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Regional Growth: Economically Important Sectors

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REGIONAL GROWTH: ECONOMICALLY IMPORTANT SECTORS

Abstract

The lack of "road map" makes it difficult for policy makers and businesses to pick up winners (i.e. which economic sectors to channel credit/business activities into). Using the latest data available, this paper combines traditional and contemporary methods to identify key sectors in various provinces in Indonesia. The result yields several expected and unexpected results. As expected, agriculture and resource-based activities remain key sectors in off-Java provinces. On the other hand, unexpectedly, financial sector appears as key sector in several less-developed provinces.

I. Introduction

Among several critical issues currently being discussed in Indonesia, the issue of regional development is undoubtedly one of the most important ones. Being heavily in debt, the central government cannot be relied upon to spend more on regional development (as was the case in the past).

Jakarta will continue to affect local development although in a less direct way, i.e. not through direct financial expenditures but through economic policies. Nevertheless, the type of policies needs to be implemented by the government to foster regional development remains an open question. To be effective, those regional policies must address uniqueness of each region's economic structure.

Since each region has different characteristics that provide different economic opportunities compared to other regions, we argue that a "regional road map" is needed in making progress to develop Indonesian regions. Both local governments and private sectors need to identify and understand these local characteristics ("road map") to make progress in their endeavor.

The lack of "road map" makes it difficult for policy makers and businesses to pick up winners (i.e. which economic sectors to channel credit/business activities into). This factor, the unavailability of road map, is a natural cause for concern given the need for regional economies to develop itself.

With regard to the "road map" issue, we further identify two relevant issues. The first is a normative issue regarding the government policy preference. Do the regional governments have preferences toward developing certain sector(s)? This preference need not be interpreted as a market intervention/distortion because the government choice of key sectors can be compatible with comparative advantage theory. Casual observations among various developing countries show that the government clearly has a role to identify key sector(s) and to accelerate development in those key sectors.

The second issue is a positive one. Even when the government has no preference (or refuse to reveal explicitly its preference), the business sector must find an objective way to identify those key sectors in regional economies.

For policy making and private sector use, identification of key sectors must be sufficiently detailed and portrays interdependence among sectors in an economy. Choosing manufacturing industry as key sector is simply too general to be useful for policy making. For example, manufacturing sub-sector itself can be disaggregated into footwear, textile, electrical appliances, etc. Policy directed toward manufacturing industry needs to be more specific for it to be effective. Hence we need more disaggregation.

In addition to emphasis on details, the choice of key sector must also portray linkage among sectors in an economy. To produce its output, manufacturing may need input from agriculture as well as from financial services.

Therefore, another key factor to be included in our study is the fact that productive sector in an economy operates in tandem with other sectors. In other words, many sectors are linked together in an economy. This inter-linkage among productive sectors is the defining characteristics of this research.

Inter-linkage means that one sector rarely operates in vacuum. As such, one sector has more influence on an economy than others (even if its size is small), especially if it is linked tightly with the rest of the production system. Hence, the level of influence may not have relation to the size of the sector in an economy (as exemplified by an off-shore oil-drilling activities which is basically an enclave, having practically no relations with other sectors in the economy).

Toward this end, we decide to use information obtained from the input-output (IO) matrix that concentrates only on the production side of an economy. Input-output data for many provinces in Indonesia are readily available, and thus enable us to do simultaneous comparison for various regions within a reasonable amount of time.

In the past, IO analysis has been limited to multiplier analysis, which was often found to be unhelpful in identifying key economic sectors. Recent advances suggest many new types of analysis (such as hypothetical extraction type of analysis and Field of Influence) for analyzing IO tables. These advances have been found to yield good and intuitive results.

The objective of this study is to provide an analytical framework to identify key sectors in Indonesian provinces incorporating both disaggregation and linkage elements. This framework will be applied to several Indonesian provinces.

The structure of the paper is as follows. This introductory part, which deals with important issues to be addressed in this paper, will be followed by a discussion on methodology and data. We will then take a look at the results of the data analysis, followed by a concluding section that will include some policy recommendations as well.

II. Methodology

Investigation of key sectors cannot escape from a construction of benchmarks. In turn, for better precision, those benchmarks cannot escape being mathematical. In this section, we will evaluate some of the benchmark indicators that have been used in the identification of key sectors.

We will start with the traditional approach of Chenery-Watanabe from the 1950s, and follow its developments and improvements, until late 1990s, focusing on the results obtained by Sonis *et al*. (1995) and Dietzenbacher and van der Linden (1997).

We need to emphasize that out discussion here is heuristic and is meant to present an idea, and it is not our intention here to be technically thorough. The interested reader can read elsewhere for mathematical derivations (for example, Miller and Lahr, 2001, and Haddad, 1995).

Traditional Approach

Identification of key sectors in an economy dated back to 1958, with the works of Chenery and Watanabe (CW, henceforth). In that paper, an important sector is defined as those that have a strong backward and/or forward linkage. In their study, for example, backward linkage of a sector can be represented as size of raw materials purchase in a sector relative to total input purchase (including value-added input) for that particular sector.

For example, if 90% of a sector's gross output comes from purchases of raw materials (with only the remaining 10% comes from labor and capital), this particular sector would be deemed to be more important than another sector that purchases 50% raw materials and 50% labor and capital.[1]

Despite their overly simplistic definition, CW have introduced a lasting influence on the notions of backward and forward linkage as a key element in identification of key sectors in an economy. With the exception of "field of Influence" methodology, various refinements (that we will introduce later on) revolved around CW's terminology.

Separate refinements to the CW concept were made both by Rasmussen in 1956 and by Hirschman in 1958. Rasmussen and Hirschman's (RH, henceforth) intuition is simple, and this was not captured well in the original CW framework. Suppose a demand for automobile has increased. To meet this demand, automobile needs more input from steel industries, which in turns needs more input from energy industry, and so on, and so forth. In other words, there is linkage effect.

In practical terms, a sector qualifies as key sector if it induces and generates multiple rounds of indirect demands in other industries. The higher the multiple, the more important a sector is.

Forward linkage, in contrast, calculates how much an output of a sector would be affected by an increased expansion elsewhere in the economy. The higher the response of a sector, the more important that sector is to the economy being examined.

Hypothetical Extraction Approach

These (CW and RH) approaches have sometimes been called the traditional approach to key sector identification. More recent approaches can be categorized under the hypothetical extraction method and the holistic matrix approach.

There are a few variants of the hypothetical extraction method (Miller and Lahr, 2001). All of them started with a key question: what would be the effect to an economy if an industry/sector is taken away (i.e. we hypothetically extract a sector from an economy). Key sectors, of course, can then be defined as those having the largest impact should they be hypothetically extracted from an economy.

Jones (1976) suggested this line of research. It was further refined through a series of papers written by Cella (1984), Clements (1990), and Sonis *et al.* (1995), and Dietzenbacher and van der Linden (1997). While the jury is still out on which variant of extraction method, if any, is the best, it is very reasonable to assume they give roughly similar results. In fact this is one of the main findings of Andreosso and Yue (undated) in analyzing China's economy.

We will therefore concentrate on the latest development by Dietzenbacher and van der Linden (DL, henceforth). Slightly different from the original ideas as espoused by Jones (1976), DL suggests that an analysis done by complete extraction (completely taking out a sector) is rather excessive. Instead, a sector can use its own output, but (hypothetically assumed) cannot demand input from other industries.

This hypothetical extraction will result in lower output for sectors in the economy. Thereby, important sectors would be those who have the largest impact on an economy. The impact would be measured by (percentage) changes in output produced, relative to the base scenario of no extraction. The larger the percentage changes, the more important a sector is to an economy.

At this point, we need to point out that using DL will provide a more incisive analysis and policy recommendation compared to the RH approach. This is important, since empirical analyses using RH approach have often found awkward policy recommendations. For example, their calculation will propose key sectors (high backward and forward linkage) that in reality only have small shares in the total GDP. It is an issue of statistical significance versus economic significance all over again.

In contrast, DL (and its siblings from extraction hypothesis) identify key sectors by taking two important factors into considerations:

- The current level of production (i.e. relative contribution to GDP) in the sectors,
- The structures of final demand and value added of the sector.

Hence there is a much smaller possibility of these awkward policy recommendations.

Field Of Influence

This recent approach, which we will denote as FOI, differs from all the previously discussed methods (see Sonis, et. al, 1995, and Haddad, 1995). Whereas the previous analysis takes the elements of the input-output matrix as given, this approach actually perturbed the IO matrix slightly, and compute the results.

There is heavy mathematics that lies behind this that we will not bother you with. However, the procedure contains several basic steps that can be summarized as follows: An element in the input-output table matrix is added (perturbed) with a small number, resulting in a new matrix. A Leontief inverse of this new matrix is calculated, along with its determinant. This step is done for each and every element in the inter-industry transactions.

This is computationally quite demanding since we have to investigate many elements of the Input-output tables. A typical table size would contain 50 sectors, leading to an investigation on 2,500 cells.

It is clear that determinants of matrices vary with each cell. Some will have large determinants, others will have small determinant. Heuristically speaking, some cells will generate large response, while others will have small response. Hence important sectors in the FOI method are defined as one that exhibits large determinants (i.e. 'response').

Since there are different 'responses', we limit ourselves to groups of cells that have, say, the 5% largest 'responses'. Usually, this group of cells is associated with certain sectors, which we will then identify as key sectors. They are key sectors, because 'disturbance' in some of their inter-industry transactions will lead to a large 'response' in the system.

We note that, as in the CW and RH approach, FOI method does not take into account the level of production and the production structure of the economy. It only looks at the inter-industry transactions. As such it shares the same weaknesses of the CW and RH approach: it can give 'strange' policy recommendations.

Nevertheless, the FOI approaches the key sector on a cell-by-cell basis, as opposed to the CW and RH approaches that go on a column or row basis. In other words, the FOI is much detailed.

In this section we have discussed various approaches that has been taken to identify key sectors in an economy. From the earlier, traditional, approaches, the Rasmussen/Hirschman is the most popular and have been used extensively in empirical works. However, without taking into account production level and production structures of an economy, they quite often give awkward policy recommendations. The DL approach, on the other hand, should be able to improve upon the results given by the RH approach.

To a certain extent, the FOI shares the same burden as the RH. Nevertheless, the FOI compensates these inherent weaknesses by providing substantially more details that can be very useful in identifying important transactions (as opposed to merely identifying important sectors).

At this stage, given cheap computational cost and the importance of the issue being analyzed, we prefer a combination of these approaches. As many researches have found out (Andreosso, undated, and Haddad, 1995), most of these approaches are not substitutes of each other. Rather, they are complementary.

III. Data

The major data sources for the empirical part of the study are regional input-output (IO) tables. Under ideal circumstances, the most recent IO tables from all provinces in Indonesia should be utilized. In practice, however, this study focuses only on IO tables from several provinces. Those provinces are:

- West Sumatra
- Lampung
- Bengkulu
- West Java

- Bali
- West Kalimantan
- Southeast Sulawesi
- West Nusa Tenggara

This study limits itself to economies where post-1998 IO tables are available. The 1998 economic crisis in Indonesia may have resulted in a substantial change in the IO structure. Using pre-1998 data, while enlarging the sample size of the economies to be analyzed, may also weaken the results and conclusion of this study. With the exception of the West Java province whose data were for 1999, the other seven provinces' data were for 2000. Many provinces have not yet released their post-1998 IO tables, including the province of Papua.

The level of disaggregation in our sample differs for several reasons. First, provinces in our sample differ in terms of production structure. Hence, a sector that is large in one province (and can stand as a single sector), may be very small in other provinces and therefore be included as part of another (closely related) sector. Second, the level of complexity in production structures also differs among provinces. Hence, province like West Java can be disaggregated into 75 sectors while Bengkulu is disaggregated into 44 sectors only.

The differing level of details brings both positive and negative impacts. On the positive side, the result can be as detailed as possible. On the negative side, such differing level of disaggregation would prohibit detailed comparison among provinces. Whether the positive aspects outweighs the negative aspects will depend on the objective of the exercise. Since the main goals of the paper are to identify key sectors among provinces and to compare different methodology (rather than making inter-provincial comparisons), the aforementioned positive impacts does outweighs the negative impacts.[2]

IV. Results: Lampung

While we have results from eight provinces, in this part we will concentrate on analyzing results from the Lampung Province. The choice of the province is purely arbitrary and is meant to provide a detailed example on how to analyze and interpret

results of the calculations. Once this step has been taken, then in the following section we will provide results from other provinces.

Lampung is the southernmost province in the island of Sumatra. It is separated with the island of Java by the narrow Sunda Strait, and as such has a long experience of interaction with the island of Java. The interaction has benefited the province tremendously, and our earlier analysis (Panggabean, 2003) shows that Lampung serves as a destination of many agricultural products from other Sumatra provinces, while it — in turn — serves as an input provider to manufacturing activities in Java.

In the Input-Output table for year 2000, the economy of Lampung is divided into 68 (sixty eight) sectors. In our data, the broad agricultural sector accounts for the first 25 sectors, while manufacturing is divided into 24 sectors.[3]

We will present a calculation of Rasmussen's index of backward and forward linkages. Given that we have 68 sectors, it is impractical to analyze all the sectors in the main text. Hence, we will be concerned with the top-10 sectors in each category of backward or forward linkages.

In the backward linkage case, we identify the following industries as having the largest coefficients of backward linkages:

1. Other food processing and preserving industries
2. Fat
3. Coffee milling
4. Rubber and plastic industries
5. Restaurant
6. Feedstock
7. Other food
8. Other milling (outside coffee)
9. Coffee shelling
10. Rice milling

At this stage, we need to remind the reader that backward linkage measures how an industry, as it expands, generates demand for raw materials from other industries. In the case of Lampung, clearly the backward linkage is to agricultural sectors, especially coffee, rubber, and coconut/palm oil plantations.

The other side of the linkage coin is forward linkage which, measure how much an output of a sector would increase if there is an increase in demand elsewhere. The top-10 rankings are:

1. Transportation vehicle and transportation services
2. Paper, paper products, and carton
3. Textile, clothing, leather
4. Other undefined activities
5. Fertilizer, pesticides, chemical
6. Rubber
7. Air transport
8. Wood
9. Other mining
10. Palm oil

Looking at the forward linkage results, we note that Palm Oil and Rubbers are two key agricultural sectors that drive the Lampung economy. We also note that some sectors such as fertilizers and pesticides act as a provider of raw materials to agricultural sectors. The rest of the sectors are those sectors that help in the packaging and transportation of agricultural and manufacturing products.

Both lists of backward and forward linkages suggest, again, an economy that combines agricultural sectors with manufacturing industries that process agricultural products. The inclusion of transportation sector as a key industry here also suggests the presence of well-established network of roads and transportation activities.

But are these results reasonable? Looking at the backward linkage case, we note that the combination of the 10 sectors listed sums up to 28.3% of Lampung's gross output in 2000. Hence, the important sectors are actually large sectors in the economy. However, the 10 key sectors in term of forward linkages contribute only 2.3% of Lampung's gross output. Taking the Rasmussen results unquestioningly might lead the government, for example, into encouraging investment in those small sectors that could not really move the economy. This is what is meant by the "awkward results" we mentioned earlier.

Moving to the next method, we will present results from the hypothetical extraction method of Dietzenbacher and van der Linden (DvL, 1997). Here, as we mentioned earlier, the important sector is defined in term of how much its absence would impact the entire economy.

In the backward linkage case, the important sectors are (with 29.1% of gross output value):

1. Fat
2. Restaurant
3. Coffee milling
4. Feedstock
5. Other food industries
6. Other food processing and preserving
7. Coffee shelling
8. Rice milling
9. Fruit and vegetable processing
10. Fish and shrimp processing

We note that there is not much difference here with the important sectors that appear in the Rasmussen case, except now the processing industries of fruit, vegetable, fish and shrimp appear in the list.

Meanwhile, in the forward linkage case, the important sectors are (with 21.7% of gross output value):

1. Feedstock
2. Wood
3. Other food processing and preservation
4. Fat
5. Rubber and plastic processing
6. Bamboo, wood, and rattan
7. Copra
8. Trade
9. Maize
10. Bank and other financial services

Clearly, the new method identifies important sectors as those that have linkages with other sectors, but also whose absence from the economy will reduce the gross output value substantially. This seems to rule out very small sectors from becoming key sectors. Quantitatively, we see that the top-10 sectors in terms of forward linkage now accounts for 21.6% of Lampung's gross output (compared to 2.3% in the case of Rasmussen's forward linkage).

Upon closer look, in terms of backward linkage the DvL's method does not yield substantial changes when compared to the traditional RH's method. The difference between the two methods, however, is actually quite substantial in terms of forward linkage. With the exception of the logging industry, the identified key sectors in both methods are completely different. Whether this is an artifact of the sample we

are using (Lampung) or whether such results appears in other province will be apparent in the following section.

The final indicator we will use for the identification of important sectors is called The Field of Influence (FOI). As we have stated earlier, this indicator does not differentiate between backward and forward linkages. We hypothetically change one cell in the input-output table by a small amount, and see how much it affects the structure of the input-output table (in terms of the matrix determinant). The larger the change, the more important the cell is.

In this scheme, the following sectors are considered as key (with 13.5% of Lampung's gross output value):

1. Rubber and plastic products
2. Paper, paper products, and cartons
3. Mineral (non-metal) products
4. Bamboo, wood, and rattan products
5. Other food industries
6. Coffee
7. Rice
8. Bank and other financial services
9. Fertilizer, pesticides, and chemicals
10. Electricity, gas, and water

As FOI does not differentiate between backward and forward linkages, the FOI results also shows that some identified key sectors are similar to either the previous results of backward and forward linkages.

The new sectors that appear under the new identification methods are: Basic metal and metal products, Bank and other financial institutions, Fertilizers and pesticides, Coffee, Rice, and Basic utilities (electricity, gas, water).

Since the identification of key sectors has been done using three different methods, it begs the question: should we identify key sectors as those that appear in any of the three methodologies, or those that appears in two-to-three methodologies? Thus far there is no agreement on this, and one may follow one's preference.

V. Results: Other Provinces

In the foregoing we went into substantial detail on how to read the results for the province of Lampung. We will not go into the same level of detailed discussion on

other provinces. Instead we will concentrate on main features of the results as given in the following tables (Table 5.1-5.3).

Table 5.1 Key Sectors: Rasmussen/Hirschmann Methodology

Province: West Sumatra

No.	Code	Name (Backward)	Code	Name (Forward)
1	35	Sugar	42	Fertilizer and pesticides
2	33	Rice milling	23	Livestock and fresh milk
3	36	Other food industries	10	Rubber
4	31	Food industries	6	Beans
5	44	Rubber products	14	Fibrous plants
6	40	Bamboo products	11	Cane
7	59	Air transportation	1	Rice
8	53	Building and Construction	40	Bamboo products
9	39	Textile	22	Other farm products
10	56	Rail transportation	43	Chemical products

Province: Bengkulu

No.	Code	Name (Backward)	Code	Name (Forward)
1	23	Rice and coffee milling	9	Palm oil
2	26	Wood and forest products	28	Fertilizer, chem. & rubber prod.
3	24	Other food products	1	Rice
4	21	Coal and metal mining	27	Paper and printing products
5	28	Fertilizer, chemic. & rubber prod.	39	Transportation support
6	31	Other manufacturing	44	Other services
7	35	Hotel and restaurant	15	Livestock and its products
8	29	Cement and non-metal quarrying	32	Electricity, gas and water
9	33	Construction	41	Bank & other financial inst.
10	22	Other mining and quarrying	22	Other mining and quarrying

Province: Lampung

No.	Code	Name (Backward)	Code	Name (Forward)
1	30	Other food procesing & preserv.	50	Transportation and its services
2	32	Oil and fat industries	44	Paper, paper products, and carton
3	36	Coffee miling	42	Textile, garment and leather
4	46	Rubber and plastic products	68	Other activities
5	55	Restaurant	45	Fertilizer, pesticide & chemicals
6	38	Feedstock	9	Rubber
7	39	Other food industries	59	Air transportation
8	37	Crops milling (outside coffee)	21	Logs
9	35	Coffee milling	27	Other mining and quarrying
10	33	Rice milling	12	palm oil

Province: West Kalimantan

No.	Code	Name (Backward)	Code	Name (Forward)
1	19	Crude palm oil	45	Education services
2	20	Food industries	18	Mining and quarrying
3	23	Rubber and its products	14	Logs
4	29	Construction	1	Rice
5	39	Telecommunication	6	Latex rubber
6	22	Paper	2	Maize
7	25	Non-metal quarrying	15	Other frest products
8	21	Wood processing	37	Transportation services
9	37	Transportation services	35	River transportation
10	31	Restaurant	42	Cooperatives

Province: Southeast Sulawesi

No.	Code	Name (Backward)	Code	Name (Forward)
1	21	Asphalt	27	Fertilizer, chemical & rubber products
2	26	Paper and printing products	26	Paper and printing products
3	27	Fertilizer, chem. & rubber prod.	30	Transportation machineries
4	40	Air transportation	21	Asphalt
5	39	Water transportation	31	Other manufacturing
6	23	Food, beverages, and tobacco	22	Other mining
7	34	Construction	28	Cement, non-metal quarrying
8	29	Basic metal, iron, steel	24	Textile, leather and footwear
9	28	Cement, non-metal quarrying	43	Bank & other financial institution
10	37	Restaurant	1	Rice

Province: Bali

No.	Code	Name (Backward)	Code	Name (Forward)
1	15	Livestock Slaughterhouse	17	Forest and its products
2	26	Food, beverages and tobacco	30	Sawmills
3	34	Chemical, chemical products	36	Mineral construction materials
4	27	Yarn Spinning and textile	37	Karoseri
5	43	Boarding	40	Other manufacturing
6	40	Other manufacturing	21	Hard rocks
7	28	Garment	33	Paper, paper products and carton
8	30	Sawmills	34	Chemical, chemical products
9	32	Other wood products	38	Basic metal & other metal products
10	33	Paper, paper products and carton	12	Other plantation products

Province: West Nusa Tenggara

No.	Code	Name (Backward)	Code	Name (Forward)
1	28	Other food industries	20	Other forest products
2	30	Cigarettes	29	Beverage
3	31	Textile, leather, and footwear	39	non-metal mineral products
4	29	Beverage	21	Sea fisheries
5	32	Saw mills and wood products	14	Cinnamon
6	47	Land transportation	27	Rice milling
7	33	Plywood	36	Paper and paper products
8	35	Rubber and plastic products	1	Rice
9	37	Basic chemical	35	Rubber and plastic products
10	4	Potato	12	Palm oil

Province: West Java

No.	Code	Name (Backward)	Code	Name (Forward)
1	52	Machinery tools	15	Other agricultural plantation
2	30	Garment, except footwear	38	Chemical and chemical products
3	42	Plastic goods	72	Business services
4	55	Other manufacturing	39	Fertilizer
5	29	Textile	37	Basic chemical except fertilizer
6	35	Paper and paper products	11	Rubber
7	31	Leather and leather products	49	Non-iron basic metal
8	36	Printing and publishing	23	Other mining
9	50	Metal products except machinery	57	Gas
10	41	Rubber and its products	18	Logs

Table 5.2 Key Sectors: Dietzenbacher- van der Linden Methodology

Province: West Sumatra

No	Code	Name (Backward)	Code	Name (Forward)
1	35	Sugar	44	Rubber products
2	33	Rice milling	35	Sugar
3	31	Food industries	36	Other food industries
4	36	Other food industries	40	Bamboo products
5	44	Rubber products	50	Other manufacturing
6	40	Bamboo products	55	Hotel and Restaurant
7	53	Building and Construction	46	Cement
8	56	Rail transportation	34	Flour
9	50	Other manufacturing	48	Machinery and equipments
10	46	Cement	42	Fertilizer and pesticides

Province: Bengkulu

No.	Code	Name (Backward)	Code	Name (Forward)
1	23	Rice and coffee milling	24	Other food products
2	24	Other food products	35	Hotel and restaurant
3	31	Other manufacturing	28	Fertilizer, chemic. & rubber prod
4	26	Wood and forest products	26	Wood and forest products
5	35	Hotel and restaurant	33	Construction
6	28	Fertilizer, chemic. & rubber prod.	32	Electricity, gas and water
7	29	Cement and non-metal quarrying	31	Other manufacturing
8	33	Construction	27	Paper and printing products
9	22	Other mining and quarrying	29	Cement and non-metal quarrying
10	32	Electricity, gas and water	25	Textile, leather and footwear

Province: Lampung

No.	Code	Name (Backward)	Code	Name (Forward)
1	32	Oil and fat industries	38	Feedstock
2	55	Restaurant	21	Logs
3	36	Coffee milling	30	Other food processing & preservations
4	38	Feedstock	32	Oil and fat industries
5	39	Other food industries	46	Rubber and plastic products
6	30	Other food processing & preserv.	43	Bamboo, wood, and rattan
7	35	Coffee shelling	31	Copra
8	33	Rice milling	54	Trade
9	28	Processing of fruit and vegetables	2	Maize
10	29	Processing of fish and shrimp	62	Bank & other financial institution

Province: West Kalimantan

No.	Code	Name (Backward)	Code	Name (Forward)
1	19	Crude palm oil	31	Restaurant
2	29	Construction	20	Food industries
3	23	Rubber and its products	36	Air transportation
4	20	Food industries	37	Transportation services
5	25	Non-metal quarrying	23	Rubber and its products
6	37	Transportation services	27	Electricity
7	31	Restaurant	29	Construction
8	39	Telecommunication	39	Telecommunication
9	32	Hotel	14	Logs
10	36	Air transportation	32	Hotel

Province: Southeast Sulawesi

No.	Code	Name (Backward)	Code	Name (Forward)
1	21	Asphalt	38	Ground transportation
2	27	Fertilizer, chemic. & rubber prod.	35	Trade
3	40	Air transportation	34	Construction
4	23	Food, beverages, and tobacco	23	Food, beverages, and tobacco
5	39	Water transportation	43	Bank & other financial institution
6	26	Paper and printing products	25	Wood and forestry products
7	34	Construction	29	Basic metal, iron, steel
8	37	Restaurant	49	Other services
9	28	Cement, non-metal quarrying	39	Water transportation
10	48	Entertainment, recreation	32	Electricity

Province: Bali

No.	Code	Name (Backward)	Code	Name (Forward)
1	15	Livestock Slaughterhouse	32	Other wood products
2	28	Garment	43	Boarding
3	32	Other wood products	15	Livestock Slaughterhouse
4	40	Other manufacturing	44	Trade
5	26	Food, beverages and tobacco	26	Food, beverages and tobacco
6	43	Boarding	65	Personal services including tour guides
7	23	Rice milling	23	Rice milling
8	42	Water	42	Water
9	31	Wood carving	14	Small livestock
10	45	Restaurant	34	Chemical, chemical products

Province: West Nusa Tenggara

No.	Code	Name (Backward)	Code	Name (Forward)
1	28	Other food industries	47	Land transportation
2	30	Cigarettes	30	Cigarettes
3	31	Textile, leather, and footwear	32	Saw mills and wood products
4	29	Beverage	35	Rubber and plastic products
5	47	Land transportation	28	Other food industries
6	33	Plywood	29	Beverage
7	32	Saw mills and wood products	48	Sea transportation
8	37	Basic chemical	51	Transportation services
9	35	Rubber and plastic products	56	General public services
10	45	Trade	52	Communication

Province: West Java

No.	Code	Name (Backward)	Code	Name (Forward)
1	30	Garment, except footwear	26	Food industries
2	42	Plastic goods	38	Chemical and chemical products
3	55	Other manufacturing	50	Metal products except machinery
4	50	Metal products except machinery	41	Rubber and its products
5	31	Leather and leather products	45	Cement
6	36	Printing and publishing	67	Air transportation
7	54	Prof., scient. & meas. equipment	65	Water transportation
8	34	Furniture	39	Fertilizer
9	32	Footwear	35	Paper and paper products
10	39	Fertilizer	42	Plastic goods

Table 5.3 Key Sectors: Field of Influence Methodology

Province: West Sumatra

No	Code	Name
1	62	Financial institution
2	48	Machinery and equipments
3	40	Bamboo products
4	26	Other forest products
5	22	Other farm products
6	11	Cane
7	11	Cane
8	10	Rubber
9	9	Other food crops
10	8	Fruits

Province: Bengkulu

No.	Code	Name
1	41	Bank and other financial institution
2	21	Coal and metal mining
3	23	Rice and coffee milling
4	28	Fertilizer, chemical and rubber products
5	1	Rice
6	26	Wood and forest products
7	36	Ground transportation
8	31	Other manufacturing
9	17	Logs
10	2	maize

Province: Lampung

No.	Code	Name
1	46	Rubber and plastic products
2	44	Paper, paper products, and carton
3	48	Basic metal and metal products
4	43	Bamboo, wood, and rattan
5	30	Other food processing and preservation
6	62	Bank and other financial institution
7	45	Fertilizer, pesticide, and chemicals
8	13	Coffee
9	1	Rice
10	52	Electricity, gas and water

Province: West Kalimantan

No.	Code	Name
1	22	Paper
2	21	Wood processing
3	20	Food industries
4	39	Telecommunication
5	24	Chemical industry
6	8	Palm oil
7	23	Rubber and its products
8	18	Mining and quarrying
9	36	Air transportation
10	35	River transportation

Province: Southeast Sulawesi

No.	Code	Name
1	30	Transportation machineries
2	26	Paper and printing products
3	38	Ground transportation
4	35	Trade
5	29	Basic metal, iron, steel
6	22	Other mining
7	27	Fertilizer, chemical and rubber products
8	42	Communication
9	31	Other manufacturing
10	25	Wood and forestry products

Province: Bali

No.	Code	Name
1	33	Paper, paper products and carton
2	34	Chemical, chemical products
3	27	Yarn Spinning and textile
4	53	Air transportation
5	37	Carroserrie
6	44	Trade
7	29	Leather products
8	40	Other manufacturing
9	39	Jewelry
10	30	Sawmills

Province: West Nusa Tenggara

No.	Code	Name
1	23	Oil/gas mining
2	24	Non-oil/gas mining and quarrying
3	32	Saw mills and wood products
4	4	Potato
5	5	Peanuts
6	54	Insurance
7	43	Construction
8	13	Coffee
9	1	Rice
10	34	Construction materials and furniture

Province: West Java

No.	Code	Name
1	52	Machinery tools
2	29	Textile
3	35	Paper and paper products
4	37	Basic chemical except fertilizer
5	38	Chemical and chemical products
6	53	Transportation equipments
7	51	machinery and equipment industries
8	41	Rubber and its products
9	36	Printing and publishing
10	30	Garment, except footwear

Agriculture and Resource-Based Economies

Unsurprisingly, key sectors in most provinces in our sample are mostly agriculture, agriculture-related sectors (such as manufacturing which takes agricultural products as raw materials and fertilizer/pesticides), and other resource-based sectors (such as forestry-based wood products).

The exception to this rule is West Java where manufacturing activities play a very dominant rule as key sectors. This is despite the fact that West Java is still one of the largest contributors of Indonesia's agricultural GDP (with 14% share).

The result on West Java vis-à-vis other provinces can be viewed as another confirmation of the well-known Java-off Java dichotomy that often characterizes discussions on Indonesia's provincial development.[4] To a certain extent, we must be careful in drawing a broad generalization, as other provinces in our sample (with the exception of Bali) are mostly small and less-developed provinces. Therefore, if data are available in the future, it might be interesting to see whether key sectors in more advanced economies such as North Sumatra will exhibit Java-off Java dichotomy.

The Role of Service Sectors

Looking at Table 5.1 through Table 5.3, we also note the appearance of what can be broadly categorized as service sectors as key sectors in an economy. Generally speaking, these service sectors can be either of the following categories:

- Financial service sectors (banks and other financial institution including insurance). These sectors appear in Bengkulu, Lampung, Southeast Sulawesi, and West Nusa Tenggara provinces.
- Hospitality-related services such as hotel and restaurant.

- Others, such as transportation and transportation support service, communication, etc.

The appearance of hospitality-related services as key sectors in an economy is likely to be related to tourism. On the other hand, transportation services become key sectors in an economy if there exist poor transportation conditions.

The presence of financial service industry as a key sector is a bit puzzling. The industry appears as a key sector in some remote (and less developed) provinces such as Bengkulu, yet financial service is not a key sector in West Java. To interpret this result, one needs to note that there is usually only a minimal presence of formal banking network in these less-developed provinces. As such, businesses must turn to other sources of financing. Hence the emergence of financial service industry as key sector in provinces should be interpreted as the lack of a formal banking network, whose function has been assumed by a less formal source of financing (i.e. rural credit institutions, loan sharks, etc.)

Comparison among methodologies

How do we know which method works best? The answer is not straightforward because our methods are not based on an optimization of certain objectives. Regression method, for example, minimizes some function of errors in predictions. Two regression models can therefore be compared, and the one that gives smaller prediction errors may be declared the better model. Our methods, in contrast, are not optimization-based. Hence they cannot be easily compared.

An alternative question will be whether different models provide different information? The answer, surprisingly, is both Yes and No. To explain this, we need to take a look at Table 5.4. The idea behind Table 5.4 is to calculate the weight (or share) of the identified top-10 key sectors in a province's gross output value.

Table 5.4 Weights of Top-10 Sectors Under Various Identification Scheme

Province	No. of Sectors	Rasmussen		Dietzenbacher		Field of Influence
		Backward	Forward	Backward	Forward	
West Sumatra	65	23.9	9.3	22.1	9.4	35.5
Bengkulu	44	24.6	15.4	21.8	13.6	33.5
Lampung	68	28.3	2.3	29.1	21.7	13.5
West Kalimantan	47	48.5	11.9	26.8	28.6	38.7
Southeast Sulawesi	49	28.0	5.2	19.6	46.4	28.2
Bali	65	20.9	2.3	32.9	37.7	20.0
West Nusa Tenggara	58	16.7	11.7	26.4	6.7	16.0
West Java	75	27.3	8.3	9.8	16.9	32.1
Mean		27.3	8.3	23.6	22.6	27.2

Source: Own calculation

As can be seen from Table 5.4, there are five different weights for each province:

- Top-10 weight for Rasmussen/Hirschmann method, backward linkage (case A).
- Top-10 weight for Rasmussen/Hirschmann method, forward linkage (case B).
- Top-10 weight for Dietzenbacher-van der Linden method, backward linkage (case C).
- Top-10 weight for Dietzenbacher-van der Linden method, forward linkage (case D).
- Top-10 weight for Field of Influence (case E).

Hence, for West Sumatra, Top-10 sectors in case A (bacward linkage, RH method) accounted for 23.9% of the province's gross output value. In comparison, the weight of the Top-10 sectors in case C (using DL) method accounted for 23.6% of West Sumatra's gross output value.

Three important items are apparent:

1. In the case of backward linkage, we note that the RH and the DL methods do not differ substantially. For the eight provinces in our sample, the Top-10 weighs an average of 27.3% in the RH scheme, compared to 23.6% in the DL scheme. In greater detail (see Tables 5.1-5.3), both methods would identify the same sectors as key sectors in 70% of the case.
2. In the case of forward linkage, the RH and the DL methods differ substantially. While the Top-10 sectors identified in RH method weighs only 8.3% of the economy's size, the results from DL weighs 22.6%.

3. In terms of weights, the Field of Influence method also identifies Top-10 sectors that are of substantial importance to the economy (with an average weight of 27.2%).

Overall, the analysis suggests that the main objective of both DL and FOI methods has been achieved: identification of relevant key sectors. Nevertheless, if is found that the more recent DL method differs from the traditional RH method only in the identification through forward links. An investigation of why this phenomenon occurs would be outside the scope of this paper.

VI. Conclusion and Policy Implications

For both government and private sectors, identification of key sectors is important. For the government, key sectors may be important because of its implication for the government's development policy. For private sectors, key sectors can be an important factor in their investment decisions.

This paper has made several contributions. First, we have introduced a mixture of new and traditional methods of identifying key sectors. We started by introducing the Rasmussen/Hirschmann method developed in the 1950s. We then introduced the most recent development in the input-output based methodology. Those are the Dietzenbacher-van der Linden method and the Field of Influence method.

Second, we found that the contemporary methods have identified important sectors that are also relevant in terms of economic size.

Third, with the exception of West Java, the key sectors in other provinces are mostly agricultural-based and resource-based industries. Also included are industries that support the aforementioned type of industries. West Java, despite being a large contributor to Indonesia's agricultural GDP, remains firmly a manufacturing-based economy.

Fourth, the existence of a financial service sector in some less developed provinces is not an anomaly. The result is entirely consistent with a minimal presence of a formal banking sector that, in turn, leads to a higher presence of non-bank financial institutions (NBFI) such as rural credit institutions and loan sharks. Assuming that these NBFI charge higher interest rates than banks, one policy implication is for the

government to devise a scheme to induce banks to increase their activities in these less developed provinces.

Future Research

At this stage, we can point to future research directions that may be undertaken. First, as new data from other provinces appear, similar calculation can be conducted. Under ideal circumstances, calculation on all provinces should be conducted to further complete the finding and conclusion of this study.

Second, a deeper analysis on an island-by-island basis will be possible. Panggabean (2003) indicates that most regional interactions in Indonesia are on an island-by-island basis. Hence a regional development strategy that exploits this fact may be desirable. In this island-based study, the Input-Output approach should be a part of a deeper analysis that should include analysis on labor, infrastructure, and other socio-economic framework. Based on Panggabean (2003), an in-depth study on Sumatra can be considered.

Third, the result of various provinces should be compared against the national results. As such, the national picture will provide a larger framework in which provincial results provide further locational detail of economic and investment activities. In a sense, this will contribute to a more coherent national-provincial development policy. As of the writing of this paper, the national IO table for 2000 has not yet been published.

Fourth, in addition to identification of key sectors, there is also an effort to identify economic clusters (loosely defined as several industries tied together in a value-adding production chain). In this type of analysis, one tries to identify several clusters of industries in economy, as well as members of each clusters. The same data that has been used thus far can also be used to identify economic clusters in each province.

NOTES

1. To save space, in what follows, we will analyze and provide examples in terms of backward linkage.
2. The usage of inter-regional IO table would be appropriate if inter-province's comparison is desired. Nevertheless, even in this case, much detail will be lost as usually an economy will only be disaggregated up to only 19 sectors.
3. The name of these sectors are available upon request.
4. See Panggabean (2003) for a new approach on regional clustering in Indonesia.

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