



Unlocking the Potential of Input-Output Tables for Spatial Analysis Using the Miyazawa Model: A Case Study of East Java Province

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Abstract. East Java Province holds a strategic role in the national economy, serving as the second-largest contributor to GDP after Jakarta and as a key trade hub to Eastern Indonesia. Yet regional disparities remain substantial, particularly reflected in the economic underdevelopment and weak logistics connectivity of Madura Island, which lies adjacent to the Gerbangkertosusila growth corridor. Addressing this gap requires a deeper understanding of sectoral and spatial linkages that shape Madura's growth trajectory. This study applies the Miyazawa Input-Output Model for East Java Province, integrating 17 economic sectors and 38 regencies/municipalities to enable simultaneous sectoral and regional analysis. The simulations assess the effects of increasing household income in Madura, spillover from surrounding regions, and the combined role of strengthening the Transportation and Warehousing sector alongside Agriculture and Manufacturing. The findings show that the logistics sector in Madura, when considered independently, has limited impact; however, its significance rises when complemented by productive local sectors. Moreover, spillover from surrounding regions into Madura proves weaker than spillover directed outside Madura, underscoring the island's fragile spatial connectivity. These results highlight the urgency of affirmative policies that strengthen productive sectors, enhance interregional linkages, and ensure Madura's integration into East Java's broader economic development.

Keywords: East Java, Inclusive Economy, Logistics, Madura, Miyazawa Input-Output.

1. Introduction

East Java Province holds a highly significant position in the national economic network with two strategic roles: as the second-largest contributor to Gross Regional Domestic Product (GRDP) at the national level after Jakarta [1], and as a central hub for trade relations toward Eastern Indonesia [2]. According to data from BPS-Statistics Indonesia (hereafter BPS), the GRDP at Current Prices of East Java Province in 2024 reached 3,168.30 trillion rupiah, accounting for 14.39 percent of the total GRDP across all provinces in Indonesia. East Java's economic contribution plays a pivotal role in sustaining Indonesia's overall economic resilience and growth. This is evident from the fact that the economic downturn in East Java contributed to Indonesia's regression into the lower-middle-income category during the Covid-19 pandemic [3]. Therefore, East Java's economic growth is not merely a responsibility of the provincial government but also a development priority that draws the attention of policymakers at the national level.



Unfortunately, East Java continues to face inclusivity issues that hinder efforts to accelerate balanced economic growth. The Gini Ratio Index of East Java Province slightly increased to 0.373 in September 2024 [4]. This figure reflects a persistent stagnation in household expenditure inequality that has lasted for six years. A similar challenge also emerges in terms of regional disparity. Barika *et al.* identified East Java as one of the few provinces categorized with high regional inequality, as measured by the Williamson Index [5]. Regional disparities in East Java can be more clearly illustrated through spatial visualization of several indicators, as shown in Figure 1. Economic growth and activities remain concentrated in and around Surabaya City, the capital of East Java Province. This area forms part of the Gerbangkertosusila agglomeration priority zone, covering regencies and municipalities connected to Surabaya City as stipulated in Presidential Regulation No. 80 of 2019.

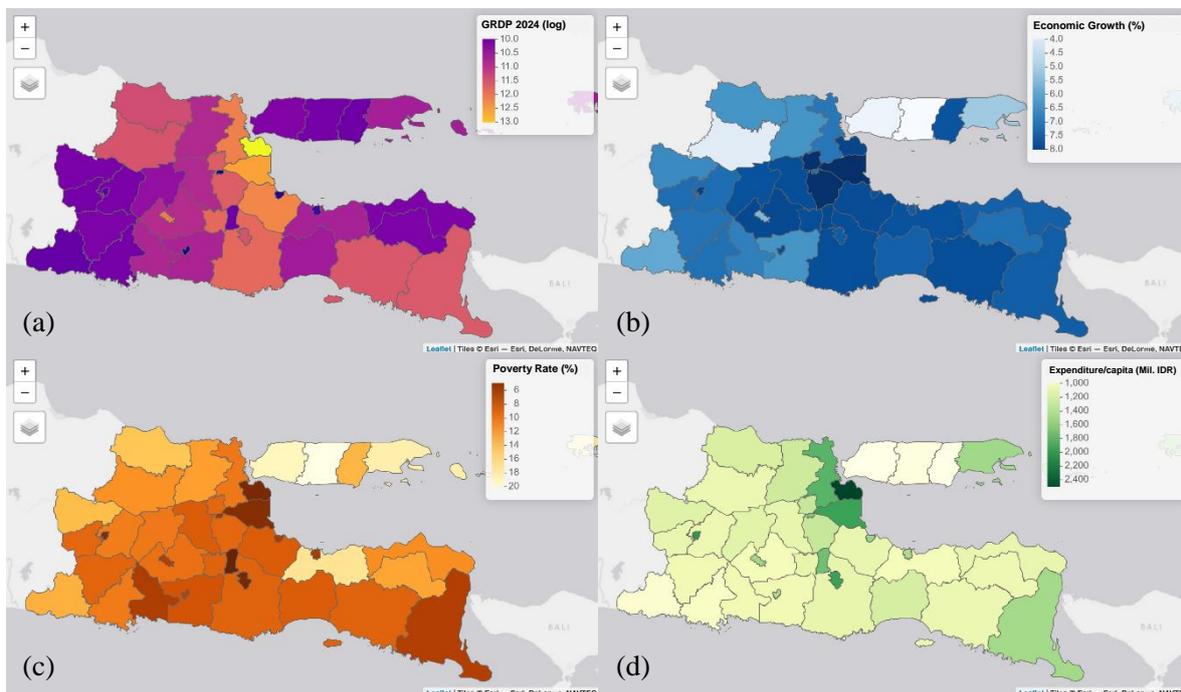


Figure 1. Economic and Regional Welfare Conditions of East Java in 2024:

- (a) GRDP at Current Prices (log value), (b) Economic Growth, (c) Percentage of Poor Population, (d) Monthly Per Capita Expenditure (Million Rupiah)

Figure 1 illustrates that the core area of Gerbangkertosusila possesses both substantial economic capacity and strong performance, as reflected in higher growth rates. However, the same figure highlights a contrasting condition in Madura Island, located in the northeast. Despite its direct border with Surabaya City, where part of its territory, Bangkalan Regency, is also included in the Gerbangkertosusila Priority Area, the disparity remains evident. In Figures 1a and 1b, a striking economic gap can be seen between Surabaya City and its surrounding areas on Java's mainland compared to Madura Island. A similar pattern is observed in Figures 1c and 1d, which depict welfare indicators. From the perspective of household consumption, regional disparities and Madura's lagging conditions become even more apparent. This situation reflects a combination of weak purchasing power, limited logistics, and insufficient community welfare on the island. Such disparities have long been recognized as a social phenomenon, with the construction of the Suramadu Bridge serving as one of the policy interventions aimed at accelerating Madura's relatively lagging economy compared to other parts of East Java in particular, and addressing interregional inequality more broadly [6].

Due to its separation from Java Island by sea, Madura and the surrounding islands face connectivity challenges that are commonly the main issue in archipelagic regions. These problems affect the



efficiency of logistics chains and household consumption dynamics, preventing the economy from operating at its full potential [7]. More accessible transportation networks and improved logistics connectivity are therefore crucial for driving economic growth, as Indonesia can no longer rely solely on commodities as the engine of growth [8], [9]. This is especially critical for island regions that are prone to experiencing bottlenecks due to limited access points. In his study, Sandee emphasized that investment in transportation infrastructure, alongside regulatory improvements and stronger coordination in policymaking, is essential to enhance interregional connectivity in Indonesia [8].

Understanding the patterns of influence that emerge in interregional economic interactions can serve as a foundation for determining the direction of development interventions and investments aimed at accelerating economic growth. One aspect that has not been extensively studied in this context is how spatial variations in household consumption can drive economic output and the regional logistics system. Consumption is not merely a passive variable but has the potential to trigger logistics flows and cross-sectoral activities across regions [10]. Therefore, understanding the spatial transmission of household consumption patterns provides crucial information for formulating evidence-based logistics interventions.

The issue of spatial disparity in East Java Province has evolved into a structural problem with implications for various aspects of regional development. Presidential Regulation No. 80 of 2019 maps the division of economic acceleration areas in East Java into five priority and supporting zones. The priority zones consist of Gerbangkertosusila Plus and Bromo-Tengger-Semeru, while the supporting zones include Madura & the Islands, Selingskar Wilis, and Selingskar Ijen. The regencies and municipalities included in each of these zones are illustrated in Figure 2.

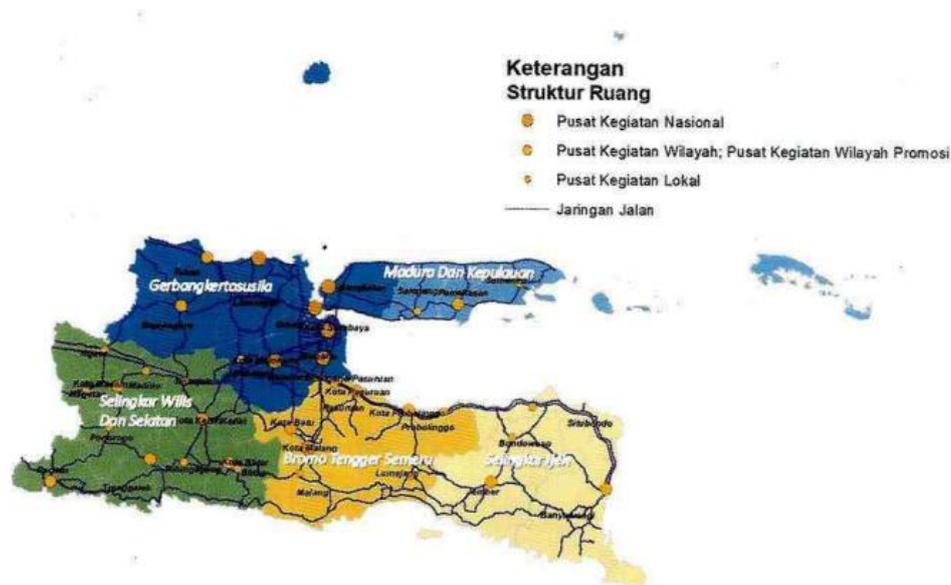


Figure 2. Regional Agglomeration Mapping of East Java Province

Within this agglomeration division, the Madura & Islands zone shows the weakest performance, contributing only a very small share to East Java's economy. Even Bangkalan Regency, which is part of the Gerbangkertosusila zone and directly connected to Surabaya City via the Suramadu Bridge, still demonstrates suboptimal performance, as noted in the previous section. Ifa *et al.* argued that economic growth has a significant impact in reducing poverty in Madura [11]. However, at the same time, Madura Island has long remained a poverty pocket within East Java, structurally entrenched to the extent that spatial dependency has formed among its regencies and municipalities [12].

Unfortunately, studies addressing the issues of disparity and underdevelopment in Madura remain limited, particularly in the context of spatial interactions. Yet, a spatial perspective is highly important



and even crucial in identifying regional development patterns, especially concerning the transport and logistics sectors, which serve as the key to distribution within economic activities. Cai *et al.*, employing a spatial approach, found that transport accessibility plays a significant role in improving community welfare by enhancing interregional interactions, thereby reducing inequality between urban centres and lagging peripheral areas in Guizhou, China [13].

Methodologically, the Input-Output (IO) Table approach expanded by Miyazawa provides an important contribution to analysing the interlinkages between production sectors and households through income and consumption mechanisms [14]. This model enables the integration of sectoral and social dimensions and, in its interregional development, extends the scope of analysis to the spatial dimension. Hewings *et al.* applied this model to analyse economic interdependencies within the Chicago metropolitan area and found that income flows between regions resulting from commuting were more significant than trade in goods and services [15]. That study laid the foundation for subsequent research emphasising the importance of the spatial dimension in regional analysis, such as by [16], [17], and [18].

The use of the Miyazawa IO Table in studies in Indonesia is not new, although the number of applications remains relatively limited. Several studies in Indonesia have developed economic analyses using the Miyazawa Input-Output Table approach based on household consumption and income. [19] applied this model to examine income distribution across household groups in Hulu Sungai Utara Regency, South Kalimantan. Another study by Imansyah *et al.* employed a similar model in the national context to analyse the linkages between the Information and Communication sector and household welfare [20]. Meanwhile, Purwanto used the Miyazawa approach to assess the impact of the energy transition on household income inequality in Indonesia [21]. At the regional level, Hardiwan *et al.* classified household expenditure to analyse the impact of tourism development in Jambi Province [22], and Obidzinski *et al.* adopted the Miyazawa approach to evaluate income distribution resulting from oil palm expansion in Papua [23]. Nevertheless, previous research has generally remained focused on the socio-economic dimension within a single region. To date, the application of the Miyazawa IO Table explicitly modelling interregional spatial linkages is still very rare in Indonesian literature, particularly for regional economic studies. This highlights the considerable scope for developing an Interregional Miyazawa IO model that can simultaneously capture the dynamics of consumption, income, and sectoral distribution across regencies and municipalities.

This study fills a gap in the literature, which has rarely addressed interregional spatial linkages based on household consumption in Indonesia. Although the Miyazawa Input-Output approach has been used to examine the relationship between sectors and households, its applications have so far tended to remain limited to the socio-economic dimension, focusing on expenditure groups within a single administrative region. This study offers a new approach by applying the Miyazawa IO model in an interregional framework (hereafter referred to as the Interregional Miyazawa IO Table) to analyse how household consumption from a given region affects both economic sectors and other regions. By focusing on lagging areas such as Madura, this research contributes to understanding the spatial dynamics of regional economies and provides a foundation for more evidence-based development planning. The analysis measures the impacts on output and income both within Madura and across other regions in East Java, thereby evaluating the effectiveness of affirmative interventions, the strength of spatial connectivity, and the identification of sectoral potentials that support balanced regional growth. Through this approach, the study provides an empirical foundation for development planning that promotes more inclusive and evidence-based growth across East Java while also highlighting its impact on Madura Island as a lagging region that can benefit from stronger interregional economic linkages.

Three scenarios are analysed in this study. Scenario 1 simulates an increase in exogenous income of 1 trillion rupiah alternately across the four regencies of Madura Island (Bangkalan, Sampang, Pamekasan, and Sumenep) to evaluate the impact of affirmative regional policies on income and the equity of regional development. Scenario 2 examines the potential spillover effects into Madura from development in surrounding areas through increased household exogenous income in neighbouring regencies and municipalities. Scenario 3 assesses whether the Transportation and Warehousing sector represents a structural bottleneck for Madura's development by applying a broad final demand shock to



this sector, reinforced with additional shocks to the Agriculture and Manufacturing sectors in East Java. The choice of sectors in the final scenario is based on the policy direction for Madura's development as a supporting region focused on strengthening agriculture, plantations, and livestock [24]. The results of these three simulations are expected to provide concrete inputs for local governments in formulating logistics policies, strengthening regional competitiveness, and designing more inclusive sectoral and spatial development planning, particularly in reducing interregional disparities such as the underdevelopment of Madura Island.

2. Research Method

2.1. Constructing Miyazawa IO Table

The construction of the 2023 Interregional Miyazawa IO Table for East Java was carried out in two main stages: (1) updating the base 2016 IO Table to 2023 using the RAS method, and (2) transforming the standard IO Table into the Miyazawa structure, which integrates both sectoral and spatial dimensions.

The first stage began with updating East Java's 2016 IO Table to 2023 using the RAS method, an iterative technique first introduced by Stone [25] and widely popularised in the IO literature by Miller and Blair [26]. This updating process required three target datasets for 2023, namely: total output by sector, total intermediate demand by sector, and total intermediate input by sector. Initial estimates of these three variables were obtained through a ratio-based approach derived from the 2016 sectoral distribution. The RAS iteration process was carried out using STATA software, with the RAS implementation module developed by Xia [27].

Once the 2023 IO Table in its standard (Leontief) form was obtained, the next step was to convert it into the Interregional Miyazawa IO Table. This approach was developed by [14], who proposed an extension of the input-output model by explicitly incorporating households as both production and consumption sectors within the matrix structure. In the context of this study, the household consumption column and the wage/salary row from the standard IO were incorporated into the technical coefficient matrix as additional sectors, replicated across administrative units (regencies/municipalities). The result is an IO system with dimensions of 55×55 , consisting of 17 sectors and 38 administrative regions in East Java.

The Miyazawa structure enables the tracing of the impacts of changes in final demand not only on sectoral output but also on income distribution and interregional linkages. Through a quadrant system that separates the effects of internal regional impacts, household-sector relations, cross-regional consumption, and interregional household feedback, the model provides a comprehensive approach to understanding sectoral and spatial interconnectedness within the regional economy. Therefore, the Miyazawa model is particularly well suited to analysing issues of logistical connectivity and the spatial distribution of development benefits, which are the focus of this study.

The conversion of household consumption into 38 administrative regions in East Java was carried out using data from the Susenas (National Socio-Economic Survey). However, since Susenas records consumption based on the COICOP classification (Classification of Individual Consumption According to Purpose), a mapping process was required to align consumption data accurately with the economic sectors in the IO framework. For this purpose, the study referred to the conversion scheme from COICOP to CPA (Classification of Products by Activity) developed by [28]. Once household consumption was grouped into 17 economic sectors, the data were then spatially classified into each regency and municipality in East Java, following the regional structure of the model. The disaggregation across regencies and municipalities was conducted based on the share of household consumption in each region, ensuring that the total provincial consumption derived from the IO column was proportionally distributed according to the relative consumption weights of each regency or municipality.

Meanwhile, for household income data in the form of wages and salaries, information from the Sakernas (National Labour Force Survey) was already available by sector, requiring only aggregation into 17 industries and distribution across all regencies and municipalities. In the process of incorporating



expenditure and income data into the intermediate input matrix of the Miyazawa model, a row and column balancing procedure was applied to address discrepancies arising from the use of different survey sources. Once the balancing process was completed and all model components were made consistent, the 2023 Interregional Miyazawa IO Table for East Java was ready to be used for analysis and the policy simulations designed in this study.

Another fundamental difference between the Miyazawa model and the conventional IO Table lies in the classification of consumption and income according to specific groupings [14], [15]. In the context of this study, the classification is based on 38 administrative regencies and municipalities in East Java for the year 2023, thereby enabling the simultaneous analysis of sectoral and spatial distribution. The Interregional Miyazawa IO Table employed in this study is formulated in matrix form as follows:

$$\bar{A} = \begin{bmatrix} A_{17 \times 17} & C_{17 \times 38} \\ V_{38 \times 17} & 0_{38 \times 38} \end{bmatrix} \quad (1)$$

In this context, \bar{A} represents the Miyazawa Augmented Coefficient Matrix, which is an extension of the conventional input-output system. Matrix A in Quadrant I shows the technical coefficients between sectors, with dimensions of 17×17 in accordance with the number of sectors in the model. Matrix C in Quadrant II illustrates the household consumption coefficients, sized 17×38 to reflect the consumption of households across 38 regencies/municipalities with respect to 17 economic sectors. Furthermore, V is the household income coefficient matrix in Quadrant III, with dimensions of 38×17 , representing the proportion of income received by households in each region from each sector. The zero matrix is a 38×38 null matrix used to complete the augmented structure so that it remains square, located in Quadrant IV.

Industries	1	...	17	Households' consumptions in 38 regions			Other final demand	Output
	$a_{1 \times 1}$	...	$a_{1 \times 17}$	$c_{1 \times 1}$	...	$c_{1 \times 38}$		
1	$a_{1 \times 1}$	...	$a_{1 \times 17}$	$c_{1 \times 1}$	...	$c_{1 \times 38}$	f_1	X_1
⋮	⋮	...	⋮	⋮	...	⋮	⋮	⋮
17	$a_{17 \times 1}$	...	$a_{17 \times 17}$	$c_{17 \times 1}$	...	$c_{17 \times 38}$	f_{17}	X_{17}
Households' wages in 38 regions	$v_{1 \times 1}$	...	$v_{1 \times 17}$	$0_{1 \times 1}$	...	$0_{1 \times 38}$		
	⋮	...	⋮	⋮	...	⋮		
	$v_{38 \times 1}$	...	$v_{38 \times 17}$	$0_{38 \times 1}$	...	$0_{38 \times 38}$		
Other value added	z_1	...	z_{17}					
Input	X_1	...	X_{17}					

Figure 3. Miyazawa IO Table with Extended Household Consumption/Wages for Regencies/Municipalities in East Java

To analyse how changes in final demand affect income distribution across all sectors and regions, the Leontief Inverse Matrix of the augmented system is employed. This matrix functions as a multiplier for both output and income, at the sectoral as well as the household level. The general form of the Inverse Matrix for the Miyazawa augmented system used in this study (derived from Equation 1) can be expressed as follows:

$$\bar{B} = \begin{bmatrix} (I - A) & -C \\ -V & I \end{bmatrix}^{-1} \quad (2)$$



If $B = (I - A)^{-1}$, $L = VBC$, and $K = (I - L)^{-1}$ so that \bar{B} can be expressed as:

$$\bar{B} = (I - \bar{A})^{-1} = \begin{bmatrix} B(I + CKVB)_{17 \times 17} & BCK_{17 \times 38} \\ KVB_{38 \times 17} & K_{38 \times 38} \end{bmatrix} \quad (3)$$

where \bar{B} is the Miyazawa Inverse Matrix. $B(I + CKVB)$ represents the Total Industrial Multiplier, which captures inter-sectoral interactions in Quadrant I. BCK is the Household Consumption-Induced Sectoral Multiplier, describing the relationship between households and sectors in Quadrant II. KVB is the Multiplier of Income Formation, which explains the relationship between sectors and households in Quadrant III, while K is the Interregional Income Formation Matrix, illustrating the interactions between households across regions in Quadrant IV through the feedback loop process.

In addition to presenting the interpretation of multiplier effects within the Interregional Miyazawa Inverse Matrix for East Java, this study also implements a series of simulation scenarios of increased sectoral final demand and spatial consumption in order to address the research objectives previously formulated. The matrix operation formula for simulating an increase in final demand or regional consumption is described as follows:

$$\Delta X = (I - \bar{A})^{-1} \cdot \Delta F \quad (4)$$

where ΔX is the vector of changes in total output or income resulting from an increase in final demand or income, $(I - \bar{A})^{-1}$ is the Interregional Miyazawa Inverse Matrix, and ΔF is the shock vector of final demand or regency/municipality exogenous income. This shock vector has dimensions of 55×1 , consisting of 17 sectors and 38 regencies/municipalities in East Java.

2.2. Simulation Method

This study then utilizes the Interregional Miyazawa IO Table that has been constructed to conduct a simulation analysis of the impact of increased household income in a particular district or municipality on the additional final demand in another district or municipality within East Java. The simulation is carried out under several scenarios as follows:

2.2.1. Scenario 1: simulation of an increase in household income of 1 trillion rupiah in the regencies of Madura Island as a priority intervention

This scenario is designed to measure the potential increase in Madura's economic activity if the region is prioritised for development intervention. A shock of 1 trillion rupiah is applied alternately to household income in each of the four regencies of Madura Island, namely Bangkalan, Sampang, Pamekasan, and Sumenep. The simulation calculates the impacts on output and income generated both within Madura and outside the island, in order to determine the extent to which the intervention effects remain local or also exert external influence. The results of this scenario provide an illustration of the impact of affirmative regional policies (interventions specifically aimed at accelerating growth in regions with relatively lower development achievements) on the equity of regional development in East Java.

2.2.2. Scenario 2: simulation of spillover effects from regions surrounding Madura

This scenario aims to trace the extent to which economic development in regions surrounding Madura can generate spillover effects on the island. A shock of 1 trillion rupiah is applied alternately to household income in neighbouring regencies/municipalities such as Surabaya, Situbondo, Probolinggo, Sidoarjo, and Gresik. Through this simulation, the amount of income indirectly created in Madura as a result of surrounding regional development is assessed. If the impact received by Madura is relatively low, this may indicate weak spatial connectivity between Madura and its neighbouring regions, thereby reinforcing the justification for direct development interventions in Madura. This scenario provides a



basis for evaluating the effectiveness of interregional connectivity and for guiding development planning that is more geographically inclusive.

2.2.3. *Scenario 3: simulation of an increase in final demand of 1 trillion rupiah in the Transportation and Warehousing sector as well as in the Agriculture and Manufacturing sectors*

This scenario is designed to test whether the Transportation and Warehousing sector constitutes the main bottleneck in Madura’s regional development. By applying a final demand shock to the Transportation and Warehousing sector in East Java, the model identifies variations in output and income effects across regions, particularly by comparing Madura’s income with that of other areas. If the impact in Madura is relatively low, this may indicate weak internal and external sectoral linkages, reflecting structural logistical problems in the region. The results of this simulation provide a basis for arguing the need for affirmative policies in the Transportation and Warehousing sector to accelerate Madura’s development in a more inclusive manner. In addition, Scenario 3 incorporates an additional shock to two sectors that underpin the economy and hold potential for development in Madura, namely Agriculture and Manufacturing, with the aim of assessing the combined effects if all three sectors simultaneously experience an increase in final demand [29], [30].

3. Result and Discussion

3.1. *Quadrant 1: Total Industrial Multiplier*

The Total Industrial Multipliers in East Java are illustrated in Figure 4. In the Leontief IO model, the multipliers in this quadrant are generally used to identify key sectors based on Forward and Backward Linkages [31]. However, the Miyazawa approach differs conceptually, as household consumption and wage are already incorporated as an endogenous component in the matrix structure. The inversion is performed on the augmented coefficient matrix, which includes not only inter-sectoral technical coefficients but also household consumption coefficients and income flows to households. Consequently, the multipliers generated in this quadrant already contain induced demand effects from households, making them less appropriate for calculating pure sectoral linkages as in the Leontief approach. Thus, the interpretation of multipliers in Quadrant I of the Miyazawa model is more relevant for assessing total aggregate sectoral effects, rather than serving as the basis for identifying structural key sectors.

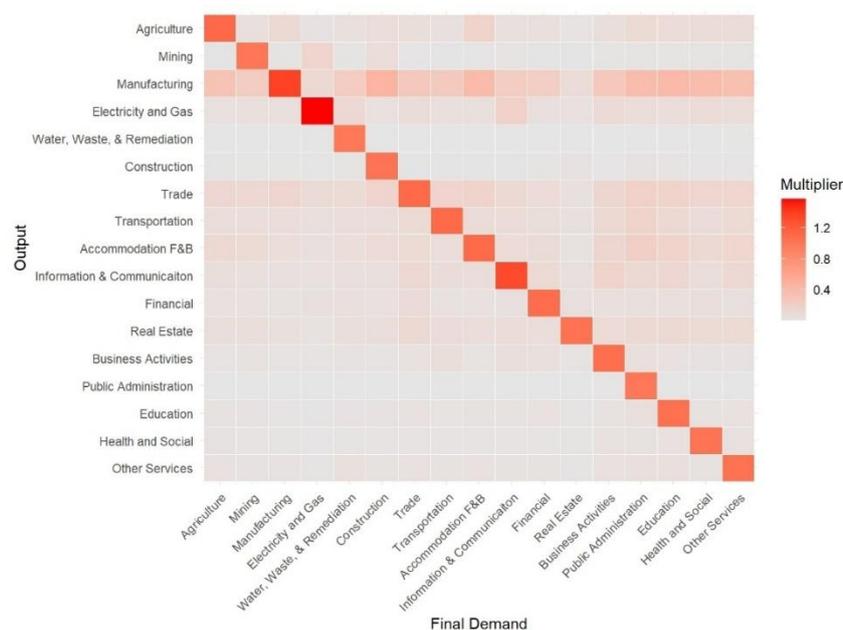




Figure 4. Coefficients of Total Industrial Multipliers in East Java

When assessed by sectors that generate the largest impact in response to an increase in their final demand, the Government Administration sector (multiplier of 2.715) and the Education Services sector (2.587) emerge as the two sectors with the greatest effect on East Java’s economy. On the other hand, the sectors that absorb the largest impacts from increases in final demand in other sectors are Manufacturing (6.156) and Trade (3.304).

These findings indicate that the Government Administration and Education Services sectors have the highest multiplier effects on total output, suggesting that public social services such as governance and education act as powerful initial catalysts for stimulating economic activity in East Java, particularly through household consumption mechanisms driven by public spending and service provision. Meanwhile, Manufacturing and Trade record the highest levels of impact absorption from increases in final demand across sectors, reflecting their strategic positions as key distribution nodes within the regional economic system. This combination highlights the importance of a development strategy that not only prioritises interventions in productive sectors but also strengthens the main absorbing sectors so that the transmission of economic growth can proceed more optimally, equitably, and sustainably.

3.2. *Quadrant 2: Household Consumption-Induced Sectoral Multiplier*

Household expenditure constitutes an important component of the economy. In the most recent (very preliminary) GRDP structure of East Java Province by expenditure, 60.96 percent consists of household consumption [4]. One of the outputs of constructing the Miyazawa IO Table is the household consumption-induced sectoral multiplier matrix, which illustrates how household spending in a region can stimulate an increase in sectoral output. Based on the Miyazawa IO Table for East Java Province, the Manufacturing sector shows the highest multiplier value overall, ranging from 0.452 to 0.667, far more dominant than other sectors. This means that, overall, when household expenditure increases, East Java Province is highly dependent on the industrial sector to meet the demand resulting from such expenditure growth. However, the values for individual regencies and municipalities tend to be distributed fairly evenly within this range. The complete values of the household consumption-induced sectoral multipliers are presented in Figure 5.

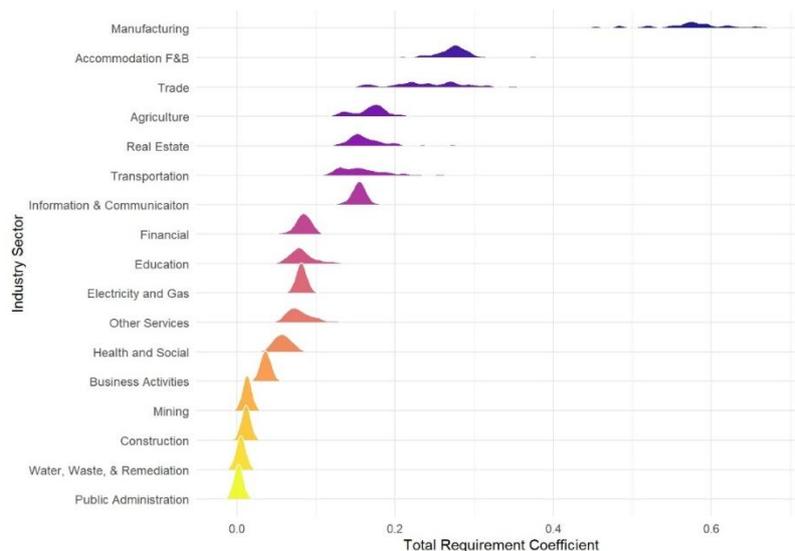


Figure 5. Coefficients of Household Consumption-Induced Sectoral Multipliers in East Java

Apart from Manufacturing, household expenditure multipliers on sectoral output that are relatively high and consistently observed across all regencies/municipalities are found in the Accommodation and



Food Services sector, as well as in Trade, followed by Agriculture, Real Estate, Transportation, and also Information and Communication, although with multiplier values considerably lower than those of Manufacturing. This highlights the important position of these sectors in meeting household demand in East Java, making interregional connectivity to facilitate the logistics distribution of consumer products from these sectors a critical issue.

3.3. Quadrant 3: Multiplier of Income Formation

One of the outputs of the Miyazawa IO Table is the multiplier of income formation matrix, which illustrates the multiplier values of sectoral final demand increases on household income growth in each regencies and municipality of East Java. This matrix is intended to address the issue of spatial inclusivity across different industries. To simplify the level of analytical complexity, the matrix is organised according to the five priority and supporting development zones: the priority zones of Gerbangkertosusila Plus and Bromo-Tengger-Semeru, and the supporting zones of Madura & the Islands, Selongkar Wilis, Semeru, and Selongkar Ijen.

Based on the results of the Interregional Miyazawa IO Table for East Java, increases in final demand across most sectors still reveal spatial disparities that warrant attention. On average, the highest household income gains are concentrated in the Gerbangkertosusila Plus area for increases in final demand across all sectors, with the exception of Agriculture alone. This dominance is illustrated in Figure 6. Such a condition indicates that communities in the Surabaya metropolitan agglomeration and its surroundings continue to be the main beneficiaries of household income growth when sectoral final demand rises.

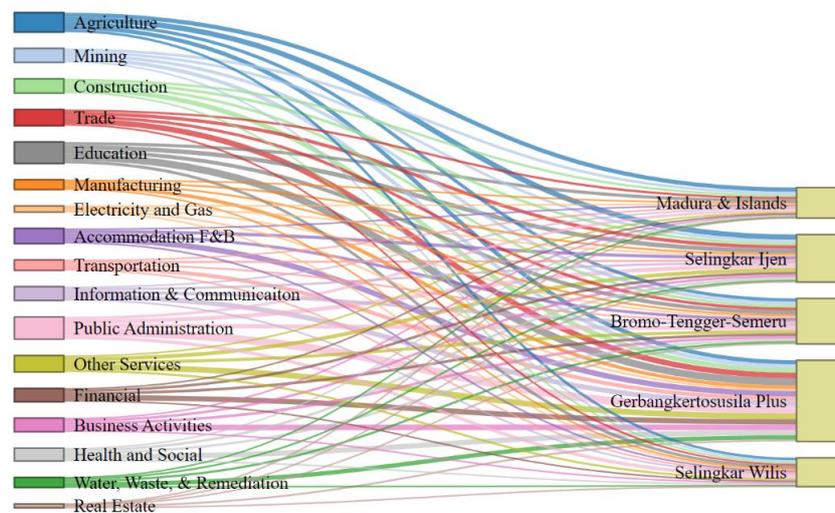


Figure 6. Average Income Formation Multiplier Values in East Java Agglomeration Areas

The Agricultural sector is the most spatially inclusive, as it generates evenly distributed impacts across all zones. In addition, sectors that are relatively inclusive with sizeable income multiplier values for the five agglomeration zones include Government Administration and Education Services. Meanwhile, the Electricity and Gas Supply sector also provides relatively equal multiplier values across zones, although at a much lower level compared to other sectors. For the remaining sectors, it can be identified that the Gerbangkertosusila Zone continues to record the largest multiplier values.

3.4. Quadrant 4: Interregional of Income Formation

In addition to sectoral and spatial linkages, the Interregional Miyazawa IO Table also produces the Interregional of Income Formation matrix, which illustrates the impact of increased household expenditure in one region on the household income of other regions in East Java. Figure 7 presents the



values of the Induced Effect Origin and the Induced Effect Received, which respectively describe the magnitude of the impacts generated and received through household consumption multipliers on income growth.

Based on the calculated Induced Effect Origin, it can be identified that Blitar Regency in the southern region records the largest source of expenditure-induced multipliers, indicated by the darkest green compared to other areas. This suggests that household expenditure in Blitar Regency generates substantial impacts on the economy, contributing significantly to income growth across East Java. Conversely, increases in expenditure in Surabaya City and Bangkalan Regency have the smallest effects on income growth in East Java, represented by dark red shading.

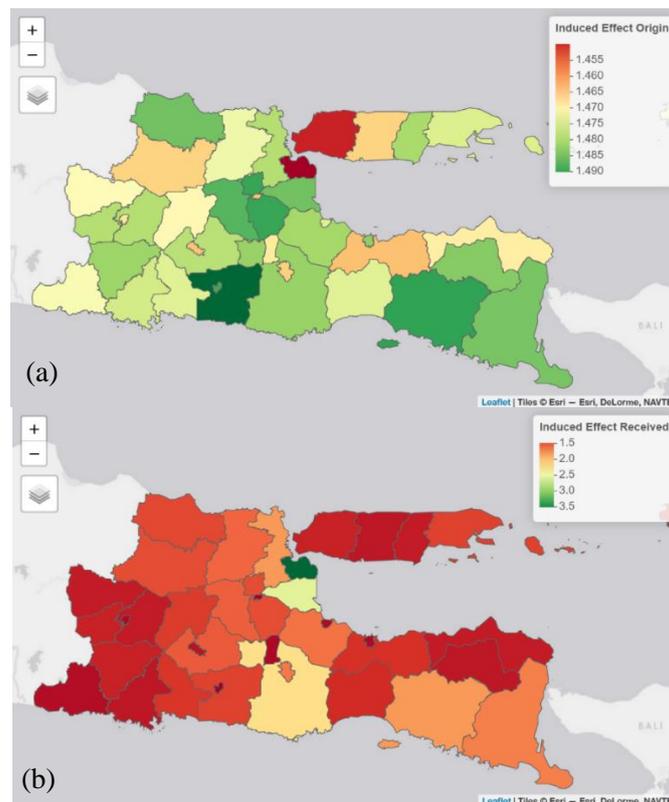


Figure 7. Spatial Distribution of Induced Effect Origin (a) and Induced Effect Received (b) in East Java

In addition, the Induced Effect Received values were obtained for all regencies and municipalities in East Java. As shown in Figure 7, Surabaya City clearly records the largest income gains resulting from increased household expenditure in East Java. The multiplier value it receives reaches 3.5, far exceeding that of any other region in the province. In contrast, the regencies on Madura Island and those in the Selongkar Wilis area in the south-west record only very small income effects.

Overall, the values of the Induced Effect reveal the spatial patterns of household consumption in East Java, where Surabaya City remains the primary destination for expenditure from across the province. Other regions of East Java, meanwhile, largely act as consumers whose household spending flows out of their own regencies or municipalities. This issue should ideally be addressed through the establishment of logistics networks that can reach all regions, enabling economic flows to operate more optimally and creating adequate and more widely distributed markets for consumers in East Java, thereby generating more equitable income gains across regions.

3.5. Analysis of the Impact of Regional Income Growth and Sectoral Final Demand



3.5.1. Scenario 1: Simulation of a Rp 1 trillion intervention in the regencies of Madura Island

This scenario examines the impact of prioritising Madura Island as the main focus of economic development. The simulation is carried out by adding household exogenous income of one trillion rupiah alternately across the four regencies of Bangkalan, Sampang, Pamekasan, and Sumenep. The analysis traces the effects of the intervention on both Madura's economy and other regions of East Java, in order to assess whether targeted stimulus in Madura can generate broader economic spillover effects alongside the direct impacts within the island itself. The detailed results of Scenario 1 are presented in Table 1.

Table 1. Impact of a Rp 1 trillion Consumption Increase in Madura's Regencies on Income in East Java (% to baseline)

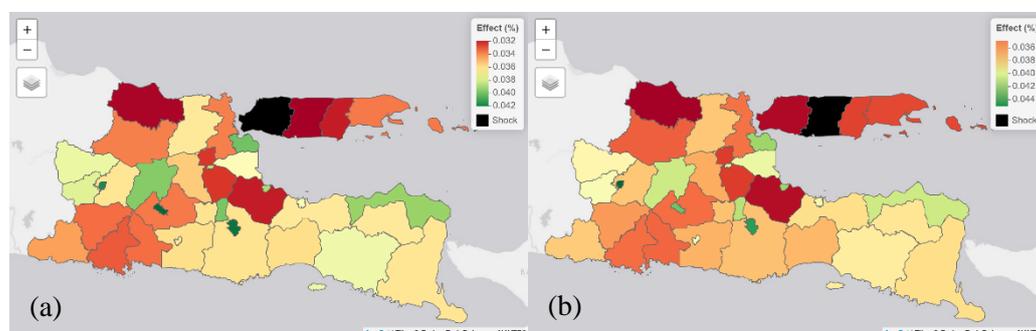
Affected Regencies/Municipalities	Source of Shock Region			
	Bangkalan	Sampang	Pamekasan	Sumenep
Pacitan	0.034	0.037	0.037	0.037
Ponorogo	0.034	0.036	0.036	0.036
Trenggalek	0.033	0.035	0.034	0.034
Tulungagung	0.033	0.034	0.037	0.036
Blitar	0.036	0.036	0.037	0.038
Kediri	0.034	0.035	0.036	0.036
Malang	0.036	0.037	0.038	0.037
Lumajang	0.036	0.036	0.037	0.038
Jember	0.037	0.038	0.040	0.040
Banyuwangi	0.036	0.038	0.039	0.038
Bondowoso	0.036	0.038	0.038	0.039
Situbondo	0.039	0.041	0.041	0.042
Probolinggo	0.036	0.038	0.039	0.039
Pasuruan	0.032	0.032	0.033	0.034
Sidoarjo	0.037	0.040	0.040	0.039
Mojokerto	0.032	0.033	0.034	0.034
Jombang	0.035	0.036	0.038	0.037
Nganjuk	0.040	0.041	0.041	0.041
Madiun	0.036	0.037	0.039	0.040
Magetan	0.038	0.039	0.041	0.041
Ngawi	0.037	0.039	0.039	0.040
Bojonegoro	0.034	0.034	0.036	0.037
Tuban	0.031	0.032	0.033	0.033
Lamongan	0.036	0.037	0.038	0.039
Gresik	0.034	0.035	0.035	0.035
Bangkalan	4.608	0.032	0.032	0.033
Sampang	0.031	5.283	0.033	0.032
Pamekasan	0.032	0.034	5.179	0.033
Sumenep	0.034	0.034	0.035	3.105



Affected Regencies/Municipalities	Source of Shock Region			
	Bangkalan	Sampang	Pamekasan	Sumenep
Kediri City	0.043	0.043	0.046	0.045
Blitar City	0.036	0.039	0.042	0.041
Malang City	0.042	0.044	0.045	0.044
Probolinggo City	0.037	0.039	0.040	0.038
Pasuruan City	0.039	0.042	0.043	0.042
Mojokerto City	0.038	0.040	0.041	0.041
Madiun City	0.042	0.046	0.049	0.046
Surabaya City	0.040	0.042	0.045	0.043
Batu City	0.040	0.041	0.044	0.045
East Java	0.051	0.051	0.052	0.052
Average Spillover in Madura	0.032	0.033	0.033	0.033
Average Spillover Outside Madura	0.036	0.038	0.039	0.039

The simulation shows that a one trillion rupiah increase in consumption in each regency of Madura Island generates a positive impact on income growth across all regions of East Java. The highest total impact is recorded when the shock is applied in Pamekasan and Sumenep Regencies, each resulting in a 0.052% increase in East Java's total household income, followed by Sampang (0.051%) and Bangkalan (0.051%). Although the aggregate figures appear relatively balanced, the variation in contributions across regions is quite diverse, reflecting differences in the sectoral and spatial linkage structures of each regency as the source of the shock.

On the other hand, when the shock is applied to one regency in Madura, the other three regencies still receive spillover effects from the resulting economic activity. However, the average impact on the three non-shock Madura regencies tends to be smaller than the average impact on regions outside Madura Island. For example, when Bangkalan receives the shock, the other Madura regencies (Sampang, Pamekasan, Sumenep) experience income increases of only around 0.031% to 0.034%, whereas many regencies/municipalities outside Madura receive the same or even greater impacts, with an average of 0.037%. This suggests that economic linkages among the regencies within Madura Island remain relatively weak compared to the linkages between Madura and the rest of East Java.



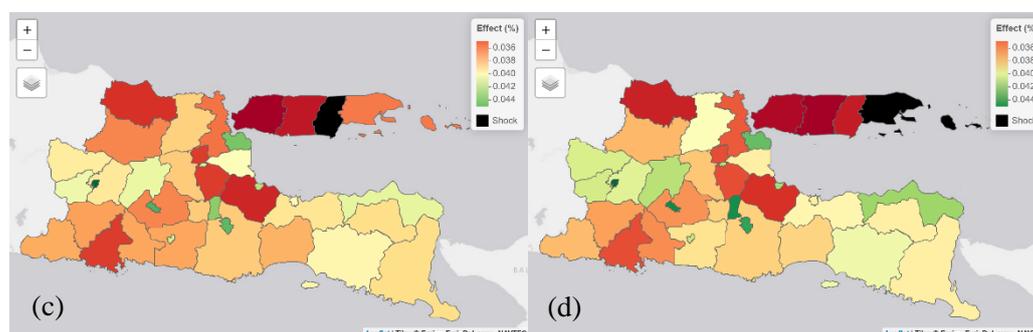


Figure 8. Spatial Distribution of Regional Income Effects from Household Consumption Shock in Madura Island (%). Regions receiving the shock: (a) Bangkalan Regency, (b) Sampang Regency, (c) Pamekasan Regency, and (d) Sumenep Regency.

Furthermore, the magnitude of spillover outside Madura Island can be observed from the consistently high impacts across various regencies and municipalities in East Java, with average effects ranging from 0.036% to 0.039%. This is especially evident in areas with closer logistical or geographical proximity to Madura, such as Surabaya City (0.040 to 0.045%), Sidoarjo (0.037 to 0.040%), and Situbondo (0.039 to 0.042%). In contrast, Figure 8 also shows that the transfer of impact among Madura’s regencies occurs on a more limited scale (0.032 to 0.033%). This suggests that, although Madura is the focus of intervention, the economic system in place is not yet fully intra-regionally integrated and tends to rely on external regions for production, distribution, and downstream consumption. These findings highlight the urgency of strengthening intra-Madura interconnectivity and increasing the capacity of local sectors so that the benefits of development can take deeper root and be distributed more equitably within Madura Island itself.

3.5.2. Scenario 2: Simulation of Spillover from Regions Surrounding Madura

This scenario evaluates the potential for economic spillover from the development of regions surrounding Madura into Madura itself. A consumption shock of one trillion rupiah is applied alternately to six neighbouring areas, namely Surabaya, Situbondo, Probolinggo (both city and regency), Sidoarjo, and Gresik. The analysis assesses the extent of the impact on household income in Madura. If the effects are limited, this reflects weak spatial connectivity between regions. These findings form the basis for assessing the effectiveness of regional integration. The simulation results for Scenario 2 are presented in Table 2.

Table 2. Impact of a Rp 1 trillion Consumption Increase in Regions Surrounding Madura on Income in East Java (% to baseline)

Affected Regencies/Municipalities	Source of Shock Region					
	Surabaya City	Situbondo	Probolinggo City	Probolinggo	Sidoarjo	Gresik
Pacitan	0.035	0.036	0.038	0.036	0.039	0.038
Ponorogo	0.034	0.036	0.036	0.035	0.038	0.037
Trenggalek	0.032	0.034	0.035	0.033	0.035	0.035
Tulungagung	0.031	0.035	0.035	0.035	0.036	0.035
Blitar	0.034	0.037	0.037	0.036	0.037	0.037
Kediri	0.032	0.035	0.035	0.034	0.036	0.035
Malang	0.034	0.037	0.038	0.037	0.038	0.037



Affected Regencies/Municipalities	Source of Shock Region					
	Surabaya City	Situbondo	Probolinggo City	Probolinggo	Sidoarjo	Gresik
Lumajang	0.033	0.037	0.036	0.036	0.036	0.036
Jember	0.035	0.038	0.039	0.038	0.039	0.039
Banyuwangi	0.035	0.038	0.038	0.037	0.039	0.038
Bondowoso	0.035	0.037	0.038	0.037	0.038	0.038
Situbondo	0.036	6.365	0.040	0.040	0.040	0.041
Probolinggo	0.033	0.037	0.037	4.133	0.037	0.038
Pasuruan	0.029	0.033	0.031	0.032	0.031	0.032
Sidoarjo	0.038	0.039	0.042	0.039	1.006	0.040
Mojokerto	0.030	0.034	0.033	0.033	0.033	0.033
Jombang	0.033	0.036	0.037	0.036	0.037	0.037
Nganjuk	0.038	0.041	0.041	0.040	0.041	0.041
Madiun	0.035	0.038	0.038	0.037	0.039	0.039
Magetan	0.037	0.039	0.041	0.039	0.041	0.041
Ngawi	0.035	0.038	0.038	0.038	0.039	0.040
Bojonegoro	0.031	0.035	0.034	0.035	0.035	0.035
Tuban	0.029	0.032	0.032	0.032	0.032	0.032
Lamongan	0.034	0.037	0.037	0.037	0.037	0.038
Gresik	0.032	0.035	0.035	0.035	0.035	1.662
Bangkalan	0.032	0.032	0.034	0.031	0.034	0.032
Sampang	0.030	0.031	0.033	0.032	0.033	0.032
Pamekasan	0.031	0.033	0.034	0.033	0.035	0.034
Sumenep	0.029	0.033	0.033	0.034	0.033	0.034
Kediri City	0.050	0.045	0.048	0.044	0.049	0.048
Blitar City	0.041	0.040	0.044	0.039	0.045	0.043
Malang City	0.046	0.045	0.049	0.043	0.049	0.048
Probolinggo City	0.038	0.039	11.680	0.039	0.042	0.040
Pasuruan City	0.041	0.042	0.045	0.041	0.044	0.044
Mojokerto City	0.039	0.041	0.043	0.040	0.043	0.042
Madiun City	0.048	0.047	0.053	0.045	0.052	0.051
Surabaya City	0.675	0.043	0.048	0.042	0.047	0.046
Batu City	0.041	0.042	0.045	0.042	0.045	0.045
East Java	0.050	0.052	0.052	0.051	0.052	0.052
Average Spillover in Madura	0.031	0.032	0.034	0.033	0.034	0.033
Average Spillover Outside Madura	0.036	0.038	0.039	0.038	0.040	0.039

The results in Table 2 indicate that development in regions surrounding Madura has not yet produced meaningful economic spillover in terms of income growth for Madura Island. In this simulation, a consumption shock of one trillion rupiah was applied alternately to six of Madura's closest neighbouring



regions: Surabaya, Situbondo, Probolinggo (regency and city), Sidoarjo, and Gresik. However, the resulting increase in household income in the four Madura regencies remained relatively low, ranging only from 0.031% to 0.034%. These values are lower than the average income effects observed in other regions, which benefited more from the same intervention with a range of 0.036% to 0.040% (the spatial distribution of these impacts is illustrated in Figure 9). This outcome reflects weak spatial connectivity between Madura and its neighbouring regions, meaning that demand-driven stimulus in surrounding areas has not been effectively transmitted to Madura Island. These findings form an important basis for evaluating the effectiveness of regional integration and highlight the urgency of more inclusive development policies for Madura’s regencies.

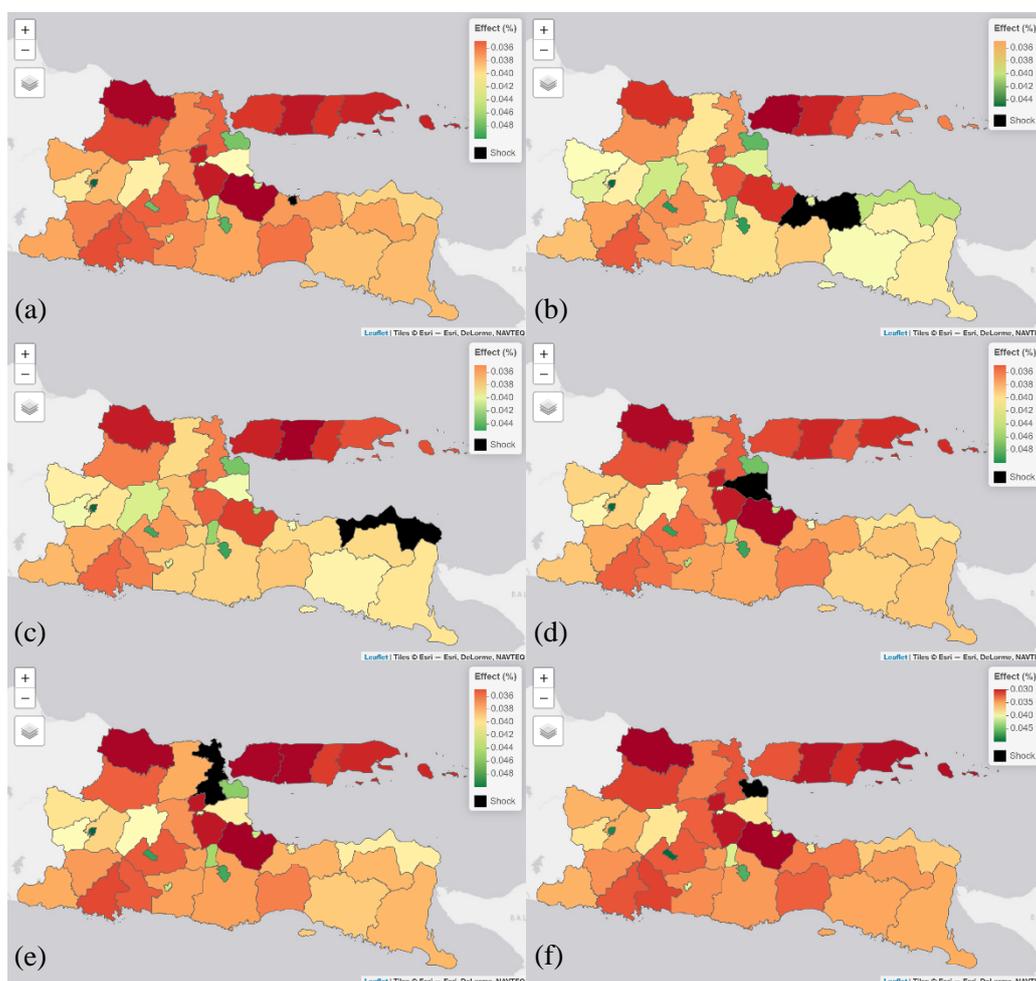


Figure 9. Spatial Distribution of Income Effects from Household Consumption Shock in Regions Surrounding Madura Island (%). Regions receiving the shock: (a) Probolinggo City, (b) Probolinggo Regency, (c) Situbondo Regency, (d) Sidoarjo Regency, (e) Gresik Regency, and (f) Surabaya City.

3.5.3. Scenario 3: Rp 1 trillion Shock in the Transportation, Agriculture, and Manufacturing Sectors

This scenario evaluates whether the Transportation and Warehousing sector (sector code H in the GRDP classification) constitutes a major constraint in Madura’s development. A final demand shock is applied to this sector across East Java to observe differences in regional impacts. If the effect in Madura is relatively small, it would indicate weak regional logistics integration. To complement this, the



simulation also includes an increase in final demand for the Agriculture sector (code A in GRDP) and the Manufacturing sector (code C in GRDP), both of which play a significant role in Madura. This is aimed at assessing the potential synergies among the three sectors in driving regional economic growth. The total shock of one trillion rupiah is evenly distributed across the three sectors. Table 3 presents the results of the Scenario 3 simulation.

Table 3. Impact of Final Demand Shock in Transportation, Agriculture, and Manufacturing on Regional Income in East Java (% to baseline)

Affected Regencies/Municipalities	Source of Shock Sector			
	Sector H	Sector A	Sector C	Combined
Pacitan	0.032	0.067	0.025	0.041
Ponorogo	0.022	0.065	0.025	0.037
Trenggalek	0.029	0.059	0.026	0.038
Tulungagung	0.023	0.063	0.030	0.039
Blitar	0.024	0.060	0.025	0.036
Kediri	0.026	0.061	0.026	0.038
Malang	0.029	0.056	0.029	0.038
Lumajang	0.026	0.068	0.030	0.041
Jember	0.028	0.074	0.029	0.044
Banyuwangi	0.033	0.065	0.027	0.042
Bondowoso	0.034	0.085	0.026	0.048
Situbondo	0.033	0.091	0.028	0.050
Probolinggo	0.030	0.074	0.029	0.044
Pasuruan	0.021	0.048	0.032	0.034
Sidoarjo	0.038	0.022	0.036	0.032
Mojokerto	0.026	0.037	0.036	0.033
Jombang	0.026	0.041	0.035	0.034
Nganjuk	0.028	0.077	0.027	0.044
Madiun	0.025	0.058	0.025	0.036
Magetan	0.026	0.062	0.027	0.038
Ngawi	0.024	0.088	0.026	0.046
Bojonegoro	0.024	0.065	0.024	0.038
Tuban	0.022	0.059	0.028	0.036
Lamongan	0.027	0.064	0.029	0.040
Gresik	0.031	0.030	0.035	0.032
Bangkalan	0.038	0.053	0.019	0.036
Sampang	0.035	0.068	0.023	0.042
Pamekasan	0.021	0.074	0.028	0.041
Sumenep	0.024	0.099	0.023	0.049
Kediri City	0.033	0.028	0.029	0.030
Blitar City	0.031	0.033	0.024	0.029
Malang City	0.037	0.024	0.030	0.030



Affected Regencies/Municipalities	Source of Shock Sector			
	Sector H	Sector A	Sector C	Combined
Probolinggo City	0.044	0.029	0.032	0.035
Pasuruan City	0.034	0.028	0.035	0.032
Mojokerto City	0.031	0.021	0.035	0.029
Madiun City	0.035	0.028	0.024	0.029
Surabaya City	0.044	0.023	0.027	0.031
Batu City	0.032	0.048	0.025	0.035
East Java	0.035	0.039	0.035	0.036
Average Spillover in Madura	0.030	0.074	0.023	0.042
Average Spillover Outside Madura	0.030	0.053	0.029	0.037

The simulation results in Table 3 show that increasing final demand in the Transportation and Warehousing sector (code H) generates an average impact of only 0.030% on household income in Madura, which is the same as the average effect observed in regions outside Madura. This suggests that if the logistics sector is developed in isolation without synergy with other sectors, its impact on Madura’s economy remains limited. Yet, transportation and warehousing are often regarded as key infrastructure for enhancing connectivity and economic efficiency. These findings reinforce the indication that this sector has not yet been effectively integrated into Madura’s production and distribution structure.

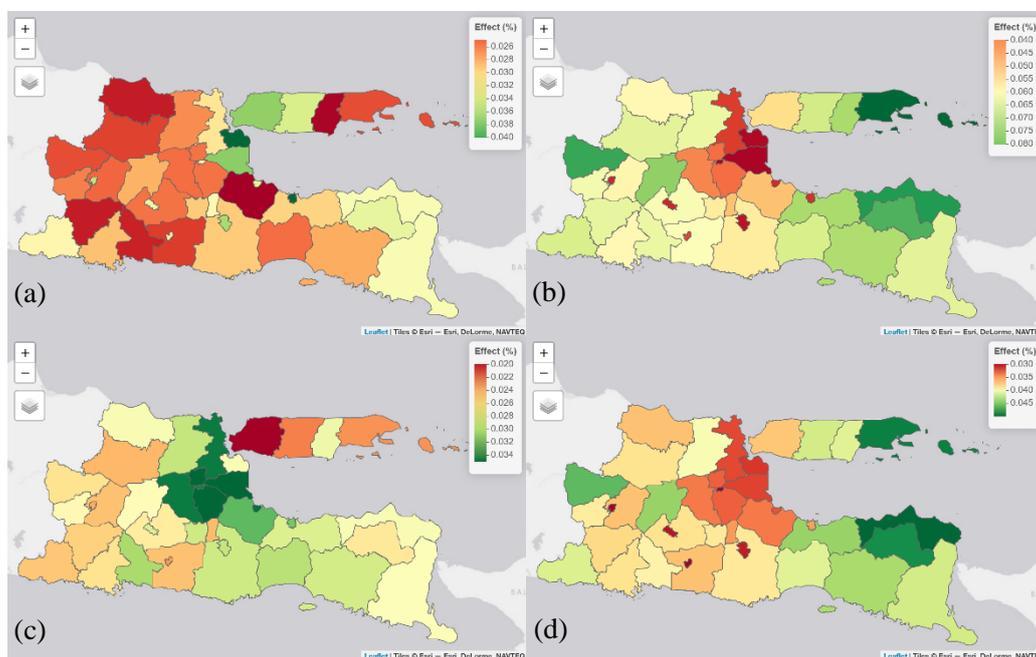


Figure 10. Spatial Distribution of Regional Income Effects from Sectoral Final Demand Shock in East Java (%). Sectors receiving the shock: (a) Transportation [H], (b) Agriculture [A], (c) Manufacturing [C], and (d) Combined sectors (a–c).

However, when the shock is evenly extended to include the Agriculture sector (code A) and the Manufacturing sector (code C), the impact increases significantly. The average income effect in Madura



from the combination of the three sectors reaches 0.042%, which is higher than the average for regions outside Madura (0.037%). The largest contribution comes from the Agriculture sector, with an impact of 0.074% in Madura, highlighting its central role in driving the local economy. Meanwhile, the Manufacturing sector produces a lower effect, indicating unrealised potential. Overall, these results suggest the importance of adopting an integrated development approach that not only addresses the logistics sector but also strengthens local productive sectors so that the economic multiplier effects can be maximised, particularly for regions such as Madura.

Furthermore, the simulation results indicate that the Transportation and Warehousing sector (logistics) continues to face structural challenges in supporting Madura's development. Although it cannot yet be considered an independent bottleneck, its low impact on household income in Madura, recorded at just 0.030 percent and equal to the average in regions outside Madura, suggests that this sector is not yet optimally integrated with local economic activities. This reflects limitations in the integration of supply chains and interregional distribution. However, when the logistics sector is combined with the Agriculture and Manufacturing sectors, the economic potential of Madura Island becomes more fully realised, with a significant increase in impact to 0.042 percent, surpassing the average effect experienced in regions outside Madura, which was 0.037 percent. These findings suggest that the Transportation and Warehousing sector becomes more strategic and essential when integrated with increased final demand in key productive sectors. This integration can drive more inclusive and effective economic growth in Madura. The spatial distribution of these impacts is shown in Figure 10.

4. Conclusion

To address the persistent development disparities between Madura Island and other regions in East Java, this study applied the Interregional Miyazawa Input-Output Table, which integrates sectoral and regional dimensions down to the regency/municipality level. The model captures both sectoral and spatial interlinkages simultaneously, overcoming the limitations of conventional IO tables and the absence of interregional IO frameworks at this scale. By evaluating different scenarios of household income and sectoral demand, this research provides robust evidence of the effectiveness of spatial and sectoral interventions for strengthening Madura's role in East Java's economy.

The study confirms that regional inequality remains a structural challenge, and that the economic potential of Madura will not be realised without deliberate interventions. Spatial connectivity, intra-island integration, and the synergy of logistics with productive sectors are critical for inclusive growth. The findings highlight the necessity of integrated regional planning that simultaneously strengthens local productive capacity, improves logistical connectivity, and leverages interregional cooperation. Importantly, the Interregional Miyazawa IO Table has proven to be an effective methodological tool for mapping sectoral and spatial linkages, offering policymakers a practical and evidence-based framework for designing more inclusive development strategies.

To achieve more inclusive and sustainable regional development, policymakers must adopt affirmative interventions for Madura by strengthening high-multiplier sectors such as Agriculture and Manufacturing through agro-industrial centres, cold storage, mechanisation support, and farmer-SME training programmes that retain value within the island. At the same time, logistics infrastructure should be developed in synergy with productive sectors, ensuring that farm-to-port roads, communal warehouses, and local logistics hubs are integrated into regional distribution systems to reduce costs and expand market access. Enhancing intra-Madura connectivity through improved road networks, agribusiness terminals, and digital platforms will consolidate local supply chains and increase efficiency, while directed spatial integration with neighbouring regions, including joint agro-maritime economic zones and optimised port linkages with Surabaya and northern East Java, will enable stronger two-way spillover. Finally, the Miyazawa Input-Output model should be more widely adopted as a practical tool in development planning, given its superior capacity to capture both spatial and sectoral linkages. By integrating household consumption, income flows, and interregional connections, this approach provides robust evidence for formulating policies that strengthen local economic capacity, enhance connectivity, and foster more inclusive regional growth.



References

- [1] BPS-Statistics Indonesia, *Produk Domestik Regional Bruto Provinsi-Provinsi di Indonesia menurut Lapangan Usaha 2020-2024*. 2025.
- [2] M. A. Alwandi and D Widyawati, "Sea Toll: A Way to Save The Economic of East Indonesia Through East Java," *East Java Econ. J.*, vol. 4, no. 2, pp. 209–228, 2020.
- [3] V. Ratnasari, S. H. Audha, and A. T. R. Dani, "Statistical modeling to analyze factors affecting the middle-income trap in Indonesia using panel data regression," *MethodsX*, vol. 11, p. 102379, 2023.
- [4] BPS of East Java Province, *Produk Domestik Regional Bruto Provinsi Jawa Timur menurut Pengeluaran 2020-2024*. Badan Pusat Statistik Provinsi Jawa Timur, 2025.
- [5] B. Barika, K. Sukiyono, R. A. Ekaputri, and B. A. Hermanto, "Determinants of Regional Inequality (Literature Review Perspective)," *Int. J. Econ. Bus. Manag. Res.*, vol. 08, no. 08, pp. 1–22, 2024.
- [6] Tempo Data and Analysis Centre, *Sejarah Panjang Pembangunan Jembatan Suramadu*. TEMPO Publishing, 2019.
- [7] M. Imron, N. Marsaoly, M. T. Y. Saputra, and I. Rauf, "Analysis of the Connectivity Index for Sea Transportation in Archipelagic Regions (Case Study of South Halmahera Regency)," *South Asian Res. J. Eng. Technol.*, vol. 6, no. 05, pp. 130–139, 2024.
- [8] H. Sandee, "Improving Connectivity in Indonesia: The Challenges of Better Infrastructure, Better Regulations, and Better Coordination," *Asian Econ. Policy Rev.*, vol. 11, no. 2, pp. 222–238, 2016.
- [9] M. H. Yudhistira and Y. Sofiyandi, "Seaport status, port access, and regional economic development in Indonesia," *Marit. Econ. & Logist.*, vol. 20, no. 4, pp. 549–568, 2018.
- [10] R. Strube and T. Wagner, "Leverage Points for Sustainable, Innovative Logistics Considering Consumer Lifestyles," in *Innovative Logistics Services and Sustainable Lifestyles*, Springer International Publishing, 2019, pp. 63–86.
- [11] K. Ifa, F. S. Liyundira, N. T. Indrianasari, and S. R. Ana, "Dinamika Kemiskinan Di Pulau Madura: Faktor Ekonomi Dan Sosial," *RELASI J. Ekon.*, vol. 21, no. 1, pp. 225–244, 2024.
- [12] R. D. Becti, "Autokorelasi Spasial untuk Identifikasi Pola Hubungan Kemiskinan di Jawa Timur," *ComTech Comput. Math. Eng. Appl.*, vol. 3, no. 1, p. 217, 2012.
- [13] J. Cai, C. Huang, Z. Deng, and L. Li, "Transport Accessibility and Poverty Alleviation in Guizhou Province of China: Spatiotemporal Pattern and Impact Analysis," *Sustainability*, vol. 15, no. 4, p. 3143, 2023.
- [14] K. Miyazawa, "Input-Output Analysis and Interrelational Income Multiplier as a Matrix," *Hitotsubashi J. Econ.*, vol. 8, no. 2, pp. 39–58, 1968.
- [15] G. J. D. Hewings, Y. Okuyama, and M. Sonis, "Economic interdependence within the Chicago metropolitan area: A Miyazawa analysis," *J. Reg. Sci.*, vol. 41, no. 2, pp. 195–217, 2001.
- [16] K. Hermannsson, "Expenditure and Displacement Impacts of Students' Consumption," in *24th IIOA Conference in SEOUL, Korea*, 2015, pp. 1–25.
- [17] G. J. D. Hewings and J. B. Parr, "Spatial interdependence in a metropolitan setting," *Spat. Econ. Anal.*, vol. 2, no. 1, pp. 7–22, 2007.
- [18] K. R. Polenske and G. J. D. Hewings, "Trade and spatial economic interdependence," *Pap. Reg. Sci.*, vol. 83, no. 1, pp. 269–289, 2004.
- [19] A. Murjani, A. Rifani, and M. F. R. Ramadhan, "Inklusivitas Perekonomian di Kabupaten Hulu Sungai Utara Tahun 2022: Pendekatan Model Miyazawa," *Ecoplan*, vol. 7, no. 1, pp. 67–80, 2024.
- [20] M. H. Imansyah, D. Hartono, T. Putranti, and Muzdalifah, "The Impacts of Digital Economy on Green Economy: The Indonesian Miyazawa Model," *Polish J. Environ. Stud.*, vol. 32, no. 2, pp. 1609–1619, 2023.
- [21] W. W. Purwanto *et al.*, "An integrated assessment of technological pathways and socioeconomic impacts for sustainable power system transition in Indonesia," *Adv. Clim. Chang. Res.*, vol. 15, pp. 1107–1120, 2024.
- [22] D. Hardiwan, A. Amir, J. Junaidi, and A. Delis, "the Linkages and Impact of Plantation-Based Sectors on Economy and Poverty in Jambi Province, Indonesia: Miyazawa'S Input-Output Model," *Agric. Resour. Econ.*, vol. 5, no. 3, pp. 5–19, 2019.
- [23] K. Obidzinski, A. Dermawan, and A. Hadianto, "Oil palm plantation investments in Indonesia's forest frontiers: limited economic multipliers and uncertain benefits for local communities," *Env. Dev Sustain*, vol. 16, pp. 1177–1196, 2014.
- [24] Government of East Java Province, "Rencana Pembangunan Daerah Provinsi Jawa Timur Tahun 2025-2026," 2023.
- [25] R. Stone, *Input-Output and National Accounts*. Paris: Organisation for European Economic Co-operation, 1961.
- [26] R. E. Miller and P. D. Blair, *Input-Output Analysis: Foundations and Extensions*. 2009.
- [27] P. S. Xia, "RAS: Stata module to implement biproportional scaling (RAS) method." Boston College Department of Economics, 2021.
- [28] Office for National Statistics of United Kingdom, "CPA-COICOP Converter for Household Final Consumption Expenditure (1997 to 2020)," 2022. [Online]. Available: <https://www.ons.gov.uk/economy/nationalaccounts/satelliteaccounts/adhocs/15293cpacoicopconverterforhouseholdfinalconsumptionexpenditure1997to2020>.
- [29] A. F. Nur, "Analisis Potensi Ekonomi Sektoral pada Empat Kabupaten di Pulau Madura," *J. Ekon. Pembang.*, vol. 9, no. 1, pp. 21–41, 2011.
- [30] N. Salam and R. N. H. Putri, "Potret Sektor Unggulan: Pemetaan Potensi Lokal Empat Kabupaten di Madura Melalui Tipologi Klassen," *Indep. J. Econ.*, vol. 4, no. 3, pp. 105–125, 2024.
- [31] A. Daryanto and Y. Hafizrianda, *Analisis Input-Output & Social Accounting Matrix untuk Pembangunan Ekonomi*



Daerah. Bogor: IPB Press, 2010.