracy and reduce unnecessary bureaucratic costs. The OECD (2009) suggests that these administrative boundaries pose various obstacles so that many countries believe that simplifying administrative boundaries by adopting a similar approach in these countries can overcome various obstacles to development. In discussing concrete problems and policy options, it is deemed necessary for each country to develop its own model and adapt the experiences of other countries to undertake administrative simplification successfully.

This paper discusses the impact of policies in the context of interregional regencies in Indonesia, namely economically autonomous regions with a case study of two neighbouring regencies. According to the facts, the two adjacent neighbouring regencies, Temanggung and Wonosobo, have similar economic and geographic structures. In the last 5 years, the proportion of the,GDRP of the main sectors are Agriculture, Manufacturing Industry, and Trade, as shown in Figure 1 and Figure 2.

Wonosobo and Temanggung regencies have strategic roles in regional development in Central Java from both economic standpoint and geographic location. Geographically, as the locations of the two are in the middle of Semarang City, Yogyakarta Special Province, and Purwokerto City (Banyumas Regency), they both have a strategic position, especially in relation to economic activities (Firmansyah et al., 2019). For example, agricultural sector might become the main business to support economic activity for both regencies if they are able to consolidate effectively the regional economic development planning. However, year on year, the economic growth trend of the two regions is still below that of Central Java (Figure 3).

Figure 3 exhibits that during 2011 to 2019, the economic growth of Central Java Province was relatively constant above that of Wonosobo and Temanggung. In fact, within those years, the economic growth of Wonosobo and Temanggung fluctuated sharply, especially Wonosobo, as if they were competing with each other.

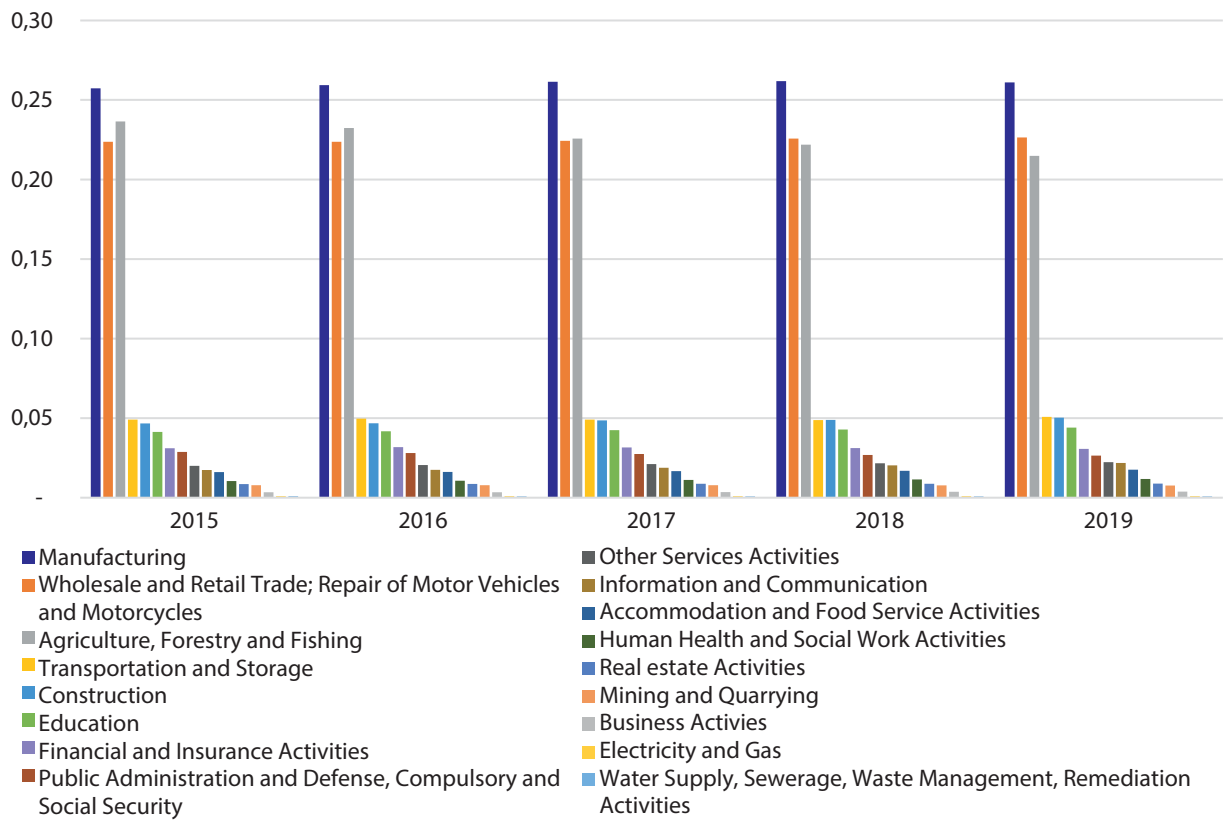

Fig. 1. *Development of Sectoral Distribution of GRDP in Temanggung Regency, 2015–2019 (%). Note: GRDP is a constant price with the 2010 base year (Statistics Indonesia. (2020a). GRDP Temanggung Regency at Constant Market Price by Industry (million rupiahs), 2010–2019. Retrieved from: https://temanggungkab.bps.go.id/statictable/2020/02/28/238/pdrb-kabupaten-temanggung-atas-dasar-harga-konstan-menurut-lapangan-usaha-juta-rupiah-2010---2019.html)*

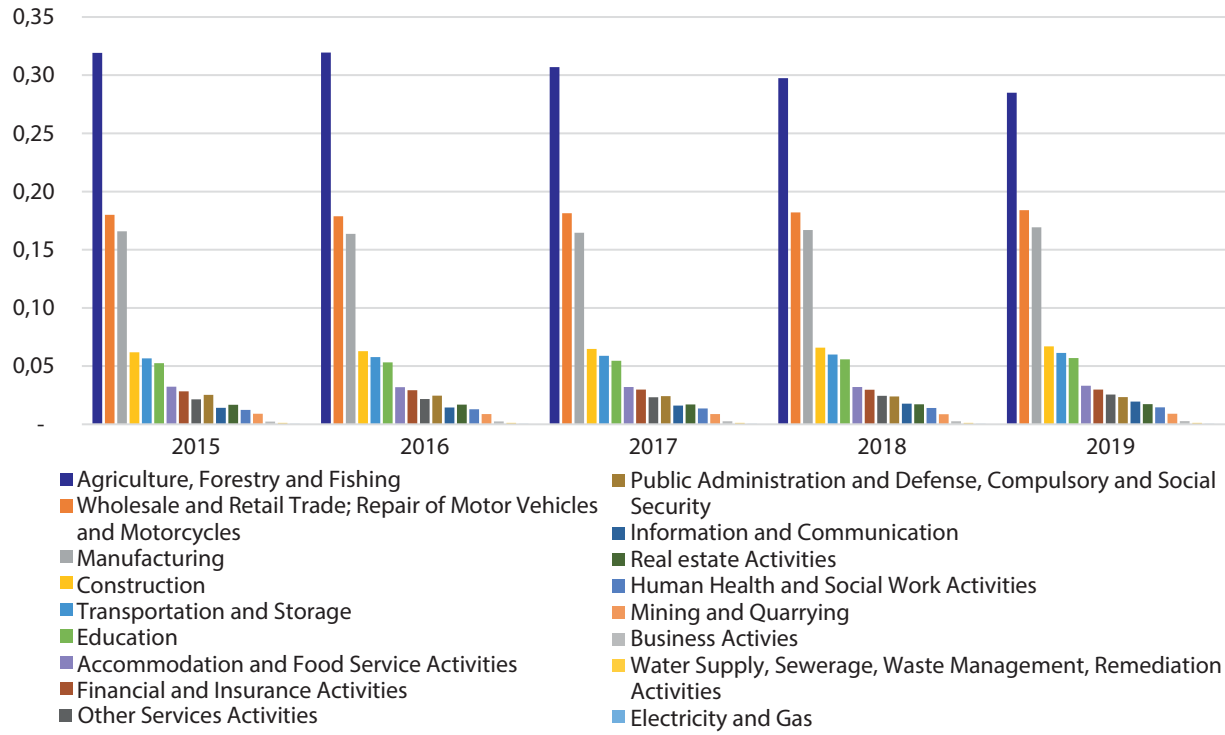

Fig. 2. *Development of Sectoral Distribution of GRDP in Wonosobo Regency, 2015–2019 (%). Note: GRDP is a constant price with the 2010 base year (Statistics Indonesia. (2020b). GRDP Wonosobo Regency at Constant Market Price by Industry (million rupiahs), 2012–2016. Retrieved from: https://wonosobokab.bps.go.id/dynamictable/2017/07/06/194/-seri-2010-pdrb-atas-dasar-harga-konstan-menurut-lapangan-usaha-kabupaten-wonosobo-2012---2016.html)*

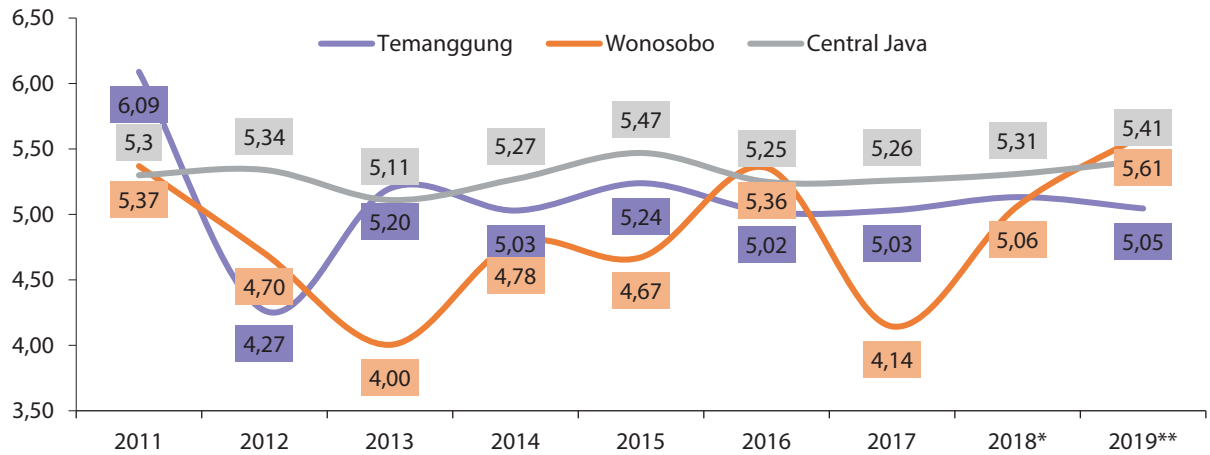

Fig. 3. *Economic Growth in Central Java, Wonosobo and Temanggung, 2011–2019 (%). Note: GRDP is constant with the 2010 base year (Statistics Indonesia. (2020c). GRDP at 2010 Constant Market Price by Regency/Municipality in Jawa Tengah (million rupiahs), 2010 — 2019. Retrieved from: https://jateng.bps.go.id/statictable/2017/02/13/1411/-seri-2010-pdrb-atas-dasar-harga-konstan-2010-menurut-kabupaten-kota-di-jawa-tengah-juta-rupiah-2010---2019.html)*

Meanwhile, the composition supporting economy of the two regions has been dominated by the secondary sector (Figure 4). Figure 4 suggests that the secondary sector or the industrial sector including manufacturing sector, offered more opportunities in terms of capital accumulation and economy of scale compared to other sectors. The manufacturing sector is the key to drive the growth dynamics for tradeable sector(s), as it is linked to world market forces not only in terms of prices, but also in terms of quality, innovation, and general knowledge (Teimouri & Joachim, 2018). Furthermore, the industrial sector is considered capable of rapidly driving the economic growth of a region, as empirical evidence has shown its capability to drive a large multiplier effect on the economy from downstream to upstream (Kaur et al., 2009; Shah, 2022).

The reason that industrialisation strategy has begun to take over economic actors and has been chosen to foster faster growth was that economic growth, which was initially led by primary sec-

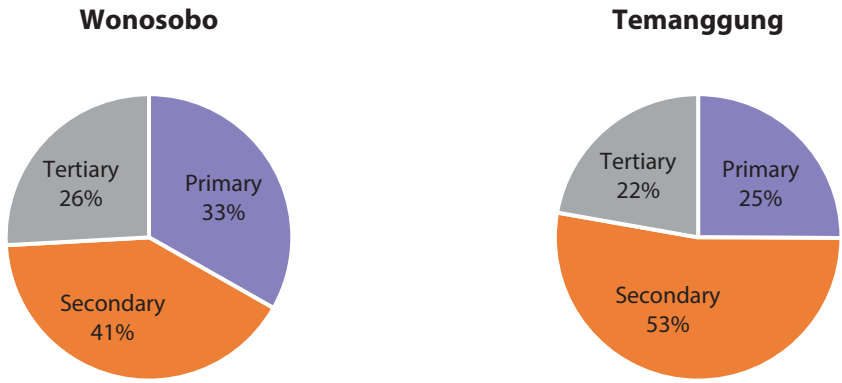

Fig. 4. *Sectoral Composition of GRDP in Wonosobo and Temanggung Regencies. Note: GRDP is constant with the 2010 base year (Statistics Indonesia. (2020a; 2020b). Op. Cit.)*

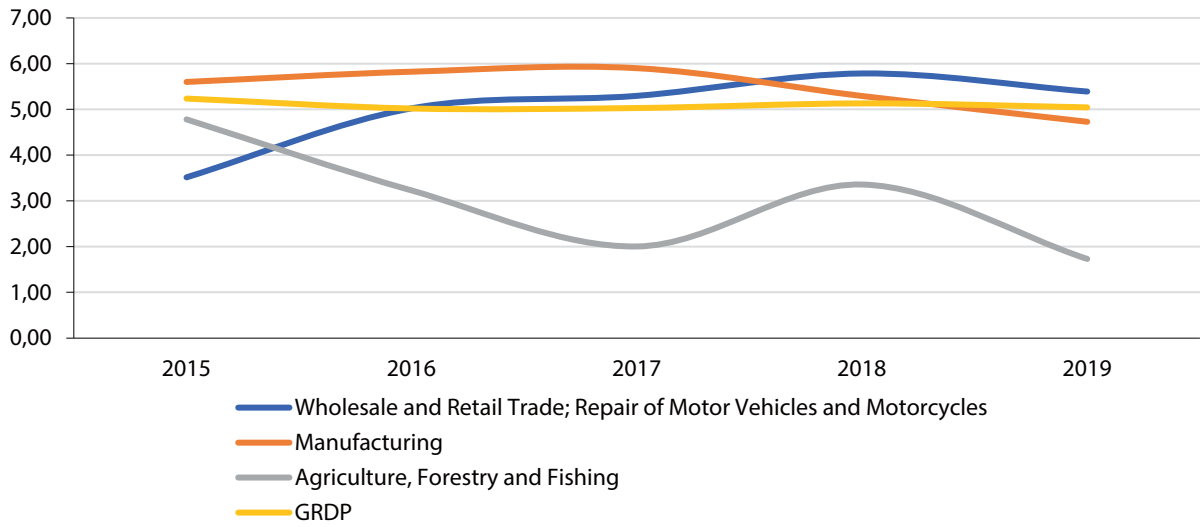

Fig. 5. *Main Sector Growth of GRDP Temanggung Regency, 2015–2019 (%). Note: GRDP is constant with the 2010 base year (Statistics Indonesia. (2020a). Op. Cit.)*

tors and depended on primary products exports, has been deemed unable to increase economic growth more aggressively. Moreover, industrial sector is considered capable of generating greater income from export and causing a multiplier effect for other sectors including the primary sector that initially was the core sector in the economy (Mikesell, 1997; Midmore et al., 2006; Dasgupta & Singh, 2006). In the case of economies in developing countries, industrial sector becomes the main driving sector, as it is motivated by policies of industrial partner countries and foreign countries that directly and indirectly intervene in the industrial sector of developing countries; for example, through the promotion of its use of "artificial" industrialisation in foreign investment projects in the developing countries (Bresser-Pereira, 2012).

In line with this explanation as well as the data in Figures 1 and 2, the trend in the proportion of agriculture sectors has decreased in the last 5 years in both regencies. This suggests that the direction of the industrial development is moving toward the secondary sectors. This shifting is supported by the data presented in Figure 5 and Figure 6, the sectoral growth with a similar trend in the two regions, that the development of the industrial-processing sector is faster than that of agriculture.

Given this explanation, the goals of this study were to analyse economic structure, select 5 main sectors in each district, and compare the impact of the economic investment on the main sectors in order to identify the effectiveness of the investment strategy in the same production sector. The analysis was performed by comparing how the development policies have an impact on the development of similar industries in each administrative area through similar policy simulations in the two regions. The findings of this study are expected to be considered by policy makers and collaborative policy-options in the two neighbouring regions so that the economic impact of the industrial development in the two regions will be maximised.

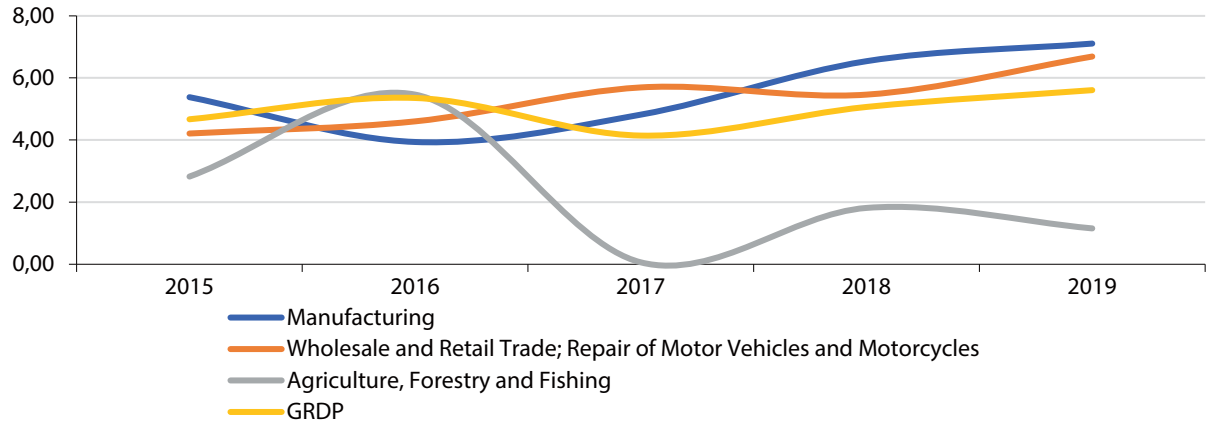

Fig. 6. *Growth of the GRDP Main Sector of Wonosobo Regency, 2015–2019 (%). Note: GRDP is constant with the 2010 base year (Statistics Indonesia. (2020b). Op. Cit.)*

Research Methods

The current investigation involved sampling and analysing of two regencies (Wonosobo and Temanggung) in order to evaluate the role of certain sectors both in the economy as a whole and in the intersectoral system. The two adjacent regencies were selected, as they had relatively similar supporting potencies and resources that might complementarily promote the development of the existing similar industries. Input-Output analysis was selected to evaluate the flow of intersectoral transactions particularly the linkages between certain sectors (Miller & Blair, 2009); besides, it can be used to develop a multiplier analysis to determine development strategies which are shock injections applied to each region (Firmansyah, 2006).

The backward and forward linkage were applied with the purpose of analysing the growth within a sector in influencing overall economic growth and in particular the one being affected by the growth of the sectors (Tregenna, 2008; Firmansyah, 2020). Several studies on sectoral linkages were conducted by Beyers (1976); Cai et al. (2005); Hewings (1982); Hoen (2002); Sonis et al. (2000), Kowalewski (2013), and Costinot and Rodrıguez-Clare (2018) in the United States, Andreosso-O'Callaghan and Yue (2004) in China, and Firmansyah et al. (2019) in several regions in Indonesia.

This study used a table of total transactions on the basis of producer prices and domestic transactions on the basis of producer prices from the latest tables of the two regions, namely the 2016 Input-Output Table of Temanggung Regency[1] and the 2016 Input-Output Table of Wonosobo Regency[2].

Input-Output is an analysis applying the concept of the Leontief production function of constant return to scale. The Leontief's production function is formulated as

$$q_i = \min\left\{\frac{x_{i1}}{a_{in}},\ldots,\frac{x_{in}}{a_{in}},\frac{K_i}{a_{iK}},\frac{L_i}{a_{iL}}\right\}, \quad (1)$$

where q_i is the output of sector i, x_{ij} is the transaction between sector i to sector j, K_i and L_i respectively the amount of capital and labour, and the technology coefficient ai (Smid, 2000).

Investment as a production function has a positive impact on changes in output value. The impact on changes in investment is calculated by the equation $X^* = (I - A)^{-1}$. Y^* where X^* is the magnitude of the output impact, $(I - A)^{-1}$ is Leontief's inverse matrix, Y^* is the value of change in investment, and A is the technology or input coefficient matrix.

Result and Discussion

In macro-sectoral economic policy, economic growth of a region is driven by the growth of certain sectors that have advantages or relative competitiveness to other economic sectors. The economic sectors that have significant linkages with other sectors (both forward and backward linkages) are sectors that are capable of contributing to the formation of Gross Regional Domestic Products (GRDP). Besides, these sectors are also potentially able to create job opportunities so that they will ultimately drive the economic development simultaneously (Firmansyah et al., 2019).

[1] Statistics Indonesia and Development Planning Agency of Temanggung Regency. (2017). Table Input-Output Kabupaten Temanggung 2016. Statistics Indonesia and Development Planning Agency of Temanggung Regency.

[2] Statistics Indonesia and Development Planning Agency of Wonosobo Regency. (2019). Table Input-Output Kabupaten Wonosobo 2016. Statistics Indonesia and Development Planning Agency of Wonosobo Regency.

As neighbouring regencies, Temanggung and Wonosobo, located in the mountainous area, were predominantly populated by people working in agricultural sector, and had similarities in economic structure. The top five sectors having similarity in providing the largest contribution to the regional economic development were agriculture, trade, manufacturing industry, construction and warehousing, and transportation. Other sectors were wood processing industry, building and construction, and other food and beverages industry (Table 1 and Table 2)

To compare the main sectors of the two regencies, data from Input-Output Table were used. The dominant sectors in Wonosobo and Temanggung supporting the largest economic-output value were manufacturing, trade, and construction. In particular, the main sector supporting the largest output for the economy in Wonosobo was trading and in Temanggung was processing industry.

Wood Processing Industry in Temanggung and Wonosobo regencies were included in the four sectors that provided large output to the economy. Other sectors were Building and Construction Sector and Other Food and Beverages Industry, as shown in Table 1 and Table 2.

Tables 2 and 3 show that Temanggung and Wonosobo had similar economic structures, but varied in absorbing other sectors in driving the economy in each of these regions viewing from the four largest sectors (selected sectors). The depth of the absorption of other sectors in the production process was illustrated by the amount of the output multiplier in each sector (Table 3). The higher the multiplier value is, the more superior the sector will be, as the ability to attract other sectors to produce is getting higher.

Table 3 exhibits that in general the economy of Temanggung regency was easier to move than that of Wonosobo regency as proven by a simulation with an increase in investment by 1 trillion rupiah as a policy shock.

In scenario 1, one trillion rupiah was divided equally to each sector in each region, assuming other sectors were constant. Thus, each of the 4 sectors received an investment of 250 billion rupiah. In scenario 2, the investment of one trillion rupiah was allocated proportionally to four sectors according to the percentage of output, assuming other sectors were constant. In this scenario, the proportion of the investment in Temanggung was IDR 403 billion in wood processing industry, IDR 325.3 billion in trade sector, IDR 154.1 billion in Building Sector, and IDR 117.4 billion in food and beverages industry sector. Meanwhile, the proportion of the investment in Wonopsobo was IDR 306.2 billion in Trade Sector, IDR 277.4 billion in other food and beverages industry, IDR 185.5 billion in wood and wood materials industry sector. In scenario 3, one trillion rupiah was invested in each region in wood processing sector; and in scenario 4, one trillion rupiah was invested in each region in trade sector.

The results of the simulation using scenario-1 and scenario-2 were that changes occurred in investment in selected sectors (Table 4 and Table 5). Overall, the impact of total output in Temanggung was greater than that in Wonosobo. The scenario-1 in Wonosobo showed that the impact of the investment on total transaction output was 27.9 % greater than that of on domestic transactions. This suggested that the total output from imports was 27.9 % greater than that without imports while in scenario-2 the total output from imports was 25.9 % greater than that without imports.

Table 1

Four Sectors with the Largest Output Value in Temanggung Regency in 2016 (millions of rupiah)*

No	Sector	Output Value
1	Wood Processing Industry	6,408,779.38
2	Trade	5,173,343.50
3	Building and Construction	2,451,565.52
4	Other Food and Beverages Industry	1,866,783.08

* Statistics Indonesia and Bappeda of Temanggung Regency. (2017). Op. Cit.

Table 2

Four Sectors with the Largest Output Value in Wonosobo Regency in 2016 (millions of rupiah)*

No	Sector	Output Value
1	Trade	3,309,677.90
2	Other Food and Beverages Industry	2,998,322.45
3	Building and Construction	2,492,575.96
4	Wood and Wood Materials Industry	2,005,274.03

* Statistics Indonesia and Bappeda of Wonosobo Regency. (2019). Op. Cit.

Table 3

Output Multiplier of 4 Main Sectors

Sector	Temanggung		Wonosobo	
	TT	DT	TT	DT
Trade	1.57	1.29	1.44	1.27
Other Food and Beverages Industry	2.11	1.66	2.12	1.26
Building and Construction	2.22	1.60	1.96	1.31
Wood and Wood Materials Industry	2.09	1.67	1.84	1.36

Source: Output Estimation using Input-Output F program (Firmansyah, 2020).

Notes:

* DT = Domestic Transaction.

* TT = Total Transaction.

Table 4

Investment Impact on Total Output: Scenario-1 (millions of rupiah)

	Total	Domestic
Wonosobo	1,840,698.57	1,438,688.85
Temanggung	1,996,570.68	1,556,756.84

Source: Output Estimation using Input-Output F (IO-F) program (Firmansyah, 2020).

Table 5

Investment Impact on Total Output: Scenario-2 (millions of rupiah)

	Total	Domestic
Wonosobo	1,823,026.41	1,447,024.90
Temanggung	1,942,692.97	1,537,380.43

Source: Output Estimation using Input-Output F (IO-F) program (Firmansyah, 2020).

Table 6

Investment Impact on Total Output: Scenario-3 (millions of rupiah)

	Total	Domestic
Wonosobo	1,843,679.40	1,361,948.82
Temanggung	2,087,396.99	1,674,035.56

Source: Output Estimation using Input-Output F (IO-F) program (Firmansyah, 2020).

Table 7

Investment Impact on Total Output: Scenario-4 (millions of rupiah)

	Total	Domestic
Wonosobo	1,437,623.56	1,268,262.21
Temanggung	1,573,719.64	1,294,833.16

Source: Output Estimation using Input-Output F (IO-F) program (Firmansyah, 2020).

Meanwhile, in the scenario-1 in Temanggung, import resulted in the increase in total output by 28.2 % compared to 26.3 % in Scenario-2.

The results of the simulation using scenario-3 and scenario-4 were that the total economic impact was greater in Temanggung than in Wonosobo when Wood and Wood Material Industry was injected with the same amount of investment in each region. The same impact also took place when Trade sector in each region was injected with investment (Table 6 and Table 7).

The result of the simulation using 4 scenarios suggested that when injection with the same value was invested in the same 4 main sectors in each region, the impact would be greater in Temanggung than in Wonosobo. Even if all investment were allocated to the trade sector, the sector with the largest multiplier, in Wonosobo, Temanggung would still have the greater output impact although this sector was the second largest one in Temanggung. This phenomenon occurred due to two reasons; 1) Wonosobo's multiplier output was higher even in each sector than Temanggung's; and 2) Overall, Wonosobo's economy was smaller than Temanggung's.

Furthermore, when the investment strategy was directed to Other Food and Beverages Industry, the greater impact would occur. As a result, the total output created would be greater in Wonosobo than in Temanggung since the output of this multiplier sector was greater in Wonosobo than in Temanggung. However, for an economy without imports, the economic impact of investment injection in Other Food and Beverages Industry was greater in Temanggung than in Wonosobo. This suggested that the dependence of this sector on inputs from outside the regions in Wonosobo was greater than in Temanggung.

The result of the simulation indicated that alternative industrial policies could be scenario by considering the four sectors. As Trade Sector and Building and Construction Sector might not be able to be concentrated in one of the two regions due to their characteristics, the policy scenario should be directed to the other two sectors of Manufacturing Industry. Consequently, alternative policies for cooperation between the two regions to increase economies of scale and industrial efficiency should be taken. For example, the concentration of Wood and Wood Materials Industry in Temanggung seemed to have maximised the total economic impact with the concentration of Other Food and Beverages Industry concentrated in Wonosobo. In this case, Temanggung might support Other Food and Beverages Industry in Wonosobo by providing inputs because the role of input imports in Wonosobo was quite substantial. Similarly, Wonosobo had to consider policies encouraging the simplication entry of outside inputs. For Wood Industry and Materials from Temanggung Wood, Wonosobo could support the industry's inputs from Wonosobo area.

Conclusion

The multiplier output contributed by trade, other food and beverage industries, building, and wood and wood materials industries which is higher in Temanggung regency than in Wonosobo regency suggests that the investment injected might lead to better economic improvement for the two regions.

Government policy supporting investment inflow drives production sectors in both regions simultaneously within the framework of intersectoral linkages from both the input supply line and the output demand line, especially through its ability to mobilise related sectors, either directly or indirectly.

As the optimal impact of the context of development planning being carried out can be assessed, it appears that providing funding policy per region is not optimal for one region; whereas, for other regions are more optimal. In fact, the invested funding to develop two border areas which have similar sectors resulted in different welfare impacts for each region.

The limitation in this study is related to the spatial aspects between regencies, namely related to the use of independent I-O tables, compared to using interregional or bilateral tables for the two regencies discussed. Information on the linkage or flow of resource and products to the sectors providing input and output buyers cannot be clearly identified between regencies.

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