Indonesia's Sectoral Economic Development Strategy: Investment Simulation Using Interregional Input-Output Analysis

Firmansyah*, Franciscus Xaverius Sugiyanto, Purbayu Budi Santosa and Siti Hilmiati Azyzia

Department of Economics, Faculty of Economics and Business, Diponegoro University, Semarang, Indonesia.

Abstract: Indonesia's economic history, marked by continuous development and intermittent contractions during economic recessions, highlights the vulnerability of dependency on foreign nations, especially for essential commodities. To achieve economic self-reliance, Indonesia, with its substantial population and abundant natural resources, needs to efficiently process these resources for domestic purposes. Sectoral analysis, using Input-Output (I-O) tables, provides valuable insights into historically engaged sectors, their roles in production, input absorption, and intersectoral dynamics. Integrating sectoral and regional perspectives, focusing on key sectors within each province, can stimulate regional development, foster national economic growth, and promote regional equity. Understanding goods flow within sectors and regions is vital for region-centric development strategies. The 2016 Indonesian Interregional Input-Output (IRIO) Table, covering 34 provincial economies and 52 economic sectors within each province, offers extensive insights into Indonesia's goods and services movement. This study utilizes the IRIO dataset to conduct simulations, identifying sectoral potential, assessing the responsiveness of sectoral development strategies, and exploring impacts on key economic indicators. The research aims to identify leading sectors, assess investment implications, evaluate the impact of investments on provincial and national economies, and understand sectoral consequences, trade patterns, and domestic goods distribution dynamics. The research provides a foundational framework for sectoral development strategies, offers insights into regional-based domestic economies, and suggests strategies to reduce import dependency, contributing to Indonesia's economic self-reliance.

Keyword: Indonesia, interregional input-output, regional development, investment impact, sectoral analysis.

1. INTRODUCTION

Indonesia's economic progress since gaining independence has demonstrated a continuous trajectory of development, as evidenced by the evolution of key macroeconomic indicators over the years. However, it is important to acknowledge that there have been periods of economic contraction, notably during the economic recession. One of the most significant economic crises in Indonesia's history occurred between 1997 and 1998, characterized by a staggering economic contraction of 13.13 percent(Statistics Indonesia, 2020). Additionally, in 2020, Indonesia faced another substantial economic crisis stemming from the Covid-19 pandemic, resulting in a contraction of the national economy by 2.07 percent in 2020(Statistics Indonesia, 2022).

The recession and crisis encountered by Indonesia have provided valuable lessons, emphasizing that an elevated reliance on foreign nations renders the domestic economy susceptible to external economic upheavals, particularly when this dependency extends to essential commodities. The global crises that lead to reduced supply from international sources have led to diminished domestic production and heightened inflation, subsequently eroding the real purchasing power of the populace. Consequently, it becomes imperative to enhance economic self-reliance, signifying a reduction in dependence on foreign sources of supply.A substantial population represents a considerable market potential, encompassing factors such as demand, income levels, and purchasing power. Moreover, from a supply perspective, it serves as a significant production factor. In addition to this demographic advantage, Indonesia is also endowed with favorable geographical features and abundant natural resources. The amalgamation of a sizable population, fertile terrain, equatorial positioning facilitating diverse seasons, and abundant and diverse terrestrial and marine resources presents a substantial foundation for fostering the nation's economic self-sufficiency. The central challenge, however, pertains to the capacity to process and generate these resources with elevated added value and efficiency for domestic economic purposes, thereby optimizing their potential to enhance the well-being of the populace.

The foremost imperative at present is to establish a comprehensive data framework elucidating the potential of these resources and the methods by which they are processed or manufactured. From a production and processing standpoint, one viable approach is the adoption of a sectoral analysis. Through this method, one can discern the sectors that have historically engaged with this potential resource base. Input-Output (I-O) tables serve as valuable tools for accessing sector-specific data concerning how economic potential has been harnessed within a particular geographical region. Within the context of Indonesia, these I-O tables illuminate

*Address correspondence to this author at the Department of Economics, Faculty of Economics and Business, Diponegoro University, Semarang, Indonesia; E-mail: firman.undip@gmail.com

the production sectors' roles in generating output, as well as their involvement in input absorption and processing within the production cycle. Additionally, these tables furnish insights into the flow of goods between sectors, encompassing both the provision of input and the sale of output. By leveraging this analytical framework, we can gain a profound understanding of the intricate interdependencies among sectors that collectively shape the nation's economy.Within the framework of achieving equitable regional development and distribution in Indonesia, a sectoral perspective can be effectively integrated with a regional approach, such as examining individual provinces. By focusing on the advancement of specific sectors, particularly the key sectors within each province, and examining their interconnections with sectors in other provinces, it is plausible to stimulate development in various regions. This approach not only has the potential to contribute to overall national economic growth but also fosters regional parity through the facilitation of sectoral interdependencies among provinces.

The delineation of the flow of goods within sectors and regions assumes paramount significance as a foundational framework for devising development strategies that are sector-specific and region-centric. This approach is pivotal in facilitating equitable development and mitigating the concentration of industries within particular geographic areas. To achieve this, it is imperative to employ more refined Input-Output data that encompasses regions, thereby evolving into what is known as Interregional Input-Output (IRIO) data.A fundamental repository of extensive data pertaining to the dynamics of goods flow within Indonesia is the creation of the Interregional Input-Output (IRIO) Indonesia in 2016 (Statistics Indonesia, 2021). This database encompasses 34 provincial economies and delineates 52 economic sectors within each province, thus offering a comprehensive account of the movement of goods and services. Notably, the IRIO not only furnishes insights based on sector categorization but also provides insights into the interplay between regions and provinces. The Indonesian IRIO table constitutes a remarkably comprehensive information resource that enables an in-depth analysis of the interrelationships among industries within Indonesia and the geographic locales in which these industries operate.

Utilizing the IRIO dataset, this study aims to conduct simulations to identify optimal sectoral potential within the context of intersectoral linkages among provinces. Subsequently, these identified sectors can be targeted for development initiatives, thereby reinforcing the supply of intermediate and final goods and services within the Indonesian economy, thereby optimizing domestic sectoral production. Multiple investment scenarios have been formulated to assess the responsiveness of sectoral development strategies in Indonesia, particularly focusing on selected sectors in specific regions, and their ensuing impact on key economic indicators, including output and income. Furthermore, these simulations are designed to illuminate the intricate relationships between the supply and expenditure of goods, offering insights into issues related to trade and the distribution of commodities.Building upon the preceding discourse, the primary objectives of this research encompass the following aspects: 1) the identification of the top 20 leading sectors in Indonesia and its constituent regions, along with the computation of the investment implications within these leading sectors; 2) the evaluation of the impact of investments in the aforementioned 20 leading sectors, as well as those within the provinces outside of Java, on the economies of both other provinces and the nation as a whole; and 3) the discernment of the intricate web of sectoral consequences stemming from these selected sectors, with the specific aim of elucidating trade pathways and the dynamics of domestic goods distribution across Indonesia.The envisaged utility of this research lies in its potential to serve as an initial analytical foundation for sectoral development strategies and as an initial step in identifying inter-provincial distribution challenges. Moreover, it serves as an invaluable information source concerning the prospects of regional-based domestic economies in Indonesia. Subsequently, this information can be harnessed to devise strategies aimed at fortifying provincial-based domestic economies, thereby mitigating dependency on imports.

2. LITERATURE REVIEW

2.1. Theory of Economic Growth with Regional Emphasis

Regional economics represents a specialized branch of economics that incorporates the spatial dimension into the examination of the conduct of economic agents and the mechanisms governing market dynamics. Within the purview of regional economics, conceptual frameworks, principles, and models are employed to elucidate the formation of prices, demand patterns, production capabilities, output levels, developmental stages, growth trajectories, and income distribution, all within the context of regional resource disparities.When local growth models incorporate space as a pivotal economic factor, distinct from other factors of production, regional economics transitions its principal analytical focus from the abstract notion of "space" to concrete geographical "regions." In essence, regional economics delves into the assessment of the capacity of subnational systems, be they provinces, cities, or regions characterized by specific economic attributes, to foster economic activities and cultivate conditions conducive to sustained long-term development (Capello, 2009).

Regional economics serves as a discipline that offers insights into the underlying mechanisms governing the occurrence of economic growth and development at the localized level. As posited by Capello (2009), regional economic development pertains to the capacity of a regional economic system to generate goods and services that align with the demands of both national and international economic systems, leveraging its comparative or absolute advantages. The underpinning theories and models of regional development draw upon a fusion of agglomeration economies and diseconomies(Sousa, 2010).In more detail, agglomeration economics pertains to the economic advantages stemming from the spatial concentration of economic activities and population, with the potential to yield reductions in production costs, enhancements in production efficiency, and elevations in overall productivity. Conversely, the concentration of both population and economic activities in a given space can also give rise to agglomeration diseconomies, leading to escalated prices for finite and scarce production factors. This, in turn, may incentivize the dispersal and deconcentration of economic activi-

ties, employment opportunities, and population to less densely populated areas (Sousa, 2010).

2.2. Leontief's Theory of Production

The analysis employing the Input-Output (I-O) model hinges on the utilization of a matrix-based tabular representation known as the I-O Table. This matrix encapsulates comprehensive data pertaining to transactions involving goods and services, as well as the intricate interdependencies among various sectors within a specific region over a defined time frame. The production process within the framework of input-output analysis adheres to either the Leontief production function or the fixed production function. The fixed proportion production function exhibits distinctive characteristics, marked by an elasticity of substitution denoted as zero (σ=0) and an isoquant displaying an 'L' shape(Nicholson and Snyder, 2017). Within this context, the flexibility to substitute inputs is non-existent. Each level of output necessitates a specific blend of labor and capital inputs, and an augmentation in output can only be realized through the addition of capital and labor in predetermined proportions (Pindyck and Rubinfeld, 2018). Companies consistently operate on an isoquant curve because it signifies the most efficient amalgamation of inputs. Mathematically, the fixed proportion production function is represented as $q = \min(\alpha k. \beta l),\ \alpha, \beta > 0$, wherein 'min' designates that 'q' is the lesser of the two values enclosed in the brackets (Nicholson and Snyder, 2017). Additionally, this production function is characterized by the constant return to scale property, indicating that an increase in input proportionately yields a corresponding increase in output, a condition applicable to all sectors within the economy.

Under the assumption of σ=0 in the production process, it signifies that each unit of output invariably demands inputs in a fixed and unalterable proportion. Within the context of the sectoral approach to Input-Output analysis, this input relationship is denoted as the input coefficient or technology coefficient, encapsulated within the inverse Leontief matrix. Mathematically, the input coefficient is articulated by the formula $A_{ij} = \frac{x_{ij}}{x_j}$ where X_{ij} represents the input value for sector j stemming from sector i, and X_j denotes the total input for sector j (Firmansyah et al., 2019). The repetitive utilization of intermediate inputs will lead to the formation of a convergent geometric series, as delineated in the Leontief inverse matrix equation $(I\text{-}A)^{-1}$, further expanded as $(I\text{-}A)^{-1}F_k$. This expression characterizes all intermediary components involved in the production of final demand (Dine and Chalil, 2021).The Interregional Input-Output (IRIO) table essentially represents an Input-Output table where sectors are grouped according to geographical regions that collectively constitute a single national entity. It shares the foundational principles of production theory with the conventional Input-Output framework.

3. METHOD

3.1. Data

The data utilized in this study is sourced from the 2021 publication by the Central Statistics Agency (BPS), specifically the 2016 Indonesian Interregional Input-Output (IRIO) Table, which categorizes 52 sectors across 34 provinces. The detailed classification of these 52 sectors within the 2016 Indonesian IRIO Table is presented in Table **1** for reference. The classification of the 34 provinces can be seen in Table **2**.

Table 1. Classification of 52 Sectors of IRIO of Indonesia.

No	Description	Code
1	Food Crops	I-01
2	Horticultural Crops	I-02
3	Plantation Crops	I-03
4	Livestock	I-04
5	Agriculture Services and Hunting	I-05
6	Forestry and Logging	I-06
7	Fishery	I-07
8	Crude Petroleum, Natural Gas, and Geothermal	I-08
9	Coal and Lignite Mining	I-09
10	Iron Ore Mining	I-10
11	Other Mining and Quarrying	I-11
12	Manufacture of Coal and Refined Petroleum Products	I-12
13	Manufacture of Food Products and Beverages	I-13
14	Manufacture of Tobacco Products	I-14

No	Description	Code
15	Manufacture of Textiles; and Wearing Apparel	I-15
16	Manufacture of Leather and Related Products and Footwear	I-16
17	Manufacture of Wood and of Products of Wood and Cork, and Articles of Straw and Plaiting Materials	I-17
18	Manufacture of Paper and Paper Products, Printing and Reproduction of Record Media	I-18
19	Manufacture of Chemicals and Pharmaceuticals and Botanical Products	I-19
20	Manufacture of Rubber, Rubber Products and Plastics Products	I-20
21	Manufacture of Other Non-Metallic Mineral Products	I-21
22	Manufacture of Basic Metal	I-22
23	Manufacture of Fabricated Metal Products, Computer, and Optical Products, and Electrical Equipment	I-23
24	Manufacture of Machinery and Equipment	I-24
25	Manufacture of Transport Equipment	I-25
26	Manufacture of Furniture	I-26
27	Other Manufacturing, Repair and Installation of Machinery and Equipment	I-27
28	Electricity	I-28
29	Gas Procurement and Ice Production	I-29
30	Water Supply, Sewerage, Waste Management and Remediation Activities	I-30
31	Construction	I-31
32	Wholesale and Retail Trade and Repair of Motor Vehicles and Motorcycles	I-32
33	Wholesale and Retail Trade Except of Motor Vehicles and Motorcycles	I-33
34	Railways Transport	I-34
35	Land Transport	I-35
36	Sea Transport	I-36
37	River, Lake, and Ferry Transport	I-37
38	Air Transport	I-38
39	Warehousing and Support Services for Transportation, Postal and Courier	I-39
40	Accommodation	I-40
41	Food and Beverage Service Activities	I-41
42	Information and Communication	I-42
43	Financial Intermediary Services	I-43
44	Insurance and Pension Fund	I-44
45	Other Financial Services	I-45
46	Financial Supporting Service	I-46
47	Real Estate Activities	I-47
48	Business Activities	I-48
49	Public Administration and Defense; Compulsory Social Security	I-49
50	Education	I-50
51	Human Health and Social Work Activities	I-51
52	Other Services Activities	I-52

No	Description	Code
53	Domestic Intermediate Input Total	190d
54	Foreign Import	2000
55	Import Between Province	2001
56	Intermediate Input Total	1900
57	Wages	2010
58	Profit	2020
59	Tax/Subsidy	2030
60	Value Added	2090
61	Input Total	2100
Component of Final Demand, Imports, Exports, Input/Output		
1	Intermediate Demand Total	1800
2	Household Consumption	3011
3	NPISH Consumption	3012
4	Government Expenditure	3020
5	Gross Fixed Capital Formation	3030
6	Changes in Inventory	3041
7	Foreign Export	3071
8	Export Between Province	3072
9	Export Total	3080
10	Final Demand	3090
11	Output Total	3100

Source: Statistics Indonesia (2021).

Table 2. Classification of Provinces in Indonesia's IRIO Table.

No	Province Name	No	Province Name
1	Aceh	18	West Nusa Tenggara
2	North Sumatera	19	East Nusa Tenggara
3	West Sumatera	20	West Kalimantan
4	Riau	21	Central Kalimantan
5	Jambi	22	South Kalimantan
6	South Sumatera	23	East Kalimantan
7	Bengkulu	24	North Kalimantan
8	Lampung	25	North Sulawesi
9	Bangka Belitung Islands	26	Central Sulawesi
10	Riau Islands	27	South Sulawesi
11	DKI Jakarta	28	Southeast Sulawesi
12	West Java	29	Gorontalo
13	Central Java	30	West Sulawesi

No	Province Name	No	Province Name
14	DI Yogyakarta	31	Maluku
15	East Java	32	North Maluku
16	Banten	33	West Papua
17	Bali	34	Papua

Source: Statistics Indonesia (2021).

Table 3. Indonesian IRIO Table Structure 52 Sectors and 34 Provinces.

Description				Intermediate Demand			Final Demand			Export	Output
				1. Prov. Aceh		34. Prov. Papua	1. Prov. Aceh		34. Prov. Papua		
				Sector		Sector	Component		Component		
				1 … 52		1 … 52	1 … 52		1 … 52		
Intermediate Input	1. Prov. Aceh	Sector	1 : 52	X_{ii}^{AA}		X_{ij}^{AB}	F_{ii}^{AA}	…	F_{ij}^{AB}	E_i^A	X_j^A
	34. Prov. Papua	Sector	1 : 52	X_{ij}^{BA}		X_{jj}^{BB}	F_{ij}^{BA}		F_{jj}^{BB}	E_i^B	X_j^B
Imports				X_j^{MA}		X_j^{MB}	F_j^{MA}		F_j^{MB}		
Value Added				V_j^A		V_j^B					
Input Total				X_j^A		X_j^B					

Source: Statistics Indonesia (2021).

The 2016 Indonesian Interregional Input-Output (IRIO) table functions as a comprehensive record of domestic producer price interactions. This implies that the IRIO table delineates the intricate network of goods and services generated by various industries within a specific region, subsequently consumed by that region itself, as well as by other regions within the nation. The structural layout of the 2016 Indonesian IRIO Table is presented in Table 3 for reference.

Transaction codes are in Table **3**, as explained in Table **1** but grouped by province. That is, in the IRIO Table, information on sectoral transactions values is not only from a sector to the same sector or other sectors within a province, as in Table **1** but there is also information on transactions values from a sector in a province to the same sector or sector others in other provinces.

3.2. IRIO Method

The Interregional Input-Output (IRIO) table elucidates the intricate web of transactions involving goods and services across multiple regions. As such, it transcends the boundaries of sectors confined to a single region and enables an examination of the intricate interconnections between sectors in one region and industries situated in other regions. Alterations in demand within Region i not only trigger heightened production and value addition within Region i itself but also exert a cascading influence on production and value addition in other regions. This, in turn, yields a reciprocal impact on demand within Region i, as depicted in Fig. (**1**).

Table **4** delineates the overarching framework of the Interregional Input-Output (IRIO) table. It illustrates a scenario involving two distinct regions, denoted as Region-r and Region-s. Within Region-r, there are three economic sectors, and similarly, within Region-s, there are three economic sectors. This configuration is manifested through the flow of goods and services between various sectors and industries. These two regions share economic interdependencies wherein shifts in final demand within Region-r instigate an upsurge in output within Region-r itself. Subsequently, this output alteration ripples through to impact output levels in Region-s, culminating in a subsequent effect on Region-r once again.

Table 4. General Structureof IRIO Table.

		Buyer Sector					
Seller Sector		r Region			s Region		
		1	2	3	1	2	3
r Region	1	z_{11}^{rr}	z_{12}^{rr}	z_{13}^{rr}	z_{11}^{rs}	z_{12}^{rs}	z_{13}^{rs}
	2	z_{21}^{rr}	z_{22}^{rr}	z_{23}^{rr}	z_{21}^{rs}	z_{22}^{rs}	z_{23}^{rs}
	3	z_{31}^{rr}	z_{32}^{rr}	z_{33}^{rr}	z_{31}^{rs}	z_{32}^{rs}	z_{33}^{rs}
s Region	1	z_{11}^{rr}	z_{11}^{rr}	z_{11}^{rr}	z_{11}^{ss}	z_{12}^{ss}	z_{13}^{ss}
	2	z_{11}^{sr}	z_{12}^{sr}	z_{13}^{sr}	z_{21}^{ss}	z_{22}^{ss}	z_{23}^{ss}
	3	z_{21}^{sr}	z_{22}^{sr}	z_{23}^{sr}	z_{31}^{ss}	z_{32}^{ss}	z_{33}^{ss}

Source: Miller and Blair (2009).

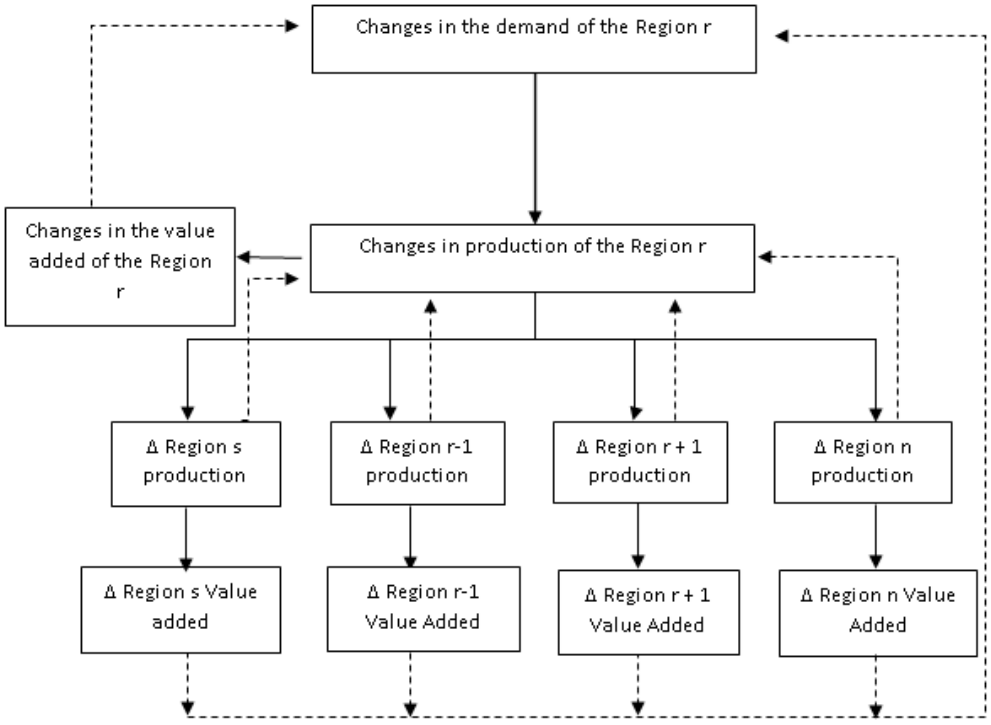

Fig. (1). Inter-Regional Impact with IRIO Table.

Source: Trinh et al. (2013).

Table **4** can be transformed into matrix Z in Equation 1(Miller and Blair, 2009).

$$Z = \begin{bmatrix} Z^{rr} & Z^{rs} \\ Z^{sr} & Z^{ss} \end{bmatrix} \quad (1)$$

The technical coefficients for Region-r and Region-s, or regional input coefficients, are formulated in Equations 3.2 and 3.3.

$$a_{ij}^{rr} = \frac{z_{ij}^{rr}}{x_j^r} \quad (2)$$

$$a_{ij}^{ss} = \frac{z_{ij}^{ss}}{x_j^s} \quad (3)$$

The inter-regional trade coefficients are as follows:

$$a_{ij}^{rs} = \frac{z_{ij}^{rs}}{x_j^s} \quad (4)$$

$$a_{ij}^{sr} = \frac{z_{ij}^{sr}}{x_j^r} \quad (5)$$

3.3. Stage of Analysis

The analysis proceeds through the following sequential phases:

1. Identification of the Dominant Sector:The dominant sector is ascertained based on its significant contribution to output distribution. This phase involves the selection of 20 leading sectors and their corresponding regions.
2. Investment Impact Simulation:Investment impact simulations are conducted to evaluate the potential

repercussions on output and income within the economy when investments are channeled into the selected sectors, guided by predefined scenarios. The research encompasses two distinct investment injection scenarios, denoted as Scenario S1 and Scenario S2:

3. Scenario S1 entails an equitable investment injection across all 20 selected leading sectors, with a total investment injection of 100 trillion rupiahs, amounting to 5 trillion rupiahs allocated to each sector.
4. Scenario S2 encompasses three sub-scenarios, designated as S2A, S2B, and S2C:Sub-scenario S2A involves an investment injection of 100 trillion rupiahs, exclusively directed towards leading sectors situated outside the Java region.Sub-scenario S2B entails an investment injection of 50 trillion rupiahs distributed to leading sectors within the Java region and another 50 trillion rupiahs directed to leading sectors located outside of Java.Sub-scenario S2C features an investment injection of 100 trillion rupiahs allocated to leading sectors within the Java region.

4. RESULTS AND DISCUSSION

4.1. Analysis of 20 Leading Sectors and Their Regions

Table **5** displays the prominent sectors within Indonesia and their respective regional prominence, as determined by the sectoral output distribution. The top five sectors with the most substantial output contributions consist of the Construction sector (I-31) located in DKI Jakarta, the Construction sector (I-31) in East Java, the Food and Beverage Industry (I-13) situated in East Java, the Wholesale and Retail Trade, excluding Cars and Motorbikes (I-33) in DKI Jakarta, and the Corporate Services sector (I-48) in DKI Jakarta.

Table 5. Leading Sectors and Regions.

Rank	Province	Sector Code	Location	Sector
1	DKI Jakarta	I-31	Java Island	Construction
2	East Java	I-31	Java Island	Construction
3	East Java	I-13	Java Island	Manufacture of Food Products and Beverages
4	DKI Jakarta	I-33	Java Island	Wholesale and Retail Trade Except of Motor Vehicles and Motorcycles
5	DKI Jakarta	I-48	Java Island	Business Activities
6	West Java	I-23	Java Island	Manufacture of Fabricated Metal Products, Computer, and Optical Products, and Electrical Equipment
7	West Java	I-33	Java Island	Wholesale and Retail Trade Except of Motor Vehicles and Motorcycles
8	West Java	I-31	Java Island	Construction
9	East Java	I-33	Java Island	Wholesale and Retail Trade Except of Motor Vehicles and Motorcycles
10	Central java	I-31	Java Island	Construction
11	DKI Jakarta	I-25	Java Island	Manufacture of Transport Equipment
12	North Sumatera	I-13	Outside of Java Island	Manufacture of Food Products and Beverages
13	DKI Jakarta	I-42	Java Island	Information and Communication
14	DKI Jakarta	I-47	Java Island	Real Estate Activities
15	East Kalimantan	I-09	Outside of Java Island	Coal and Lignite Mining
16	Riau	I-13	Outside of Java Island	Manufacture of Food Products and Beverages
17	West Java	I-24	Java Island	Manufacture of Machinery and Equipment
18	Central Java	I-13	Java Island	Manufacture of Food Products and Beverages
19	DKI Jakarta	I-49	Java Island	Public Administration and Defence; Compulsory Social Security
20	East Java	I-14	Java Island	Manufacture of Tobacco Products

Source: (Statistics Indonesia, 2021), processed.

The predominant presence of the leading sectors is concentrated within the geographical confines of Java Island, accounting for approximately 85% of their distribution, spanning across provinces such as DKI Jakarta, West Java, Central Java, and East Java. The residual 15% is situated in North Sumatra, Riau, and East Kalimantan (outside of Java Island). This distribution pattern is visually represented in Fig. (**2**).

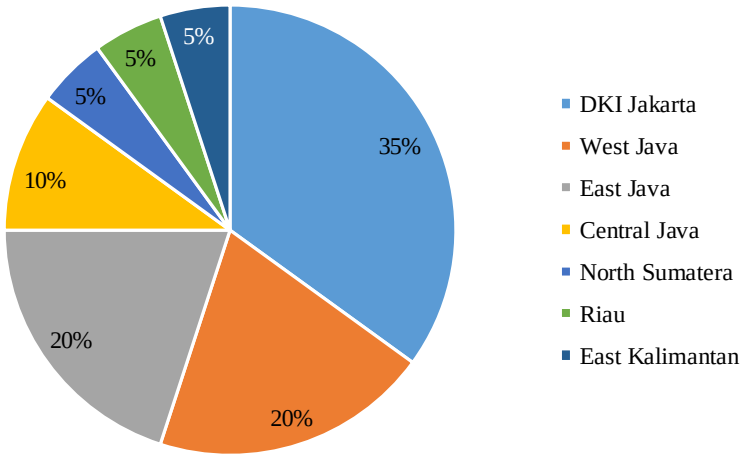

Fig. (2). Distribution of Leading Sector by Provinces.
Source: (Statistics Indonesia, 2021), processed.

4.2. Analysis of the Impact of Investments

4.2.1. Simulation Result of Scenario S1

Scenario S1 involves a uniform augmentation of investment across all 20 leading sectors. As depicted in Table **6**, an incremental infusion of 100 trillion rupiahs into these sectors yields a commensurate upsurge in the total economic output, amounting to 170.21 trillion rupiahs. Notably, the most substantial increments in output occurred in five provinces: DKI Jakarta, West Java, East Java, Central Java, and North Sumatra.

Table 6. Output Impact of Scenario S1 Simulation (million Rupiah).

Rank	Province	Output Impact
1	DKI Jakarta	50,515,084.44
2	West Java	34,914,510.49
3	East Java	31,428,893.59
4	Central Java	18,591,348.26
5	North Sumatera	10,677,543.88
6	Riau	9,824,572.45
7	East Kalimantan	7,996,742.46
8	Banten	1,366,709.31
9	South Sumatera	903,545.25
10	West Sumatera	485,125.42
11	Central Kalimantan	412,507.95
12	Aceh	325,922.34
13	Central Sulawesi	304,033.82
14	Lampung	262,425.37
15	South Sulawesi	254,430.04
16	Jambi	193,730.09
17	Papua	161,414.37
18	West Kalimantan	153,864.10
19	DI Yogyakarta	152,264.71
20	Bali	144,169.64
21	Riau Islands	143,273.78
22	North Kalimantan	139,287.66
23	West Nusa Tenggara	116,956.08
24	North Sulawesi	110,035.37
25	Bangka Belitung Islands	110,021.17
26	South Kalimantan	91,000.31
27	Southeast Sulawesi	87,219.04
28	West Papua	85,191.72
29	East Nusa Tenggara	68,611.62
30	Maluku	63,820.17
31	Bengkulu	58,841.43
32	North Maluku	48,276.19
33	West Sulawesi	11,114.90
34	Gorontalo	10,714.66
Total		170,213,202.07

Source: (Statistics Indonesia, 2021), processed.

The consequence of augmenting the overall investment by 100 trillion rupiahs across the 20 leading sectors will manifest as a rise in Indonesia's total income by 33.07 trillion rupiahs (as indicated in Table **7**). Notably, the provinces that recorded the most significant output increments were DKI Jakarta, East Java, West Java, Central Java, and Riau.

Table 7. Income Impact of Scenario S1 Simulation (million Rupiah).

Rank	Prov. Code	Province	Income Impact
1	31	DKI Jakarta	11,529,887.37
2	35	East Java	6,727,766.26
3	32	West Java	6,482,982.52
4	33	Central Java	3,004,482.27
5	14	Riau	1,846,168.20
6	12	North Sumatera	1,198,990.25
7	64	East Kalimantan	1,108,682.63
8	16	South Sumatera	171,865.56
9	36	Banten	137,862.22
10	13	West Sumatera	123,551.97
11	11	Aceh	87,690.71
12	62	Central Kalimantan	62,950.54
13	72	Central Sulawesi	59,552.00
14	18	Lampung	50,207.57
15	15	Jambi	49,944.33
16	73	South Sulawesi	49,649.99
17	65	North Kalimantan	38,138.88
18	71	North Sulawesi	35,590.26
19	34	DI Yogyakarta	35,454.47
20	51	Bali	32,810.75
21	21	Riau Islands	31,827.43
22	52	West Nusa Tenggara	30,948.76
23	61	West Kalimantan	29,505.64
24	19	Bangka Belitung Islands	26,050.75
25	74	Southeast Sulawesi	20,091.74
26	94	Papua	16,839.25
27	17	Bengkulu	14,659.64
28	53	East Nusa Tenggara	13,970.38
29	91	West Papua	13,850.69
30	82	North Maluku	12,598.90
31	63	South Kalimantan	11,695.45
32	81	Maluku	11,350.81
33	75	Gorontalo	2,661.29
34	76	West Sulawesi	2,547.54
Total			33,072,826.99

Source: (Statistics Indonesia, 2021), processed.

4.2.2. Simulation Result of Scenario S2A

Tables **8** and **9** present the simulation outcomes of Scenario S2A with regard to Indonesia's output and income. As indicated in Table **8**, an augmentation of 100 trillion rupiahs in total investment in leading sectors located outside of Java will yield a commensurate escalation in Indonesia's overall output, amounting to 191.86 trillion rupiahs. Notably, the provinces registering the most substantial output increments encompass North Sumatra, Riau, East Kalimantan, West Java, and DKI Jakarta.

Table 8. Output Impact of Scenario S2A Simulation (million Rupiah).

Rank	Prov. Code	Province	Output Impact
1	12	North Sumatera	66,813,745.84
2	14	Riau	60,757,803.99
3	64	East Kalimantan	49,019,420.39
4	32	West Java	3,001,135.46
5	31	DKI Jakarta	2,322,964.46
6	11	Aceh	1,812,505.07
7	35	East Java	1,647,473.20
8	13	West Sumatera	1,558,375.16
9	36	Banten	898,199.74
10	33	Central Java	564,292.87
11	15	Jambi	521,991.22
12	16	South Sumatera	457,293.74
13	73	South Sulawesi	351,492.98
14	21	Riau Islands	304,778.37
15	65	North Kalimantan	285,467.36
16	72	Central Sulawesi	184,688.87
17	91	West Papua	178,527.97
18	18	Lampung	171,431.28
19	53	East Nusa Tenggara	124,572.58
20	61	West Kalimantan	106,332.75
21	34	DI Yogyakarta	106,223.99
22	51	Bali	91,919.49
23	82	North Maluku	83,019.26

Rank	Prov. Code	Province	Output Impact
24	62	Central Kalimantan	81,099.94
25	63	South Kalimantan	78,129.77
26	71	North Sulawesi	69,018.55
27	94	Papua	51,675.15
28	76	West Sulawesi	49,057.25
29	52	West Nusa Tenggara	39,594.71
30	81	Maluku	36,508.49
31	17	Bengkulu	34,842.76
32	74	Southeast Sulawesi	31,125.65
33	19	Bangka Belitung Islands	12,773.56
34	75	Gorontalo	7,855.90
Total			191,855,337.77

Source: (Statistics Indonesia, 2021), processed.

Table 9 reveals that an augmentation of 100 trillion rupiahs in total investment within leading sectors located outside of Java will culminate in an expansion of Indonesia's overall income by 28.80 trillion rupiahs. Notably, the provinces that recorded the most substantial income increments encompass Riau, North Sumatra, East Kalimantan, West Java, and DKI Jakarta.

Table 9. Income Impact of Scenario S2A (million Rupiah).

Rank	Prov. Code	Province	Income Impact
1	14	Riau	11,400,775.25
2	12	North Sumatera	7,145,480.56
3	64	East Kalimantan	6,814,046.95
4	32	West Java	584,113.76
5	31	DKI Jakarta	563,110.19
6	11	Aceh	507,060.41
7	13	West Sumatera	412,976.74
8	35	East Java	408,319.08
9	15	Jambi	146,962.97
10	33	Central Java	104,043.30
11	36	Banten	100,421.64
12	21	Riau Islands	88,017.05
13	65	North Kalimantan	79,542.85
14	16	South Sumatera	65,375.36
15	73	South Sulawesi	60,640.88
16	72	Central Sulawesi	38,726.54
17	18	Lampung	37,341.49
18	91	West Papua	27,592.68
19	34	DI Yogyakarta	24,675.85
20	51	Bali	23,221.82
21	82	North Maluku	22,514.38
22	71	North Sulawesi	22,328.03
23	53	East Nusa Tenggara	20,160.61
24	62	Central Kalimantan	19,293.88
25	61	West Kalimantan	15,227.83
26	63	South Kalimantan	12,760.42
27	76	West Sulawesi	10,871.34
28	52	West Nusa Tenggara	9,146.23
29	17	Bengkulu	8,393.51
30	74	Southeast Sulawesi	6,911.99
31	94	Papua	6,598.86
32	81	Maluku	5,635.33
33	19	Bangka Belitung Islands	2,867.19
34	75	Gorontalo	1,898.58
Total			28,797,053.57

Source: (Statistics Indonesia, 2021), processed.

4.2.1. Simulation Result of Scenario S2B

As indicated in Table **10**, an investment injection of 50 trillion rupiahs allocated to leading sectors situated on the Java Island, along with another 50 trillion rupiahs allocated to leading sectors outside of Java, yielded a consequent augmentation in Indonesia's total output by 179.12 trillion rupiahs. Notably, the provinces that witnessed the most substantial increments in output included North Sumatra, Riau, DKI Jakarta, East Kalimantan, and West Java.

Table10. Output Impact of Scenario S2B (million Rupiah).

Rank	Prov. Code	Province	Output Impact
1	12	North Sumatera	33,792,450.57
2	14	Riau	30,797,079.55
3	31	DKI Jakarta	30,671,270.33
4	64	East Kalimantan	24,888,433.37
5	32	West Java	21,773,709.01
6	35	East Java	19,165,955.78
7	33	Central Java	11,168,443.10
8	36	Banten	1,173,793.60
9	11	Aceh	938,044.64

Rank	Prov. Code	Province	Output Impact
10	13	West Sumatera	927,051.78
11	16	South Sumatera	719,794.63
12	15	Jambi	328,896.44
13	73	South Sulawesi	294,397.13
14	62	Central Kalimantan	276,045.83
15	72	Central Sulawesi	254,891.78
16	18	Lampung	224,957.21
17	21	Riau Islands	209,775.67
18	65	North Kalimantan	199,479.30
19	61	West Kalimantan	134,292.37
20	34	DI Yogyakarta	133,306.77
21	91	West Papua	123,624.29
22	51	Bali	122,654.87
23	94	Papua	116,227.63
24	71	North Sulawesi	93,146.09
25	53	East Nusa Tenggara	91,654.37
26	63	South Kalimantan	85,700.68
27	52	West Nusa Tenggara	85,101.40
28	19	Bangka Belitung Islands	69,978.03
29	74	Southeast Sulawesi	64,121.77
30	82	North Maluku	62,582.16
31	81	Maluku	52,574.18
32	17	Bengkulu	48,959.63
33	76	West Sulawesi	26,738.22
34	75	Gorontalo	9,537.52
Total			179,124,669.71

Source: (Statistics Indonesia, 2021), processed

The allocation of a 50 trillion-rupiah investment to leading sectors on Java Island, coupled with a 50 trillion-rupiah allocation to leading sectors outside Java Island, will result in an elevation of Indonesia's overall income by 31.31 trillion rupiahs (refer to Table **11**). Notably, the provinces that recorded the most significant income increments encompass DKI Jakarta, Riau, East Java, West Java, and North Sumatra.

Table 11. Income Impact of Scenario S2B (million Rupiah).

Rank	Prov. Code	Province	Income Impact
1	31	DKI Jakarta	7,014,155.59
2	14	Riau	5,780,418.16
3	35	East Java	4,125,640.95
4	32	West Java	4,054,036.56
5	12	North Sumatera	3,647,545.08
6	64	East Kalimantan	3,457,950.29
7	33	Central Java	1,810,183.87
8	11	Aceh	260,372.35
9	13	West Sumatera	242,726.88
10	16	South Sumatera	128,016.65
11	36	Banten	122,445.51
12	15	Jambi	89,893.18
13	65	North Kalimantan	55,187.58
14	21	Riau Islands	54,964.33
15	73	South Sulawesi	54,175.65
16	72	Central Sulawesi	50,976.81
17	62	Central Kalimantan	44,974.27
18	18	Lampung	44,909.77
19	34	DI Yogyakarta	31,016.22
20	71	North Sulawesi	30,129.34
21	51	Bali	28,862.37
22	61	West Kalimantan	23,626.55
23	52	West Nusa Tenggara	21,971.25
24	91	West Papua	19,509.16
25	82	North Maluku	16,681.74
26	53	East Nusa Tenggara	16,519.30
27	19	Bangka Belitung Islands	16,504.57
28	74	Southeast Sulawesi	14,664.79
29	94	Papua	12,622.62
30	63	South Kalimantan	12,133.97
31	17	Bengkulu	12,079.47
32	81	Maluku	8,997.38
33	76	West Sulawesi	5,974.99
34	75	Gorontalo	2,347.23
Total			31,312,214.41

Source: (Statistics Indonesia, 2021), processed

4.2.3. Simulation Result of Scenario S2C

The execution of Scenario S2C entails the provision of an investment injection totaling 100 trillion rupiahs, strategically allocated to leading sectors situated on the Java Island. This infusion engendered an upswing in Indonesia's overall output, tallying up to 166.40 trillion rupiahs (see Table **12**).

Notably, the provinces that witnessed the most substantial output impacts encompassed DKI Jakarta, West Java, East Java, Central Java, and Banten.

Table12. Output Impact of Scenario S2C (million Rupiah).

Rank	Prov. Code	Province	Output Impact
1	31	DKI Jakarta	59,019,576.20
2	32	West Java	40,546,282.56
3	35	East Java	36,684,438.36
4	33	Central Java	21,772,593.33
5	36	Banten	1,449,387.47
6	16	South Sumatera	982,295.51
7	14	Riau	836,355.12
8	12	North Sumatera	771,155.30
9	64	East Kalimantan	757,446.35
10	62	Central Kalimantan	470,991.72
11	72	Central Sulawesi	325,094.69
12	13	West Sumatera	295,728.40
13	18	Lampung	278,483.14
14	73	South Sulawesi	237,301.28
15	94	Papua	180,780.12
16	61	West Kalimantan	162,251.99
17	34	DI Yogyakarta	160,389.54
18	51	Bali	153,390.25
19	15	Jambi	135,801.66
20	52	West Nusa Tenggara	130,608.08
21	19	Bangka Belitung Islands	127,182.51
22	71	North Sulawesi	117,273.64
23	21	Riau Islands	114,772.97
24	65	North Kalimantan	113,491.24
25	74	Southeast Sulawesi	97,117.88
26	63	South Kalimantan	93,271.59
27	91	West Papua	68,720.61
28	81	Maluku	68,639.88
29	11	Aceh	63,584.21
30	17	Bengkulu	63,076.49
31	53	East Nusa Tenggara	58,736.16
32	82	North Maluku	42,145.06
33	75	Gorontalo	11,219.15
34	76	West Sulawesi	4,419.19
Total			166,394,001.66

Source: (Statistics Indonesia, 2021), processed.

Table **13** illustrates that an investment infusion of 100 trillion rupiahs, apportioned among leading sectors situated on Java Island, leads to a consequent augmentation in Indonesia's overall income by 33.83 trillion rupiahs. Notably, the provinces that recorded the most significant income increments encompassed DKI Jakarta, East Java, West Java, Central Java, and South Sumatra.

Table 13. Income Impact of Scenario S2C(million Rupiah).

Rank	Prov. Code	Province	Income Impact
1	31	DKI Jakarta	13,465,200.99
2	35	East Java	7,842,962.82
3	32	West Java	7,523,959.36
4	33	Central Java	3,516,324.44
5	16	South Sumatera	190,657.95
6	14	Riau	160,061.07
7	12	North Sumatera	149,609.61
8	36	Banten	144,469.38
9	64	East Kalimantan	101,853.64
10	13	West Sumatera	72,477.01
11	62	Central Kalimantan	70,654.65
12	72	Central Sulawesi	63,227.08
13	18	Lampung	52,478.05
14	73	South Sulawesi	47,710.42
15	71	North Sulawesi	37,930.65
16	34	DI Yogyakarta	37,356.58
17	52	West Nusa Tenggara	34,796.26
18	51	Bali	34,502.92
19	15	Jambi	32,823.39
20	61	West Kalimantan	32,025.26
21	65	North Kalimantan	30,832.30
22	19	Bangka Belitung Islands	30,141.96
23	74	Southeast Sulawesi	22,417.58
24	21	Riau Islands	21,911.61
25	94	Papua	18,646.37
26	17	Bengkulu	15,765.43
27	11	Aceh	13,684.30
28	53	East Nusa Tenggara	12,877.98

29	81	Maluku	12,359.43
30	63	South Kalimantan	11,507.51
31	91	West Papua	11,425.63
32	82	North Maluku	10,849.11
33	75	Gorontalo	2,795.88
34	76	West Sulawesi	1,078.63
Total			33,827,375.24

Source: (Statistics Indonesia, 2021), processed.

4.2.4. Summary of Simulation Results

Upon reviewing the outcomes of the conducted simulations (as presented in Table **14**) for scenarios S1, S2A, S2B, and S2C, it becomes evident that the most substantial output impact materializes when investments are directed towards leading sectors located outside Java (Scenario S2A). Specifically, this is observed within the Food and Beverage Industry sector (I-13) in North Sumatra and Riau Provinces, along with the Coal and Lignite Mining sector (I-09) in East Kalimantan. Conversely, the most pronounced income impact is observed when investments are channeled into leading sectors situated on Java Island (Scenario S2C).

Table 14. Simulation Result Summary (million Rupiah).

Description		**Output Impact Total**	**Income Impact Total**
Scenario S1		170,213,202.07	33,072,826.99
Scenario S2	A	191,855,337.77	28,797,053.57
	B	179,124,669.71	31,312,214.41
	C	166,394,001.66	33,827,375.24

5. CONCLUSION

Based on the Indonesian Interregional Input-Output (IRIO) provinces dataset, 20 leading sectors were identified for subsequent simulations involving investment in these sectors. These simulations involved uniform investment sizes in each shock scenario, allowing for the assessment of sectoral and overall output and income impacts.

The analysis revealed that when investment is evenly distributed across all leading sectors, both within and outside Java, the impact on total output is relatively modest, yet it yields a substantial income impact. In contrast, concentrating all investment in 15 percent of the leading sectors, exclusively located outside Java, results in the highest output impact among the available scenarios but generates the lowest income impact.

Furthermore, allocating 50 percent of the investment to leading sectors outside Java and the remaining 50 percent to leading sectors within Java produces intermediate impacts compared to scenarios where either 100 percent of the investment goes to leading sectors outside Java or 100 percent goes to leading sectors within Java. The income level also demonstrates a similar intermediate effect, contrasting with the lowest impact when 100 percent of the investment is allocated exclusively outside Java.

These findings underscore the importance of distributing investments throughout Indonesia, particularly in regions outside Java, particularly those housing nationally superior sectors. This strategic approach is driven by the diminishing resource capacity and diminishing economic multiplier effects of Java's sectors. While increasing investment in Java may enhance income levels within the region, it also poses challenges for achieving equitable income distribution.

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