Development of SME-SAM for Analysis of Income Distribution in Malaysia

Chakrin Utit[a], M. Yusof Saari[a,b*], Nor Ezrine Yussoff[c] and M. Khalid Ahmad Kamal[b]

[a]Faculty of Economics and Management, Universiti Putra Malaysia, Malaysia
[b]Institute of Agricultural and Food Policy Studies, Universiti Putra Malaysia, Malaysia
[c]Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA, Malaysia

*Corresponding author: mysaari@gmail.com

Abstract

Small and Medium Enterprises (SMEs) are observed to be an important sources for income generation and employment growth in developing countries. Recent development of inter-industry model for income distribution analysis is unable to deal with dualistic aspects of production structures, distinguishing between SMEs and large sectors. Failing to recognize the dualistic production structures in the inter-industry models implying that homogeneity assumption in the macroeconomic models cannot be avoided. In particular, one might get a false impression that growth in some sectors will "trickle down" equally to benefit all sectors regardless the sizes. This paper aims to develop a unique database so-called Malaysian SME-social accounting matrix (SME-SAM) that captures inter-industry linkages between micro, small, medium and large sectors, and income distribution. In our SME-SAM, a sector is separated into micro, small, medium and large sized sectors. In addition, labor and household are further disaggregated into several income classes by ethnic groups. Database from input-output table, economic census, household income and expenditure survey, and other sources are used to construct the SME-SAM for Malaysia. Based on this unique dataset, results confirm our expectation that each production size exhibits different input structures with respect to income generation and income distribution. Thus, failing to account for heterogeneity of production structures in SAM models may lead to bias in income distribution analysis.

Keywords: Small and medium enterprises (SMEs), social accounting matrix (SAM), income distribution, Malaysia

JEL codes: C67, D30, O21

1. Introduction

A social accounting matrix (SAM) is an extension of input-output table that demonstrates total transactions in an economy as depicted by the circular flow diagram. An input-output table demonstrates interdependence among production sectors in an economy. A SAM does not only provide inter-industry links but also shows the links between production sectors and all institutions in the economy (household, enterprise, government, and the rest of the world). SAM is a useful tool for investigating impacts on household income because it's ability to capture income generation, income distribution and income re-distribution. The construction and application of SAM for income distribution analysis is well documented in the literature (see, for example, Akkemik, 2012; Saari et al., 2015; Morrissey et al., 2019).

In any SAM, disaggregation of factor of production in particular labor is important because it must be able to address income distribution. This is because generation of income from production activities (factor income) accounts for more than two-thirds of household incomes (Saari et al., 2014; Blancas 2006; Tarp et al., 2002). However, the existing SAM literature pays a little attention on the dualistic production structures while analyzing income distribution. Failing to account for the dualistic production structures in the SAM models implying that homogeneity assumption cannot be avoided. If sectors serve different markets, but the production technologies adopted (which include the use of various labor types) are not identical across destinations, serious misrepresentations of reality could occur. In particular, one might get a false impression that development in some sector will "trickle down" equally to benefit all sectors. What is needed is a SAM that is able to account for different production structures in the models.

This paper develops a unique SAM for Malaysia, so-called SME-SAM that separates each production sector into micro, small, medium and large sized sectors. In this SME-SAM, we expands the current 2010 input-output table to include disaggregated information for micro, small, medium and large firms. Although input-output provide the most detailed and comprehensive inter-industry flows, it is often not disaggregated enough for some analyses. This is especially true when policy maker request for the direct and indirect effects of changes in output technology that has been aggregated with other information. As such, further disaggregating the input-output table to provide useful information for policy analysis and implications remains a novelty area of research since disaggregation can be in different forms.

Based on this unique dataset, results confirm our expectation that micro, small, medium and large sized sectors exhibit different production structures with respect to income generation and income distribution. Thus, the most significant implication drawn from this paper is the importance to separate production sectors into sizes for income distribution analysis. Failing to account for heterogeneity of production structures in the SAM models may lead to bias in income distribution analysis.

The remainder of the paper is organized as follows. In the next section, structure of our unique SME-SAM and level of disaggregation for production sectors, factors of production and household are explained. Section 3 discusses the estimation procedures for our SME-SAM along with data requirements. Section 4 discusses results of the analysis and main findings derived from the SME-SAM database. Finally, Section 5 provides summary and concluding remarks.

2. Structure of SME-SAM for Malaysia

A square matrix of accounting structure underlying the aggregative accounts for the Malaysian SAM is presented in Table 1. There are nine accounts are distinguished in the SAM which include (i) production sector, (ii) factor of production, (iii) household, (iv) enterprise (v) government, (vi) consolidated capital, (vii) current and (viii) capital for the rest of the world (RoW), and (ix) indirect tax. Following the conventional approach, each row (*i*) of Table 1 shows incomes in which they are located while expenditure is indicated for the column (*j*). The corresponding row and column totals of the matrix must be equal, indicating total incomes equal total expenditures. This equality consistent with the fundamental law of economics[1] that for every income there is a corresponding expenditure (Pyatt, 1988).

The links between the accounts are provided by the transaction flows in row (*i*) and column (*j*). For example, row (1) and column (1) displays the production incomes (output) and expenditure (input). Row (1) records incomes that production receives from the supply of intermediate input (1,1) and from the supply to final demands—household (1,3), government (1,5), investment (1,6) and exports (1,8). Column (1) demonstrates the detail categories of production inputs or costs of production. Production inputs are taken up in part by purchases of labor and capital or value added (2,1), domestically produced (1,1) and imported (7,1) intermediate inputs and indirect tax on commodities (9,1). These gross production inputs must balance with gross outputs as depicted in the input-output table. Specific the transaction flows for other accounts can be referred to Table 1.

Schematic in Table 1 shows the inter-links between production sectors and all institutions in the economy (household, enterprise, government, capital and the rest of the world). Thus, it is a useful tool to investigate the impact of a change in an exogenous account on all economic sectors and institutions. The SAM serves a dual purpose. Firstly, it should be in a form which is adequate to display existing macroeconomic data according to conventional accounting procedures. Secondly, it extends conventional accounts far beyond this, and embraces classifications which are capable of tracing the essential inter-connections throughout the economic system. Simultaneously with this, the classifications must reflect those areas of particular concern to policy makers in planning to meet their development objectives.

For our case, production, factor of production and household accounts are disaggregated into several classifications. The size of disaggregation for production, factor of production and household accounts are indicated in parenthesis in Table 2. There are 13 sectors that disaggregated into micro, small, medium and large sized, 10 categories of factors of production and 24 groups of households. The rest of the accounts in the SAM are in aggregated form and thus, we combine them all as 'other accounts'.

[1] To be more precise, there are two main characteristics of SAM; (i) a square matrix i.e. identical number of rows and columns; (ii) corresponding row and column totals of the matrix must be equal. The second condition must be equal because, according to fundamental law, for every receipt there must be some matching expenditures that are equal in aggregate to the total income. In other words, the fundamental law of economics is satisfied only if the second condition is satisfied.

Table 1. Schematic SME-SAM for Malaysia, 2010

				Expenditures (*j*)									
				(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
				Production activities	Factor of production	Institutions			Consolidated capital	Rest of the World		Indirect tax	Total
						Household	Enterprise	Government		Current	Capital		
Incomes (*i*)	(1)	Production activities		Intermediate inputs		Private consumption		Government consumption	Investment expenditure ⁑	Exports			Gross output (aggregate demand)
	(2)	Factor of production		Value added payments						Net factorial income			Total factor income
	(3)	Institutions	Household		Compensation of employee and unincorporated business profit		Distributed profit	Pension and periodical payments					Total household income
	(4)		Enterprise		Business corporate profits			current transfer		Non-factor income			Total company incomes
	(5)		Government			Income tax	Corporate tax			Non-factor income		Indirect tax	Total government revenue
	(6)	Consolidated capital				Household savings	Enterprise saving	Government savings		Balance of payment of current account	Investment from abroad		Aggregate saving
	(7)	Rest of the World	Current	Import of intermediate inputs	Net factorial income paid	Private consumption on imported commodities	Non-factor income paid abroad	Government consumption imported commodities	Imports of capital goods	Re-exports			Total imports
	(8)		Capital						Investment to abroad				Total capital paid abroad
	(9)	Indirect tax		Tax on products		Tax on products		Tax on products	Tax on products	Export tax			
Total				Gross input (aggregate supply)	Total factor payments	Total household expenditure	Total company expenditure	Total government expenditure	Aggregate investment	Total exports	Total capital received		

Notes: (⁑) investment expenditures include gross fixed capital formation and change inventory.

Table 2. Structure of SME-SAM for Malaysia, 2010

			Production sectors					Factor of production	Household	Other accounts
			Micro	Small	Medium	Large	Others			
			(13)	(13)	(13)	(13)	(33)	(10)	(24)	(5)
Production	Micro-sized	(13)	$T_{1,1}$	$T_{1,2}$	$T_{1,3}$	$T_{1,4}$	$T_{1,5}$	0	$T_{1,7}$	$T_{1,8}$
	Small-sized	(13)	$T_{2,1}$	$T_{2,2}$	$T_{2,3}$	$T_{2,4}$	$T_{2,5}$	0	$T_{2,7}$	$T_{2,8}$
	Medium-sized	(13)	$T_{3,1}$	$T_{3,2}$	$T_{3,3}$	$T_{3,4}$	$T_{3,5}$	0	$T_{3,7}$	$T_{3,8}$
	Large-sized	(13)	$T_{4,1}$	$T_{4,2}$	$T_{4,3}$	$T_{4,4}$	$T_{4,5}$	0	$T_{4,7}$	$T_{4,8}$
	Others	(33)	$T_{5,1}$	$T_{5,2}$	$T_{5,3}$	$T_{5,4}$	$T_{5,5}$	0	$T_{5,7}$	$T_{5,8}$
Factor of production		(10)	$T_{6,1}$	$T_{6,2}$	$T_{6,3}$	$T_{6,4}$	$T_{6,5}$	0	0	$T_{6,8}$
Households		(24)	0	0	0	0	0	$T_{7,6}$	0	$T_{7,8}$
Other accounts		(5)	$T_{8,1}$	$T_{8,2}$	$T_{8,3}$	$T_{8,4}$	$T_{8,5}$	$T_{8,6}$	$T_{8,7}$	$T_{8,8}$
Total			T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8

Notes: Number in parenthesis indicate size of disaggregation for the corresponding accounts.

Disaggregation of production sectors into micro, small, medium and large sized sectors implies that the available Malaysian input-output table needs to be extended. In the ordinary input-output table that constructed by the Department of Statistics Malaysia, there are 124 sectors have been included. However, the sectors in the ordinary input-output table are not separated between micro, small, medium and large sized. That is, sectors are defined as aggregated "homogenous" sectors—combined micro, small, medium and large sized.

To expand sectors in the input-output table into micro, small, medium and large sized sectors, we extend the work of Utit et la. (2016). Utit et al. (2016) had constructed the so-called IO-TECH, expanding sectors in the ordinary input-output table into small, medium and large sized. In this study, we extend and improve the IO-TECH in two ways: (i) disaggregating sectors into four sizes—micro, small, medium and large sizes (IO-TECH separates small, medium and large sized) and (ii) classifying the micro, small, medium and large sizes according to the latest definition used by the authority (IO-TECH applies old definition). Table 3 shows the classification used in our study.

In our extended input-output table, we split sectors into micro, small, medium and large sized and link them into inter-industry framework. For example, matrix $T_{1,1}$ shows the demand and supply of intermediate inputs among micro sized sectors, matrices $T_{1,2}$, $T_{1,3}$, $T_{1,4}$ and $T_{1,5}$ indicate supplies of intermediate inputs by micro sized to small, medium and large sized sectors.

Table 3. Classification of micro, small, and medium sized firms in Malaysia

Firm sizes	Definition
Manufacturing sector	
Micro	Less than 5 full-time employees/less than RM300,000 annual sales turnover
Small	Between 5 and 75 full-time employees/between RM300,000 and less than RM15 million annual sales turnover
Medium	Between 75 and 200 full-time employees/between RM15 million and RM50 million annual sales turnover
Services and other sectors	
Micro	Less than 5 full-time employees/less than RM300,000 annual sales turnover
Small	Between 5 and 30 full-time employees/between RM300,000 and less than RM3 million annual sales turnover
Medium	Between 30 and 75 full-time employees/between RM3 million and RM20 million annual sales turnover

Source: Department of Statistics Malaysia (2017a)

In our SME-SAM, separation of a sector into micro, small, medium and large sized is available for 93 sectors and detailed below.

i. Manufacturing – 49 sectors
ii. Services – 30 sectors
iii. Agriculture, Fishing and Forestry – 7 sectors
iv. Construction – 4 sectors
v. Mining and Quarrying – 3 sectors

Thus, in total our SME-IO has 372 sectors ($93\ \text{sectors} \times 4\ \text{sizes}$). For our SME-SAM, we need to aggregate these 93 sectors into 13 broad sectors because our household survey data that used to mapping employment with sectors, and mapping consumption of household with sectors, only available at 13 broad sectors. Taking into consideration of this data constraint, our SME-SAM only has 52 sectors with four different sizes ($13\ \text{sectors} \times 4\ \text{sizes}$).

In Table 2, there are 33 sectors named as 'others' because they cannot be disaggregated due to confidentiality of data. Some of these sectors have disaggregated the four sizes but they cannot stand alone because that could be disaggregated into the four different sizes. Number of firms in these sectors are small and according to the confidentiality act that prevented the Department of Statistics, Malaysia from releasing micro data for these sectors.

It is important to note that technologies in input-output can be differentiated according to different production proxies. Technologies can be distinguished by using any or all of a number of criteria. Formally, we may define each element of a technology set T, $\mathrm{T} = (\mathrm{t}_{1,}\mathrm{t}_{2,} \ldots \mathrm{t}_{n)}$ where t_1 = the *i*th characteristic of the technology T. Two technologies T and T′ are distinct when there exist at least t_i and t'_i such that $\mathrm{t}_i \neq \mathrm{t}'_i$.

Among the technological indicators which have been utilized and proposed as admissible by previous studies are capital-labor ratio, output-capital ratio, value added per worker, ratio of skilled-to-unskilled workers, vintage and origin of capital stock, and firm size. Under an ideal

condition, the choice of technological criteria depends entirely upon the data availability and policy interest. As the main concern of our investigation is focused on SMEs, we distinguish dualistic technologies on the basis of firm sizes—small, medium and large firms.

Second disaggregation of our SME-SAM is related to factor of production. Factor of production is split into 10 categories with labors are separated according to nine types and a single category for capital. Disaggregation of labors is crucial for income distribution analysis because compensation of employees contribute large share to the total household income with 65% in 2014 (see Department of Statistics Malaysia, 2017b). The distinction among occupations and education levels proxies for skills explain largely income differences (see, Saari et al., 2014; Pieters 2010). In our case, labors are distinguished into nine occupational categories according to the Malaysia Standard Classification of Occupations (MASCO)—managers; professionals; technicians and associate professionals; clerical support workers; service and sale workers; skilled agricultural, forestry and fishery workers; plant and machine operators and assemblers; craft and related trade workers; and elementary occupations.

Finally, households are disaggregated into 24 groups. First, households are split according to four ethnic groups: Bumiputra, Chinese, Indians, and others (a group of ethnic minorities). Bumiputra is the term used to by the Malaysian government to describe the Malays and other indigenous ethnics. Total Malaysian population in 2015 estimated at 32.4 million and the demographic composition in the country are as follows: 79.9% of the population are Bumiputera (50.8% are the Malays) 22.8% are the Chinese, 7% are the Indians, and 1% are other ethnics (see Department of Statistics Malaysia, 2018). Each ethnic group then is further disaggregated according to six income classes: less than RM1,000; RM1,000-RM1,999; RM2,000-RM2,999; RM3,000-RM3,999; RM4,000-RM4,999; RM5,000 and above. Altogether, 24 (4 × 6) different groups of households are distinguished. Defining households by ethnic groups and income classes is important in the Malaysian context because the current government includes specific attention to these groups.

3. Data Sources and Estimation Procedures

We use a top-down approach in estimating the SME-SAM (see Saari et al., 2014; Reinert and Roland-Holst 1992; Roland-Holst and Sancho 1992; Pyatt and Round 1984). The top-down approach can be thought of as a deductive approach as it starts to building an aggregated SAM (macro SAM) from the controlled totals which compiled from the input-output table and the national account statistics. Then, the macro SAM is used as ‘control values’ when estimating disaggregated SAM accounts (micro SAM). Appendix 1 gives the macro SME-SAM for Malaysia in 2010.

Recall that our SME-SAM details production sectors into four different firm sizes, disaggregates factor of production into 10 categories and split household into 24 groups. The rest of the accounts in the SAM are in aggregated form. A SAM is an extension of an input-output table, thus a good starting point for the estimation is start developing the SME-SAM from input-output table. Not only does the input–output table provide all data for the production account, but it also contains most of the other basic data requirements in the macro SAM. The following sub-sections detail estimation procedures for production, factor of production and household accounts.

3.1 Disaggregation of production sectors

There are three main datasets utilized for the development of extended input-output for accounting different sizes. The first dataset is the latest national input-output table for 2010. Data from the input-output table are used as the control totals in the disaggregation process (see Department of Statistics Malaysia, 2014). This to ensure that the summation of the disaggregated flows for micro, small, medium and large sectors yields the control totals for each of the output, final demand and primary input components. Second dataset is micro data of Economic Census for 2010 that obtained from the Department of Statistics Malaysia. The micro data consist of 300,435 establishments that detailed into relevant indicators for expanding the input-output table such as revenue, expenditure, salary and wages, input expenditures and number of establishments. These datasets provide the basis for the disaggregation of micro, small, medium and large sectors. The third dataset are retrieved from the Profile of Small and Medium Enterprise (see Department of Statistics Malaysia, 2017a). This report presents the detail information for the output and value added generated by the different firm sizes that is compiled based on the Economic Census for 2010.

Before we can proceed with the estimation process, the available micro datasets from the Economic Census and Profile of Small and Medium Enterprise need to be harmonized with the sectoral classifications in the national input-output table. The reason is that the micro-data from the Economic Census are provided in three-digit levels of the Malaysia Standard Industrial Classification (MSIC) 2008, while the 2010 input-output table is classified based on five-digit levels. Thus, some of the sectors need to be aggregated. In addition to the aggregation constraint, the confidentiality policy prevented some of the MSIC that falls under the services sector such as defense and public order cannot be released by the Department of Statistics Malaysia. For this reason, we are not able to disaggregate the sectors into micro, small, medium and large classifications, but instead we classify them as 'others'.

We start the estimation by separating the total output into micro, small and medium sized sectors. The estimation involves two steps. First, output for broad micro, small and medium sized sectors are compiled directly from the Profile of Small and Medium Enterprise. The next step is to disaggregate the broad sectors into individual sub-sectors, using the micro-data of Economic Census. The disaggregation is carried out by taking output data that derived from the micro-data of Economic Census. For large sized sectors, the output is estimated based on the differences between the output from the national input-output table and the estimated output for micro, small and medium sized sectors.

The next step is to disaggregate primary input components (value added, imports and indirect tax) by micro, small, medium and large sized sectors. Procedures for the estimation of value added are similar to the estimation of output. The control totals for broad micro, small and medium sized sectors are taken directly from the Profile of Small and Medium Enterprise. Then, the individual sub-sector within the broad sectors is estimated by taking value added data that obtained from the micro-data of Economic Census. For imports and indirect tax, data are not available in our micro-data of Economic Census. Thus, imports and indirect tax for micro, small and medium sized sectors are estimated by generalizing it from the "average" sector in the national input-output table. For each sector, we calculate the import and indirect tax coefficients, and these coefficients are multiplied with the total output of micro, small and medium sized sectors. This implies that import requirement and indirect tax paid by small and medium sized sectors is determined by the output sizes. Given the estimated for output, value

added, imports and indirect tax for micro, small and medium sized are available, the estimated intermediate inputs can be obtained residually.

Next to the primary inputs, we need to disaggregate final demand components by micro, small, medium and large sized sectors. Data that are needed to estimate output that consumed by final demand components for each size are limited. The only available information is amount of exports by micro, small and medium sized sectors. Given output and intermediate demand are obtained through estimation and exports are available, the domestic final demand is estimated residually.

The final step is to estimate matrix of intermediate deliveries by using the RAS technique. Before this technique can be applied, the initial estimate of the intermediate matrix must be derived. We cannot use the matrix of intermediate deliveries from the national input-output table because it formed only one matrix whereas in our case, the intermediate matrix has 12 sub-matrices (excluding 'others', see Table 2). To derive the initial estimates, we decompose the micro, small, medium, and large sectors using the share of total intermediate demand and intermediate input. For example, sector *i* delivers output to sector *j* as intermediate demand for RM2 million in the national input-output table. To disaggregate sector *j* into micro, small, medium and large sectors, the share of intermediate demand for micro, small, medium and large sectors to the total intermediate demand is used. The similar procedures are applied for the disaggregation of intermediate input into micro, small, medium and large sectors. Using the initial estimates for the intermediate matrix and provided the control totals for the intermediate demand and intermediate input, the nine sub-matrices are adjusted by using the RAS technique.

3.2 Disaggregation of factor of production and household

Household income survey (HIS) and household expenditure survey (HES) are used to estimate detailed accounts for labor in the factor of production and household. Recall that labor in the factor of production is disaggregated into nine categories and household is grouped into 24 types. For labor, the HIS is used to mapping labor income generation from production activities and distribution of income from labor to household groups.

Information contained in HIS also used to estimate transfer incomes which are received by various household groups from enterprise, government and from the rest of the world. Besides providing detail component of incomes from different sources, the HIS also gives valuable information on estimating detail of household expenditures which includes direct and indirect taxes, saving and consumption on imported goods. Consumption on commodities which are domestically produced by different household groups is identified by the HES according to consumption categories.

4. Results and Discussion

This section illustrates the links between four different production sizes and income distribution in the Malaysian economy. The main message that we would like to convey here is the importance to separate production sectors by sizes for income distribution analysis. Results confirm our expectation that different production sizes have different implications of income generation and income distribution. Thus, relying on the 'average' sector in the SAM model for income distribution may lead to serious misrepresentations of reality could occur. To convey our message, we present the results in two ways. First, using an aggregated version

of our SME-SAM, we show the variation in income generation from different production sizes on labors. Second, we discuss the economy-wide multiplier on various household groups that modeled from our SME-SAM database.

Table 4 shows the aggregate production structures of micro, small, medium and large sectors by presenting the percentage share of inputs used in the production. We also include production structure of an average all sectors (obtained from ordinary input-output table) as comparison. Information in Table 4 is derived based on aggregated version of our SME-SAM. There are several interesting features that can be observed from Table 4.

Table 4. Structure of production inputs (%)

Production inputs	**Production sectors**					
	Micro	Small	Medium	Large	Others	Average
Domestic intermediate inputs	**35.5**	**40.9**	**53.4**	**38.6**	**43.6**	**41.8***
Micro-sized	6.26	4.50	2.05	0.89	2.43	-
Small-sized	10.39	11.97	9.63	3.93	6.25	-
Medium-sized	4.16	8.16	14.79	5.42	5.02	-
Large-sized	5.16	10.60	21.60	23.97	11.46	-
Others	9.56	5.65	5.34	4.43	18.40	-
Imported intermediate inputs	**12.22**	**15.62**	**16.53**	**25.58**	**11.57**	**19.55**
Labor income	**16.74**	**13.51**	**9.02**	**8.78**	**22.75**	**12.63**
Managers	3.67	2.96	1.98	1.92	4.97	2.77
Professionals	3.52	2.84	1.90	1.85	3.80	2.46
Technicians and associate professionals	2.32	1.87	1.25	1.22	2.85	1.69
Clerical support workers	1.80	1.46	0.97	0.95	2.45	1.36
Service and sale workers	1.29	1.04	0.69	0.67	1.68	0.96
Skilled agriculture, forestry and fishery workers	0.42	0.34	0.23	0.22	0.56	0.32
Plant and machine operators	1.40	1.13	0.76	0.74	1.98	1.07
Craft and related trade workers	1.34	1.08	0.72	0.70	3.15	1.28
Elementary occupation	0.97	0.79	0.52	0.51	1.32	0.73
Capital income	**35.50**	**29.99**	**21.03**	**27.01**	**22.12**	**25.99**

Notes: (*) intermediate input consumption by 'average' sector cannot be differentiated into sizes because such disaggregation is not available in the ordinary input-output table.

For consumption of intermediate inputs, there are three main findings can be observed. First, the share of consumption on domestic intermediate inputs has increases as the production sizes increases. Specifically, the share of domestic intermediate input consumed by micro, small, and medium sectors is 35.5%, 40.9% and 53.4%. The similar observation holds for the consumption of imported intermediate inputs by these three production sizes. That is, import content increases as production sizes become larger with 12.2% for micro, 15.6% for small and 16.5% for medium.

Second observation shows that large sized sector is more import dependence which explains the relatively lower for the consumption on domestic intermediate inputs. Specifically, large sized sector consumes domestic intermediate inputs lower than small sized sector (38.6% vs. 40.9%) while the large sized sector shows the highest import share by 25.6% compared to micro, small and medium sized sectors.

Third, there is a clear weakest link between the micro, small, medium and large sectors in the production linkages of intermediate inputs. Micro sized sector depends largely input suppliers from small sized (10.4%) and others (9.6%). For small sized sector, it mainly relies on input suppliers among the small (12.0%) and large (10.6%) sized sectors. The medium sized sector also shows the similar pattern as the small sized sector. For large sized sector, it highly dependent on the large sector with 24.0% compared to 10.3% consumption on inputs that supplied by micro, small, and medium. In other words, it exhibits an unbalanced linkages, in which micro, small and medium sized sectors are highly connected to the large sized sector but the large sector less integrated with micro, small and medium sectors.

For income generation that indicated by the labor payment from production sectors, the most striking finding is the shares of labor income decrease as production sizes increase. When production sizes increase from micro-to-small, small-to-medium and medium-to-large, the labor income shares decrease by 3.2%, 4.5% and 0.2%. Results at individual occupational category also show similar observation with different magnitude. Comparing the structure of average sector, it can be seen that the labor income share for micro and small sized is relatively lower while that of medium and large sized sectors is relatively larger than the average sector.

Altogether, results clearly show the variation of production structures revealed by our SME-SAM. The share of intermediate inputs and income generation to the labor by various production sizes is not uniform. For policy analysis, relying on the ordinary input-output table for growth simulations in some sectors and assuming the impacts will "trickle down" equally to benefit all sectors is bias.

Next, we show the variation in income multiplier on various household groups modeled from our SME-SAM database. Appendix 2 gives the technical details of the multiplier methodology. Results of the income multiplier are presented in Table 5. The income multiplier indicates the economy-wide effects on household groups induced by an injection of final demand.

Results in Table 6 show the considerable variations in magnitude of multiplier generated by different production sizes. The magnitude income multiplier generated by micro, small, medium and large sized sectors is not similar to the average sector. The capacity of micro and small sized sectors to generate income is relatively higher than the average sector while medium and large sized sectors show relatively lower. Among the sectors, the most egalitarian sector is the micro sized sector, one *Ringgit* increases in final demand potentially generates RM0.359 to the total household income compared to small, medium and large sized sectors that generate RM0.321, RM0.286 and RM0.242.

5. Concluding Remarks

This paper confirms our expectation that homogeneity assumption that embodied in the production structures of SAM models may lead to bias in income distribution analysis. We have shown in this study that each production size exhibits different input structures with respect to income generation and income distribution. For example, the magnitude of income multiplier generated by micro, small, medium and large sized sectors is not similar to the average sector with the micro sized sector is the most egalitarian sector. Results of the analysis are derived from our unique and novel SAM for Malaysia, so-called SME-SAM that separates each production sector into micro, small, medium and large sized sectors. In this SME-SAM,

we expands the current 2010 input-output table to include disaggregated information for micro, small, medium and large firms.

It is also important to note that our SME-SAM is developed based on the available dataset and it may not give a perfect measure due to data limitations. For example, although our HIS is used to mapping labor income from production sectors, it does not differentiate sectors into various sizes. As alternative to this constraint, we use proportionality assumption to split labor income received from various production sizes by using aggregated sectoral compensation of employees. For future, this limitation needs to be addressed by requesting actual data from the respective authority in Malaysia.

Table 5. Household income multiplier generated from injection of final demand

Household groups	Micro	Small	Medium	Large	Average
Bumiputera					
Less than RM1000	0.005	0.004	0.004	0.003	0.004
RM1000-RM1999	0.008	0.007	0.006	0.005	0.007
RM2000-RM2999	0.010	0.009	0.008	0.007	0.009
RM3000-RM3999	0.013	0.012	0.010	0.009	0.011
RM4000-RM4999	0.014	0.013	0.011	0.010	0.012
RM5000 and over	0.028	0.025	0.022	0.019	0.023
Sub-total	**0.078**	**0.070**	**0.062**	**0.053**	**0.065**
Chinese					
Less than RM1000	0.004	0.003	0.003	0.003	0.003
RM1000-RM1999	0.009	0.008	0.007	0.006	0.008
RM2000-RM2999	0.014	0.013	0.011	0.009	0.012
RM3000-RM3999	0.018	0.016	0.014	0.012	0.015
RM4000-RM4999	0.021	0.019	0.017	0.014	0.018
RM5000 and over	0.042	0.038	0.033	0.029	0.035
Sub-total	**0.109**	**0.097**	**0.086**	**0.073**	**0.091**
Indians					
Less than RM1000	0.004	0.004	0.004	0.003	0.004
RM1000-RM1999	0.009	0.008	0.007	0.006	0.008
RM2000-RM2999	0.010	0.009	0.008	0.007	0.008
RM3000-RM3999	0.014	0.013	0.011	0.010	0.012
RM4000-RM4999	0.017	0.016	0.014	0.012	0.015
RM5000 and over	0.037	0.033	0.030	0.025	0.031
Sub-total	**0.093**	**0.083**	**0.074**	**0.063**	**0.078**
Others					
Less than RM1000	0.002	0.001	0.001	0.001	0.001
RM1000-RM1999	0.004	0.003	0.003	0.002	0.003
RM2000-RM2999	0.022	0.020	0.018	0.015	0.018
RM3000-RM3999	0.007	0.007	0.006	0.005	0.006
RM4000-RM4999	0.011	0.009	0.008	0.007	0.009
RM5000 and over	0.034	0.031	0.027	0.023	0.029
Sub-total	**0.080**	**0.071**	**0.063**	**0.054**	**0.066**
Total	**0.359**	**0.321**	**0.286**	**0.242**	**0.300**

References

Akkemik, K.A. (2012). Assessing the importance of international tourism for the Turkish economy: a social accounting matrix analysis. *Tourism Management*, 33, 790-801.

Blancas, A. (2006). Interinstitutional linkage analysis: a social accounting matrix multiplier approach for the Mexican economy. *Economic Systems Research*, 18, 29-59.

Department of Statistics Malaysia (2014). *Input-output tables Malaysia 2010*. Putrajaya: Department of Statistics Malaysia.

Department of Statistics Malaysia (2016). *Labor force survey report*. Putrajaya: Department of Statistics Malaysia.

Department of Statistics Malaysia (2017a). *Profile of small and medium enterprises*. Putrajaya: Department of Statistics Malaysia.

Department of Statistics Malaysia (2017b). *Household income and basic amenities survey report*. Putrajaya: Department of Statistics Malaysia.

Department of Statistics Malaysia (2018). *Current population estimates Malaysia 2018*. Putrajaya: Department of Statistics Malaysia.

Morrissey, K., Burthoo-Barah, S.B., Dawoonauth, M. and Scandizzo, P.L. (2019). Exploring the distributional impact of investment in the port sector on households in Mauritius: a social accounting matrix approach. *Marine Policy*, 99, 324-333.

Pieters, J. (2010). Growth and inequality in India: analysis of an extended social accounting matrix. *World Development*, 38, 270-281.

Pyatt, G. (1988). A SAM approach to modeling. *Journal of Policy Modeling*, 10, 327-352.

Pyatt, G. and Round, J.I. (1984). *Improving the macroeconomic data base: a SAM for Malaysia, 1970*. World Bank: Washington D.C.

Reinert, K.A. and Roland-Holst, D. (1992). A detailed social accounting matrix for the USA, 1988. *Economic Systems Research*, 4, 173-187.

Roland-Holst, D. and Sancho, F. (1992). Relative income determination in the United States: a social accounting perspective. *Review of Income and Wealth*, 38, 311-327.

Round, J.I. (2003). Constructing SAMs for development policy analysis: lessons learned and challenges ahead. *Economic Systems Research*, 15, 161-83.

Saari, M.Y. Dietzenbacher, E. and Los, B. (2014). Income distribution across ethnic groups in Malaysia: results from a new social accounting matrix. *Asian Economic Journal*, 28, 259-278.

Saari, M.Y. Dietzenbacher, E. and Los, B. (2015). Sources of income growth and inequality across ethnic groups in Malaysia 1970-2000. *World Development*, 76, 311-328.

Tarp, F., Roland-Holst, D. and Rand, J. (2002). Trade and income growth in Vietnam: estimates from a new social accounting matrix. *Economic Systems Research*, 14, 157-84.

Utit, C., Saari, M.Y., Hamid, N.A. and Maji, K.I. (2016). *Exploring drivers for small and medium-sized sectors using a new macroeconomic model*. Paper presented in the 24th International Input-Output Conference, Seoul, Korea.

Appendix 1. Macro SAM for Malaysia, 2010 (RM billion)

			1	2	3	4	5	6	7	8	9	
			Production activity	Factor of production	Institution			Consolidated capital	Rest of the World (RoW)		Indirect tax	Total
					Household	Enterprise	Government		Current	Capital		
1	Production activity		862.2		356.6		101.4	109.5	644.5			2,074.2
2	Factor of production		796.1						38.3			834.4
3	Institution	Household		308.8		2.8	135.7					447.3
4		Enterprise		460.8			9.1		3.2			473.1
5		Government			17.8	61.2			0.3		32.6	111.9
6	Consolidated capital				7.4	268.4	-139.4		60.0	0.1		196.5
7	RoW	Current	403.1	64.8	56.1	140.6	5.2	82.0	35.7			787.5
8		Capital						0.1				0.1
9	Indirect tax		12.8		9.4			4.9	5.5			32.6
Total			2,074.2	834.4	447.3	473.1	111.9	196.5	787.5	0.1	32.6	

Appendix 2. Methodology for SME-SAM multiplier

In modelling multiplier, accounts in the SME-SAM need to be assigned into endogenous and exogenous accounts. For our model, we define the first three accounts (production P, factor of production F, household and enterprise H) as endogenous and the remaining four accounts (government, consolidated capital, current and capital for RoW) as exogenous.[2] Using Table 2, it follows that

$$\begin{bmatrix}\mathbf{y}_P\\ \mathbf{y}_F\\ \mathbf{y}_H\end{bmatrix}=\begin{bmatrix}\mathbf{A}_{PP} & 0 & \mathbf{A}_{PH}\\ \mathbf{A}_{FP} & 0 & 0\\ 0 & \mathbf{A}_{HF} & \mathbf{A}_{HH}\end{bmatrix}\begin{bmatrix}\mathbf{y}_P\\ \mathbf{y}_F\\ \mathbf{y}_H\end{bmatrix}+\begin{bmatrix}\mathbf{x}_P\\ \mathbf{x}_F\\ \mathbf{x}_H\end{bmatrix} \quad (1)$$

where the matrices $\mathbf{A}_{ij}=\mathbf{T}_{ij}\hat{\mathbf{y}}_j^{-1}$ (i, j = P, F, H) give the average expenditure propensities for the endogenous accounts. That is, the average share of the income in account *j* that goes to account *i*. The model in (1) can also be written as

$$\mathbf{y}=\mathbf{B}\mathbf{y}+\mathbf{x} \quad (2)$$

which is the standard SAM model, with $\mathbf{y}$ denoting the vector of incomes for the endogenous accounts ($\mathbf{y}_P$= gross output of the production sectors; $\mathbf{y}_F$= factor incomes; $\mathbf{y}_H$= incomes of household and enterprise), $\mathbf{B}$ the square matrix with average expenditure propensities for the endogenous accounts, and $\mathbf{x}$ the vector of exogenous expenditures or incomes.

In (2), $\mathbf{B}$ is a 120×120 matrix that consists of the following submatrices: $\mathbf{A}_{PP}$ the 85×85 matrix with the intermediate input coefficients (reflecting the interdependencies between production sectors); $\mathbf{A}_{FP}$ the 10×85 matrix with value added (factor) coefficients; $\mathbf{A}_{HF}$ the 24×10 matrix with income coefficients; $\mathbf{A}_{PH}$ the 85×24 matrix with the coefficients of domestic consumption by households and enterprises (where the domestic consumption of companies is zero); and $\mathbf{A}_{HH}$ the 24×24 matrix representing the coefficients for re-distribution between households and enterprises (in our case the companies' profits that flow to each of the nine household groups). For the vector of exogenous components ($\mathbf{x}$), $\mathbf{x}_P$ corresponds to final demands for industries' production (government consumption, investments, and exports), $\mathbf{x}_F$ relates to factor incomes from abroad, and $\mathbf{x}_H$ stands for institutional income transfers (domestic and foreign) for households and enterprises.

In this model formulation, prices are assumed to be fixed and changes in the exogenous components lead to changes in the quantity levels. To keep the prices fixed, two additional assumptions are applied. First, there is excess supply of labor and other resources. Consequently, supply of production factors (including labor from the various ethnic groups in both rural and urban regions) is sufficiently elastic to accommodate increases in demand without upward effects on factor prices.[3] Second, the average expenditure propensities for the endogenous accounts ($\mathbf{A}_{PP}$, $\mathbf{A}_{FP}$, $\mathbf{A}_{HF}$ and $\mathbf{A}_{HH}$) are assumed to be fixed.

Equation (2) is solved as

$$\mathbf{y}=\mathbf{M}\mathbf{x} \quad (3)$$

[2] See Pyatt (2001) for useful comments on the choice of endogenous and exogenous accounts.

[3] This seems to be a reasonable assumption, given that the overall labor participation in Malaysia in 2015 68%, with 81% for male and 54% for female workers (see Department of Statistics Malaysia, 2016).

where $\mathbf{M} \equiv (\mathbf{I} - \mathbf{B})^{-1}$is the inverse matrix with SAM multipliers. The multipliers indicate the economy-wide effects on all endogenous accounts induced by an injection of any exogenous account.