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Assumptions and Data Sources for the Construction of a Multi-Region Input-Output Table for Indonesia

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ASSUMPTIONS AND DATA SOURCES FOR THE CONSTRUCTION OF A MULTI-REGION INPUT-OUTPUT TABLE FOR INDONESIA

MRIO

Restricted

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Regional Economic Analysis for Regional Investment Planning Project (TAP4I/NEI)
Badan Perencanaan Pembangunan Nasional (BAPPENAS)

PREFACE

The Regional Economic Analysis for Regional Investment Planning Project (TAP4I/NEI) is attached to Deputy V of BAPPENAS. It is funded by the PMU-TAP 4I Loan Number 3385 IND for Public and Private Provision of Infrastructure and executed by the Netherlands Economic Institute. The project is aimed at strengthening the regional planning capabilities of BAPPENAS in general and Deputy V in particular. During this Addendum period the project activities focusses on the transfer and training of the members of the Research Development Planning Unit within Deputy V of BAPPENAS. This training and transfer consist of training on the job and classroom sessions. The contents of these classroom sessions are regularly presented in the Transfer Memorandum Series.

This third Memorandum of this series discusses the construction of the Multi-Region Input-Output Table, its assumptions and the data sources used. This memorandum is prepared by Mr. Albert W. de Groot.

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1. Introduction

The release of the National Input Output Table (NIOT) for 1990 by BPS, allowed the project team last year to re-estimate the Multi-Region Input-Output Table (MRIOT) for 25 economic sectors and 27 provinces. A detailed description of this construction, with all the related files is given in an earlier Research Memorandum of this project[1].

This document is written in the context of the transfer of the project tools to the Regional Development Planning Unit (RDPU) within Deputy V. Therefore it pays extensive attention to the available data, the estimation procedure and its assumptions. We explain the main lines of the estimation procedures, without paying to much attention to complicated exceptions. Section 2 discusses the data requirements of the construction of MRIOTs in general. Section 3 pay attention of the data used in the case our MRIOT for Indonesia. Section 4 elaborates upon the estimation procedure and in particular the assumptions introduced during the construction of the MRIOT. Appendix A shows the sector names and its numbers of the complete MRIOT. In Appendix B a simplified construction example is given. In this example we apply step by step the estimation procedure on the national input-output table of 3 sectors and construct a MRIOT of 3 regions and 3 sectors.

1 See "The Multi-Region Input-Output Table of Indonesia for 1990, Construction, Description and Analysis", Research Memorandum Series, No. 7, BAPPENAS, TAP4I/NEI, August 1994.

2. Multi-Region Input Output tables

Considerable literature has been written on the construction of regional input output tables and more specifically on MRIOTs; generally a distinction is made between the so-called 'survey' and 'non-survey' methods. The survey method is usually applied at the national level in the construction of national input output tables. National account data, budget surveys, public finance accounts, trade statistics, industrial surveys and detailed investigations into the cost structure and destination of products of branches of industry constitute the basis for the estimation of NIOTs. While this approach is generally recognized to be superior, it is also very demanding in terms of time, money and manpower requirements. For this reason this method is seldom applied to the construction of regional input output tables.

The reliability of regional input output tables obtained by applying a non-survey method depends basically on the quantity and quality of data available and the underlying assumptions used in its construction. Data availability differs from region to region; in some countries final demand, including inter-regional trade can be estimated with a great degree of accuracy, and in such cases constructing a regional input output table does not pose insurmountable problems. However, if some of the important building stones are not available, the estimation procedure requires additional assumptions which are then from a practical point of view certainly justified, but it might lead to biased results.

In principle regional input output tables do not differ from national input output tables. Complications arise because a disaggregation of the national input output table into regional input output tables not only requires knowledge about the *industrial* origin and destination of the flow of commodities, but about the *regional* origin and destination of these flows as well. If regions within a country are relatively specialized in the production of certain commodities and services, like for example in Indonesia Jawa in the production of manufactured goods and the provinces of Aceh, Riau, and Kalimantan Timur in the production of migas, this problem is not very serious; knowledge about the origin of the commodities is then at least available for a number of activities. The destination of these commodities poses however a more serious problem. Regional exports and imports statistics are generally not available at a detail comparable to the national external trade statistics. Furthermore, generally information about final demand categories is not available either at a very detailed level. Confronted with such a situation additional assumptions have to be introduced, of which the validity and acceptability can only be judged by studying carefully the outcome of the estimation procedure.

In summary, construction of regional input output tables is extremely demanding in terms of time and resources. For that reason a non-survey method is often preferred. This results in the need of estimating a number of flows for which generally independent estimates are only available at the national level. Additional assumptions have therefore to be introduced and this can, and often will lead to biased results. For this reason the user of estimated regional input output tables and regional input output models has to exercise utmost care in interpreting the results obtained from this type of analysis.

3. Available data

The availability of data has largely determined the estimation procedure for the construction of the MRIOT. This section describes the data used for this construction together with its sources. The next publications from BPS are the main data sources of the MRIOT.

A. BPS, Tabel Input Output Indonesia (Indonesian Input-Output Table), 1990, Volume 1, Jakarta, 1994.

B. BPS, Produk Domestik Regional Bruto Propinsi-Propinsi di Indonesia Menurut Lapangan Usaha (Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin), 1987-1991, Jakarta, 1994.

C. BPS, Produk Domestik Regional Propinsi Propinsi di Indonesia menurut Penggunanaan (Gross Regional Domestic Product of Provinces in Indonesia by Expenditure), 1987-1992, Jakarta, 1994.

D. BPS, Statistik Perdagangan Luar Negeri Indonesia, Ekspor (Indonesia Foreign Trade Statistics, Exports) 1990, Volume 2, Jakarta 1991.

E. BPS, Survey Sosial Ekonomi Nasional (SUSENAS), buku 3: Pengeluaran Untuk Konsumsi Penduduk Indonesia per Provinsi 1990 (Expenditure for Consumption of Indonesia per Province 1990), Jakarta 1992.

ad. A. The most important source is the National Input Output Table (NIOT) from BPS for 1990, which is available for 161 economic sectors. This NIOT aggregated to 25 economic sectors forms the basic framework in the estimation procedure (see Appendix A for sector names and numbers). LNG (Liquid Natural Gas) is treated as a separate sector because of its clear regional appearance. Starting with this NIOT guarantees that the resulting MRIOT adds to this national table. This means that data extracted from other sources as indicated below, have to be adapted in such a way that they add up to the national totals in the NIOT. An approach like this means that all cells of the NIOT are broken down to the provincial level, i.e. disaggregated into a number of cells.

ad. B. Provincial GDP (= value added) data by economic sector is another important input in the estimation procedure. BPS provides, in cooperation with provincial statistical offices, time series of these data in "Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin". Although the quality of these data is improving over time, they are not consistent with the national data[2]. Another problem is the level of aggregation. For example non-migas manufacturing is usually presented as

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2 For this reason, the above-mentioned BPS publication shows both the sum of the 27 provinces and the national values for each sector.

two sectors, large & medium scale and small scale & home (or household and cottage) industries, whereas "our 25 sectors" include 9 non-migas manufacturing sectors. Additional provincial information from the Survey of Manufacturing Industries, Large and Medium and from the Small Scale and Household Statistics, has been used to breakdown the aggregate provincial GDP figures.

ad. C. Provincial GDP data by expenditure category are used to estimate the provincial distribution for most of the final demand components, such as private consumption and (private and Government) investment. These statistics are annually published by BPS in "Gross Regional Domestic Product of Provinces in Indonesia by Expenditure". Since export and import in this source include not only foreign but also domestic trade, another source is used for the export to abroad (see below).

ad. D. Series on exports by province for 1990, published by BPS in "Indonesia Foreign Trade Statistics, Exports". These data are based on documents filled out by the actual exporter. This exporter is not necessarily also the actual producer of the exported good, but for instance a wholesale trader exporting possibly from another region than the region of origin (i.e. production) of the commodity. This should be borne in mind when interpreting the tables.

ad. E. The last important source is SUSENAS, book 3 "Expenditure for Consumption of Indonesia per Province 1990" which gives data on household expenditures per province. These data are used to describe the consumption pattern of the inhabitants in each of the provinces.

other data sources used in the MRIOT construction:

- BPS, Survey Tahunan Perusahaan Industri Besar dan Sedang, 1990, unpublished prints (Industrial Statistics, Survey of Manufacturing Industries Large and Medium), also called Industrial Surveys.

- BPS, Statistik Industri Kecil, 1991 (Small Scale Manufacturing Industry Statistics).

- BPS, Statistik Industri/Kerajinan Rumahtangga, 1991 (Household /Cottage Industry Statistics.

- BPS, Social Accounting Matrix Indonesia 1990, preliminary version.

4. The estimation procedure and its assumptions

This section discusses the estimation procedure and assumptions for the construction of the MRIOT for 27 provinces and 25 sectors. Each time when an assumption is introduced the implications for the construction of the MRIOT will be discussed. The estimation process starts with the aggregation of the NIOT of 161 sectors (at producer prices) to an NIOT with only 25 sectors. Subsequently the MRIOT can be estimated in four independent blocks (see figure 1). First we will pay attention to the intermediate deliveries (section 4.1.), then to the cost composition (or primary inputs, section 4.2.). Finally section 4.3 discusses the final demand, broken down in components for which the provincial origin and destination needs to be determined (i.e. private and government consumption and investment) and components for which only the province of origin matters (i.e. foreign export of goods and services and change in stocks).

Figure 1: Estimation of the MRIOT in 4 independent blocks.

sectors	sectors 1 2 3 . . . n	Cp Cg Ig Ip	Xg Xs stocks
1 2 3 . . . . . n	INTERMEDIATES (section 4.1.)	INTERPROVINCIAL FINAL DEMAND (section 4.3.1.)	OTHER FINAL DEMAND (section 4.3.2.)
import wages depreciation net ind. taxes oper. surplus	PRIMARY INPUTS (section 4.2.)		

In the estimated MRIOT the final demand blocks have a more solid base than the intermediate and the primary input blocks. Due to the availability of provincial household consumption and export data roughly 75 percent of estimated total provincial final demand is survey based.

4.1 Intermediate deliveries

The intermediate block of the large MRIOT for 27 provinces with 25 sectors consist of 675 by 675 cells. We start the estimation with the preparation of a consistent set of 675 sectoral GRDP figures for 1990, which add to the national sector totals given in the NIOT. For most of the sectors data are published by BPS. For the 9 non-migas manufacturing sectors (i.e. sector 8 up to 16, see Appendix A) information is used from the Industrial Statistics, Survey for Large and Medium Industries, 1990 and from the Small Scale and Household/Cottage Industry Statistics (see Section 3). These statistics also provide provincial specific information on total output and foreign import by sector for these 9 non-migas manufacturing sectors.

For the other 16 sectors the introduction of Assumption 1 is necessary to obtain the estimates for the domestic intermediate deliveries (or domestic inputs) and for the foreign imports.

Assumption 1:

> *Provincial ratios for GRDP/output and foreign import/output are for the 16 non-manufacturing sectors equal to the national ratios.*

Based on this Assumption, the domestic inputs of each sector can be calculated, since total input minus GDP and foreign import is equal to domestic inputs. The origin of these domestic inputs is within the country, but this could be either within or outside the province.

The validity of Assumption 1 depends on two factors. Firstly the introduction of an aggregation bias might result in an over- or underestimation of total output and foreign imports from abroad, and secondly no firm evidence exist that the average import quote is indeed equal for the same sectors across all provinces. It should however be added that there is no firm evidence for the contrary either.

To break the domestic intermediate inputs of each sector down to sectors of origin, we assume the following.

Assumption 2:

> *The input structure of the domestic intermediate inputs of the NIOT is equal to the provincial input structure for each of the 25 sectors.*

This assumption of equality of regional and national input structure is often made and probably as often criticized. Criticism originates from the concern that there exists large variations in the regional input structures. This is probably true, especially at high levels

of aggregation, as in that case different activities are combined into single sectors. For example, if fisheries and foodcrops are combined into a single agricultural sector. The product mix will in such a case exercise an important influence on the magnitudes of the input structure. However at lower levels of aggregation the product mix will decreasingly exercise an important influence on the input structure. For this reason it has been assumed that only at the lowest available level of aggregation the domestic input structure at the national and the provincial is the same.

The application of this assumption results for each province in a table of 25 by 25 with the domestic provincial intermediate deliveries, originating from the own province or from the other 26 provinces. Total domestic *requirements* for intermediate deliveries from one sector are calculated by summing the relevant *row* of regional intermediate deliveries obtained. This means that sum of a row of such a provincial table gives the domestic intermediate *demand or requirements* of the province for the goods and services produced in the respective sector.

To be able to make a breakdown within the domestic intermediate deliveries matrix to demand from the own province and imports from other provinces we first have to know some more of the provincial supply of intermediate products. Therefore we introduce the next assumption.

Assumption 3:

> *The share of total sector provincial intermediate supply, which is either supplied to sectors within the province or to other provinces, in total the output of the sector equals the share of total intermediate domestic supply of this sector in total output of the NIOT.*

This assumption is needed to be able calculate the domestic intermediate *supply* of the provincial economy. After knowing the provincial intermediate supply on the one hand and the requirements (from assumption 2), (net) flows of inter-provincial trade in intermediate commodities can be identified. These net trade flows are estimated by confronting the total intermediate requirements for the goods of a sector with the total provincial intermediate supply of these goods[3].

At the provincial level for each sector a surplus or a deficit emerges, meaning that the supply is larger respectively smaller than the demand. Deficits leads to domestic imports from other provinces, since the own provincial economy seems not able to supply all the required intermediate inputs itself. Surpluses on the other hand, will be exported to other provinces.

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3 This implies that no cross hauling occurs at the level of 25 sectors and 27 provinces, i.e. a sector in a province is either an exporter or an importer.

The result of this operation is that for each sector it has been established as to whether the province is a net domestic importer or exporter of intermediate goods and services. This knowledge for each sector in all provinces needs to be merged at sector level. In this way for each sector an Origin/Destination matrix of 27 by 27 will be made. The border totals of these matrices are the domestic net imports (as a column total) and domestic net exports (as a row total) of the provinces. To fill up all these cells of this matrices the following assumption is required.

Assumption 4:

> *Inter-provincial intermediate trade flows are estimated on the basis of minimizing of distance, or minimizing of transport costs.*

As a result, the *province of origin and destination* of the flows of commodities and services is determined. However, it remains still to be solved how the domestic intermediate imports are distributed over the *sectors of destination*. For that purpose the introduction of assumption 5 is needed.

Assumption 5:

> *The average domestic import quote of intermediate deliveries by sector of origin is for each province equal for all sectors.*

Introducing this assumption renders it possible to distribute the provincial imports of intermediate deliveries over the sectors of destination. It simply means that total imports by sector of origin are distributed proportionally over the sectors of destination. This results in an intermediate deliveries import matrix from other provinces. Subtracting this matrix from the matrix of domestic intermediate deliveries which are either obtained from within the region or from within Indonesia, results in a matrix of intra provincial trade elements.

4.2. Cost composition

After a block for regional domestic intermediate deliveries has been estimated the cost composition of regional GDP can be approached next. The main parts of this block, the foreign import and the GRDP by sector are already prepared and discussed above. To complete this block of primary inputs we need to make a breakdown of provincial GDP into the four GDP components: wages, depreciation, net indirect taxes and operating surplus.

For 9 non-migas manufacturing sectors, we use information from the Industrial Survey of Large and Medium Scale Industries and from the Statistics for Small Scale and Home

Industries[4]. For the other 16 sectors we introduce assumption 6.

Assumption 6:

> *The cost composition of the provincial GRDPs is for each sector the same as at the national level.*

This assumption is necessary to make the breakdown within the GRDP for the 16 non-manufacturing sectors in each province. This assumption basically means that a Cobb Douglas production function is assumed, implying constant factor shares. Differences in productivity of the factors of production are reflected in differences in factor payments.

4.3. Final demand

The final stage in the construction of the MRIOT concerns the estimation of the final demand components.

The following six final demand components can be distinguished in the NIOT.

- private consumption;
- government consumption;
- investment;
- exports of goods to abroad;
- exports of services to abroad;
- change in stocks.

We approach estimation of the final demand block in two parts. First, the estimation of the final demand with interprovincial trade (i.e. private and government consumption and investment) will be discussed, while subsequently attention is paid to the final demand components without a provincial destination, i.e. the export of goods and services and the change in stocks.

For this interprovincial final demand block, the basic steps for the estimation of interprovincial trade flows are identical to the intermediate block: first estimate the provincial demand (or requirements) for goods and services, then make an assumption for the calculation of the provincial supply for each of these goods. Confrontation of supply and demand again leads to a net trade balances for each sector of origin. These balances will function as border totals for 25 Origin/Destination matrices for interprovincial trade in final demand.

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4 See Research Memorandum Series, No.7, 1994 for an elaboration of this.

4.3.1. Interprovincial final demand

Private consumption

The provincial totals for private consumption are taken from the GRDP by expenditure from BPS, as mentioned in section 3. These provincial figures are scaled to the national figure in the NIOT. For the determination of the sectors of origin of this consumption (i.e. the provincial demand column) in each province, provincial data of monthly expenditure per capita from SUSENAS are used. These data are transformed from the 18 SUSENAS expenditure categories to the 25 economic sectors of origin[5]. Since SUSENAS data are in consumer prices, while the input output tables are in producer prices, we need to adjust the SUSENAS figures for trade and transport margins[6].

Finally, the resulting SUSENAS block is subject to a RAS procedure (of proportional adjustment) with the private consumption by province and the national consumption by sector as border totals. The result is a private consumption block (25 by 27) that shows the consumption requirements of the 27 provinces, without taking the province or country of origin into account.

Government consumption

Government consumption consists for 95 percent of wages and salaries paid to civil servants, while the other five percent includes depreciation. The GRDP of the sector government services (public administration) is by definition equal to the deliveries of the sector government services to government consumption. Assuming a fixed relationship between value added of the sector public administration and government consumption, which is available from the NIOT, we are able to calculate a provincial government consumption column for all 27 provinces. The other cells of this demand vector are estimated with ratios from the NIOT.

Private and Government investment

Estimating the provincial investment proves to be hard and only some trail and error has led to satisfying results. The provincial investment estimates in the "Gross Regional Domestic Product of Provinces in Indonesia by Expenditure" from BPS seems not always accurate. For this reason we have used two other data sources for a kind of consistency check.

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5 The transformation matrix used for this was constructed by this project in the past and is based on a thorough examination of the expenditure of the 1987 figures of SUSENAS.

6 Trade and transport margins are the differences between commodity prices at producer and consumer prices. The size of these margins for each sector at the national level is given in the NIOT.

The GRDP in the construction sector is the first other source. At the national level there appears to be a strong relation between the level of output of the construction sector and the level of investment. More than 90 percent of the output of the construction sector is channelled into investment, which in turn constitutes about 60 percent of total investment. Other useful information on the provincial level of investment are the estimates of the *Government* investment earlier made within this project[7]. The total (i.e. private plus Government) investment of a province should at least be equal to level of Government investments.

For the MRIOT, we use this information on Government investment to make a breakdown of total investment in a private and a government part. The latter is important for policy studies. In the NIOT, this breakdown is not available. We approach private investment as a rest item. The total provincial investment is checked against the GRDP in the construction sector. For the determination of the sectors of origin of these investments, the provincial GRDP in the construction is an important indicator, while the other sectors of origin are similar to the NIOT.

In this way, for all four interprovincial final demand categories, private and government consumption and private and government investment, the total requirements are estimated, i.e. from the own province, the other provinces and abroad. However, for the determination of interprovincial trade with Origin/Destination matrices, we also need to take into account the domestic requirements. Therefore a breakdown between domestic and foreign requirements is made, by comparing the final demand of two versions of the NIOT, one with and one without foreign imports. We can assume:

Assumption 7:

> *At the provincial level the foreign import quote of final demand by sector of origin and final demand category is the same as the national foreign import quote.*

By introducing this assumption we are able to calculate for each final demand category the direct import requirements from abroad. This means that each cell can be reduced with its foreign import share in accordance with the NIOT.

For the provincial *supply* of final goods, we introduce the following assumption. Actually, this assumption is implicitly made within Assumption 3 above.

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7 "Regional and Sectoral Investment in Indonesia, Past Performance and Present Potentials", Research Memorandum Series, No 6, BAPPENAS, TAP4I/NEI, 1994.

Assumption 8:

> *The share of total provincial supply of final goods and services in total sector supply, which is either supplied to sectors within the province or to other provinces, equals the share of total domestic supply of final goods and services in total domestic output of the NIOT.*

Within final supply we introduce another assumption that offers the opportunity to estimate the supply of final goods for the interprovincial final demand components on the one hand and the "other final demand" (export and change in stocks) on the other hand.

Assumption 9:

> *The share of provincial domestic supply of a sector to consumption and investment on the one hand and to export and change in stocks on the other equals the share of these components in the final domestic supply of the same sector in the NIOT.*

A following step is the confrontation of supply and demand for interprovincial final goods. This confrontation leads to the estimation of net trade flows for each sector in each province. In the same way as for intermediate trade 25 Origin/Destination matrices can be made with these net trade flows as row and column borders. By applying Assumptions 4 and 5 also to the interprovincial final demand, these Origin/Destination matrices can be filled and the complete interprovincial trade block for final demand can be prepared.

4.3.2. Other final demand

As mentioned earlier, other final demand includes export of commodities and services and change in stocks. These components are not traded between the provinces. This means that these components consist of only one column in the MRIOT.

Exports to abroad

Exports of commodities to abroad are available from the export statistics of BPS. This concerns exports which are exported directly to abroad; exports of a province which are exported through the harbors of another province are included in the MRIOT as domestic exports to other provinces.

Provincial export figures from BPS are by sector in US dollars and at consumer prices. For a transformation to Rupiah and producer prices, respectively, the Rupiah/US dollar exchange rate and trade and transport margins in the same way as for private consumption need to be applied. Finally, the results are made consistent with the final demand column in the NIOT by proportional adjustment.

The national export of services in the NIOT is allocated to the provinces (of origin) in accordance with the size of the provincial GRDP in the sector that exports the services.

Change in stocks

Lastly, change of stocks for each sector is calculated as a rest item, thus as total final demand minus consumption, investment and exports.

With change in stocks we have completed the estimation of the final demand and therefore the whole MRIOT. This also completes our description of the estimation methodology and the assumptions applied in the calculation of the MRIOT.

Appendix A. The 25 sectors of the Multi-Region Input-Output Table

1. foodcrops
2. estate crops
3. livestock
4. forestry
5. fisheries
6. non-migas mining
7. migas mining
8. food, beverage and tobacco
9. textile
10. wood products
11. paper products
12. chemical products
13. non-metal products
14. basic metals
15. metal products
16. other manufacturing
17. petroleum refinery
18. liquid natural gas (lng)
19. electricity, gas & water (public utilities)
20. construction
21. trade, hotel & restaurants
22. transport & communication
23. finance
24. public administration & defense
25. other services

Appendix B. A simplified construction example for 3 regions and 3 sectors

To understand the theoretical assumptions of this Memorandum we present in this Appendix in a simplified manner the impact of the different assumptions in the construction process of the intermediate and the primary input block of the MRIOT. In this straightforward example we start with the National Input Output Table at 3 sectors (agriculture, industry and services, see Table B.1.). We follow one by one the assumptions 1-6 as described in section 4.1 and 4.2 of this Memorandum. Finally an intermediate and a primary input (or cost composition) block of a Multi-Region Input-Output Table of 3 regions (Sumatera, Jawa+Bali and Kawasan Timur Indonesia (KTI)) results (see Table B.2).

We can compare these results with a MRIOT of the same size that results from aggregating the large MRIOT of 27 provinces and 25 sectors (Table B.3). This table has *net* trade flows at the level of 25 sectors and 27 regions. Net trade implies that a province is either an importer or an exporter of the output of each sector. Comparing these two tables (i.e. Table B.2 and B.3), we see similarities but also large differences. The differences in our straightforward example are due to a) a higher level aggregation in the table construction and b) not using other statistics (such as the Industrial Surveys of BPS) than the National Input Output Table and the GRDPs by province.

Especially the table of our example (i.e. Table B.2.) occurs to have much more zero values and smaller trade flows in the intermediate block. This can be explained by the high level of aggregation of the construction in combination with our standard assumption of no cross hauls at the level of construction (in our example 3 sectors and 3 regions). For example for interprovincial trade of industrial commodities (including migas) we see a positive net trade flow from Sumatera to Jawa/Bali. Since this means that Jawa/Bali is a net importer of industrial commodities from Sumatera the net flow of these commodities from Jawa/Bali to Sumatera is zero.

In the large MRIOT aggregated to the above-mentioned 3 sectors and 3 regions, we see flows of industrial products between Sumatera and Jawa/Bali in both directions (see Table B.3.), since there exist for instance a positive net trade flow of textile and metal products (sector 9 and sector 15 respectively) from Jawa/Bali to Sumatera and there is are flows of wood & furniture (sector 10) and petroleum products (sector 17) from Sumatera to Jawa/Bali. This comparison of Table B.2. and B.3. shows again the importance of using statistical information at the lowest level of aggregation available.

Table B.1.: National Input-Output Table, 1990, billions of Rupiah, current prices

	intermediates			final demand									
TO FROM	1	2	3	Cp	Cg	Ig	Ip	E-good	E-serv	stocks	total interm	total final	total
1. agriculture	4057	22710	3439	21280	21	0	0	1379	0	298	30206	22979	53185
2. industry	3777	30098	26872	42271	773	278	4284	41720	167	1427	60746	90919	151665
3. services	2238	13543	26439	52690	16876	10174	31447	5640	4383	31	42220	121243	163463
domestic inputs	10072	66351.45	56750	116242	17671	10452	35731	48739	4550	1756	133173	235140	368313
foreign imports	581	17712	9046	7942	979	883	12691	0	0	0	27339	22496	49835
wages	7951	12771	36256	0	0	0	0						
depreciation	886	6136	8377	0	0	0	0						
net indirect taxes	401	3822	4981	0	0	0	0						
operating surplus	33293	44873	48053	0	0	0	0						
input	53184	151665	163464	124184	18649	11335	48422	48739	4550	1756	160512	257636	418148
GDP	42532	67601	97668										207801

TABLE CONSTRUCTION FROM NATIONAL TABLE TO MRIOT

ASSUMPTION 1:

1a. calculate national ratios:

	GDP	output	foreign import
1. agriculture	42532	53184	581
2. industry	67601	151665	17712
3. services	97668	163464	9046
total	207801	368313	27339

GDP / output	foreign imp / output
0.80	0.01
0.45	0.12
0.60	0.06

1b. apply these to regions

	GDP			
	Sumatera	Jawa+B	KTI	national
1. agriculture	10198	23587	8747	42532
2. industry	22382	33269	11950	67601
3. services	16909	67447	13312	97668
TOTAL	49489	124303	34009	207801

calculated output			
Sumatera	Jawa+B	KTI	national
12752	29495	10937	53184
50214	74640	26811	151665
28300	112884	22281	163464
91266	217018	60029	368313

calculated import			
Sumatera	Jawa+B	KTI	national
139	322	119	581
5864	8717	3131	17712
1566	6247	1233	9046
7570	15286	4484	27339

1c. domestic intermediates = total input minus GDP minus import:

	domestic intermediates			
	Sumatera	Jawa+B	KTI	national
1. agriculture	2415	5586	2071	10072
2. industry	21968	32654	11729	66351
3. services	9825	39190	7735	56750
TOTAL	34208	77429	21536	133173

ASSUMPTION 2:

2a. calculate input structure domestic intermediates:

	1. agr.	2. ind.	3. serv	
1. agriculture	0.40	0.34	0.06	
2. industry	0.37	0.45	0.47	
3. services	0.22	0.20	0.47	
total	1.00	1.00	1.00	
value	10072	66351	56750	133173

2b. calculate domestic DEMAND by applying this domestic input structure on the regions

	Sumatera			
	1. agr.	2. ind.	3. serv	total (=domestic DEMAND)
1. agriculture	973	7519	595	9087
2. industry	906	9965	4652	15523
3. services	537	4484	4577	9598
total	2415	21968	9825	34208
check	2415	21968	9825	34208

	Jawa+Bali			
	1. agr.	2. ind.	3. serv	total (=domestic DEMAND)
1. agriculture	2250	11177	2375	15801
2. industry	2095	14812	18557	35464
3. services	1241	6665	18258	26164
total	5586	32654	39190	77429
check	5586	32654	39190	77429

	KTI			
	1. agr.	2. ind.	3. serv	total (=domestic DEMAND)
1. agriculture	834	4015	469	5318
2. industry	777	5321	3663	9760
3. services	460	2394	3604	6458
total	2071	11729	7735	21536
check	2071	11729	7735	21536

check national	10072	66351	56750	133173

ASSUMPTION 3:

3a. calculate national intermediate output/total output ratios:

	ratios
1. agriculture	0.57
2. industry	0.40
3. services	0.26

3b. calculate the regional SUPPLY by applying these ratios on the output ofthe regions

	regional SUPPLY			
	Sumatera	Jawa+B	KTI	national
1. agriculture	7243	16752	6212	30206
2. industry	20112	29895	10739	60746
3. services	7309	29156	5755	42221
total	34664	75804	22705	133173

3c. calculate regional net trade flows for intermediate goods

	Sumatera					
	DEMAND	SUPPLY	BALANCE	NET EXPORT	NET IMPORT	Ratio Supply/Demand
1. agriculture	9087	7243	-1845		1845	0.80
2. industry	15523	20112	4590	4590		1.30
3. services	9598	7309	-2288		2288	0.76
total	34208	34664	456	4590	4133	

	Jawa+Bali					
	DEMAND	SUPPLY	BALANCE	NET EXPORT	NET IMPORT	Ratio Supply/Demand
1. agriculture	15801	16752	950	950		1.06
2. industry	35464	29895	-5568		5568	0.84
3. services	26164	29156	2992	2992		1.11
total	77429	75804	-1626	3942	5568	

	KTI					
	DEMAND	SUPPLY	BALANCE	NET EXPORT	NET IMPORT	Ratio Supply/Demand
1. agriculture	5318	6212	894	894		1.17
2. industry	9760	10739	979	979		1.10
3. services	6458	5755	-703		703	0.89
total	21536	22705	1169	1873	703	

ASSUMPTION 4:

4a. making Origin Destination matrices with net trade flows as border totals

1. agriculture				
to:	Suma	Jawa+B	KTI	total export
from:				
Sumatera				
Jawa+B				950
KTI				894
total import	1845			

2. industry				
to:	Suma	Jawa+B	KTI	total export
from:				
Sumatera				4590
Jawa+B				
KTI				979
total import		5568		

3. services				
to:	Suma	Jawa+B	KTI	total export
from:				
Sumatera				
Jawa+B				2992
KTI				
total import	2288		703	

4b. fill these Origin Destination matrices

1. agriculture				
to:	Suma	Jawa+B	KTI	total export
from:				
Sumatera				
Jawa+B	950			950
KTI	894			894
total import	1845			

2. industry				
to:	Suma	Jawa+B	KTI	total export
from:				
Sumatera		4590		4590
Jawa+B				
KTI		979		979
total import		5568		

3. services				
to:	Suma	Jawa+B	KTI	total export
from:				
Sumatera				
Jawa+B	2288		703	2992
KTI				
total import	2288		703	

ASSUMPTION 5:

5a. calculate domestic demand (import) from other regions (using structure in 2b)

	Sumatera				
	1. agr.	2. ind.	3. serv	total	check
1. agriculture	197	1526	121	1845	1845
2. industry	0	0	0	0	0
3. services	128	1069	1091	2288	2288
total	325	2595	1212	4133	

	Jawa+B				
	1. agr.	2. ind.	3. serv	total	check
1. agriculture	0	0	0	0	0
2. industry	329	2326	2914	5568	5568
3. services	0	0	0	0	0
total	329	2326	2914	5568	

	KTI				
	1. agr.	2. ind.	3. serv	total	check
1. agriculture	0	0	0	0	0
2. industry	0	0	0	0	0
3. services	50	261	392	703	703
total	50	261	392	703	

5b. calculate domestic demand from own region as difference between total domestic demand and demand from other regions

	Sumatera			
	1. agr.	2. ind.	3. serv	total
1. agriculture	775	5993	475	7243
2. industry	906	9965	4652	15523
3. services	409	3415	3486	7309
total	2090	19373	8613	30075

	Jawa+B			
	1. agr.	2. ind.	3. serv	total
1. agriculture	2250	11177	2375	15801
2. industry	1766	12487	15643	29895
3. services	1241	6665	18258	26164
total	5257	30328	36276	71861

	KTI			
	1. agr.	2. ind.	3. serv	total
1. agriculture	834	4015	469	5318
2. industry	777	5321	3663	9760
3. services	410	2133	3211	5755
total	2021	11469	7343	20833

ASSUMPTION 6:

6a. calculate national GDP ratios

	national values (NIOT)			
	1. agr	2. ind	3.serv	TOTAL
wages	7951	12771	36256	56978
depreciation	886	6136	8377	15400
net indirect taxes	401	3822	4981	9204
operating surplus	33293	44873	48053	126219
GDP	42532	67601	97668	207801

	national shares (NIOT)		
	1. agr	2. ind	3.serv
wages	18.7	18.9	37.1
depreciation	2.1	9.1	8.6
net indirect taxes	0.9	5.7	5.1
operating surplus	78.3	66.4	49.2
GDP	100.0	100.0	100.0

6b. apply these ratio to the estimated regional GRDPs (from step 1)

	1. agr	2. ind	3.serv	1. agr	2. ind	3.serv	1. agr	2. ind	3.serv	TOTAL
wages	1906	4228	6277	4410	6285	25037	1635	2258	4942	56978
depreciation	213	2032	1450	492	3020	5785	182	1085	1142	15400
net indirect taxes	96	1265	862	223	1881	3440	83	676	679	9204
operating surplus	7983	14857	8319	18464	22083	33184	6847	7932	6550	126219
GDP	10198	22382	16909	23587	33269	67447	8747	11950	13312	207801

Table B.2. Result of example: Intermediate and primary inputs of MRIOT
for only 3 sectors and 3 regions (1990, Rp. bln, current prices)

	TO	Sumatera			Jawa+Bali			KTI			total
FROM		1	2	3	1	2	3	1	2	3	interm
Sumatera	1. agriculture	775	5993	475	0	0	0	0	0	0	7243
	2. industry	906	9965	4652	271	1917	2402	0	0	0	20112
	3. services	409	3415	3486	0	0	0	0	0	0	7309
Jawa+B	1. agriculture	102	786	62	2250	11177	2375	0	0	0	16752
	2. industry	0	0	0	1766	12487	15643	0	0	0	29895
	3. services	128	1069	1091	1241	6665	18258	50	261	392	29156
KTI	1. agriculture	98	740	59	0	0	0	834	4015	469	6212
	2. industry	0	0	0	58	409	512	777	5321	3663	10739
	3. services	0	0	0	0	0	0	410	2133	3211	5755
TOTAL domestic intermediates		2415	21968	9825	5586	32654	39190	2071	11729	7735	133173
foreign import		139	5864	1566	322	8717	6247	119	3131	1233	27339
wages		1906	4228	6277	4410	6285	25037	1635	2256	4942	56978
depreciation		213	2032	1450	492	3020	5785	182	1065	1142	15400
net indirect taxes		96	1265	862	223	1881	3440	83	676	679	9204
operating surplus		7983	14857	8319	18464	22083	33184	6847	7932	6550	126219
GDP		10198	22382	16909	23587	33269	67447	8747	11950	13312	207601
output		12752	50214	28300	29495	74640	112863	10937	26811	22281	368313

Table B.3. Result of large MRIOT after aggregation: Intermediate and primary inputs of MRIOT
(1990, Rp. bln, current prices)

	TO	Sumatera			Jawa+Bali			KTI			total
FROM		1	2	3	1	2	3	1	2	3	interm
Sumatera	1. agriculture	991	4643	607	55	727	184	0	0	0	7407
	2. industry	873	6784	3259	66	1530	2069	79	93	470	15222
	3. services	517	2657	3640	10	153	283	5	21	37	7324
Jawa+B	1. agriculture	6	211	10	2078	12289	1747	21	0	30	16392
	2. industry	94	521	784	1946	18723	15710	400	514	1438	38128
	3. services	108	876	746	1026	7951	17906	78	313	418	29422
KTI	1. agriculture	14	576	11	130	1679	405	762	2362	445	6408
	2. industry	0	0	0	6	657	1647	314	3276	1497	7396
	3. services	7	55	56	11	168	319	476	1348	3033	5474
TOTAL domestic intermediates		2611	16526	9113	5327	41877	40270	2134	7948	7367	133173
foreign import		157	2103	1364	314	15187	6544	110	422	1139	27339
wages		2082	2813	6110	4248	8172	25008	1621	1786	5136	56978
depreciation		248	1539	1493	391	3597	5706	248	1001	1176	15400
net indirect taxes		99	481	891	218	3064	3419	85	277	672	9204
operating surplus		7769	17549	8415	18730	18437	33312	6793	8887	6326	126219
GDP		10198	22382	16909	23587	33269	67447	8747	11950	13312	207601
output		12966	41011	27386	29228	90333	114260	10991	20321	21818	368313