# Constructing Indonesian Social Accounting Matrix for Distributional Analysis in the CGE Modelling Framework

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**Abstract**

The distributional impact of policies analyzed in the CGE modelling framework have been constrained in part by the absence of a Social Accounting Matrix (SAM) with disaggregated households. Since Indonesian official SAM does not distinguish households by income or expenditure size, it has prevented accurate assesment for the distributional impact, such as calculation of inequality or poverty incidence. This paper describes how the Indonesian SAM for the year 2003, with 181 industries, 181 commodities, and 200 households (100 urban and 100 rural households grouped by expenditure per capita centiles) was constructed. The SAM (with the size of 768x768 accounts) constitutes the the most disaggregated SAM for Indonesia at both the sectoral and household level. SAM Construction is an essential part of CGE modeling, and this documentation provides greater transparency as well as replicability for further improvement.

*Keywords:* Social Accounting Matrix, CGE, Indonesia
*JEL Classification:* D30; D50

## 1 Introduction

A Social Accounting Matrix (SAM) is a matrix representation of transactions in a socioeconomic system. It is a comprehensive, flexible, and disaggregated framework, which elaborates and articulates the generation of income by activities of production and the distribution and redistribution of income between social and institutional groups (Round 2003b). The need for a Social Accounting Matrix for assessing a more elaborate distributional impact of development, and the inadequacy of standard System of National Account (SNA) has been long acknowledged (Stone 1985)[1].

A Social Accounting Matrix is an essential database for computable general equilibrium (CGE) modelling. In a SAM framework every agent's expenditure has to equal its

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[1]Richard Stone himself was granted nobel prize for the development of the SNA.

receipt (in the form of equality between column and row sum), so that SAM explicitly represents the initial equilibrium, or market clearing conditions in the economy. Every good and service produced by industry is equal to what is demanded. Each factor of production supplied has to be absorbed by industry, and household spending has to be equal to income. An exercise using a CGE model, is basically comparing this initial equilibrium condition, with other equilibrium induced by changing exogenous shocks to the model.

The Indonesian statistics office (BPS) publishes SAM[2], every five years. However, this official SAM is limited in terms of its sectoral disaggregation (it only has 23 sectors), and most importantly in terms of household classifications. Since many policy shocks typically analyzed in a CGE model are at a specific sectoral level, it is often necessary to have a lot more detailed sectoral disaggregation. Consequently, building a specifically-designed SAM to cover detailed sectoral disaggregation is unavoidable for most CGE modellers.Yusuf and Koundouri (2005)

Moreover, an official Indonesian SAM distinguishes only 10 households groups, which classifies households according to their occupational status[3]. This classification is sufficient as long as the analysis is just to compare and contrast the policy impact among these socioeconomic classes. However, when ones start to ask more precise questions, such as: how different are the impact of policies between the poor and the rich; how much will inequality change; whether the policies are regressive or progressive; and how much is poverty incidence changed by the policies; this classification has prevented those questions from being adequately answered.

The next question is, how feasible is to construct an Indonesian SAM that allows such research on distributional issues? This paper is based on researches in exploring this issue by studying how an Indonesian SAM is typically constructed, what is the limitation of such typical construction, and what sources of data available that may improve it. Therefore, the objective of this paper is to construct an Indonesian Social Accounting Matrix with the emphasis on distribution. More specifically, the SAM to be constructed is aimed at detailing 181 sectoral classifications, 16 labour classifications[4], and distinguishing 200 households classified by expenditure per capita size (100 urban, and 100 rural household, grouped by centiles of expenditure per capita). This will constitute the most detailed and disaggregated Indonesian SAM at sectoral and household level ever constructed[5]. Since there has not yet been any attempt to disaggregate and classify households by expenditure or income centiles to an Indonesian SAM, this is expected to be a contribution to the literature, not only on Social Accounting Matrix, but also in the literature on CGE modelling. In addition, since in practice, CGE modelers often

[2]or In bahasa Indonesia, "Sistem Neraca Sosial Ekonomi (SNSE)", or System of Social and Economic Accounts.

[3]Occupational status refers to the type of occupation of the household head, such as whether professional, farmers, casual workers, and so on.

[4]See Table 6 for the list of sectors, and Table 7, for the list of labour classifications in the Appendix.

[5]The size of the SAM will be of $768 \times 768$ accounts, in contrast to official BPS SAM of $102 \times 102$.

rely on BPS to produce a specifically designed SAM, the transparency in the description of the SAM construction in this paper implies greater replicability, and it is expected to invite further improvement in the future.

This paper is organized as follows. Section 2 has a more detailed discussion of Social Accounting Matrix, especially in relation to a CGE model in analyzing distributional issues. Section 3 describes the construction of the 768×768 SAM in detail, from how this SAM is extended from the official BPS SAM, the data used, the structure of the SAM, and its step-by-step construction. Section 4 shows some snapshot of the result in the form of an aggregated SAM, as well as some extract from the SAM such as industrial cost structures, and households' pattern of expenditure and income. Finally, section 5 has concluding remarks, ending with discussion on some limitations of the Indonesian SAM constructed, and the potential for further improvement.

# 2 SAM, CGE Model, and Distribution

## 2.1 SAM and CGE model

Table 1 shows a typical Social Accounting Matrix. This table also shows the skeleton or structure of the 768×768 SAM to be constructed. A SAM records transactions taking place during an accounting period, usually one year. As Round (2003b) summarizes, A SAM has three main features. First, it is represented as a square matrix; where the incomings and outgoings for each account are shown as a corresponding row and column of the matrix. The transactions are shown in the cells, so the matrix displays the explicit inter-linkage between agents in the economy. Second, it is comprehensive, in the sense that it portrays all the economic activities of the system. Thirdly, a SAM is flexible, in a sense that there is quite a large degree of flexibility in disaggregation or emphasis.

On the other hand, general equilibrium theory is a formalization of the observation that real-world markets are interdependent; changes in supply or demand conditions usually have repercussions on supply and demand conditions, and thus equilibrium prices in several other markets. The theoretical basis lies in general equilibrium models developed by Arrow and Debreu (1954). Computable general equilibrium (CGE) modeling is an attempt to use general equilibrium theory as an operational tool for empirically oriented analyses of resource allocation issues in market economies.

Although developed almost independently, a SAM and a computable general equilibrium model (CGE) model have been closely related. de Melo (1988) suggests social accounting literature has its root in the early work of Richard Stone in the 1960s. In the meantime, although not necessarily in the SAM framework, literature of the CGE model started with the Johansen (1960 in de Melo 1988) model. The SAM framework received particular attention when Dervis et al. (1982) started to emphasize the need for a balanced SAM, in the CGE models, especially for calibration of the model.

Table 1: Structure of 768×768 Indonesian SAM

| | | | Commodity | | Factor | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Activities 1⋯181 | Domestic 1⋯181 | Imported 1⋯181 | labour 1⋯16 | Capital | Ind. Tax | S-I | Households 1⋯200 | Transfers | Enterprises | Gov't | ROW | TOTAL |
| Activities | 1 ⋯ 181 | | MAKE Matrix | | | | | | | | | | | Industry Sales |
| Domestic Commo-dities | 1 ⋯ 181 | Domestic Intermedi-ate Input | | | | | | Domestic Invest-ment | Domestic Hou. Con-sumption | | | Domestic Gov't Con-sumption | Export | Total Dom. Demand |
| Imported Commo-dities | 1 ⋯ 181 | Imported Intermedi-ate Input | | | | | | Imported Invest-ment | Imported Hou. Con-sumption | | | Imported Gov't Con-sumption | | Total Import |
| labour | 1 ⋯ 16 | Salary and Wages | | | | | | | | | | | labour used abroad | Total labour Demand |
| Capital | | Non-labour | | | | | | | | | | | Cap. used abroad | Capital Demand |
| Ind. Tax | | Tax/ Subsidy | | Tariff | | | | | | | | | | Ind. Tax Reven. |
| Urban HH | 1 ⋯ 100 | | | | labour Income: Urban | Capital Income: Urban | | | | Inter-Hous. Transfer | | | ROW transfer to HH | Total Hous. Income |
| Rural HH | 1 ⋯ 100 | | | | labour Income: Rural | Capital Income: Rural | | | | Inter-House. Transfer | | | ROW transfer to HH | Total Hous. Income |
| Transfer | | | | | | | | | Transfer to HH | | | | | Int. Hou. Transfer |
| S-I | | | | | | | | | Household Saving | | Enterprise Saving | Gov't Saving | | Total Saving |
| Govern-ment | | | | | | | Ind.Tax Revenue | | Direct Tax | | Ent. Trans. to Gov't | Inter G Transfer | ROW Tans. to Gov't | Govt Revenue |
| Enter-prises | | | | | | Enter-Capital | | | | | Inter Ent. Trans. | | ROW Trans. to Enter. | Ente. Income |
| ROW | | | | Import | Foreign labour | Foreign Capital | | | HH Transfer to abroad | | Ent Trans. to abroad | G. Transfer to abroad | | Forex Outflow |
| TOTAL | | Industry Costs | Dom. Supply | Import Supply | labour Supply | Capital Supply | Ind. Tax Revenue | Total Invest. | Household Spending | Int. Hou. Transfer | Enter. Spending | Govern. Spending | Forex Inflow | |

A CGE model uses a Social Accounting Matrix as a representation of initial equilibrium. One of the most important features of a SAM, i.e., the equality between row total and column total in the matrix, explicitly portrays some of the most important market clearing conditions in the economy. Market clearing in the commodity market will be reflected in commodity accounts, that is, the value of commodities supplied by industry has to be equal to what is demanded by various demanders (intermediate demand by industries, various institutions, and various households). At the same time, the equality of column total and row total of factor accounts in SAM also records market clearing in the market of various factors of production. In addition, some theoretical features of a standard CGE model are also explicitly represented in a SAM. Among others, these are the equality between industry costs and sales (zero-profit competitive condition), and the conditions that household budget constraint is satisfied. In short, SAM is the basic and necessary ingredients for a CGE model. Technically, before any simulation is conducted, a balanced and consistent SAM ensures all agents' income or receipts are spent, which in turn guarantees equilibrium, database balance, and nominal homogeneity[6] of the CGE model.

## 2.2 Distribution in the CGE Model and the need for SAM with disaggregated households

In a general equilibrium framework, the distributional impact of any exogenous shocks to the model (e.g., policy or external shocks) works through the market mechanism. Optimizing firms will change their demand for factor inputs, intermediate inputs, and their supply of commodities. Change in a firm's demand for factors will affect factor prices, i.e., wages and non-labour income in the factor market, and at the end affect household's incomes and its distribution across households. Change in the income of every household depends on the composition of factor ownership (unskilled labour, skilled labour, capital, or land) of the household.

Change in household income together with change in all commodity prices, will simultaneously change household expenditures on various commodities. This will affect distribution of income and expenditure. In a general equilibrium framework, this series of mechanisms, works simultaneously in inter-related markets. Therefore, any attempt to assess the distributional impact of policies, by identifying either their impact on household expenditure "or" household income will be considered incomplete, because it is a one-sided story. Both sides are endogenous, and a CGE model elegantly takes these two different forces into account.

There are a few approaches for dealing with income distribution analysis in a CGE model. The traditional one is the representative household method, where it is assumed

[6]Real/quantity variables will not change if all prices increase, a standard and basic theoritical implication of neo-classical CGE model.

income or expenditure of households follows a certain functional form of distribution[7]. Distribution is assumed to remain constant before and after the shock, and usually the behaviour of the group is also dominated by the richest. There has been growing evidences to sugges variation within the one single household-category is important and can significantly affect the results of the analysis (Decaluwé et al. 1999). Household-specific shocks, such as transfers to targeted household groups, are also impossible to carry out with approach. Studies by Indonesia by Sugema et al. (2005) and Oktaviani et al. (2005), among others, belong to this type of approach.

The most common studies for Indonesia are CGE studies that use the official household classification of the SAM, i.e., 10 socioeconomic classes. The distributional impact is only analyzed by comparing the impact of policies among these socioeconomic classes. Studies by Resosudarmo (2003), Azis (2000), and Azis (2006), among others, follow this approach.

Another approach is a top-down method, where price changes produced by the CGE model are transferred to a separate micro-simulation model, such as a demand system model or an income-generation model. Price changes are exogenous in this micro-model, hence endogeneity of prices is ignored. Studies for Indonesia by Bourguignon et al. (2003) and Ikhsan et al. (2005) are among this type of approach. Some attempt has been made to improve this approach by providing feedback from the micro-model to the CGE model. Belonging to this category among others are studies by Filho and Horridge (2004) for Brazil, and Savard (2003) for the Philippines.

The most recent approach is multiplying the number of households into as many as households available in the household level data. Increasing computation capacity allows a large number of households to be included in the model. It allows the model to take into account the full detail in the household data, and avoids pre-judgment about aggregating households into categories. All prices are endogenously determined by the model, and no prior assumption of parameter distribution is necessary. Difficult data reconciliation and that the size of the model can become a constraint are among the drawbacks of this approach. This integrated-microsimulation-CGE model has been conducted in various studies including Annabi et al. (2005) for Senegal, Plumb (2001) for U.K., Cororaton and Cockburn (2005) and, Cororaton and Cockburn (2006) for the Philippines.

The last approach, to be used in this paper, is disaggregating or increasing the number of household categories by the size of expenditure or income per capita. If the categories is detailed enough, such as centiles, the distributional impact such as poverty incidences or standard inequality indicators can be estimated more precisely. For example, Warr (2006) used this approach for Laos in assessing the poverty impact of large scale irrigation investment.

[7]Of which the most popular one is log-normal distribution.

# 3 Constructing Indonesian SAM 2003

Table 1 is the structure of the Social Accounting Matrix to be constructed. It has 768 rows and 768 columns in all. It distinguishes industries from commodities to allow for industries producing multiple commodities, or the same commodity produced by several industries. 181 sectoral classifications are distinguieshe, and 200 households (100 urban and 100 rural classified by centile of expenditure per capita) are classified by centile of expenditure per capita. This section describes the process of constructing the SAM, starting with describing the data used, and other steps carried out to produce it.

The principle is to extend the 181 sectors Input-Output table into a Social Accounting Matrix structure, using the offical SAM 2003 as initial information. In the first step, the goal is to construct 181 sectors SAM with similar structure as the official SAM 2003 but with only one single household and one single labour. The labour classification will be extended in step 2, while the household will be disaggregated in step 3. This approach follows the practice called Macro to Micro SAM, and as Round (2003a) suggests has been the approach used by most SAMs compiled under the IFPRI modelling projects.

## 3.1 Data Sources and Description

The data sources used in this SAM construction are[8]

1. Official BPS SAM 2003 (102×102 accounts)
2. 181 sectors Input-Output table 2003.
3. SUSENAS Core Module 2003, with 894,427 individual observations.
4. SUSENAS Core Module 2002, with 862,210 individual observations.
5. SUSENAS Consumption Module 2002, with 64,441 household observations.
6. SUSENAS Income Module 2002, with 64,441 households observations.

### 3.1.1 BPS SAM (102×102), and Input-Output Table (181 sectors)

The BPS SAM is regularly published every 5 years and has less detailed sectors and distinguishes only 8 to 10 households. In its recent SAM for the year 2003, BPS recognises 23 industries and 8 household categories. The household categories in this SAM are (1) agricultural employee; (2) agricultural employer; (3) casual employer low-income, clerical, sales, casual employee in transportation sectors, personal services, office employee; (4) non-labour force and unaccounted occupation (rural); (5) high-income casual employer, non agricultural employer, manager, military, professional, technical, teacher, clerical, and high-income sales; (6) casual employer low-income, clerical, sales, casual

[8]In addition to these, SAKERNAS 2003 is also used for comparison with SUSENAS 2003 Core Module.

employee in transportation sectors, personal services, office employee; (7) non-labour force and unaccounted occupation (urban) and; (8) high-income casual employer, non agricultural employer, manager, military, professional, technical, teacher, clerical, and high-income sales.

This classification is mainly based on the occupational status of the household head. In distributional analysis where difficult questions are posed such as: whether the cost of certain policies are biased toward the poor or the rich; whether they are regressive or progressive; and how much their impact are on poverty incidence; are difficult to assess. In addition. certain policies directed toward the poor, such as cash transfers, are also difficult to analyse.

Although the BPS SAM is limited in sectoral and household detail, it is still very informative, in the sense that it records a lot of information with regard to transactions among institutions such as government, enterprises, and the rest of the world.

The Input-Output table records industry's costs and sales. Industry costs (or input) comprise purchases of raw materials (intermediate inputs), both from domestic, and imported sources, as well as primary factor costs (salary, operating surplus, and indirect taxes/subsidies). On the other hand, Industry output consists of their sales to other industries as both intermediate and final demand. The latter consist of household, investment, government, and exports demand. The Input-Output table serves as a core basis for constructing the Social Accounting Matrix.[9]

The I-O table is also regularly published every 5 years, the latest of which is for the year 2000. However, occasionally BPS publishes an interim I-O/SAM . This "interim" SAM/I-O table is an update of the regular 5 year interval publication using information of the most recent aggregates, such as value-added or final demand[10]. Once, this updated I-O is published, the SAM division of the BPS follows by publishing the updated SAM.

The most recent "updated" I-O table and SAM published by the BPS are for the year 2003. Usually, I-O table has up to 175 sectors. Since the research questions or case studies in the author's forthcoming dissertation[11] require detailed sectoral disaggregation, especially, on energy related sectors (electricity, and detail of fuels e.g. gasoline, kerosene, etc.), the 181 sector Input-Output table was obtained from the I-O division of the BPS.

The 181 sectors Input-Output table, and the 102 accounts BPS SAM will be used as a starting point to construct the 768 accounts SAM. This will be described in detail in the Step 1 section.

[9]SAM and I-O table are closely related, not only because the I-O table is part of the SAM, but also in constructing the SAM, I-O is usually used as the basis or the anchor. Whenever there is inconsistency, information from the I-O table dictates the SAM (Source: interview with SAM divison of the BPS).

[10]For the I-O table, for example, the Leontief technical coefficient is usually assumed to be constant, and the transaction using information from more recent aggregates are estimated.

[11]Distributional Impact of Environmental Policies: the Case of Carbon Tax and Energy Price Reform in Indonesia.

### 3.1.2 Household Survey Data

The National Socioeconomic Survey (SUSENAS) is a series of large-scale multi-purpose socioeconomic surveys initiated in 1963-1964 and fielded every year or two. Since 1993, SUSENAS surveys cover a nationally representative sample typically composed of 200,000 households. Each survey contains a core questionnaire which consists of a household roster listing gender, age, marital status, and educational attainment of household members, supplemented by modules covering about 60,000 households that are rotated over time to collect additional information such as health care and nutrition, household income and expenditure, and labour force experience

Household disaggregation of the Social Accounting Matrix, requires detailed expenditure, and income sources. This disaggregated information, which is contained in the SUSENAS Module is not collected annually, but every 3 years. The latest SUSENAS data with an expenditure and income module is for the year 2002. The sample size of this module is 64,442 households compared to the core SUSENAS which has a sample size of about 200,000 households. This smaller sampling frame attempts to represent the population of provinces, while the core can be disaggregated to represent every district.

As will be explained in detail in section 3.3, the information from the expenditure module of the SUSENAS will be used to disaggregate household consumption expenditures. The expenditure for each commodities in the SAM will be distributed to 200 households aggregated by expenditure per capita centile. The same will be applied to sources of income such as labour income by skills, as well as non-labour income and transfers. In constructing the SAM, SUSENAS as well as SAKERNAS (labour force surveys) play a crucial role. These are used as information to disaggregate industry use of primary inputs (labour and capital). The industry use of primary inputs that come from the I-O table has two limitations. First, it has onlytwo factors (labour and capital[12]). Secondly it does not capture the informality (duality) in the economy. It only records formal labour payments (salary and wages) incurred by industry. There are some significant amounts of unpaid labour lumped together in the operating surplus (residuals).

## 3.2 Step 1: Disaggregated Sectors but One labour, and One Household

The official Indonesian Social Accounting Matrix 2003 has 102 accounts, and consists of 16 labour categories, one non-labour factors, 8 households, 23 industries, 23 commodities (domestic and imported), and other institution accounts (Saving-Investment, Government, Enterprises, and Rest of the World). On the other hand, the Indonesian Input-Output table 2003 has 175 sectors, which is then expanded to 181 sectors to cover energy sectors in detail. The expansion disaggregates the petroleum products sector into 6 components (Gasoline, Automotive Diesel Oil/ADO, IDO, Kerosene, LPG, and

[12]Or in the I-O table definition capital is referred to gross operating surplus.

other fuels), and separate electricity from electricity and gas sectors[13].

As illustrated in Table 1, information from the Input-Output table was used to fill the following sub-matrix in the SAM.

1. Domestic intermediate input matrix (181×181).
2. Imported intermediate input matrix (181×181).
3. labour payment by industries (1×181).
4. Gross operating surplus or non-labour payment by industries (1×181).
5. Indirect tax and subsidies, paid or received by industries (2×181). The sum of tax and subsidy over industries are received by Government, in the Government account.
6. Domestic final demand, i.e. domestic commodity purchased as capital formation, household consumption, government consumption, and exports (181×4).
7. Imported final demand, i.e., imported commodities purchased as capital formation, household consumption, and government consumption (181×3).
8. Tariff on imported commodities (1×181)
9. Rest of the world receipts from domestic sales of imported commodities. This is total imported commodities, sum over all demanders (industry as intermediate and final demand).
10. The MAKE matrix, a diagonal matrix that show how industries supply commodity to the market. Currently it is assumed the MAKE matrix is diagonal or a single industry producing only a single commodity. Other modifications, such as single industry producing multiple commodities can be conveniently setup in sectoral aggregation.

1 to 5, if sum over rows, are total industry cost or input, while 1 to 6, if sum over column will be total industry sales. The former is equal to the latter.

As also illustrated in Table 1, information from the SAM 2003 was used to fill in the following sub matrix.

1. labour and non-labour payments received by Rest of the World.
2. Non-labour payments (capital) received by Enterprises.
3. The rest of factor payment (salary and non-labour) received by households.

[13]This expansion of the I-O table was conducted by staffs from the BPS Input-Output Table Division.

4. Household other expenditures, which consist of savings, transfers to other households, direct tax, and transfers to the Rest of the World.

5. Household non-factor income, which consists of, transfers from other households, from Enterprises, from Government, and from the Rest of the World.

6. Enterprises' receipts and outlays.

7. Government revenue and expenditures.

The next step is to disaggregate labour into more detail categories.

### 3.3 Step 2: Disaggregating Factor Payments

SAM 2003 has 16 classifications of labour. It recognises 4 skills types (agricultural, non-agricultural unskilled, clerical and services, and professional workers), urban-rural distinction, and formal and informal (unpaid) workers[14]. However, the Input-Output table, only distinguishes a single type of labour recorded in the wage bills of industrial costs. Gross operating surplus is then calculated as residuals. In developing countries, where a significant portion of industry does not officially record all payments to labour, this practice, may lead to misleading information.

First, the economy will appear to be highly endowed with capital, which is unlikely to be the case for developing countries like Indonesia. For example, from the Input-Output table, compensation of employees in Indonesia only accounts for around 35% of value added, whereas in the European Union, for example, the number is around 65%[15].

Second implication, is that certain industries which are supposed to be relatively labour intensive (e.g. agriculture compared with manufacturing) will instead appert to be capital intensive. Factor intensity is a very important driver of behaviour in the CGE model. For example, the parameters of most production functions used in the CGE model are function of factor shares. The reliability of some CGE models which rely purely on Input-Output table with understatement of labour, will be in question[16]. Understatement of labour compensation is quite common in a developing country Input-Output table. Cororaton (2003), for example shows the case for the Philippines.

In the Social Accounting Matrix, BPS has attempted to correct this issue by making a distinction between paid and unpaid labour. BPS defines unpaid labour as labour who run a household business, or are employed by a family member. These are subtracted from the gross operating surplus recorded in the Input-Output table. For example, data from the Labour Force Survey (SAKERNAS) records the number of hour these "informal" labours works, but without recording the amount of the wage payment[17].

[14]See Table 7 at the Appendix, for detail.

[15]Source: GTAP Database.

[16]Standard WAYANG model, for example, is based mainly on Indonesian Input-Output table which records around 34.36% of the aggregate labor share (source: Wayang 2002 database).

[17]Which in many cases, such as family workers, do not even involve cash (unpaid).

Table 2: Employment Status

| | Employment Status | Un-weighted Freq. | Un-weighted % | Weighted/Pop. Freq. | Weighted/Pop. %. |
|---|---|---|---|---|---|
| 1. | Self Employed: without workers | 85,415 | 22.7 | 19,635,423 | 21.67 |
| 2. | Self Employed: with unpaid workers | 76,225 | 20.26 | 17,480,674 | 19.3 |
| 3. | Self Employed: with paid workers | 11,966 | 3.18 | 3,037,090 | 3.35 |
| 4. | Employee (formal) | 103,961 | 27.63 | 26,986,276 | 29.79 |
| 5. | Agricultural casual workers | 14,135 | 3.76 | 4,698,661 | 5.19 |
| 6. | Non-agricultural casual workers | 8,480 | 2.25 | 2,524,201 | 2.79 |
| 7. | Unpaid workers | 76,059 | 20.22 | 16,233,250 | 17.92 |
| | Total | 376,241 | 100 | 90,595,575 | 100 |

Source: SUSENAS 2003 (Core Module)

The number of hours is imputed as labour compensation by multiplying it with the average wage in the formal sector for a similar type of labour (distinguished by skill type, and industry of employment). From the same data, BPS can disaggregate labour by 16 skills-type in the construction of the SAM.

In constructing the 181 sectors SAM, a similar kind of approach is used. Instead of SAKERNAS, however, the SUSENAS Core Module 2003 is used. The necessary information is available in both survey data. However, the SUSENAS sample size is a lot larger (894,427 compared to 297,642 individuals). From SUSENAS, the employment status for employed workers (shown in table 2) can be obtained. It is clear, that in terms of the number of labour employed, the degree of informality in the Indonesian labour market is very high.

The Rupiah salary earned is only recorded for employees in category 4 of Table 2. However, a wage imputation, will be carried out only for the self employed workers in category 1, 2, and 3. The reason is related to the difficulties involved in the next step (disaggregating households) if imputation is carried out to the rest of the employment status. In the Income module of SUSENAS[18], (Rupiah) earning form household business is recorded, in addition to (formal) salary and other income, whereas there is no record on other informal labour employment. It is assumed that informal wage from self employment is contained in net-household business income, and an attempt will be made to separate them into return to labour and return to capital (non-labour). Therefore, informal salary, in this SAM is defined as the imputed wage of those who are self-employed or own a household business. This approach is also used by Ivanic (2004) in the reconciliation of the GTAP database[19] with household survey data.

SUSENAS 2003 distinguishes 341 skills type sor job classifications. To match the SAM, this classification is first aggregated into 4 classifications (agricultural, produc-

[18]SUSENAS 2002, to be used in step 3.
[19]including Indonesian GTAP database.

tion/manual, clerical, and professional). Average[20] wage per hour in the formal sector is then calculated for specific skill-type, urban-rural location, and sectoral classification[21]. Finally, the monthly return to labour (earning) for self-employed individuals is imputed by multiplying number of hours per month with the average wage in the formal sector. The result is the distribution of wage earning over sectors, skills type, urban-rural, and distinguishes return to labour by self-employed individuals, which is disregarded in Input-Output table. This information is then used to disaggregate labour payments in the SAM constructed in step 1.

However, sectoral classification in the Input-Output table, is not exactly similar to that used in SUSENAS. The sectors in SUSENAS which has detailed 182 classification, is fairly disaggregated in manufacturing and services, but is very broad in agriculture. Both the IO and SUSENAS sectors have to be first aggregated into 88 sectors to have a consistent comparison[22]. Therefore, to maintain the 181 sectoral detail, it has to be assumed that some industries within the same broader categories[23] have similar pattern of compensation of employees.

The share or composition of skill-type estimated in SUSENAS is then used to disaggregate formal compensation of employees in the SAM. The ratio of informal labour to formal labour from SUSENAS is used to take out some imputed labour from gross operating surplus ("residual" non-labour payment). This informal labour is then disaggregated using informal skill-type composition by industry as estimated from SUSENAS. The new non-labour payment is what remains.

## 3.4 Step 3: Disaggregating Household Expenditures and Incomes

Households accounts in the SAM will distinguish urban and rural households each of which comprises 100 households grouped by centile of expenditure per capita. As mentioned in the previous section, unlike the household classification in BPS SAM which classifies households by occupation of household head, an income or expenditure size classification may allow more detail and precise distributional impact of policy analysis. Poverty incidence and Gini coefficient in urban, rural, as well as nation wide, can also be conveniently assessed. For example, Warr (2006) using a Social Accounting Matrix of the Lao economy with the same classification of households as a database in the CGE model calculates the impact of large-scale investment on poverty and inequality.

### 3.4.1 Expenditure

The first task of disaggregation of household expenditure is to reclassify commodity classification in SUSENAS into the classification of the I-O table. In SUSENAS, con-

[20] Median is used instead of mean.
[21] Classification is aggregated into 14 broad sectors.
[22] Based on mapping from BPS (ISIC to I-O classification).
[23] 88 sectoral classification.

sumption expenditure is classified into 339 commodities, while the I-O table only has 181 commodities. They do not coincide. As emphasized by Keuning and de Ruijter (1988), a household survey classification is a typical category of household's wants, while the I-O table (or SAM) classification is more closely linked to the production system. Fortunately, official mapping between those classifications is available from BPS.

However[24], the mapping of this classification is not a simple "*some to one*[25]" mapping. There are a few cases, where one commodity type purchased as final goods by households are considered sales from various industry in I-O classification. The mapping is made slightly more complex. Furniture purchased by household, for example, may come from sale of the leather industry, the wood product industry, or the even metal industry.

Suppose that $x_j^{IO}$ is the target classification of expenditure which is 181 commodities of the I-O table, where $j = 1, \ldots, m$, $m = 181$. From SUSENAS, household expenditure can be defined as $x_i^{SUS}$, where $i = 1, \ldots, n$, $n = 339$, $m < n$. The mapping, then can be represented by the following equation, by which for each of 64,442 households[26], the consumption spending classified by I-O classification can be calculated.

$$x_j^{IO} = \sum_{i=1}^{n} \omega_{ij} \cdot x_i^{SUS} \tag{1}$$

such that,

$$\sum_{j=1}^{m} \omega_{ij} = 1 \tag{2}$$

where $\omega_{ij}$ is the contribution of consumption of good $i$ to the consumption of good $j$ which is the element of a weight matrix $\mathbf{W}_{m \times n}$. This matrix is constructed based on information from the official I-O to SUSENAS commodity mapping. This mapping has been used in the process of the I-O table and the SAM construction by BPS.

### 3.4.2 Income

In the SAM, the household's income source distinguishes labour income (16 classification, i.e., 4 skill-type, 2 urban-rural, 2 formal-informal), non-labour income, transfers from other household, and transfers from other institutions[27]. Disaggregated labour income classification, allows flexibility in the CGE model structure in terms of labour market segmentation. For example, urban unskilled-labour may have a different wage with rural-unskilled labour, because the wages are cleared in a different labour market. This structure is not possible when there is only one aggregated unskilled labour category.

Table 3 shows the source of household income, calculated from the SUSENAS Income

[24]As confirmed during the visit to BPS.
[25]Single I-O commodity mapped to some SUSENAS commodities.
[26]Number of observations in SUSENAS 2002 Consumption Module.
[27]Transfer from other institutions include from government, enterprises, and the Rest of the World.

Table 3: Household Source of Income (pct)

| | Urban | Rural | Total |
|---|---|---|---|
| Salary/Wages | 49.1 | 31.2 | 42.2 |
| Household Business | 32.1 | 53.0 | 40.2 |
| Agriculture | 3.7 | 31.9 | 14.6 |
| Non-agriculture | 28.4 | 21.1 | 25.6 |
| Capital | 9.6 | 7.9 | 8.9 |
| Transfer | 9.2 | 7.9 | 8.7 |
| Total | 100.0 | 100.0 | 100.0 |

Source: SUSENAS 2002 (Income Module)

Module 2002. Again it shows that, if all net revenue from household business is considered to be return to capital (or non-labour), it will under-estimate labour endowment in the economy. The task now, is

1. To disaggregate formal salary/wage into return to 8 classifications of labour. This could be identified, since the data records the occupation or skill-type of every working family member[28].
2. To separate the return to labour and the return to capital from what is recorded as net revenue (production revenue minus cost) of household production/business. The approach is similar to step 2, i.e., wage imputation. Since, individuals whose status is self-employed also record their working-time, the imputed salary, is then calculated as their working time multiplied by the average formal wage for their specific skill type, and their specific sector of employment. The imputed wage, is then subtracted from household business net-revenue, and the residual is defined as part of the return to capital.
3. The imputed labour can also be classified by 8 skill-types.

The result is then estimates of income sources for each household in the survey data, as detailing 16 classifications of labour, non-labour, and transfers. Table 4 shows the sources income category after the imputation of wage from self-employment.

The results quite closely resemble the structure of labour income calculated from the official BPS SAM. However, it should be noted that the official SAM definition of informal labour is a little bit broader than defined here. This paper only recognizes self-employed labour as informal labour, not other unpaid labour. Therefore, the higher share of imputed labour, and lower share of non-labour in the BPS SAM, is expected.

[28]Even to a lot more detailed classification than the broader 4 skills classes.

Table 4: Household Income Source with Imputed Labor

| Income Source | Urban | Rural | Total | BPS SAM |
|---|---|---|---|---|
| labour | 69.12 | 59.68 | 65.44 | 68.47 |
| Formal | 56.43 | 34.44 | 47.85 | 42.19 |
| Agricultural | 2.02 | 9.36 | 4.88 | 4.98 |
| Production/Manual | 19.48 | 12.68 | 16.83 | 15.48 |
| Clerical/Services | 22.20 | 6.43 | 16.05 | 14.47 |
| Professional | 12.73 | 5.97 | 10.09 | 7.26 |
| Imputed | 12.69 | 25.24 | 17.59 | 26.27 |
| Agricultural | 1.31 | 15.48 | 6.84 | 10.29 |
| Production/Manual | 3.81 | 4.35 | 4.02 | 5.49 |
| Clerical/Services | 7.19 | 5.28 | 6.45 | 9.71 |
| Professional | 0.39 | 0.14 | 0.29 | 0.79 |
| Non-labour | 21.39 | 32.22 | 25.62 | 19.94 |
| Transfers | 9.49 | 8.11 | 8.95 | 11.59 |
| Other Household | 5.07 | 5.39 | 5.19 | 5.52 |
| Other transfers | 4.42 | 2.72 | 3.75 | 6.07 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 |

Source: Author's calculation

### 3.4.3 Aggregation and Reconciliation

The next step is to combine or merge household expenditure data, calculated from the SUSENAS Consumption Module, which is already classified by the Input-Output commodity group, with income data, as calculated from the SUSENAS Income Module. Apart from consumption expenditure, transfers to other households, as well as other transfers are also recorded. Saving is calculated as a residual. Since, all accounts in the SAM constructed in step 1 are already balanced (receipts and layouts of every account are equal), it is also important to maintain the balance (expenditure equal income) of households at the micro or household level data.

Ideally when total consumption from the household survey is aggregated, taking into account sampling weight, the aggregate has to be close to the national aggregates. In fact, even in total (not by component of expenditure), this is rarely the case. Aggregate from SUSENAS will fall short of the national account by quite significant factors. For example, Akita et al. (1999) suggest it is reported that there is a wide discrepancy between total household expenditure estimated based on the SUSENAS data and total private consumption expenditure from the national accounts. This problem is typical it is necessary to reconcile both data sources. This is also confirmed by Ravallion (2003), after comparing datasets for 90 countries.

After aggregating by taking into account household sampling weight, the total consumption expenditure calculated from SUSENAS falls short of that from the I-O table by a factor of 2.8. It also shows, that the factor is higher for non-food expenditure, especially luxury goods. A few reasons could account for this discrepancy. These are (1) the SUSENAS and the I-O are recorded for different years, i.e., SUSENAS is for 2002 and the I-O table is for 2003; (2) under-reporting, especially for certain expenditure such as non-necessities; (3) some expenditures in the I-O table are imputed, such that, expenditure items in the I-O do not exist in SUSENAS. In this case, these are expenditure on banking, finance, and trade; (3) sample bias, i.e., the possibility that the sampling does not perfectly represent the population. The under-representation of high income groups is very likely, and could be due to the non-response rate or even the sampling frame itself[29]. Consequently, the household sampling weight used in the aggregation is not accurate; and (4) Mapping error, namely the inaccuracy in the mapping between the household survey commodity classification and the I-O commodity classification.

The discrepancy between data calculated from the household survey with its aggregated counterpart is common and expected in the practice of constructing a Social Accounting Matrix using data from household surveys (Robilliard and Robinson 2003). The same problem also arises in any studies which require reconciliation between data from national accounts and household surveys. As Ravallion (2003) suggests, the relationship between these two datasets is becoming of more considerable interest in the area of applied work to assess the effect of economic growth, or growth promoting policies on the extent of absolute poverty.

Two different routes are common in the reconciliation process. The first is to adjust the household survey data to fit the aggregate or macro SAM. The second is the other way around. In the first method, it is likely the process may change the pattern of expenditure or income at the household level part. In the second method, the process may have implication on the structure of the economy. The decision to follow one, over the other, depends on a judgement as towhich data is more reliable and the implication and complication that may arise in the process. Considering that fitting an already established and official national account data to match the household survey will likely change the economic structure such as standard macroeconomic aggregates like value added (GDP), the approach with the flavour of the first one will be used. The scale factor is calculated by comparing the aggregate expenditure from the Input-Output table, and from the survey data, for every 181 items of consumption[30]. After that, working again with the household survey data, consumption spending by item is re-scaled using the scale factor, but total consumption for every household is controlled to maintain the balance of income and spending.

[29] A few interviews with BPS staffs suggest that this may be the case.

[30] Before this, three commodities have to be imputed to the household survey data since they are not recognized in the survey. They are trade, banking, and finance. For trade, it is imputed using the aggregate share of the I-O table. For Banking and finance it is imputed using the aggregate share but only applied to households that record having any transaction with financial sectors (i.e. saving accounts for banking, and buying and selling financial assets for the finance sector). This will reduce the error of forcing poor households, for example, to have similar patterns of financial dealing to the rich ones. Working at the level of the household survey data makes this kind of adjustment possible.

Aggregation is conducted by assigning to each household, an expenditure per capita class. Every household must belong to one of the 100 centiles of expenditure per capita. The data is then is aggregated, or added-up, taking into account each household sampling weight, producing 100 household groups for each urban and rural area. The income and expenditure of the 200 households is then fitted into the SAM, as explained in the next section (step 4).

### 3.5 Step 4: Final Reconciliation and Balancing

The final process involves some other reconciliation and final adjustment to minor imbalances in the SAM. The final process in disaggregating households account in the SAM is as follows.

1. Total income, which is equal to total expenditure, of the single representative household in the Macro SAM is distributed to the 200 households using the share calculated in step 3. This total will be the control in the later step of splitting this total income/expenditure into its detailed components for each household group.

2. The total income/expenditure of each household group is split into its detailed component using the pattern (share) calculated in step 3. The component of expenditure includes consumption expenditure on 181 commodities, transfers, and saving, whereas the component of income includes labour income (16 classifications), non-labour income, and transfers.

3. Total aggregate consumption expenditure (sum over commodities) in the Macro SAM is used as a control to maintain the value of aggregate consumption expenditure in the component of GDP by expenditure. To do this, every household's components of consumption spending is re-scaled by a single aggregate scaling factor.

4. Each of the 181 items of consumption spending for every household is split into domestic and imported components using the share from the Macro SAM[31].

5. Household saving is re-calculated as residuals by subtracting from total expenditure (as a control), consumption expenditure and other non-consumption spending (non-household transfer, transfer to ROW and direct tax is calculated using the share from the Macro SAM taking into account tax-spending calculated in step 3).

6. Components of household income are calculated using the pattern (share) calculated in step 3. Non-household transfers (transfer from government, enterprises, and ROW are calculated using the share from the Macro SAM.

[31] Here, it is assumed spending on every commodity carries the same import content disregarding who consumes it.

The method of disaggregating households in step 1 to 6, ensures household accounts for each of the 200 households are balanced, i.e., total income is always equal to total spending. However, since other accounts, i.e., commodity account (which shows the amount each commodity is demanded and supplied) and factor account (which shows how much each factor of production is supplied and used by industries) may not be balanced as a consequences of controlling household accounts.

However, the imbalance in the commodity account, is not significant, after the reconciliation in step 3 at the micro level. The standard deviation of the scale factor (ratio of spending in Macro SAM to spending calculated from the household survey data) has been reduced by the reconciliation in step 3 from 12.04 (with the mean of 3.81) to 0.32 (with the mean of 1.04). These minor imbalances will be taken care of at the final stage using the balancing program.

A final reconciliation is carried out for factor accounts and the following pattern found, labour, especially imputed, is more supplied than demanded, while non-labour is more demanded than supplied. It is assumed that for imputed (informal) labour, the imbalance is due to under-record of informal labour (and equivalently over-record of non-labour/capital, since the operating surplus is calculated as residuals) by industry. Therefore the compensation of informal labour costs is scaled-up (with different scale for every skill-type) to match the supply. This is taken out of the operating surplus, hence non-labour compensation is equivalently reduced.

In contrast, for formal labour-compensation, the adjustment is made at the household accounts level. Since (formal) salary and wage are original data from the I-O table, and its record of salary/wage is usually considered more reliable, it is kept intact. It is assumed, households underestimate non-labour income, and the adjustment at the household account is the switch between (formal) labour and non-labour income. At the same time, the imbalance in formal labour and non-labour account is reduced.

To produce an exactly balanced SAM, the SAM is balanced using a program to estimate or balance the Input-Output table or Social Accounting Matrix. In this case, *SAMBAL,* a GEMPACK program, developed by Horridge (2003), is used in the final refinement[32].

# 4 Result and Discussion

This section shows, and briefly comments on the snapshots of the constructed SAM, as well as illustrates examples of how distributional impact analysis made possible by the SAM. Table 5 shows the SAM aggregated into 24 accounts. The industries and commodities are aggregated into 3 sectors, i.e., agriculture and resource (AgRes), manufacturing (Manuf), and services (Service). Households are aggregated into 6 households, 3 urban (25% low, 50% middle, and 25% high expenditure per capita), and 3 rural households.

[32]See Appendix detail.

The structure of industry's costs at the aggregated level is also shown in Figure 1 for the share between labour and capital in value added, Figure 2 for the composition between skilled and unskilled labour, and Figure 3 for the share of formal and informal labour. Some extracts from the SAM of the household accounts are also shown. Figure 4 shows the food expenditure share for several commodities for urban and rural households by centiles. figure 5 shows it for the case of non-food expenditure. Finally, Figure 6 shows the structure of household income for the 200 households.

For example, Figure 1, shows that the mining and petroleum industry and utility sectors are among the capital intensive sectors, while agriculture and services are relatively labour intensive. Ignoring the under-recording of labour in industry cost, such as relying only on the input-output table, shows that food crops sectors will be judged as capital intensive since formal labour only accounts for less than 20% of the total primary factor cost (Figure 3). The same thing apply to services sectors, such as trade and restaurants. Another extract from the SAM (Figure 2) also suggests that almost all compensation of labour in agriculture are for unskilled labour, while in the services sector such as trade, hotel/restaurants, and other services, is for skilled labour. The detail of the composition of factor payments by industry in this SAM, besides giving much more flavour of a realistic factor market in developing countries, also gives more flexibility in the later specification of the factor market in the CGE model.

Figures 4 and figure 5 show the food and non-food expenditure share, respectively, as well as several selected commodities extracted from the social accounting matrix. It shows the expenditure share in the vertical axis and the centile of expenditure per capita on the horizontal axis for both urban and rural households. Total food expenditure shows a clear (non linear) declining pattern, following Engel's law, while non-food expenditure follows the opposite pattern. The highly detailed commodities in this SAM make it possible to show that certain food commodities, such as fruits and meats,may be regarded as luxuries in Indonesia, since their shares are increasing with income.

The detailed classification of commodities in this SAM also allows flexibility in assessing policies which affect specific commodities. It also makes it possoble reduced subsidies with different changes to different types of fuel to assess in greater detail. For example, Figure 5 reveals that share of expenditure on vehicle fuel, such as gasoline and diesel increase toward the richer households. This may indicate reducing fuel subsidy tends to have greater impact on the rich than the poor, *ceteris paribus*.

From Figure 6, the pattern of income sources are informative and intuitive. The labour income share declines for the rich; informality or self-employment is more prevalent in rural than in urban a declining pattern for the rich. The skill-content of labour income is also shown to be highly increasing by income both in urban and rural areas.

Table 5: Aggregated Indonesian SAM 2003 (Rp. Trilion)

| | | Activies | | | Dom Comm. | | | Imp Comm. | | | Factor | | | Tax | Urban HH | | | Rural HH | | | Trans | S-I | Gov't | Ent. | ROW | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | |
| Activities | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AgRes | 1 | | | | 643 | | | | | | | | | | | | | | | | | | | | | 643 |
| Manuf | 2 | | | | | 1,649 | | | | | | | | | | | | | | | | | | | | 1,649 |
| Service | 3 | | | | | | 1,871 | | | | | | | | | | | | | | | | | | | 1,871 |
| Dom. Comm. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AgRes | 4 | 46 | 247 | 69 | | | | | | | | | | | 14 | 41 | 27 | 16 | 40 | 27 | | -5 | | | 123 | 643 |
| Manuf | 5 | 39 | 405 | 288 | | | | | | | | | | | 46 | 130 | 107 | 46 | 123 | 96 | | -20 | | | 389 | 1,649 |
| Service | 6 | 36 | 231 | 428 | | | | | | | | | | | 39 | 159 | 200 | 24 | 76 | 76 | | 323 | 165 | | 116 | 1,871 |
| Imp. Comm. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AgRes | 7 | 9 | 41 | 4 | | | | | | | | | | | 0 | 1 | 1 | 1 | 1 | 1 | | 1 | | | | 60 |
| Manuf | 8 | 8 | 124 | 66 | | | | | | | | | | | 3 | 13 | 21 | 3 | 10 | 16 | | 65 | | | | 329 |
| Service | 9 | 1 | 12 | 55 | | | | | | | | | | | 3 | 12 | 17 | 1 | 5 | 7 | | 1 | 2 | | | 114 |
| Factor | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Skilled | 10 | 14 | 52 | 367 | | | | | | | | | | | | | | | | | | | | | 1 | 434 |
| Unskilled | 11 | 191 | 149 | 129 | | | | | | | | | | | | | | | | | | | | | 0 | 470 |
| Non-labour | 12 | 291 | 340 | 428 | | | | | | | | | | | | | | | | | | | | | 8 | 1,067 |
| Indirect Tax | 13 | 7 | 49 | 38 | | | | 6 | 27 | | | | | | | | | | | | | | | | | 127 |
| Urban HH | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25% low | 14 | | | | | | | | | | 32 | 51 | 32 | | | | | | | | 6 | | 1 | 2 | 0 | 125 |
| 50% mid | 15 | | | | | | | | | | 143 | 118 | 120 | | | | | | | | 20 | | 9 | 10 | 2 | 421 |
| 25% high | 16 | | | | | | | | | | 170 | 64 | 168 | | | | | | | | 27 | | 9 | 10 | 2 | 450 |
| Rural HH | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25% low | 17 | | | | | | | | | | 8 | 51 | 33 | | | | | | | | 5 | | 1 | 1 | 0 | 98 |
| 50% mid | 18 | | | | | | | | | | 33 | 119 | 105 | | | | | | | | 15 | | 3 | 3 | 0 | 278 |
| 25% high | 19 | | | | | | | | | | 47 | 66 | 117 | | | | | | | | 16 | | 4 | 5 | 1 | 257 |
| Transfer | 20 | | | | | | | | | | | | | | 5 | 23 | 34 | 3 | 10 | 15 | | | | | | 90 |
| S-I | 21 | | | | | | | | | | | | | | 13 | 38 | 35 | 4 | 12 | 16 | | | 111 | 210 | | 438 |
| Government | 22 | | | | | | | | | | | | 60 | 127 | 1 | 4 | 8 | 1 | 2 | 3 | | | 48 | 121 | 0 | 374 |
| Enterprises | 23 | | | | | | | | | | | | 364 | | | | | | | | | | | 58 | 8 | 429 |
| ROW | 24 | | | | | | | 55 | 302 | 114 | 1 | | 66 | | 0 | 1 | 1 | 0 | 1 | 1 | | 74 | 21 | 11 | | 648 |
| TOTAL | | 643 | 1,649 | 1,871 | 643 | 1,649 | 1,871 | 60 | 329 | 114 | 434 | 470 | 1,067 | 127 | 125 | 421 | 450 | 98 | 278 | 257 | 90 | 438 | 374 | 429 | 648 | 14,539 |

One of the most important contribution of the SAM constructed in this paper, is the possibility of analyzing distributional impact of certain policies with compensation targetted to certain households, such as the poor. For example, one of the most policy-relevant issue, nowadays, in Indonesia is how to assess the impact of reducing subsidy for various energy but minimizing its distributional impact. Using the SAM with 200 households classified by centile of expenditure per capita, the poor can essentially be identified. Therefore, reducing subsidy can be accompanied by various scheme of compensation, and compare these scenarios to find which policies are the most equitable. Among the possible compensation schemes that can be considered are unconditional cash transfers to the poor, and conditional transfers, such as subsidising the poor's certain expenditures such as education and health. The detailed labor types and sectoral classification also allow comparing some scenarios of indirect mitigation more conveniently. Subsidising industries which employ relatively more factors owned by the poor, such as informal unskilled rural labor, can be exercised.

# 5 Concluding remarks

This paper describes the construction of an Indonesian Social Accounting Matrix, putting more emphasis on distribution across households. It extends the official BPS SAM by having 181 detailed sectoral classifications, 16 labour classifications, and distinguishing 200 households classified by centile of expenditure per capita. This SAM constitutes the biggest and most disaggregated Indonesian SAM at the sectoral and household level ever constructed, hence contributing to the literature on SAM construction especially in developing countries. A SAM is also a basic and necessary element in CGE modelling, and its construction has provided a pathway for later studies to analyze relevant policy issues. In addition, since SAM construction is rarely well-documented, the transparency in the description of this SAM construction, hopefully provides greater replicability for SAM construction in future[33], as well as for other researchers.

Shortcomings in this SAM construction may include possible weak assumptions (or lack, availability and quality of the data used). The variety of different data sources, although collected by the same agency, may have been produced for different purposes and with different methods. Inconsistency among those data sources, are unavoidable. In these situations, definitions, with the assumptions contained, as well as judgments are an inevitable but common practice in the SAM construction. In many parts of the process, art is more dominant than science. This concern is actually one of the motivations for this paper, with the expectation that improvement will be made in the future.

[33]For example, when data source is updated to more recent years.

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# A Appendixes

## A.1 List of Industries/Commodities

Table 6: List of 181 Industries/Commodities

| | | | | | |
|---|---|---|---|---|---|
| 1 | Paddy | 62 | Sugar | 123 | Non-iron metal products |
| 2 | Maize | 63 | Peeled grain | 124 | Kitchen wares, and tools |
| 3 | Cassava | 64 | Chocolate | 125 | Metal furniture |
| 4 | Sweet potatoes | 65 | Milled and peeled coffee | 126 | Structural metal product |
| 5 | Other root crops | 66 | Processed tea | 127 | Other metal products |
| 6 | Groundnut | 67 | Soya bean products | 128 | Prime movers engine |
| 7 | Soybean | 68 | Other foods | 129 | Machinery and apparatus |
| 8 | Other beans | 69 | Animal feed | 130 | Electrical generator, motor |
| 9 | Vegetables | 70 | Alcoholic beverages | 131 | Electrical machinery etc. |
| 10 | Fruits | 71 | Non alcoholic beverage | 132 | Communication apparatus |
| 11 | Cereals and other food crops | 72 | Tobacco products | 133 | Household appliances |
| 12 | Rubber | 73 | Cigarettes | 134 | Other electrical appliances |
| 13 | Sugarcane | 74 | Cleaning kapok | 135 | Battery |
| 14 | Coconut | 75 | Yarn | 136 | Ship and its repair |
| 15 | Oil palm | 76 | Textile | 137 | Train and its repair |
| 16 | Fibre crops | 77 | Textile products | 138 | Motor vehicles (cars) |
| 17 | Tobacco | 78 | Knitting mills | 139 | Motor cycle |
| 18 | Coffee | 79 | Carpet, rope and textile | 140 | Other transport equipment |
| 19 | Tea | 80 | Wearing apparel | 141 | Aircraft and its repair |
| 20 | Clove | 81 | Leather | 142 | Photographic and optical eq. |
| 21 | Cacao | 82 | Leather products | 143 | Jewelry |
| 22 | Cashew fruit | 83 | Footwear | 144 | Musical instruments |
| 23 | Other estate crops | 84 | Sawmill and preserved wood | 145 | Sporting and athletics goods |
| 24 | Other agriculture | 85 | Plywood and the like | 146 | Other manufacturing |
| 25 | Livestock and product | 86 | Wooden building component | 147 | Electricity |
| 26 | Fresh milk | 87 | Wooden furniture | 148 | Gas |
| 27 | Poultry and its product | 88 | Other wood products | 149 | Water supply |
| 28 | Other livestock raising | 89 | Non-plastic plait | 150 | Residential building |
| 29 | Wood | 90 | Pulp | 151 | Construction on agriculture |
| 30 | Other forest product | 91 | Paper and cardboard | 152 | Public work |
| 31 | Sea fish and product | 92 | Paper and cardboard product | 153 | Utility construction |
| 32 | Inland water fish and product | 93 | Printing and publishing | 154 | Other construction |
| 33 | Shrimp | 94 | Basic chemical | 155 | Trade |
| 34 | Agriculture services | 95 | Fertilizer | 156 | Vehicle repairs |
| 35 | Coal | 96 | Pesticides | 157 | Restaurant |
| 36 | Crude oil | 97 | Synthetics resin, plastic etc. | 158 | Hotel |
| 37 | Natural gas and geothermal | 98 | Paints, vernishes etc. | 159 | Railway transport |
| 38 | Tin ore | 99 | Drug and medicine | 160 | Road transport |
| 39 | Nickel ore | 100 | Native medicine | 161 | Sea transport |
| 40 | Bauxite ore | 101 | Soap and cleaning product | 162 | River and lake transport |
| 41 | Copper ore | 102 | Cosmetics | 163 | Air transport |
| 42 | Gold ore | 103 | Other chemicals product | 164 | Services allied to transport |
| 43 | Silver ore | 104 | Gasoline | 165 | Communication services |
| 44 | Ore and sand iron | 105 | Automotive Diesel Oil | 166 | Banking |
| 45 | Other mining | 106 | IDO | 167 | Other financial intermediaries |
| 46 | Non-metal mining | 107 | Kerosene | 168 | Insurance and pension funds |
| 47 | Crude salt | 108 | LPG | 169 | Real estate and dormitory |
| 48 | Quarrying all kinds | 109 | Other fuels | 170 | Business services |
| 49 | Meats | 110 | Liquefied of natural gas | 171 | General government |
| 50 | Processed meat | 111 | Smoked and crumb rubber | 172 | Government education |
| 51 | Dairy products | 112 | Tire | 173 | Government health services |
| 52 | Canned fruits and vegetables | 113 | Other rubber products | 174 | Other government services |
| 53 | Salty fish and dry fish | 114 | Plastics product | 175 | Private education services |
| 54 | Processed and preserve fish | 115 | Ceramic and earthenware | 176 | Private health services |
| 55 | Copra | 116 | Glass product | 177 | Other private services |
| 56 | Animal and vegetable oil | 117 | Clayand ceramic products | 178 | Private motion picture |
| 57 | Rice | 118 | Cement | 179 | Recreations |
| 58 | Wheat flour | 119 | Other non-ferrous products | 180 | Personal and household ser. |
| 59 | Other flour | 120 | Basic iron and steel | 181 | Other goods and services |
| 60 | Bakery products and the like | 121 | Basic iron and steel products | | |
| 61 | Noodle, macaroni, etc. | 122 | Non-ferrous basic metal | | |

## A.2 List of labour Classification

Table 7: List of (official SAM) Labor Classfication

| | Urban/ Rural | Formal/ Imputed | Skill type |
|---|---|---|---|
| 1. | Urban | Formal | Agricultural Workers |
| 2. | Rural | Formal | Agricultural Workers |
| 3. | Urban | Imputed | Agricultural Workers |
| 4. | Rural | Imputed | Agricultural Workers |
| 5. | Urban | Formal | Production, Transport Operator, Manual, and Unskilled Workers |
| 6. | Rural | Formal | Production, Transport Operator, Manual, and Unskilled Workers |
| 7. | Urban | Imputed | Production, Transport Operator, Manual, and Unskilled Workers |
| 8. | Rural | Imputed | Production, Transport Operator, Manual, and Unskilled Workers |
| 9. | Urban | Formal | Clerical, Services workers |
| 10. | Rural | Formal | Clerical, Services workers |
| 11. | Urban | Imputed | Clerical, Services workers |
| 12. | Rural | Imputed | Clerical, Services workers |
| 13. | Urban | Formal | Administrative, Managerial, Professional, and Technician Workers |
| 14. | Rural | Formal | Administrative, Managerial, Professional, and Technician Workers |
| 15. | Urban | Imputed | Administrative, Managerial, Professional, and Technician Workers |
| 16. | Rural | Imputed | Administrative, Managerial, Professional, and Technician Workers |

## A.3 SAM Balancing Program

As described in more detail in Horridge (2003), in the final stage of constructing a SAM, the balance in a SAM $A_{ij}$, is often not satisfied, i.e.,

$$\sum_i A_{iq} \neq \sum_j A_{qj} \tag{A1}$$

or column total $q$ is not equal to row total $q$. Therefore, the problem is to seek to construct a revised SAM $B_{ij}$, which is close to $A_{ij}$, and is balanced,

$$\sum_i B_{iq} = \sum_j B_{qj}. \tag{A2}$$

However, before doing any balancing using this method, a significant imbalance due to a more structural problem has to be resolved first.

The solution to the above problem is to find a scale vector $K$ such that

$$B_{ij} = A_{ij} \frac{K_i}{K_j} \tag{A3}$$

where $K$ satisfies equation A2 above. This is what is implemented by the SAMBAL GEMPACK program, where K can be discovered by direct or iterative methods. This program carry the same principle as in the RAS or Entropy method, and as McDougall (1999) suggests many of those matrix balancing methods are in fact producing more or

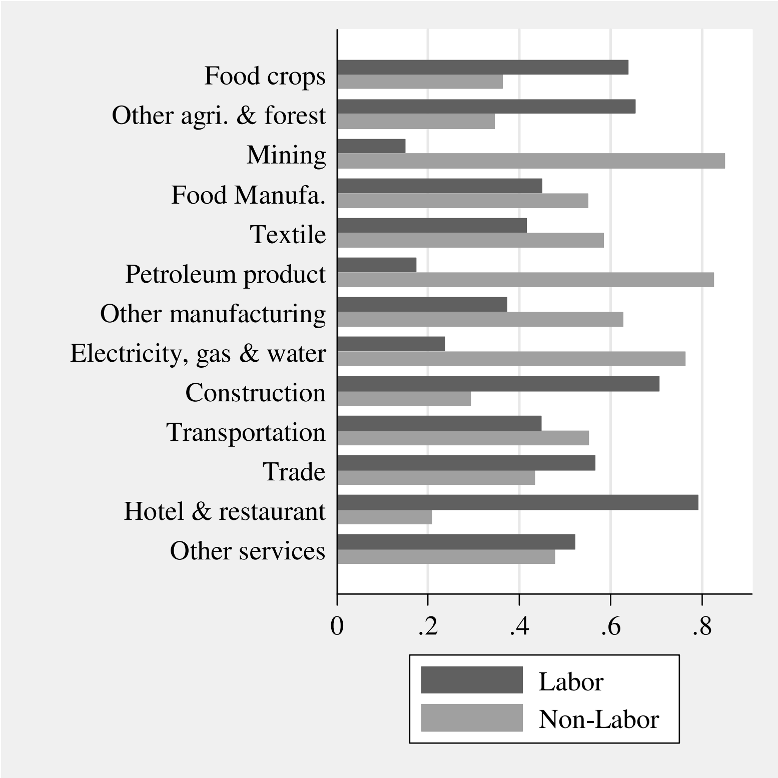


Figure 1: Industry Cost: Labor and Capital

less the same results. The reason to choose one program is simply the familiarity of the software used. In this case, this program is chosen because of the convenience of having the program in the GEMPACK environment.

This program also allows flexibility in fixing certain cells in the SAM in the balancing process. This will be useful when it is certain that some cells are produced by reliable information so that there is no need to change them. In this case of this SAM construction, these are (1) value added or primary factors for every industry, since this will guarantee that GDP will not change at all, (2) cells that involve trade data, i.e., export and import by commodity, and finally (3) indirect taxes, subsidy, and tariffs.

## A.4 Figures

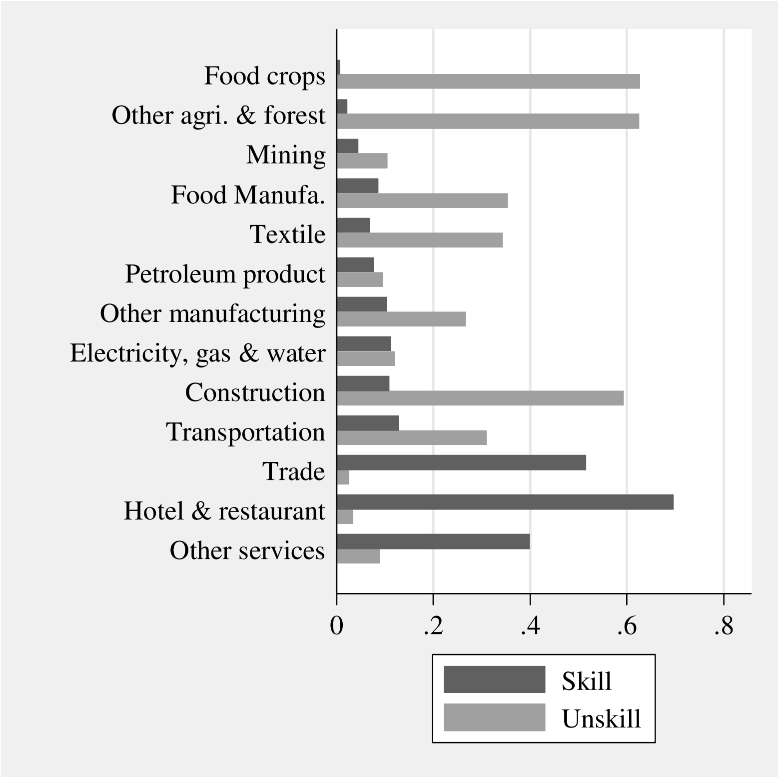


Figure 2: Industry Cost: Skilled and Unskilled Labor

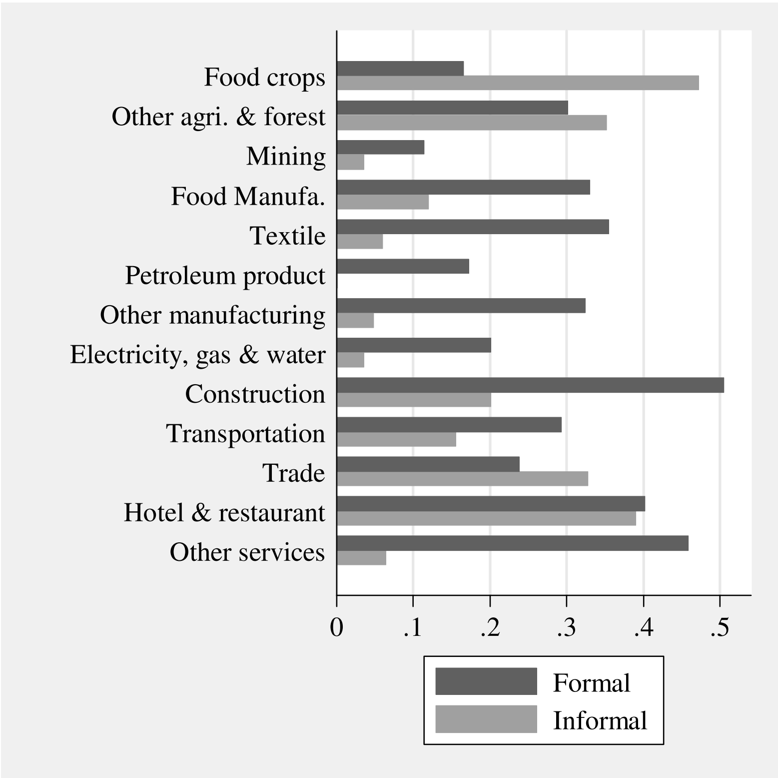


Figure 3: Industry Cost: Formal and Informal Labor

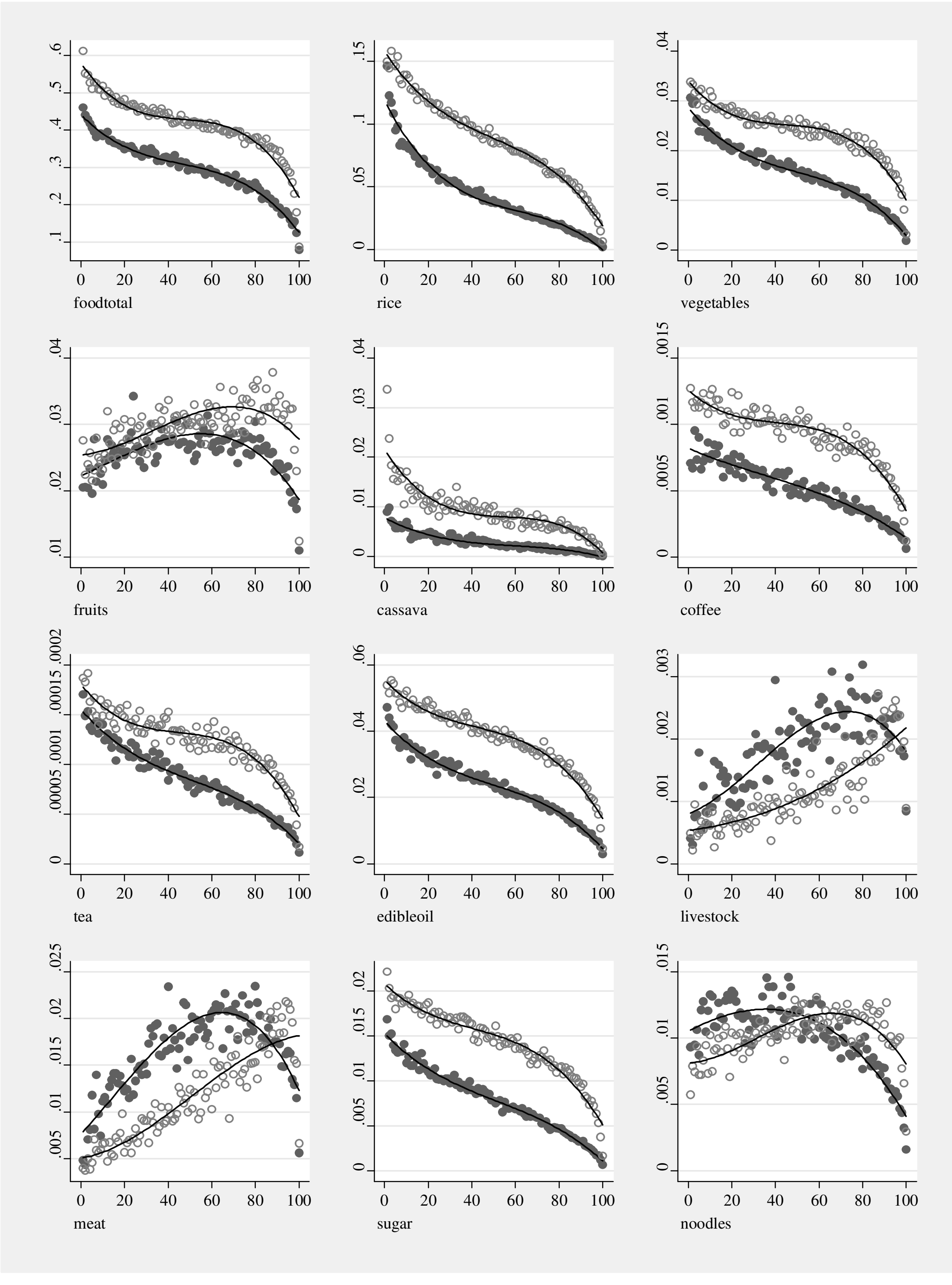


Figure 4: Household's Food Expenditure Share

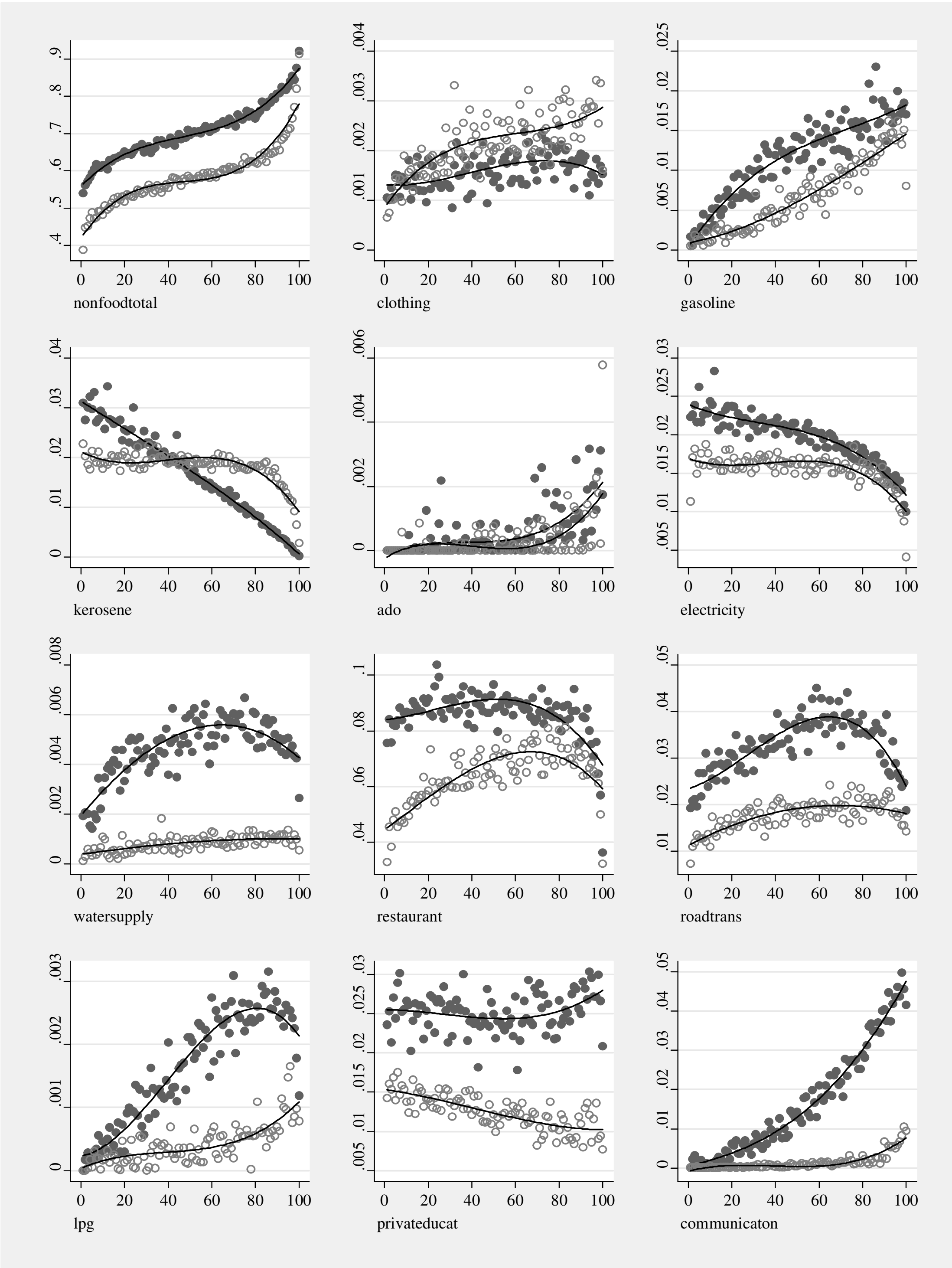


Figure 5: Household's Non-food Expenditure Share

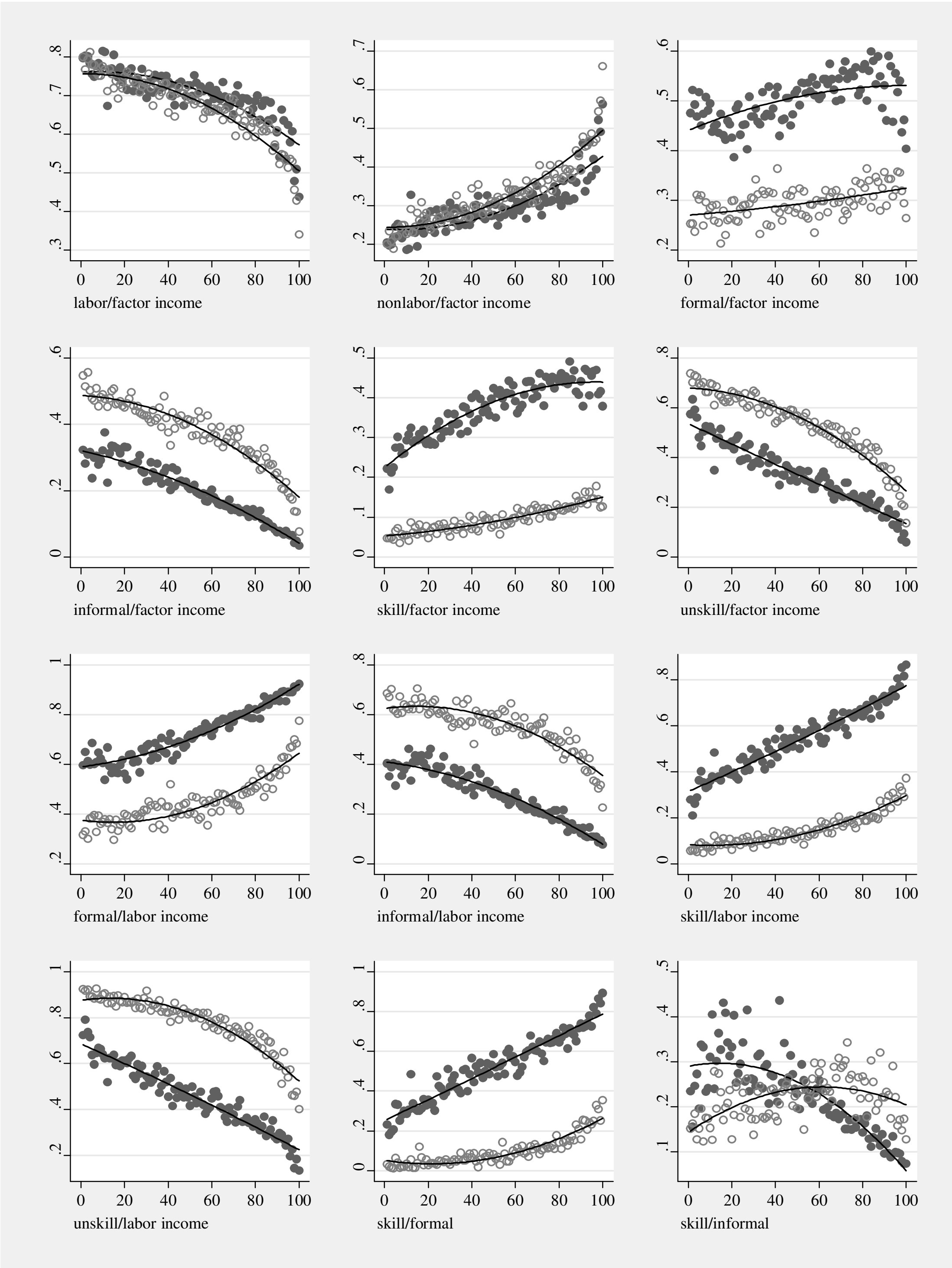


Figure 6: Household's Source of Income