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# Spatial Dimension of Multipliers and Flow-on Effects in Java Island Economy: An Inter-Island Input-Output Analysis

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**Abstract:** ***This paper is aimed to provide the results of analysis on total, sector-specific, and spatial-specific multipliers and flow-on effects in Java Island economy. The model employed was Inter-Island Input-Output Model (IIIOM) developed using new hybrid procedures with special attention on Island economy. Data used for model were updated to Indonesian data for the year of 2015. The results show that firstly, the important sectors of Java Island economy could be based on total multipliers and flow-on effects of output, income and employment. Secondly, important economic sectors could be based on sector-specific multipliers; multipliers that occurred in own sector and other sectors. Thirdly, important economic sectors could be based on spatial-specific multipliers; multipliers that occurred both in own region and other regions. Fourthly, important economic sectors could be based on spatial distribution of flow-on; flow-on effects that occurred in own region as well as in other regions.***

**Keywords:** sectoral-specific multipliers; spatial-specific multipliers; flow-on effects

## 1. Introduction

Java (Indonesian; *Jawa*; Javanese) is an island of Indonesia with a population of over 141 million (the island itself) or 145 million (the administrative region) as of 2015 Census released in December 2015 (Anonymous, 2015). Java is home to 56.7 percent of the Indonesian population and is the most populous island on Earth. The Indonesian capital city, Jakarta, is located on western Java. Java was also the center of the Indonesian struggle for independence during the 1930s and 1940s. Java dominates Indonesia politically, economically and culturally.

The origins of the name "Java" are not clear. One possibility is that the island was named after the *jáwa-wut* plant, which was said to be common in the island during the time, that the island had different names. There are other possible sources: the word *jaú* and its variations mean "beyond" or "distant". In Sanskrit *yava* means barley, a plant for which the island was famous. "Yawadvipa" is mentioned in India's earliest epic, the Ramayana. Sugriva, the chief of Rama's army dispatched his men to Yawadvipa, the island of Java, in search of Sita (Kapur, 2010). Another source states that the "Java" word is derived from a Proto-Austronesian root word, *Iawa* that meaning "home" (Hartley, *et.at*, 1984).

Administratively, Java Island consists of 6 provinces: Banten (Capital: Serang), West Java (Capital: Serang), Special Region of Capital City of Grater Jakarta, Central Java (Capital: Semarang), Special Region of Yogyakarta and East Java (Capital: Surabaya).

Though Java is increasingly becoming more modern and urban, only 75% of the island has electricity. Villages and their rice paddies are still a common sight. Unlike the rest of Java, the population growth in Central Java remains low. Central Java however has a younger population than the national average. The slow population growth can in part be attributed to the choice by many people to leave the more rural Central Java for better opportunities and higher incomes in the bigger cities (Maryono, A, 2009). With a combined population of 145 million in the 2015 census (including Madura's 3.7 million), which is estimated for 2014 at 143.1 million (including 3.7 million for Madura), Java is the most populous island in the world and is home to 57% of Indonesia's population (Anonymous, 2010). At over 1,100 people per km² in 2014, it is also one of the most densely populated parts of the world.

Initially the economy of Java relied heavily on rice agriculture. Java was famous for rice surpluses and rice export since ancient times, and rice agriculture contributed to the population growth of the island (Cribb, 2016). During these colonial times, the Dutch introduced the cultivation of commercial plants in Java, such as sugarcane, rubber, coffee, tea, and quinine.

According to Prihawantoro et al,(2013), the main economic activities in Java Island were Sector-3 manufacturing (Banten, West Java, Central Java, and East Java), Sec-8 Banking and other finance services (Jakarta), Sector-6 Trade, hotel and restaurant (Yogyakarta and East Java) and Sector-9 Other Services (Jakarta, Yogyakarta). Based on the statistical data by the year of 2013 which is released by Badan Pusat Statistik, Java Island itself contributes at least 58.15% of Indonesia's Gross Domestic Product (BPS, 2015).

In macroeconomics, a multiplier is a factor of proportionality that measures how much an endogenous variable changes in response to a change in some exogenous variable (see among others: Dornbusch, R., & Stanley, F., 1994; McConnell, C., et., al, 2011; Pindyck, R & Rubinfeld, D., 2012). In monetary microeconomics and banking, the money multiplier measures how much the money supply increases in response to a change in the monetary base (see among others: Krugman & Wells 2009; Mankiw, 2008). Multipliers can be calculated to analyze the effects of fiscal policy, or other exogenous

changes in spending, on aggregate output. Other types of fiscal multipliers can also be calculated, like multipliers that describe the effects of changing taxes, such as lump-sum taxes or proportional taxes.

Literature on the calculation of Keynesian multipliers traces back to Richard Kahn's description of an employment multiplier for government expenditure during a period of high unemployment. At this early stage, Kahn's calculations recognize the importance of supply constraints and possible increases in the general price level resulting from additional spending in the national economy (Ahiakpor, J.C.W., 2000). Hall (2009) discusses the way that behavioral assumptions about employment and spending affect econometrically estimated Keynesian multipliers.

The literature on the calculation of I-O multipliers traces back to Leontief, who developed a set of national-level multipliers that could be used to estimate the economy-wide effect that an initial change in final demand has on an economy. Isard in 1951 then applied input-output analysis to a regional economy. The first attempt to create regional multipliers by adjusting national data with regional data was Moore & Peterson in 1955 for the state of Utah. In a parallel development, Tiebout in 1956 specified a model of regional economic growth that focuses on regional exports. His economic base multipliers are based on a model that separates production sold to consumers from outside the region to production sold to consumers in the region. The magnitude of his multiplier is based on the regional supply chain and local consumer spending (Muchdie, 2011).

Surveys of input-output and economic base multipliers have been conducted by Richardson in 1985 note the difficulty inherent in specifying the local share of spending. The growth of survey-based regional input-output models in the 1960s and 1970s allowed for more accurate estimation of local spending, though at a large cost in terms of resources (Muchdie, 2011). To bridge the gap between resource intensive survey-based multipliers and "off-the-shelf" multipliers, Beemiller (1990) of the BEA describes the use of primary data to improve the accuracy of regional multipliers. The literature on the use and misuse of regional multipliers and models is extensive. Coughlin & Mandelbaum (1991) provide an accessible introduction to regional I-O multipliers. They note that key limitations of regional I-O multipliers include the accuracy of leakage measures, the emphasis on short-term effects, the absence of supply constraints, and the inability to fully capture interregional feedback effects.

Three other papers on the general topic of the use and misuse of regional multipliers are briefly noted. Grady & Muller (1988) argue that regional I-O models that include household spending should not be used and argue that cost-benefit analysis is the most appropriate tool for analyzing the benefits of particular programs. Mills (1993) notes the lack of budget constraints for governments and no role for government debt in regional IO models. As a result, in less than careful hands, regional I-O models can be interpreted to over-estimate the economic benefit of government spending projects. Hughes (2003) discusses the limitations of the application of multipliers and provides a checklist to consider when conducting regional impact studies. Additional papers focus on the uses and misuse of regional multipliers for particular types of studies. Harris (1997) discusses the application of regional multipliers in the context of tourism impact studies, one area where the multipliers are commonly misused. Siegfried, Sanderson, and McHenry (2006) discuss the application of regional multipliers in the context of college and university impact studies, another area where the multipliers are commonly misused. Input-output analysis, also known as the inter-industry analysis, is the name given to an analytical work conducted by Leontief in the late 1930's. The fundamental purpose of the input-output framework is to analyze the interdependence of industries in an economy through market based transactions. Input-output analysis can provide important and timely information on the interrelationships in a regional economy and the impacts of changes on that economy.

The notion of multipliers rests upon the difference between the initial effect of an exogenous change (final demand) and the total effects of a change. Direct effects measure the response for a given industry given a change in final demand for that same industry. Indirect effects represent the response by all local industries from a change in final demand for a specific industry. Induced effects represent the response by all local industries caused by increased (decreased) expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect effects of the change in final demand for a specific industry. Total effects are the sum of direct, indirect, and induced effects.

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West & Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

The objective of this paper is to report the research in developing and applying a model that provides information on multipliers: total, flow-on, sectoral-specific and spatial-specific, so they can further be used for planning and evaluating regional economic development in Java Island. The significant contribution of this chapter is the calculation of sector-specific multipliers as well as spatial-specific multipliers.

## 2. Methods of Analysis

An inter-regional input-output model divides a national economy not only into sectors but also regions (Hulu, 1990). An industry in the Leontief model is split into as many regional sub-industries as there are regions. The table consists of two types of matrices representing the two types of economic interdependence. The first are the intra-regional matrices, which are on the main diagonal showing the inter-

sectoral transactions which occur within each region. The second are the trade matrices, termed inter-regional matrices, representing inter-industry trade flows between each pair of regions. These matrices show the specific inter-industry linkages between regions, allowing each economic activity to be identified by industry as well as by location.

The inter-regional model can be expressed similar to the equations for the national as well as the single region model. In the general case:

$${}^{r}X_i = \sum_j \sum_s {}^{rs}X_{ij} + \sum_s {}^{rs}Y_i;\ (i, j = 1,2,...,n) \text{ and } (r, s = 1,2,...,m) \quad (1)$$

There are ($m$ x $n$) equations of this type for each sector in each region showing that the output of each sector is equal to the sales to all intermediate sectors in all regions plus sales to final demand in all regions. In matrix term, the model can be expressed as:

$$x = Ax + y \quad \text{or} \quad x = (I - A)^{-1} y \quad (2)$$

where: x is a vector of output, A is a matrix of input-output coefficients with elements of $a_{ij}$-s and y is a vector of final demand; $(I - A)^{-1}$ is Leontief inverse matrix with elements of $b_{ij}$-s. Basically, A matrix in equation (2) contains both technical and trade characteristics, Hartwick (1971) separated these input coefficients (${}^{rs}a_{ij}$) into trade coefficients (${}^{rs}t_{ij}$) and technical coefficients (${}^{s}a_{ij}$). This separation is essentially the same as one that has been done for the single region model (Muchdie, 2011). Equation (2) can then be rewritten as:

$$x = T(Ax + y) \quad \text{or} \quad x = (I - TA)^{-1} y \quad (3)$$

Method employed for constructing Indonesian Inter-regional Input-Output model was hybrid method that specified for studying Island economy of Indonesia. In this model, the regions were disaggregated into 5 regions, namely 5 big-group of Island, namely SUM for Sumatera Island, JAV for Java Island, KAL for Kalimantan Island, NUS for Nusa Tenggara Island and OTH for Other Island which includes Sulawesi, Maluku and Papua Islands. Meanwhile, economic activities were disaggregated into 9 economic sectors, namely: Sec-1 for Agriculture, livestock, forestry and fishery, Sec-2 for Mining and quarrying, Sec-3 for Manufacturing, Sec-4 for Electricity, water and gas, Sec-5 for Construction, Sec-6 for Trade, hotels and restaurants, Sec-7 for Transportation and communication, Sec-8 for Banking and other finance, and Sec-9: Other services.

The GIRIOT (Generation Inter-Regional Input-Output Tables) procedures proposed and developed by Muchdie (1998) and have been applied using Indonesian data for the year 1990 (Muchdie, 1998; 2011). The GIRIOT procedure consists of three stages, seven phases and twenty four steps. Stage I: Estimation of Regional Technical Coefficients, consists of two phases, namely Phase 1: Derivation of National Technical Coefficients and Phase 2: Adjustment for Regional Technology. Stage II: Estimation of Regional Input Coefficients, consists of two phases, namely Phase 3: Estimation of Intra-regional Input Coefficients, and Phase 4: Estimation of Inter-regional Input Coefficients, and Stage III: Derivation Transaction Tables, consists of three phases, namely Phase 5: Derivation of Initial Transaction Tables, Phase 6: Sectoral Aggregation, and Phase 7: Derivation of Final Transaction Tables. These procedures have been revisited, evaluated and up-dated using Indonesian data for the year 2015 (Muchdie, 2017).

As a measurement of response to an economic stimulus, a multiplier expresses a cause and effect line of causality. In input-output analysis the stimulus is a change (increase or decrease) in sales to final demand. Similar to those in the single-region model, in the inter-regional model West *et.al*, cited by Muchdie (2011) defined the major categories of response as: initial, first-round, industrial-support, consumption-induced, total and flow-on effects. Formulas of such effects are provided in Table 1.

DiPasquale & Polenske in Muchdie (2011) specify four types of multipliers, in which two of them are relevant in the context of the inter-regional input-output model; sector-specific and spatial-specific multipliers. Table 2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment. The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region. Formula provided in Table 1 and Table 2 were used to calculate total and flow-on multipliers, sector-specific multipliers and spatial-specific multipliers.

**Table 1:** Component Effects of Output, Income and Employment Multipliers

| Effects | Output | Income | Employment |
|---|---|---|---|
| Initial | 1 | $h_j$ | $e_j$ |
| First-round | $\sum a_{ij}$ | $\sum a_{ij} h_i$ | $\sum a_{ij} e_i$ |
| Industrial-support | $\sum b_{ij} - 1 - \sum a_{ij}$ | $\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$ | $\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$ |
| Consumption-induced | $\sum (b^*_{ij} - b_{ij})$ | $\sum (b^*_{ij} h_i - b_{ij} h_i)$ | $\sum (b^*_{ij} e_i - b_{ij} e_i)$ |
| Total | $\sum b^*_{ij}$ | $\sum b^*_{ij} h_i$ | $\sum b^*_{ij} e_i$ |
| Flow-on | $\sum b^*_{ij} - 1$ | $\sum b^*_{ij} h_i - h_i$ | $\sum b^*_{ij} e_i - e_i$ |

**Note**: $h_j$ is household income coefficient, $e_j$ is employment output ratio, $a_{ij}$ is direct input coefficients, $b_{ij}$ is the element of open inverse of Leontief matrix, and $b^*_{ij}$ is the element of closed inverse Leontief matrix.

**Table 2:** Inter-Regional Sector-Specific and Spatial-Specific Multipliers

| | Output | Income | Employment |
|---|---|---|---|
| Sector-Specific | $\sum {}^{rs}b^*_{ij}$; r = 1,..m | $\sum {}^{rs}b^*_{ij}\ {}^{s}h_i$; r = 1,..m | $\sum {}^{rs}b^*_{ij}\ {}^{s}e_i$; r = 1,..m |
| Spatial-Specific | $\sum {}^{rs}b^*_{ij}$; i = 1,..n | $\sum {}^{rs}b^*_{ij}\ {}^{s}h_i$; i = 1,..n | $\sum {}^{rs}b^*_{ij}\ {}^{s}e_i$; i = 1,..n |

**Note** : *r* and *s* are the *m* origin and destination regions, *i* and *j* are the n producing and purchasing sectors, ${}^{rs}b^*_{ij}$ is the element of closed inverse of Leontief matrix, m is the number of regions and n is the number of sectors.

Table 2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment. The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region. Formula provided in Table 1 and Table 2 were used to calculate total and flow-on multipliers, sector-specific multipliers and spatial-specific multipliers.

## 3. Result and Discussion

### 3.1. Total Multipliers and Flow-on Effects

Table 3 present total output, income and employment multipliers and flow-on effects in Java Island. In term of output, the highest output multipliers was JAV-5 (Construction Sector in Java Island), 2.886. It means that an increase of final demand of the sector by 1.000 would increase total output by 2.886 including the initial increase of 1.000. It was followed by JAV-4 (Electricity, water and gas in Java Island), 1.568 meaning that an increase of final demand of that sector by 1.000 would increase total output by 1.568 including the initial increase of 1.000. The lowest total multipliers was in JAV-2 (Mining and quarrying in Java Island), 1.329. An increase of final demand of that sector by 1.000 units would increase total output by 1.329 including the initial increase of 1.000. The flow-on effects of output were the difference between total increase and initial increase. Flow-on effect is summation of direct, indirect and induced effects of an economic activity. In case of highest total multipliers (JAV-5) the flow-on effect was 1.866, meaning the impact of increase of final demand of JAV-5 (Construction) to total output was 1.866 as the initial effect was not included. The rank of total output multipliers might be different than that of output flow-on effects. The evidence from Java Island economy showed that JAV-8 (Banking and other finance) had the highest output flow-on effects, followed by JAV-6 (Trade, hotel and restaurant) and the lowest value of output flow-on effects was JAV-7 (Transportation and Communication).

**Table 3:** Total Multipliers and Flow-on Effects: Output, Income and Employment

| SECTOR | Output Initial | Output Flow-on | Output Total | Income Initial | Income Flow-on | Income Total | Employment Initial | Employment Flow-on | Employment Total |
|---|---|---|---|---|---|---|---|---|---|
| **JAV-1** | 1.000 | 0.629 | 1.629 | 0.186 | 0.108 | 0.294 | 0.595 | 0.145 | 0.740 |
| **JAV-2** | 1.000 | 0.329 | 1.329 | 0.052 | 0.062 | 0.114 | 0.078 | 0.063 | 0.141 |
| **JAV-3** | 1.000 | 1.248 | 2.248 | 0.112 | 0.198 | 0.310 | 0.129 | 0.307 | 0.436 |
| **JAV-4** | 1.000 | 1.568 | 2.568 | 0.091 | 0.234 | 0.325 | 0.145 | 0.287 | 0.432 |
| **JAV-5** | 1.000 | 1.866 | 2.866 | 0.165 | 0.297 | 0.462 | 0.145 | 0.374 | 0.519 |
| **JAV-6** | 1.000 | 0.908 | 1.908 | 0.169 | 0.157 | 0.326 | 0.184 | 0.191 | 0.375 |
| **JAV-7** | 1.000 | 1.217 | 2.217 | 0.182 | 0.242 | 0.424 | 0.099 | 0.243 | 0.342 |
| **JAV-8** | 1.000 | 0.924 | 1.924 | 0.243 | 0.173 | 0.416 | 0.145 | 0.186 | 0.331 |
| **JAV-9** | 1.000 | 1.564 | 2.564 | 0.501 | 0.271 | 0.772 | 0.246 | 0.328 | 0.574 |

**Source**: Data Processed using IO7 software.

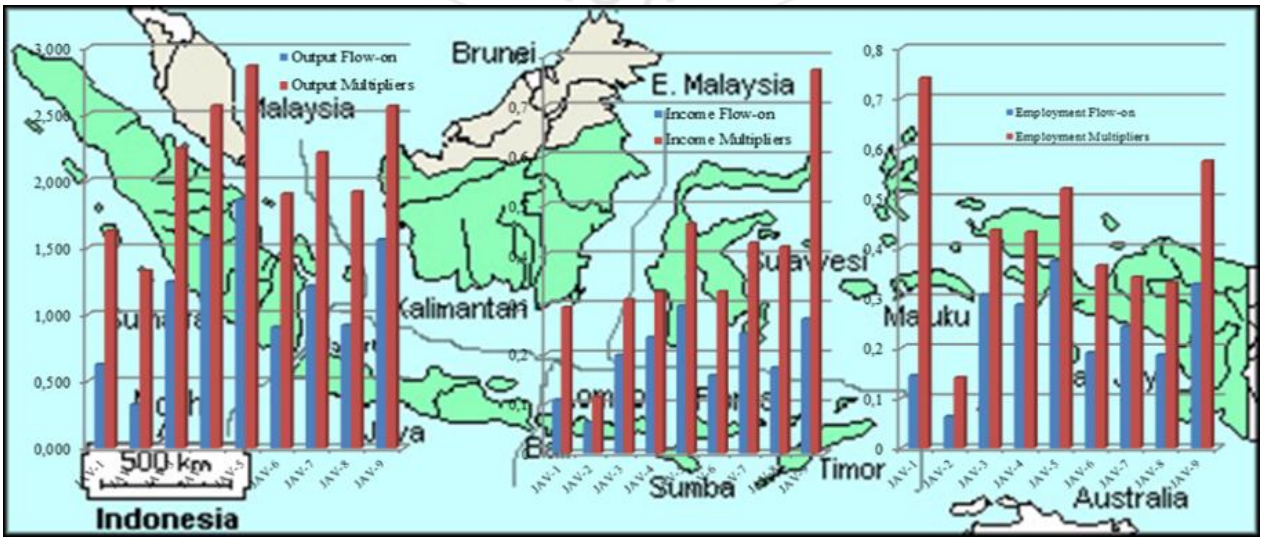


**Figure 1**

**Total Multipliers and Flow-on Effects: Output, Income and Employment**

In term of household income, the highest total income multiplier was in JAV-9 (Other services), 0.772. It means that an increase of final demand of JAV-9 (Other services) by 1.000 units would increase initial household income by 0.501 and then would increase total income by 0.772. It was followed by JAV-5 (Construction) with total income multipliers of 0.462. The lowest total income multiplier was, again, in JAV-2 (Mining and quarrying in Java Island) with total income multipliers of 0.294. Income flow-on effects were the difference between total income multipliers and initial income effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects of an economic activity. For instance, in JAV-9 (Other services), the increase of final demand by 1.000 would have initial income effects by 0.501, resulting total income of 0.772. The income flow-on effect of JAV-9 (Other services) was 0.271. The highest income flow-on effect was in JAV-8 (Banking and other finance), followed by JAV-6 (Trade, hotel and restaurant). The lowest income flow-on effect was in, again, JAV-2 (Mining and quarrying).

In term of employment, the highest total employment multiplier was in JAV-1 (Agriculture, livestock, forestry and fishery), 0.740. It means that an increase of final demand of JAV-1 (Agriculture, livestock and fishery) by 1.000 units would increase initial employment of JAV-1 (Agriculture, livestock and fishery) by 0.595 and then would increase total employment by 0.740. It was followed by JAV-9 (Other services) with total income multipliers of 0.574. The lowest total employment multiplier was, again, in JAV-2 (Mining and quarrying) with total employment multipliers of 0.141. Employment flow-on effects were the difference between total employment multipliers and initial employment effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects on employment from an economic activity. The highest employment flow-on was in JAV-5 (Construction), followed by JAV-9 (Other services). The lowest income flow-on effect was in, again, JAV-2 (Mining and quarrying).

### 3.2. Sector-Specific Multipliers

Table 4 and also Figure 2 provide sector-specific multipliers for output, income and employment in Java Island economy. In term of output, there were 3 sectors that less than 50 per cent of multipliers occurred in own sectors; it means that more than 50 per cent of Multipliers occurred in other sector, namely JAV-4 (Electricity, water and gas), JAV-5 (Construction) and JAV-9 (Other). Meanwhile, other 6 sectors with more than 50 per cent multipliers occurred in own sector; in other words that there were 6 sectors with less than 50 per cent multipliers occurred in other sector. These sectors were: JAV-1 (Agriculture, livestock, forestry and fishery), JAV-2 (Mining and quarrying), JAV-3 (Manufacturing), JAV-6 (Trade, hotel and restaurant), JAV-7 (Transportation and communication) and JAV-8 (Banking and other finance).

In term of income, there were 4 sectors that less than 50 per cent of multipliers occurred in own sectors; it means that more than 50 per cent of multipliers occurred in other sectors, namely JAV-2 (Mining and Quarrying), JAV-4 (Electricity, water and gas ) JAV-5 (Construction) and JAV-7 (Transportation and communication). Meanwhile, other 5 sectors with more than 50 per cent multipliers occurred in own sector; in other words that there were 5 sectors with less than 50 per cent of multipliers occurred in other sectors. These sectors were: JAV-1 (Agriculture, livestock, forestry and fishery), JAV-3 (Manufacturing), JAV-6 (Trade, hotel and restaurant), JAV-8 (Banking and other finance) and JAV-9 (Other services).

**Table 4:** Sector-Specific Multipliers: Output, Income and Employment

| SECTOR | Output | | | Income | | | Employment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Own Sector | Other Sector | Total | Own Sector | Other Sector | Total | Own Sector | Other Sector | Total |
| **JAV-1** | 69.55% | 30.45% | 1.629 | 71.77% | 28.23% | 0.294 | 90.27% | 9.73% | 0.740 |
| **JAV-2** | 76.22% | 23.78% | 1.329 | 45.61% | 54.39% | 0.114 | 56.03% | 43.97% | 0.141 |
| **JAV-3** | 66.77% | 33.23% | 2.248 | 53.87% | 46.13% | 0.310 | 44.50% | 55.50% | 0.436 |
| **JAV-4** | 47.90% | 52.10% | 2.568 | 34.15% | 65.85% | 0.325 | 40.74% | 59.26% | 0.432 |
| **JAV-5** | 35.42% | 64.58% | 2.866 | 36.15% | 63.85% | 0.462 | 28.13% | 71.87% | 0.519 |
| **JAV-6** | 58.49% | 41.51% | 1.908 | 57.98% | 42.02% | 0.326 | 54.40% | 45.60% | 0.375 |
| **JAV-7** | 52.10% | 47.90% | 2.217 | 49.53% | 50.47% | 0.424 | 33.63% | 66.37% | 0.342 |
| **JAV-8** | 59.56% | 40.44% | 1.924 | 66.83% | 33.17% | 0.416 | 50.15% | 49.85% | 0.331 |
| **JAV-9** | 43.49% | 56.51% | 2.564 | 72.28% | 27.72% | 0.772 | 47.56% | 52.44% | 0.574 |

**Source**: Data Processed using IO7 software.

In term of employment, there were 5 sectors that less than 50 per cent of multipliers occurred in own sectors; it means that more than 50 per cent of multipliers occurred in other sectors, namely JAV-3 (Manufacturing), JAV-4 (Electricity, water and gas), JAV-5 (Construction), JAV-7 (Transportation and communication) and JAV-9 (Other services). Meanwhile, other 4 sectors with more than 50 per cent multipliers occurred in own sector; in other words that there were 4 sectors with less than 50 per cent of multipliers occurred in other sectors. These sectors were: JAV-1 (Agriculture, livestock, forestry and fishery), JAV-2 (Mining and quarrying), JAV-6 (Trade, hotel and restaurant), and JAV-8 (Banking and other finance).


**Figure 2:** Sector-Specific Multipliers: Output, Income and Employment

### 3.3. Spatial-Specific Multipliers

Table 5 and Figure 3 provide spatial-specific multipliers of output, income and employment multipliers. In term of output, all sectors had more than 50 per cent of multipliers occurred in own region, in Java Island. All sectors had less than 50 per cent of multipliers occurred in other regions; other Islands. It applied for income. All sectors had more than 50 per cent of multipliers occurred in own region; own Island. All sectors had less than 50 per cent of multipliers occurred in other regions; other Islands. In term of employment, all sectors had more than 50 per cent of multipliers occurred in own region; own Island. Again, all sectors had less than 50 per cent of multipliers occurred in other regions; other Islands.

**Table 5:** Spatial-Specific Multipliers: Output, Income and Employment

| SECTOR | Output | | | Income | | | Employment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Own Region | Other Region | Total | Own Region | Other Region | Total | Own Region | Other Region | Total |
| **JAV-1** | 90.24% | 9.76% | 1.629 | 91.50% | 8.50% | 0.294 | 94.59% | 5.41% | 0.740 |
| **JAV-2** | 93.60% | 6.40% | 1.329 | 86.84% | 13.16% | 0.114 | 89.36% | 10.64% | 0.141 |
| **JAV-3** | 91.01% | 8.99% | 2.248 | 90.32% | 9.68% | 0.310 | 90.60% | 9.40% | 0.436 |
| **JAV-4** | 80.14% | 19.86% | 2.568 | 76.92% | 23.08% | 0.325 | 79.17% | 20.83% | 0.432 |
| **JAV-5** | 85.31% | 14.69% | 2.866 | 85.06% | 14.94% | 0.462 | 82.85% | 17.15% | 0.519 |
| **JAV-6** | 92.61% | 7.39% | 1.908 | 92.94% | 7.06% | 0.326 | 92.53% | 7.47% | 0.375 |
| **JAV-7** | 89.45% | 10.55% | 2.217 | 90.09% | 9.91% | 0.424 | 85.38% | 14.62% | 0.342 |
| **JAV-8** | 93.50% | 6.50% | 1.924 | 95.19% | 4.81% | 0.416 | 92.15% | 7.85% | 0.331 |
| **JAV-9** | 91.38% | 8.62% | 2.564 | 95.60% | 4.40% | 0.772 | 91.29% | 8.71% | 0.574 |

**Source**: Data Processed using IO7 software.

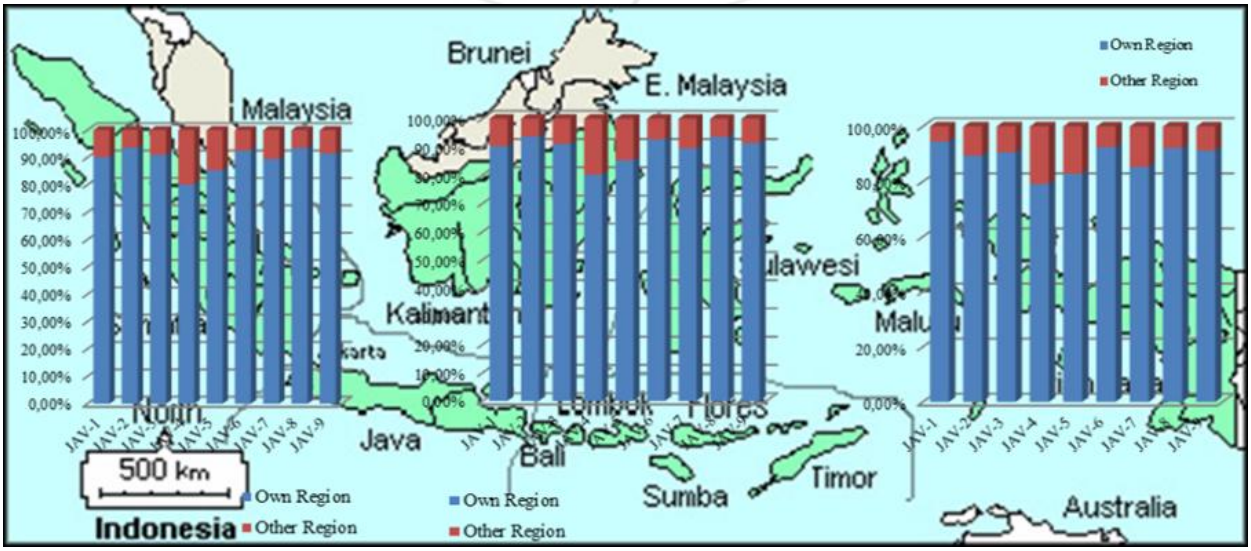


**Figure 3:** Spatial-Specific Multipliers: Output, Income and Employment in Java Island

### 3.4. Spatial Distribution of Flow-on

Flow-on effects are the difference between total effects (total multipliers) and initial effect. It consists of direct effects, indirect effect and induced effects of a change in final demand. As Table 3 and Figure 1 provided the total flow-on effects for every spatial sector in Java Island, Table 6 and Figure 4 presents spatial distribution of flow-on effects in Java Island economy.

In term of output, all sectors had flow-on effects that more than 50 per cent of flow-on occurred in own region. It means that, in all sectors, flow-on effects that occurred in other regions were less than 50 per cent. The highest output flow-on effect that occurred in other regions was in JAV-4 (Electricity, water and gas) and the lowest output flow-on effect that occurred in other regions was in JAV-8 (Banking and other finance). The same case also applies in income flow-on effects. All sectors had flow-on effects that more than 50 per cent of the flow-on occurred in own region. The flow-on effects that occurred in other regions were less than 50 per cent. The highest income flow-on effect that occurred in other regions was in JAV-4 (Electricity, water and gas) and the lowest income flow-on that occurred in other regions was in JAV-8 (Banking and other finance).

In term of employment, again, all sector had employment flow-on that occurred in own region more than 50 per cent. All sectors had the flow-on effects that occurred in other regions were less than 50 per cent. The highest employment flow-on effect that occurred in other regions was in JAV-4 Electricity, water and gas) and the lowest employment

**Table 6:** Spatial Distribution of Flow-on: Output, Income and Employment

| SECTOR | Output | | | Income | | | Employment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Own Region | Other Region | Total | Own Region | Other Region | Total | Own Region | Other Region | Total |
| JAV-1 | 74.8 | 25.2 | 0.629 | 77.6 | 22.4 | 0.108 | 73.9 | 26.1 | 0.145 |
| JAV-2 | 74.2 | 25.8 | 0.329 | 79.7 | 20.3 | 0.062 | 76.2 | 23.8 | 0.063 |
| JAV-3 | 83.9 | 16.1 | 1.248 | 85.7 | 14.3 | 0.198 | 87.8 | 12.2 | 0.307 |
| JAV-4 | 67.5 | 32.5 | 1.568 | 68.8 | 31.2 | 0.234 | 69.4 | 30.6 | 0.287 |
| JAV-5 | 77.5 | 22.5 | 1.866 | 77.6 | 22.4 | 0.297 | 76.4 | 23.6 | 0.374 |
| JAV-6 | 84.4 | 15.6 | 0.908 | 87.0 | 13.0 | 0.157 | 85.8 | 14.2 | 0.191 |
| JAV-7 | 80.8 | 19.2 | 1.217 | 83.0 | 17.0 | 0.242 | 80.4 | 19.6 | 0.243 |
| JAV-8 | 86.5 | 13.5 | 0.924 | 90.0 | 10.0 | 0.173 | 87.0 | 13.0 | 0.186 |
| JAV-9 | 85.9 | 14.1 | 1.564 | 87.8 | 12.2 | 0.271 | 85.5 | 14.5 | 0.328 |

Source: Data Processed using IO7 software.

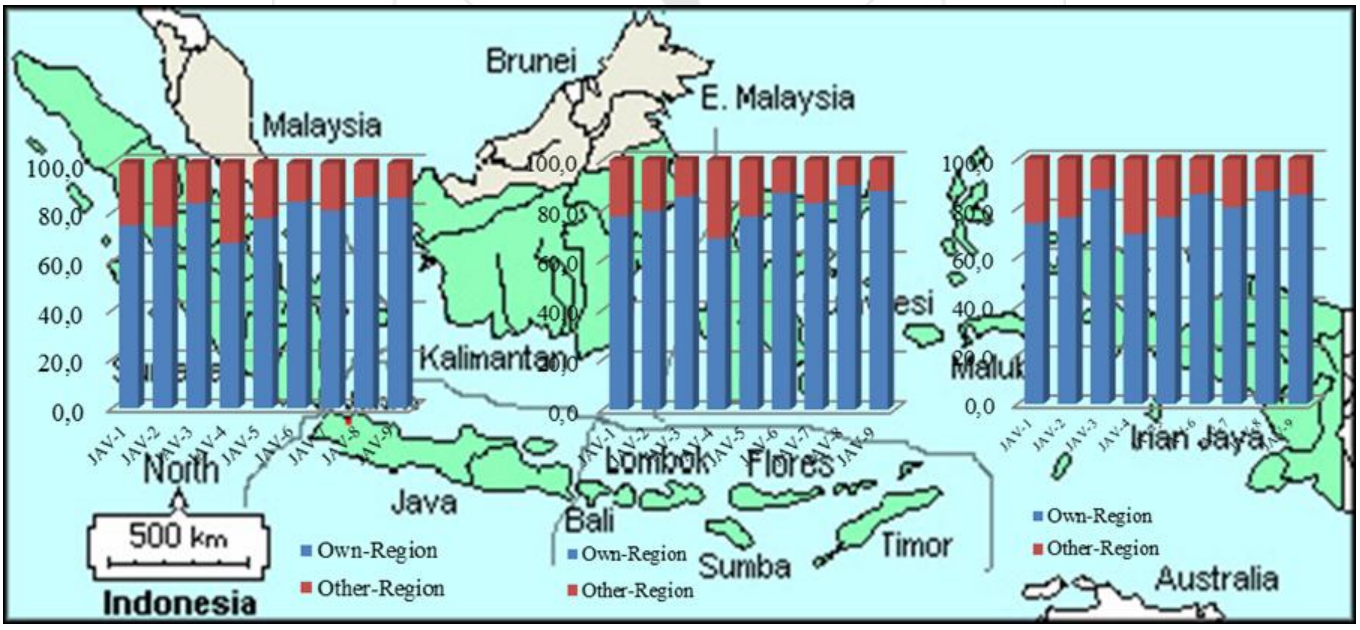


**Figure 4:** Spatial Distribution of Flow-on: Output, Income and Employment

## 4. Conclusion

The conclusions could be drawn were: firstly, the important sectors of Java Island economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Java Island economy were JAV-5 (Construction), JAV-4 (Electricity, water and gas) and JAV-9 (Other services). Based on total income multipliers, three important sectors in Java Island economy were JAV-9 (Other services), JAV-5 (Construction) and JAV-7 (Transportation and communication). Based on total employment multipliers, three important sectors in Java Island economy were JAV-1 (Agriculture, livestock, forestry and fishery), JAV-9 (Other services) and JAV-5 (Construction). Based on output flow-on effects, three important sectors in Java Island economy were JAV-5 (Construction), JAV-4 (Electricity, water and gas) and JAV-9

(Other services). Based on income flow-on effects, three important sectors in Java Island economy were JAV-5 (Construction), JAV-9 (Other services) and JAV-7 (Transportation and communication). Based on employment flow-on effects, three important sectors were JAV-5 (Construction), JAV-9 (Other services) and JAV-3 (Manufacturing).

Secondly, important economic sectors could be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were JAV-2 (Mining and quarrying), JAV-1(Agriculture, livestock, and fishery) and JAV-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were JAV-9 (Other services), JAV-1 (Agriculture, livestock and fishery) and JAV-8 (Banking and other finance). Based on employment sector-specific multipliers that occurred in own sector, three important sectors were JAV-1 (Agriculture, livestock and fishery), JAV-2 (Mining and quarrying) and JAV-6 (Trade, hotel and restaurant).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Java Island. Based on output spatial-specific multipliers that occurred in own region, three important sectors were JAV-2 (Mining and quarrying), JAV-8 (Banking and other finance) and JAV-6 (Trade, hotel and restaurant). Based on income sector-specific multipliers that occurred in own region, three important sectors were JAV-9 (Other services), JAV-8 (Banking and other finance) and JAV-6 (Trade, hotel and restaurant). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were JAV-1 (Agriculture, livestock and fishery), JAV-6 (Trade, hotel and restaurant and JAV-8 (Banking and other finance).

Fourthly, important economic sectors could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Java Island. Based on output spatial distribution of low-on that occurred in own region, three important sectors were JAV-8 (Banking and other finance), JAV-9 (Other services) and JAV-6 (Trade, hotel and restaurant). Based on income spatial distribution of low-on that occurred in own region, three important sectors were JAV-8 (Banking and other finance), JAV-9 (Other service) and JAV-6 (Trade, hotel and restaurant). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were JAV-3 (Manufacturing), JAV-8 (Banking and other finance) and JAV-6 (Trade, hotel and restaurant).

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