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Sources of Income Growth and Inequality Across Ethnic Groups in Malaysia, 1970–2000

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Summary. — This paper examines the sources of income growth for major ethnic groups in Malaysia. An input–output structural decomposition analysis is extended and applied to the social accounting matrices of 1970 and 2000. The results indicate that the expansion of exports and the changes in the compensation of labor and capital inputs are the main determinants for the income changes. The effects differ largely between rural and urban areas, between skilled and unskilled workers, and between the major ethnic groups. The combination of these two determinants, however, is a dominant factor in explaining the increase in income inequality in Malaysia.

Key words — income distribution, social accounting matrix (SAM), structural decomposition analysis, ethnic groups

1. INTRODUCTION

The implications of economic growth on income inequality in developing countries are often measured at the national level. Such aggregate measures obviously hide many details of inequality, for example differences across various ethnic groups. Income inequality is a major concern in particular for multiracial countries because ethnically more homogenous populations tend to have more equal income distributions (see Alesina & Glaeser, 2004). For that reason, there has been growing research interest in measuring the relationship between economic growth and ethnic diversity (see for example, Agostini, Brown, & Roman, 2010; Gören, 2014; Iniguez-Montiel, 2014). This is supported by the growing body of economic literature that finds that ethnic heterogeneity induces social conflicts and violence, which in turn, affects economic growth (see for example, Easterly & Levine, 1997; Mauro, 1995; Montalvo & Reynal-Querol, 2005). The negative consequences of ethnic diversity imply that adequate policies are required to ensure that the benefits of economic growth are equally shared among all ethnic groups. This paper examines the contribution of economic growth and structural changes during 1970–2000 to income growth for all ethnic groups in Malaysia, which in turn, has implications for income inequality. [1]

Malaysia has been chosen for three main reasons. First, the bloody ethnic riots in May 1969 highlighted the dangers that can arise in a multiracial society when ethnic prejudices are exacerbated by income disparities (see Faaland, Parkinson, & Saniman, 2003; Heng, 1997; Shari, 2000). In the post-independence period (1957–1969) little has been done to redistribute wealth toward the poor, despite respectable economic growth. In 1970, per capita income of the Chinese and Indians were 129% and 76% higher than those of the Malays. Another aspect that contributed to the ethnic unrests was that the economic activities were run mostly by the non-Malays whereas political decision making was dominated by the Malays. As a result of the ethnic riots on May 13, 1969, growth policies have been shifted from strategies with an emphasis purely on economic growth toward policies that aimed at combining growth with reducing income inequality between ethnic groups. This policy shift was formalized in the New Economic Policies (NEP) for the period 1971–1990 (see Economic Planning Unit, various years). Although economic growth is satisfactory, the income gaps remain large—in 2005, per capita income for the ethnic Chinese and Indians were 64% and 27% higher than for the ethnic Malays.

Second, Malaysia's income distribution is very different from that of other developing economies, such as Vietnam (see van de Walle & Gunewardena, 2001) and Chile (see Agostini *et al.*, 2010). In these countries, ethnic minorities earn the lower incomes whereas in Malaysia it is the ethnic majority that earns the low incomes. Third, an analysis that encompasses many intertwined mechanisms that are relevant to study the links between growth and income inequality requires a detailed dataset. Malaysia has a rich dataset with household-based surveys that include information on ethnic groups across geographical locations. These surveys were essential in constructing the social accounting matrix (SAM) on which the empirical work in this paper is based.

The changes in household incomes during 1970–2000 are disentangled into their underlying determinants, using a so-called structural decomposition analysis (SDA, see e.g., Dietzenbacher & Los, 1998). Traditionally, SDA has been developed for applications based on input–output tables. Because such tables focus primarily on analyses related to production, they do not cover all relevant aspects related to income distribution. A SAM, however, does include socio-economic information. We therefore apply SDA to SAMs, which requires a non-trivial extension of the methodology and which—to our knowledge—is novel. One interesting aspect of the application is that it integrates into a single decomposition the primary effects of income generation

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(through the production structure and demand) and the secondary effects of income re-distribution (e.g., through institutional transfers). Two SAMs are available for Malaysia (for 1970 and 2000) and both include detailed information on ethnic groups. The results in this paper thus aim at providing insights into the causes of the changes in income in general and its distribution across ethnic groups in particular after three decades of policy reforms. Although decompositions of income changes at an aggregate level have been conducted (see, e.g., Oosterhaven & Hoen, 1998; Oosterhaven & van der Linden, 1997) we are not aware of any attempts at decomposing income changes at the level of disaggregated household groups.

The remainder of this paper is organized as follows. The next section briefly reviews the economic policies that were implemented during 1970–2000, and links them to income growth and its distribution over ethnic groups. Section 3 briefly explains the general structures of the SAMs for 1970 and 2000 that are used for the decomposition analyses. Section 4 discusses the technical details of our decomposition analyses that are applied to the SAMs and Section 5 presents the results. Finally, Section 6 summarizes and draws conclusions.

2. ECONOMIC GROWTH AND INCOME INEQUALITY, 1970–2000

During the British colonial period (1786–1957), Malaysia was characterized by a dual economic system. Two coexisting modes of production can be distinguished. The first mode was found—in particular—in tin mining and on rubber plantations. It relates to activities that were executed at a large scale and used modern technologies. These economic activities were concentrated in west Malaysia where most of the tin deposits and suitable land for rubber cultivation were found. The profits obtained from exports were relatively high for these commodities (when compared to other commodities). The second mode of production was peasant agriculture (mainly paddy farming, coconut farming, coffee farming, and inshore fishing) based on traditional methods. Products from these activities were locally consumed and were not intended for sale in the international market. These activities very much reflect the way of life in what is called "the Malay belt".

While the commercial and industrial sectors with modern modes of production expanded and increasingly clustered in the urban areas, the traditional sectors faced stagnation or they even deteriorated. Due to population growth, the pressure on land worsened the situation over time in traditional agricultural sectors. In contrast, increasingly sophisticated technologies were introduced in the modern sectors. Thus, differences in productivity, income, and ultimately wealth of those engaged in the two sectors increased. Since the employment structure was largely determined by ethnicity, the current concerns about inequality between ethnic groups dates back to periods long before Malaysian independence. Under the British colonial labor policy of "divide and rule", the Chinese and Indians were segregated from each other and from the Malays by economic activity and geographical location. Over generations, the Chinese and Indians who had migrated to Malaysia to work in the tin mines and on the rubber plantations owned by the British, had been allowed to gradually venture into modern commercial and industrial activities (which were essentially located in urban areas), whereas the Malays were mainly engaged in traditional activities such as peasant agriculture and fishing (mainly in rural areas). The Malays were only allowed by the British to be involved in modern economic activities as civil servants, i.e., in the police and the military forces (for more information see Faaland *et al.*, 2003).

Although the economic expansion during the post-independence period (i.e., 1957–1969) was respectable, it failed to make a substantial contribution toward reducing the differences in economic welfare between the Malays (the largest group that is the poorest on average), the Chinese, and the Indians. In particular two features were characteristic for this period. First, the economic policy in the post-independence period continued to be one of *laisser-faire*, just as it had been before the independence. There was little attempt to re-distribute wealth toward the economically dispossessed. Second, although the political power was dominated by the Malays, the economic activities were run mostly by the non-Malays. For all ethnic groups, this led to the question whether their interests were sufficiently safeguarded in Malaysia. The disenchantment that had been growing among all segments of the population ultimately erupted in the bloody ethnic riots in May 1969. As a result, economic policies shifted from a planning that entirely focused on growth, toward policies that focused on growth combined with a more equal income distribution. This policy shift was formalized in the New Economic Policies (NEP) for the period 1971–1990 (see, Economic Planning Unit, various years).

The objectives of the NEP were: (i) to eradicate poverty (irrespective of ethnic groups) and (ii) to restructure the society, attempting to eliminate the identification of ethnic groups by economic function (i.e., the former labor policy of "divide and rule"). For the first objective, the overall development strategy was reformulated by emphasizing export-oriented industrialization and setting up ambitious rural and urban development programs. Development programs were focused primarily at increasing participation and involvement of disadvantaged households in economic activities. Land development and *in situ* agriculture were the main strategies next to the absorption of the rapidly growing rural labor force into higher income jobs in the industrial and services sectors. Additional support in the form of replanting grants, the provision of subsidized inputs to various agricultural activities and the use of special agencies to assist in marketing was provided to stimulate income growth in rural areas. For the urban poor, low-cost housing projects and programs to assist urban petty trade (e.g., the acquisition of stalls and equipment) were set up.

For the second objective, long-term targets were established to (a) increase the Malays ownership of shares in limited companies, and (b) increase the proportion of Malays at managerial positions. The strategies that were formulated to pursue (a) included the promotion of Malays participation in business by providing them privileged access to the private sector (e.g., through the introduction of a quota system). An expansion of the public sector (where the Malays held most of the key positions) was the main strategy to pursue (b). Also the Industrial Coordination Act (ICA) was introduced to strengthen participation of the Malays in medium- and large-scale enterprises by requiring that the composition of employees reflected the composition of ethnic groups in society.

The implications of the NEP policies on economic growth are presented in Table 1. We observe that during the period of NEP, the economy expanded at an average rate of 12% per year (in current prices). Given an average inflation rate of somewhat more than 4% per year, the real growth would amount to approximately 8%, which is still considerable. The rapid growth during this period was accompanied by a substantial transformation of the economic structure from

Table 1. *Value-added growth and percentage share by sector, 1970–2000*

	Selected periods			
A. Average annual growth rates (%)				
	1965–1970	*1970–1990*	*1990–2000*	*1970–2000*
Agriculture	6.85	8.13	5.25	7.16
Mining and quarrying	1.07	15.59	10.28	13.79
Manufacturing	9.91	15.38	14.52	15.09
Construction	4.11	12.08	11.57	11.91
Services	4.36	12.60	11.61	12.27
Private services	3.94	13.06	12.50	12.88
Public services	5.18	11.06	7.31	9.80
Total	5.51	12.32	11.50	12.04
B. Percentage shares (%)				
	1965	*1970*	*1990*	*2000*
Agriculture	31.53	32.03	14.97	8.41
Mining and quarrying	8.96	6.56	11.66	10.44
Manufacturing	10.41	13.92	23.84	31.14
Construction	4.11	4.01	3.84	3.87
Services	44.99	43.48	45.69	46.14
Private services	39.38	32.38	36.46	39.86
Public services	6.17	11.1	9.21	6.28

Sources: Department of Statistics Malaysia (2004, 2006) and Economic Planning Unit (various years).
Notes: Based on value-added data in current prices.

an agricultural basis (reducing its share from 32% in 1970 to 15% in 1990) to an industrial basis (of manufacturing, and mining and quarrying, increasing its share from 20% in 1970 to 36% in 1990). The expansion of the manufacturing sector is strongly accompanied by an outward policy orientation, i.e., by export-led growth. The contribution of manufacturing to total exports increased rapidly from 12% in 1970 to 85% in 1990 (Zakariah & Ahmad, 1999). Especially in the early 1970s and 1980s, the export growth was largely due to resource-based products such as petroleum products, processed foods, and chemical products (these three groups of products accounted for 77% of total resource-based exports in 1985). [2]

This export-led growth has led to considerable employment growth. Total employment increased at an average rate of 3.6% per year during 1970–90, whereas population growth was only 2.6%. The share of manufacturing in total labor employment increased from 14% in the mid-1970s to over 26% in the mid-1990s (Athukorala & Menon, 2002). Malay employment benefitted from an expansion of the public sector (as shown in Table 1, its growth rate during 1970–90 was comparable to that of the other sectors). For all Malay workers, the share that is employed in the public sector increased in this period from 15% to 28%, whereas the share of Chinese workers in the public sector only increased by 1 percentage-point (from 7% to 8%) and that of Indian workers remained unchanged at 17% (see Appendix A).

Next, we link the changes in economic structure during the period of NEP to the income inequality between ethnic groups. Panel A of Table 2 displays per capita income along with income and population growth for periods 1970, 1990, and 2000. In 1970, per capita income of the Malays was the lowest among the three major ethnic groups with per capita income of Chinese and Indians 79% and 41% higher than that of Malays. Compared with 1970, inequality in per capita income in 1990 further widened by 8% between the Malays and Chinese and improved by 12% between the Malays and Indians. It follows from the growth rates in row 4 that income increased for all ethnic groups in the period 1970–90, income of the Malays expanded 12% and 35% more than the income of the Chinese and Indians. This implies that the structural economic transformation in the NEP period had a significant improvement in stimulating income growth of the poorest ethnic group. However, the differences in the population growth among ethnic groups lead to the variation in per capita income inequality. It follows from row 5 that during 1970–90 the Malay population growth was 49% and 75% higher than the Chinese and Indian population growth. This explains, for example, why the per capita income of the Chinese increased more than that of the Malays.

During the period of 1991–2000, the economy was driven by the National Development Policy (NDP). In contrast to the NEP where the public sector was actively engaged in economic activities mainly through public sector investments in a large number of public enterprises, the NDP sought to maximize economic growth through a policy that allowed for free play of market mechanisms and active participation of private sectors (see Economic Planning Unit, various years). The main thrust of the NDP was to emphasize sustaining economic progress in order to achieve the status of a fully developed nation by 2020 as envisaged in the long-term plan *Vision 2020*. To achieve this target, private sectors played an important role in improving efficiency and productivity, and reliance on the public sector was decreased. Also the size of the public sector has been reduced by privatizing public agencies. This was done to accelerate economic growth and to reduce the financial and administrative burden of the public sector. In addition, the Promotion Investment Act was introduced in the late 1980s in order to attract more foreign capital inflows and provided more generous incentives to foreign investors. These market-oriented policy reforms were accompanied by a strong focus on maintaining macro-economic stability and meeting the infrastructure needs for a rapidly expanding economy.

The approach that the government had adopted—in the period 1970–90—toward income distribution was also further liberalized, especially the policies related to the Malays. The support now came in the form of assistance to the Malays in their competition with other ethnic groups, without making them rely too much on the government. The government thus relaxed regulations on foreign equity participation in the nation and liberalized parts of the ICA. For example, the requirement for industries to create an employment structure

Table 2. *Income inequalities, 1970–2000 (in 2000 constant prices)*

		Malays	Chinese	Indians	Others
A. Inequality of household income per capita (thousand MR)					
Per capita income 1970	(1)	2.455	4.394	3.455	1.110
Per capita income 1990	(2)	4.609	8.609	5.938	1.908
Per capita income 2000	(3)	5.591	9.992	8.433	2.948
Average annual growth 1970–1990 (%)					
Income	(4)	5.96	5.33	4.41	7.82
Population	(5)	2.77	1.86	1.58	18.88
Average annual growth 1990–2000 (%)					
Income	(6)	5.06	2.94	5.52	6.02
Population	(7)	2.88	1.42	1.88	1.50
Average annual growth 1970–2000 (%)					
Income	(8)	5.66	4.53	4.78	7.22
Population	(9)	2.81	1.71	1.68	12.78
B. Inequality of labor income per worker					
Labor income per worker 1970	(10)	5.939	10.027	8.379	37.158
Labor income per worker 1990	(11)	n.a	n.a	n.a	n.a
Labor income per worker 2000	(12)	8.858	12.963	11.095	5.944
Average annual growth in labor income (1970–2000)	(13)	5.30	4.10	4.18	5.54
Average annual growth in employment (1970–2000)	(14)	3.93	3.25	3.24	12.22
C. Gini coefficient for household income					
Inequality 1970	(15)	0.466	0.455	0.463	0.667
Inequality 1990	(16)	0.428	0.423	0.394	0.404
Inequality 2000	(17)	0.433	0.434	0.413	0.393

Sources: Economic Planning Unit (various years), Pyatt and Round (1984) and Saari *et al.* (2014).
Notes: n.a. = not available.

that reflected the ethnic composition of society was abandoned.

In the NDP, economic growth was still driven by the manufacturing sector, but the emphasis had changed from a resource-based to a non-resource-based export-orientation. The major structural shift within the manufacturing sector, and perhaps in the economy as a whole, was the emergence of electric and electronic sub-sectors as the leading export sectors. Their share in the total exports increased significantly from 9% in 1978 to 53% in 2000 (Department of Statistics Malaysia, 2004). As a consequence, agriculture as the traditional engine of growth became less significant, with an annual growth rate that dropped from 8% in the period 1970–90 to 5% in the period 1990–2000 (see Panel A of Table 1).

What have been the implications of economic liberalization under the NDP on income inequality? Income inequality for the period of the NDP shows a limited improvement when compared to the period of the NEP. The gaps in the per capita income between the Malays and Chinese improved from a ratio 1.87 in 1990 to 1.79 in 2000. This improvement can be explained mainly by the growth rates in row 6 of Table 2, showing that income growth of the Malays was 72% higher than that of Chinese. The gap between the Malays and Indians increased from a ratio of 1.29 to 1.51. Rows 6 and 7 show that income growth was 9% higher for the Indians than for the Malays, but population growth was 53% smaller. Overall, the consequences of economic growth and the transformations during 1970–2000 could not improve the inter-ethnic income inequality (which is measured in 2000 constant prices). Similarly, the intra-ethnic income inequality (or inequality within each ethnic group, which is measured by the Gini coefficients in Panel C of Table 2) is not only sizeable but also shows an increase during 1990–2000. For all ethnic groups, the Gini coefficients have improved during 1970–90. Despite the importance of intra-ethnic inequality, our empirical analysis is unable to capture this aspect of inequality due to data limitations (see Section 3).

Panel B of Table 2 gives the inequality in labor income per worker. The labor income inequality is closely related to the household income inequality. For example, inequality in labor income and in household income inequality exhibits the same pattern but less variance, both in 1970 and in 2000. This is because approximately two-thirds of household income consists of labor income (labor income constitutes about 69% of income in 1970 and 61% in 2000). Observe, however, that gap in per capita labor income is much smaller than the gap in per capita household income in 2000, whereas they were very similar in 1970. Part (but certainly not all) of the differences between household income and labor income inequalities can be attributed to differences in non-wage income.[3]

There are two components that contribute to the change in labor income per worker inequality, i.e., the change in labor income and in employment. These changes are for the period 1970–2000 given in rows (13) and (14). One of the aims in this paper is to identify the factors (or determinants) that have contributed to the variation in labor income and employment changes, and how these determinants have affected incomes differently across ethnic groups. From a policy point of view, the analysis would—admittedly—have been more insightful if we had been able to break the analyses into two sub-periods, i.e., 1970–90 (the NEP period) and 1990–2000 (the NDP period). For example, it would have been interesting to examine the effects of different NEP strategies (such as public sector expansion and export promotion through private sectors) on income growth. Unfortunately, however, the unavailability of a SAM for 1990 limits our analyses to the period during 1970–2000 as a whole.

3. DATASET: SOCIAL ACCOUNTING MATRICES

For decomposing the income changes, we have used the Malaysian SAMs for 1970 and 2000 that were constructed by Pyatt and Round (1984) and Saari *et al.* (2014), respectively.[4] In general, the structures of a SAM may vary, depend-

ing on the policy focus and the data availability. Also the 1970 and 2000 SAMs are not consistent with each other in terms of structure and classification. Specifically, the 1970 SAM comprises the following 11 sets of accounts: wants; factors of production; households; two accounts for production, one with commodities, one with activities; companies; government; consolidated capital; two accounts for the rest of the world, one with transactions on the current account, one with transactions on the capital account; and indirect taxes.[5] The 2000 SAM contains only nine sets of accounts, because it has only a single account for production and because it does not contain an account for wants. For the purpose of our decomposition analysis, the two SAMs must be harmonized, resulting in versions that are comparable. Appendix B includes a detailed discussion of the differences between the SAMs and the procedure to harmonize them.

The harmonized versions of the 1970 and 2000 SAMs are outlined in Table 3. Following the conventional approach, incomes (receipts) are recorded in row i for actor i (e.g., a group of rural households, one of the production activities, or owners of capital). The actor's outlays are given as expenditures in column j. Corresponding row and column totals of the matrix must be equal to each other, consistent with the accounting principle that the sum of incomes equals the sum of expenditures for each account. The harmonized SAMs for 1970 and 2000 consist of 48 detailed accounts: 17 production activities (commodities, or industries); 18 factors of production (16 types of labor, i.e., four ethnic groups × 2 skills × 2 geographical locations, and two types of capital, i.e., unincorporated business profits and corporate business profits); eight household groups (four ethnic groups × 2 geographical locations); and single (i.e., aggregate) accounts for companies, government, consolidated capital, rest of the world (current and capital), and indirect taxes. Skills are categorized into unskilled and skilled workers and they are classified based on education levels. Those who do not have any formal education as well as those with a primary school certificate are defined as unskilled and those with a secondary school certificate and those with a diploma or degree are categorized under skilled workers. Geographical locations for each ethnic and worker are distinguished between rural and urban areas.

In order to reveal the real changes in the variables, we express the harmonized version of the 1970 SAM in 2000 constant prices through deflation procedures using the available price indices. The price indices that have been used are the producer price index (PPI) and the import price index (IPI) which are available for 10 aggregate sectors.[6] Further, we use the 'indirect price deflators' (IPD) obtained from DOSM (2004, 2006) for value added, for certain types of GDP expenditures (e.g., household consumption) and for a few other aggregates. The other price indices (PPI and IPI) were also obtained from DOSM (2004, 2006). The available price indices, however, are not sufficient to deflate all transactions in the 1970 SAM. Consequently, several transactions in constant prices are obtained by residual imputation or by estimation. The deflation procedures are summarized in Table 3 by adding a superscript to each transaction. The details of the deflation procedures are provided in Appendix B.

It should be stressed that our decomposition analyses (as developed in the next section) are based on these two published SAMs. Several aspects that might be important for income inequality cannot be addressed because the SAMs do not measure everything. First, intra-ethnic income inequality is sizeable (see the Gini coefficients in Table 1) but our data are unable to deal with this aspect of inequality. Second, households in the SAMs are identified as rural and urban. We are aware that more details on the geographical location of households and connecting them to household characteristics may be important not only for achieving policy targets but also for minimizing administrative costs and leakages (see Besley & Kanbur, 1990; Partridge & Rickman, 2008). Third, the SAMs are unable to deal with dualistic aspects of the economy, such as the role of formal and informal sectors. In a similar vein, it would have been interesting to consider the role of multinational corporations (MNCs) that operate in free industrial zones and are given favorable tax incentives in promoting income growth. The empirical examination of such aspects would only be possible with additional data and is beyond the scope of this paper. For example, the analysis of intra-ethnic inequality would require a disaggregation in the SAMs of households into sub-groups, which requires household-based surveys (which are not available for 1970).

4. STRUCTURAL DECOMPOSITION ANALYSES

Section 2 suggested that growth in income is the main force behind the change in per capita income during 1970–2000. This section develops two decomposition analyses that attempt to quantify the sources of income growth across ethnic groups. First, we decompose the changes in household incomes and the changes in labor incomes. Household-income inequality is closely related to labor-income inequality and the second decomposition is therefore developed for the changes in employment.

(a) *Decomposition of the changes in income*

Within the context of a SAM, a number of studies have decomposed the economy-wide multiplier effects on income (reflecting the endogenous components of the model). For example, Pyatt and Round (1979) introduced the multiplicative decomposition, Stone (1985) developed the additive decomposition which was extended by Defourny and Thorbecke (1984) with a structural path analysis, and Thorbecke and Jung (1996) used a multiplicative decomposition for a certain sub-account in a SAM. These studies decomposed the SAM multipliers at a single point of time. Recently, Llop (2007) analyzed the changes in SAM multipliers over time. In order to provide a full description of the changes in income, however, not only the changes in the endogenous components (i.e., the SAM multipliers) matter, but also the changes in the exogenous components. This study attempts to fill this gap by disentangling the changes in income into the changes in the endogenous and the exogenous parts (and their constituent components). For this purpose, we apply a structural decomposition analysis that has become familiar within the input–output literature.

We start by defining the first four accounts (production, factors, households, and companies) as endogenous and the remaining five accounts as exogenous.[7] Using Table 3, it follows that

$$\begin{bmatrix}\mathbf{y}_1\\ \mathbf{y}_2\\ \mathbf{y}_3\\ \mathbf{y}_4\end{bmatrix} = \begin{bmatrix}\mathbf{A}_{11} & 0 & \mathbf{A}_{13} & 0\\ \mathbf{A}_{21} & 0 & 0 & 0\\ 0 & \mathbf{A}_{32} & 0 & \mathbf{A}_{34}\\ 0 & \mathbf{A}_{42} & 0 & 0\end{bmatrix}\begin{bmatrix}\mathbf{y}_1\\ \mathbf{y}_2\\ \mathbf{y}_3\\ \mathbf{y}_4\end{bmatrix} + \begin{bmatrix}\mathbf{T}_{15}+\mathbf{T}_{16}+\mathbf{T}_{17}\\ \mathbf{T}_{27}\\ \mathbf{T}_{35}+\mathbf{T}_{37}\\ \mathbf{T}_{45}+\mathbf{T}_{47}\end{bmatrix} \quad (1)$$

Table 3. *Schematic representation of the Malaysian SAMs for 1970 and 2000*

				Expenditures (*j*) 1 Production activities	2 Factors of production	3 Institutions			6 Consolidated capital	7 Rest of the world (ROW)		9 Indirect taxes	Total
						Households	Companies	Government		Current	Capital		
Incomes (*i*)	1	Production activities	Domestic intermediate demands $(T_{1,1})^{(PPI)}$		Consumption of domestic commodities $(T_{1,3})^{(PPI)}$		Consumption of domestic commodities $(T_{1,5})^{(PPI)}$	Investment expenditures on domestic commodities $(T_{1,6})^{(PPI)}$	Exports $(T_{1,7})^{(PPI)}$			Gross output (aggregate demand) $(y_1)^{(PPI)}$	
	2	Factors of Production	Value-added Payments $(T_{2,1})^{(R,S)}$						Factor incomes received from abroad $(T_{2,7})^{(R)}$			Total factor income $(y_2)^{(IPD)}$	
	3	Institutions	Households		Compensation of employees and unincorporated business profits $(T_{3,2})^{(D,S)}$		Distributed profits $(T_{3,4})^{(RAS)}$	Pensions and periodical payments $(T_{3,5})^{(RAS)}$		Social benefits received from abroad $(T_{3,7})^{(RAS)}$			Total incomes household $(y_3)^{(IPD)}$
	4		Companies		Corporate business profits $(T_{4,2})^{(S)}$			Current transfers $(T_{4,5})^{(RAS)}$		Non-factor incomes from abroad $(T_{4,7})^{(RAS)}$			Total incomes company $(y_4)^{(IPD)}$
	5		Government			Income taxes $(T_{5,3})^{(RAS)}$	Corporate taxes $(T_{5,4})^{(RAS)}$			Non-factor incomes from abroad $(T_{5,7})^{(RAS)}$		Indirect taxes $(T_{5,9})^{(S)}$	Total government revenue $(y_5)^{(IPD)}$
	6		Consolidated capital			Household savings $(T_{6,3})^{(RAS)}$	Corporate savings $(T_{6,4})^{(RAS)}$	Public Savings $(T_{6,5})^{(RAS)}$					Aggregate saving $(y_6)^{(IPD)}$
	7	Rest of the world (ROW)	Current	Imports of intermediate inputs $(T_{7,1})^{(IPI)}$	Factor incomes paid abroad $(T_{7,2})^{(S)}$	Consumption of imports $(T_{7,3})^{(RAS)}$	Non-factor incomes paid abroad $(T_{7,4})^{(RAS)}$	Consumption of imported commodities $(T_{7,5})^{(RAS)}$			Current account deficit ROW $(T_{7,8})^{(R)}$		Total exchange paid $(y_7)^{(IPD)}$
	8		Capital						Net investments abroad $(T_{8,6})^{(R)}$				Total capital paid abroad $(y_8)^{(R)}$
	9	Indirect taxes	Commodity taxes $(T_{9,1})^{(S)}$									Total indirect taxes $(y_9)^{(S)}$	
			Gross input (total cost) (y'_1)	Total factor Payment (y'_2)	Total expenditures household (y'_3)	Total expenditures company (y'_4)	Total expenditures government (y'_5)	Aggregate investment (y'_6)	Total exchange earning (y'_7)	Total capital received from abroad (y'_8)	Total indirect taxes (y'_9)		

Notes: (PPI) = producer price index; (IPI) = import price index; (D) = redistribution; (R) = residual estimates; (S) = current value shares; (IPD) = implicit price deflators for value added and for type of GDP expenditure; (RAS) = updated by the RAS procedure.

where the matrices (or vectors, or scalars) $\mathbf{A}_{ij} = \mathbf{T}_{ij}\hat{\mathbf{y}}_j^{-1}$ give the average expenditure propensities for the endogenous accounts. [8] 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

$$\mathbf{z} = \mathbf{B}\mathbf{z} + \mathbf{x} \tag{2}$$

which is the standard framework for calculating SAM multipliers, with $\mathbf{z}$ denoting the vector of incomes for the endogenous accounts, $\mathbf{B}$ the square matrix with average expenditure propensities for the endogenous accounts and $\mathbf{x}$ the vector of exogenous expenditures or incomes. In the current case, $\mathbf{B}$ is a 44×44 matrix that consists of the following submatrices: $\mathbf{A}_{11}$ the 17×17 matrix with domestically produced intermediate input coefficients (reflecting the input–output linkages); $\mathbf{A}_{21}$ the 18×17 matrix with value-added (factor income) coefficients; $\mathbf{A}_{32}$ the 8×18 matrix with income coefficients for households; $\mathbf{A}_{42}$ the 1×18 matrix (row vector) with income coefficients for companies; $\mathbf{A}_{13}$ the 17×8 matrix with the coefficients of domestic consumption by households; and $\mathbf{A}_{34}$ the 8×1 matrix (column vector) representing the coefficients for the distribution of the companies' profits to the households.

For the vector of exogenous components ($\mathbf{x}$), we would like to separate certain components. These are, the split of final demands for domestic products into government consumption ($\mathbf{x}_g$), investments ($\mathbf{x}_s$), exports, ($\mathbf{x}_e$) the factor incomes from abroad ($\mathbf{x}_f$), and the domestic and foreign institutional transfers ($\mathbf{x}_h$). Using Eqn. (1), we define

$$\mathbf{x}_g = \begin{bmatrix} \mathbf{T}_{15} \\ 0 \\ 0 \\ 0 \end{bmatrix}, \quad \mathbf{x}_s = \begin{bmatrix} \mathbf{T}_{16} \\ 0 \\ 0 \\ 0 \end{bmatrix}, \quad \mathbf{x}_e = \begin{bmatrix} \mathbf{T}_{17} \\ 0 \\ 0 \\ 0 \end{bmatrix},$$

$$\mathbf{x}_f = \begin{bmatrix} 0 \\ \mathbf{T}_{27} \\ 0 \\ 0 \end{bmatrix}, \quad \text{and } \mathbf{x}_h = \begin{bmatrix} 0 \\ 0 \\ \mathbf{T}_{35} + \mathbf{T}_{37} \\ \mathbf{T}_{45} + \mathbf{T}_{47} \end{bmatrix}$$

which implies that Eqn. (2) can be written as

$$\mathbf{z} = \mathbf{B}\mathbf{z} + (\mathbf{x}_g + \mathbf{x}_s + \mathbf{x}_e + \mathbf{x}_f + \mathbf{x}_h). \tag{3}$$

Eqns. (2) and (3) are solved as

$$\mathbf{z} = \mathbf{M}\mathbf{x} = \mathbf{M}(\mathbf{x}_g + \mathbf{x}_s + \mathbf{x}_e + \mathbf{x}_f + \mathbf{x}_h) \tag{4}$$

with $\mathbf{M} \equiv (\mathbf{I} - \mathbf{B})^{-1}$ the inverse matrix with SAM multipliers. Eqn. (4) shows that the incomes of the endogenous accounts can be obtained by simply post-multiplying the inverse matrix $\mathbf{M}$ with the vector $\mathbf{x}$ of exogenous incomes or expenditures.

When SAMs for two different points in time (say 0 and 1) are available, we can decompose the changes in endogenous incomes over time by taking the first difference of (4):

$$\Delta\mathbf{z} = \mathbf{z}_1 - \mathbf{z}_0 = \mathbf{M}_1\mathbf{x}_1 - \mathbf{M}_0\mathbf{x}_0 \tag{5a}$$

$$= (\mathbf{M}_1 - \mathbf{M}_0)\mathbf{x}_1 + \mathbf{M}_0(\mathbf{x}_1 - \mathbf{x}_0) = (\Delta\mathbf{M})\mathbf{x}_1 + \mathbf{M}_0(\Delta\mathbf{x}) \tag{5b}$$

$$= (\mathbf{M}_1 - \mathbf{M}_0)\mathbf{x}_0 + \mathbf{M}_1(\mathbf{x}_1 - \mathbf{x}_0) = (\Delta\mathbf{M})\mathbf{x}_0 + \mathbf{M}_1(\Delta\mathbf{x}) \tag{5c}$$

Accordingly, the change in incomes between the base year (0) and the end year (1) can be decomposed into the effects that are due to changes in the endogenous ($\Delta\mathbf{M}$) and in the exogenous ($\Delta\mathbf{x}$) components of income.

The issue of the non-uniqueness of structural decomposition forms has received considerable attention in the literature. For example, (5b) and (5c) are equivalent expressions but produce different outcomes because they apply different weights for the two components (or determinants). For the case with more than two determinants, Dietzenbacher and Los (1998) show that the average of the two polar decompositions—similar to (5b) and (5c)—yield a very good approximation of the average of all the potential decompositions that exist (see also de Haan, 2001, and Liu & Saal, 2001). [9] Using the average of the two polar decompositions has therefore become the common practice. Hence,

$$\Delta\mathbf{z} = 1/2(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}) + 1/2(\Delta\mathbf{M})(\mathbf{x}_0 + \mathbf{x}_1) \tag{6}$$

A consequence of the non-uniqueness problem is that we can never provide *the* effect of a determinant (for example, changes in $\mathbf{x}$). Following Dietzenbacher and Los (1998), we will also calculate the standard deviation (over all potential decompositions) for each of the determinants (expressed as a percentage contribution to the total effect) to check the robustness of our results.

The change in the multiplier matrix $\mathbf{M}$, can be expressed in terms of the change in the average expenditure propensities matrix $\mathbf{A}$, as follows. $\Delta\mathbf{M} = (\mathbf{M}_1 - \mathbf{M}_0) = \mathbf{M}_1[(\mathbf{I} - \mathbf{B}_0) - (\mathbf{I} - \mathbf{B}_1)]\ \mathbf{M}_0 = \mathbf{M}_1(\mathbf{B}_1 - \mathbf{B}_0)\mathbf{M}_0$ and similarly $\Delta\mathbf{M} = \mathbf{M}_0(\mathbf{B}_1 - \mathbf{B}_0)\mathbf{M}_1$. Therefore,

$$\Delta\mathbf{M} = \mathbf{M}_1(\Delta\mathbf{B})\mathbf{M}_0 = \mathbf{M}_0(\Delta\mathbf{B})\mathbf{M}_1 \tag{7}$$

Substituting (7) into the second term of (6), we obtain the following expression

$$\begin{aligned} 1/2(\Delta\mathbf{M})(\mathbf{x}_0 + \mathbf{x}_1) &= 1/2[\mathbf{M}_1(\Delta\mathbf{B})\mathbf{M}_0\mathbf{x}_0 + \mathbf{M}_0(\Delta\mathbf{B})\mathbf{M}_1\mathbf{x}_1] \\ &= 1/2[\mathbf{M}_1(\Delta\mathbf{B})\mathbf{z}_0 + \mathbf{M}_0(\Delta\mathbf{B})\mathbf{z}_1] \end{aligned} \tag{8}$$

Combining the elements of Eqns. (6) and (8), we have

$$\Delta\mathbf{z} = 1/2[\mathbf{M}_1(\Delta\mathbf{B})\mathbf{z}_0 + \mathbf{M}_0(\Delta\mathbf{B})\mathbf{z}_1] \tag{9a}$$

$$+ 1/2(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_g) \tag{9b}$$

$$+ 1/2(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_s) \tag{9c}$$

$$+ 1/2(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_e) \tag{9d}$$

$$+ 1/2(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_f) \tag{9e}$$

$$+ 1/2(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_h) \tag{9f}$$

According to (9), the change in the incomes of the endogenous accounts can be decomposed into the effects that are determined by the changes in: (9a) average expenditure propensities for the endogenous accounts; (9b) government consumption; (9c) investments; (9d) exports; (9e) factor income transfers from abroad; and (9f) institutional income transfers.

Note that the matrix $\mathbf{B}$ contains several submatrices, which allows us to decompose the change in the average expenditure propensities into its constituent parts. As a consequence, we can establish the effects of changing interdependencies among endogenous accounts on their incomes. Thus, Eqn. (9a) can be further decomposed as:

$$1/2[\mathbf{M}_1(\Delta\mathbf{B})\mathbf{z}_0 + \mathbf{M}_0(\Delta\mathbf{B})\mathbf{z}_1] \tag{10a}$$

$$= 1/2[\mathbf{M}_1(d\mathbf{A}_{11})\mathbf{z}_0 + \mathbf{M}_0(d\mathbf{A}_{11})\mathbf{z}_1] \tag{10b}$$

$$+ 1/2[\mathbf{M}_1(d\mathbf{A}_{21})\mathbf{z}_0 + \mathbf{M}_0(d\mathbf{A}_{21})\mathbf{z}_1] \tag{10c}$$

$$+ 1/2[\mathbf{M}_1(d\mathbf{A}_{13})\mathbf{z}_0 + \mathbf{M}_0(d\mathbf{A}_{13})\mathbf{z}_1] \tag{10d}$$

$$+ 1/2[\mathbf{M}_1(d\mathbf{A}_{34})\mathbf{z}_0 + \mathbf{M}_0(d\mathbf{A}_{34})\mathbf{z}_1] \tag{10e}$$

$$+ 1/2[\mathbf{M}_1(d\mathbf{A}_{\text{Inc.}})\mathbf{z}_0 + \mathbf{M}_0(d\mathbf{A}_{\text{Inc.}})\mathbf{z}_1] \tag{10f}$$

where

$$d\mathbf{A}_{11} = \begin{bmatrix} \Delta\mathbf{A}_{11} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}, \quad d\mathbf{A}_{Inc.} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & \Delta\mathbf{A}_{32} & 0 & 0 \\ 0 & \Delta\mathbf{A}_{42} & 0 & 0 \end{bmatrix}$$

and similar definitions for $d\mathbf{A}_{21}$, $d\mathbf{A}_{13}$ and $d\mathbf{A}_{34}$. Eqns. (10) break down the change in the average expenditure propensities into the effects of: (10b) changes in the use of domestically produced intermediate inputs; (10c) changes in the compensation of labor and capital; (10d) changes in consumption coefficients; (10e) changes in the distribution of companies' profits to households; and (10f) changes in the income coefficients for the households and companies. Combining Eqns. (9) and (10), decomposes the change in incomes into 10 separate determinants. Notice that each of the 10 decomposition forms yields a 44-element vector. The first 17 elements give the changes in production outputs, the second 18 elements reveal the changes in factor incomes, the next 8 elements list the changes in household incomes and the last element gives the change in the income of companies.

For the interpretation of the empirical results, it is important to discuss the role of imports. For a small and open economy like Malaysia, policies that stimulate export growth also increase imports. For example, exports and imports have increased on average by 12% and 13% per year during 1987–2000 (in 1987 prices) so that the ratio of exports over imports decreased from 1.28 to 1.10 (see DOSM, various years). Export activities are mostly driven by multinational corporations (MNCs) that were offered favorable tax incentives (e.g., exemption from import duties) and infrastructure facilities (e.g., free trade industrial zones). These activities rely heavily on imported inputs that have no or few backward linkages to domestically-owned industries, in particular small and medium sized enterprises (see, Hobday, 2001). Imports may affect the coefficient changes in $\Delta\mathbf{A}_{11}$ and $\Delta\mathbf{A}_{21}$ in two ways. First, if domestically produced intermediate inputs are substituted for imported inputs (implying that demand for intermediate inputs shifts in favor of imports), the matrix $\mathbf{A}_{11}$ will decrease. Second, if offshoring activities (and thus the outputs of certain industries) increase largely and if only relatively little domestic inputs and factors are used, the coefficients in $\mathbf{A}_{11}$ and $\mathbf{A}_{21}$ (measuring inputs per unit of output) will decrease.

One way to account for the use of imports in our modeling formulation is to introduce a matrix of technical coefficients (with the sum of domestically produced and imported inputs) and a matrix of so-called trade coefficients (with the share of imports for each input) that can be derived from the full matrix of imports (see Oosterhaven & van der Linden, 1997). However, this standard solution is not possible because a full matrix of imports is not available. Alternatively, an approach developed by Dietzenbacher and Los (2000) for a different case may be applied but would require further methodological development, which is beyond the scope of this study. In any case, it should be taken into account that some of our interpretations (especially about the effects of changes in, $\mathbf{A}_{21}$ which we call changes in factor compensation per unit of gross output) are incomplete because we cannot quantify the role that imports have on certain coefficients.

(b) *Decomposition of the changes in employment*

In order to decompose the change in employment ($\Delta\mathbf{e}$), we have compiled data on employment across production sectors for the periods 1970 and 2000. The main data source for employment in 1970 is Pyatt and Round (1984) and figures for employment in 2000 can be obtained from the household income survey (see DOSM, 2001).[10] However, employment data for 1970 appear not to be entirely comparable to those for 2000. First, employment data for ethnic groups were only available in 1970 for west Malaysia, but not for east Malaysia. Total employment in east Malaysia was about 17% of the total employment in Malaysia (see Economic Planning Unit, various years). To make the comparison possible, we have assumed that the 1970 distribution of employment for west Malaysia applied also to east Malaysia (see also the explanation in Appendix B). Second, employment data for 1970 for different skills are not comparable to data for 2000, while also data are lacking. We therefore focus on aggregated employment (i.e., no distinction according to skill types) and have eight employment categories (four ethnic groups × 2 geographical locations).

The decomposition of the changes in employment during 1970–2000 is given by

$$\Delta\mathbf{e} = 1/2(\Delta\mathbf{L})(\mathbf{z}_0 + \mathbf{z}_1) \tag{11a}$$
$$+ 1/2(\mathbf{L}_0 + \mathbf{L}_1)[\mathbf{M}_1(\Delta\mathbf{B})\mathbf{z}_0 + \mathbf{M}_0(\Delta\mathbf{B})\mathbf{z}_1] \tag{11b}$$
$$+ 1/2(\mathbf{L}_0 + \mathbf{L}_1)(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_g) \tag{11c}$$
$$+ 1/2(\mathbf{L}_0 + \mathbf{L}_1)(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_s) \tag{11d}$$
$$+ 1/2(\mathbf{L}_0 + \mathbf{L}_1)(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_e) \tag{11e}$$
$$+ 1/2(\mathbf{L}_0 + \mathbf{L}_1)(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_f) \tag{11f}$$
$$+ 1/2(\mathbf{L}_0 + \mathbf{L}_1)(\mathbf{M}_0 + \mathbf{M}_1)(\Delta\mathbf{x}_h) \tag{11g}$$

where $\mathbf{L}$ is the 8 × 44 matrix with labor coefficients (i.e., labor per unit of output). Note that labor coefficients only apply to the 17 production sectors. $\mathbf{L}$ thus consists of two sub-matrices: an 8 × 17 matrix with the actual labor coefficients and an 8 × 27 matrix that is entirely zero. Eqn. (11a) gives the effect on the changes in employment due to changes in the use of labor per unit of output. The interpretation of Eqns. (11b)–(11g) is similar to the interpretation of Eqns. (9). Note that (11b) can be further decomposed in the same fashion as (9a) that was further decomposed in (10).

5. RESULTS AND DISCUSSION

Given our interest in the effects of policy reforms, we focus on the results for the decomposition of income changes for ethnic groups. Part (a) of this section studies changes in household incomes and labor incomes (which account for 58% of the household income changes). Results show that changes in the employment structure play an important role. They are therefore further decomposed in part (b) of this section.

(a) *Decomposing changes in household incomes and labor incomes*

Panel A of Table 4 displays household income, population and per capita for 1970 and 2000. For each ethnic group, rows 1 and 2 show the household incomes in 1970 and 2000, rows 3 and 4 give the population sizes, and rows 5 and 6 list the per capita incomes. The changes in per capita income during 1970–2000 are given in row 7. Observe that the gap between per capita income for rural and for urban households has decreased considerably. Setting per capita income of rural households at unity, urban incomes exceed rural incomes by 192% in 1970 and reduced by 140% in 2000. The income gaps between the ethnic groups, however, increased substantially, in

Table 4. *Decomposition of changes in household incomes, 1970–2000.*

		Rural Malays	Rural Chinese	Rural Indians	Rural Others	Urban Malays	Urban Chinese	Urban Indians	Urban Others	Total
A. Income levels (billion MR), population (million persons) and per capita income (thousand MR per person)										
Income in 1970	(1)	8.92	5.63	1.75	0.27	3.60	9.44	1.74	0.76	32.11
Income in 2000	(2)	25.18	10.06	3.87	4.51	40.13	46.83	10.31	3.85	144.74
Population in 1970	(3)	4.45	2.06	0.72	0.05	0.65	1.37	0.29	0.03	9.61
Population in 2000	(4)	7.04	1.53	0.59	1.98	4.64	4.16	1.09	0.86	21.89
Per capita income in 1970	(5)	2.00	2.73	2.42	5.28	5.57	6.91	5.90	29.77	3.34
Per capita income in 2000	(6)	3.57	6.56	6.58	2.28	8.65	11.26	9.43	4.50	6.61
Growth in per capita income (%)[a]	(7)	1.95	2.96	3.39	−2.76	1.48	1.64	1.57	−6.10	2.30
B. Total changes (1970–2000)										
Income (billion MR)	(8)	16.26	4.43	2.12	4.24	36.53	37.39	8.57	3.09	112.63
Growth rate in income (%)[a]	(9)	3.52	1.96	2.67	9.84	8.38	5.49	6.12	5.54	5.15
C. Decomposition of total income changes (%)										
Contribution of changes in										
Intermediate inputs ($\Delta\mathbf{A}_{11}$)	(10)	20.1	38.9	29.2	−1.8	5.1	16.1	21.9	−12.6	13.2
Compensation of labor and capital ($\Delta\mathbf{A}_{21}$)	(11)	−180.1	−559.5	−291.6	10.9	−19.2	−133.2	−95.0	−119.9	−114.0
Income coefficients ($\Delta\mathbf{A}_{inc}$)	(12)	−49.3	−104.4	−40.6	18.1	12.2	6.7	−6.6	12.6	−5.3
Consumption coefficients ($\Delta\mathbf{A}_{13}$)	(13)	−2.3	13.7	11.8	1.4	2.6	3.0	10.7	5.0	3.3
Distributed profits ($\Delta\mathbf{A}_{34}$)	(14)	−4.2	−68.3	−3.1	4.6	−0.3	−27.3	−0.8	3.6	−12.3
Government consumption ($\Delta\mathbf{x}_g$)	(15)	47.6	69.4	51.6	15.4	21.8	20.3	26.7	29.2	27.8
Investments ($\Delta\mathbf{x}_s$)	(16)	35.4	103.5	43.7	7.0	10.0	30.6	18.7	23.0	25.7
Exports ($\Delta\mathbf{x}_e$)	(17)	219.6	585.8	283.7	40.1	60.6	176.1	115.9	153.3	152.7
Factor income transfers ($\Delta\mathbf{x}_f$)	(18)	6.9	14.4	7.7	2.0	2.5	4.5	3.8	3.2	4.5
Institutional transfers ($\Delta\mathbf{x}_h$)	(19)	6.2	6.6	7.6	2.4	4.7	3.2	4.8	2.5	4.4
D. % differences between average polar decompositions and average of full set of decompositions										
Intermediate inputs ($\Delta\mathbf{A}_{11}$)	(20)	0.00	−0.09	−0.09	−0.15	−0.08	−0.09	−0.09	−0.11	
		(*0.01*)	(*0.01*)	(*0.08*)	(*0.00*)	(*0.00*)	(*0.01*)	(*0.01*)	(*0.00*)	
Compensation of labor and capital ($\Delta\mathbf{A}_{21}$)	(21)	0.00	−0.08	−0.08	−0.11	−0.08	−0.09	−0.09	−0.08	
		(*0.06*)	(*0.89*)	(*0.81*)	(*0.00*)	(*0.01*)	(*0.04*)	(*0.03*)	(*0.04*)	
Income coefficients ($\Delta\mathbf{A}_{inc}$)	(22)	0.00	−0.07	−0.07	−0.07	−0.07	−0.08	−0.07	−0.07	
		(*0.02*)	(*0.16*)	(*0.11*)	(*0.01*)	(*0.00*)	(*0.00*)	(*0.00*)	(*0.00*)	
Consumption coefficients ($\Delta\mathbf{A}_{13}$)	(23)	0.00	−0.11	−0.10	−0.08	−0.06	−0.08	−0.09	−0.08	
		(*0.00*)	(*0.02*)	(*0.00*)	(*0.00*)	(*0.00*)	(*0.00*)	(*0.00*)	(*0.00*)	
Distributed profits ($\Delta\mathbf{A}_{34}$)	(24)	0.00	−0.09	−0.11	−0.09	−0.07	−0.09	−0.10	−0.09	
		(*0.00*)	(*0.12*)	(*0.01*)	(*0.00*)	(*0.00*)	(*0.01*)	(*0.00*)	(*0.00*)	
Government consumption ($\Delta\mathbf{x}_g$)	(25)	0.00	−0.07	−0.07	0.02	0.00	−0.04	−0.04	−0.02	
		(*0.01*)	(*0.10*)	(*0.03*)	(*0.00*)	(*0.01*)	(*0.01*)	(*0.01*)	(*0.01*)	
Investments ($\Delta\mathbf{x}_s$)	(26)	0.00	−0.06	−0.06	0.05	0.00	−0.04	−0.03	−0.03	
		(*0.01*)	(*0.15*)	(*0.11*)	(*0.00*)	(*0.00*)	(*0.01*)	(*0.01*)	(*0.01*)	
Exports ($\Delta\mathbf{x}_e$)	(27)	0.00	−0.07	−0.06	0.05	0.00	−0.05	−0.04	−0.05	
		(*0.07*)	(*0.88*)	(*0.69*)	(*0.01*)	(*0.02*)	(*0.06*)	(*0.04*)	(*0.05*)	
Factor income transfers ($\Delta\mathbf{x}_f$)	(28)	0.00	−0.05	−0.03	0.04	0.01	−0.02	−0.01	0.01	
		(*0.00*)	(*0.01*)	(*0.01*)	(*0.00*)	(*0.00*)	(*0.00*)	(*0.00*)	(*0.00*)	
Institutional transfers ($\Delta\mathbf{x}_h$)	(29)	0.00	−0.08	−0.02	0.01	0.00	−0.04	−0.01	−0.01	
		(*0.00*)	(*0.00*)	(*0.01*)	(*0.00*)	(*0.00*)	(*0.00*)	(*0.00*)	(*0.00*)	

Notes: [a]average annual growth rate. (8) = (2) − (1) and (10)+ ⋯ (19) = 100. Incomes in 1970 are expressed in 2000 constant prices. Figures in parentheses are standard errors that are calculated from the average of the full set of decompositions.

particular for rural households. Among rural households, the per capita income gap between Malays and Chinese, and between Malays and Indians increased by 34% and 52%, respectively. For urban households, the increases were 5% and 3%, respectively. The changes (and thus the growth rates) in per capita income were positive for the three major ethnic groups but incomes of the Chinese and Indians grew faster than those of the Malays. The changes in the Malaysian economy led to an increase in inequality of per capita income.

It should be mentioned that the results for the group of other minority ethnics (others) in 1970 should be interpreted with caution. The results for this household group may suffer from data inconsistencies and may not reflect the real effects. First, data for income and population in 1970 are not entirely comparable to those in 2000 due to a lack of data for east Malaysia (see Appendix B for further discussion). Second, data in the SAM are estimated using information from various sources. In particular, when the share (e.g., income, or population, or employment) is small for a certain cell in the SAM, the percentage estimation error may become relatively large. At the level of individual cells, one should therefore realize that taking ratios (income over population) may produce outliers that cannot be given a reasonable explanation.

Population and income growth are two forces that explain the changes in inequality of per capita income. The methodologies developed in this paper are based on the

demand-driven viewpoint and are thus unable to deal with the decomposition of population growth. Population growth reflects a supply-side perspective and is determined by factors such as fertility rates, mortality rates, and net migration. A decomposition of population growth would require the development of an appropriate methodology and different types of data (both of which are beyond the scope of the present paper). Population growth is thus taken exogenous in this study.

The following paragraphs discuss the results for the decomposition of changes in household incomes and labor incomes. The calculations are based on Eqns. (9) and (10) where $\Delta \mathbf{z}$ is broken down into 10 components. Note that $\Delta \mathbf{z}$ is a 44-element vector, see Eqns. (1) and (2). The 8 household incomes (4 ethnic groups, rural and urban) are in the elements 36–43. The 16 labor incomes (4 ethnic groups, rural and urban, skilled and unskilled) are in the elements 18–33.

Panel B of Table 4 presents the total income changes and the average annual growth rates during 1970–2000 in rows 8 and 9. Urban households are found to benefit substantially more from the structural transformation of the economy than rural households. Whereas in 1970 the total household income of rural households was more or less the same as that of urban households, they were very different in 2000. The average annual growth in income for urban households was more than 3 times the growth rate for rural households. For the changes among the three major ethnic groups, we observe that relative income changes were the largest for the Malays, the smallest for the Chinese, with the Indians in between, which holds both for rural and urban areas.

Rows 10–19 in Panel C of Table 4 show—for each ethnic group—the decomposition of the change in household income. Each row corresponds to one of the 10 components as given in Eqns. (9) and (10). The contribution of each component is expressed as a percentage of the total income change (for the corresponding ethnic group). For example, the changes in the domestically produced intermediate input coefficients explain 20.1% of the 16.3 billion MR (Malaysian *Ringgit*) income change for rural Malays households, which is equivalent to 3.3 billion MR. Note that the sum over the 10 components, i.e., rows 10–19, equals 100.

Recall that the results in Panel C are obtained from the average of the two polar decompositions, see Eqns. (9) and (10). Notice that for n determinants, there are 2^{n-1} possible decomposition forms (see de Boer, 2009) which implies that there are 512 decomposition forms in our case with 10 determinants. To investigate the variability and robustness of our main results, Panel D presents the percentage differences between the average of the two polar decompositions and the average of all 512 decomposition forms. For all ethnic groups, the results for the two average effects are remarkably close to each other. The largest difference (in absolute sense) is only 0.15%. In most cases, the average of the polar decompositions marginally overestimates the average of all 512 decompositions. The results for the standard errors (in parentheses) show that the variation in the outcomes of the 512 decompositions is small. These small standard errors imply that it suffices to focus only on the average effects from the polar decompositions.

Two components—the expansion of the exports and the changes in the compensation for the use of labor and capital inputs—are by far the most important determinants for the changes in household income. For the contribution of the exports growth, if only the exports had changed in the way they actually have (and all other things would have remained unchanged) the income of rural households would have increased by 69 billion MR and the income of urban households by 103 billion MR. The 69 billion MR contribution of export growth to the rural income increase (of 27 billion MR) is relatively much more than the 103 billion MR export growth contribution to the urban increase (of 86 billion MR). This explains why the percentages in row 17 of Table 4 are much larger for rural than for urban households. Export growth during 1970–2000 has had a substantial positive influence on the income situation for all households. In comparison to all the other developments, export growth was more important for rural than for urban households. Export growth alone would have led to a smaller gap in 2000 between rural and urban household incomes. Among the three major ethnic groups, export growth has generated the largest effect on income growth for the Chinese, followed by the Indians, while the smallest effect was observed for Malay households.

For the contribution of the changes in the compensation of labor and capital inputs (per *Ringgit* of output), the outcomes show a similar pattern as the outcomes for export growth except that they point in the opposite direction. Under the *ceteris paribus* clause, the changes in the compensation of factor inputs would have decreased rural household income by 60 billion MR and urban household income by 69 billion MR. Again, in terms of percentage contributions to the income changes, the effect of factor compensation changes is much larger for rural than for urban households. Changes in the compensation of labor and capital inputs have had a negative impact on all household incomes, but—when compared to other developments—much more for rural than for urban households. Also the ordering between the three major ethnic groups is the same as for the effects of export growth. The negative effects were the largest for the Chinese, followed by the Indians, and the Malays.

It follows that two very strong forces have been at work during 1970–2000 in Malaysia. For both changes, the effects on rural household incomes were much stronger than the effects on urban household incomes. However, the forces work in opposite directions and the effects partly cancel each other out. The question is what the effect is of the resultant. Using the sum of rows (11) and (17), we can calculate that the combination of just these two effects would have led to an income growth of 10 billion MR for rural households and 34 billion MR for urban households. This implies that the combination of export growth and changes in the compensation of labor and capital inputs contributed a very similar share of the income growth for rural (where the contribution is 37%) and urban households (where it is 40%).

At the national level, export growth and the changes in the compensation of labor and capital inputs contribute 39% of the overall growth in household income. Other sizeable components are government consumption (28%) and investments (26%). Observe that their effects on incomes of ethnic groups or on rural *versus* urban households are more evenly spread. The rest of the components show a small effect on income changes at the national level, each less than 15% and together they contribute only 7%. [11]

Table 5 presents the changes in labor income and the contribution of changes in the compensation of labor and capital inputs (in column 3), changes in exports (in column 4), and all other changes taken together (in column 5). Observe in column (1) that the growth in labor income across geographical locations and ethnic groups shows a large similarity with the growth in household income, i.e., urban workers and Malay labors show the largest income changes. Observe also that labor income changes for skilled workers are much larger than for unskilled workers (which are even negative for the three major ethnic groups in rural areas).

Table 5. *Decomposition of changes in labor and capital incomes 1970–2000*

	Total changes		Decomposition (%)		
	Billon MR (1)	Growth rate (%) (2)	$\Delta\mathbf{A}_{21}$ (3)	$\Delta\mathbf{x}_e$ (4)	Other (5)
Rural-Malays-unskilled	−1.60	−1.31	−1,227.7	949.5	178.2
Rural-Malays-skilled	11.49	9.87	25.1	36.5	38.3
Rural-Chinese-unskilled	−1.05	−1.40	−1,528.4	1,211.4	217.0
Rural-Chinese-skilled	3.52	6.61	−75.4	104.0	71.4
Rural-Indians-unskilled	−0.33	−1.06	−1,236.8	887.7	249.1
Rural-Indians-skilled	1.14	7.35	−39.4	67.4	72.0
Rural-others-unskilled	0.90	9.01	28.3	58.4	13.3
Rural-others-skilled	1.37	7.53	25.8	28.0	46.2
Urban-Malays-unskilled	0.32	0.54	−3,620.6	2,453.3	1,267.3
Urban-Malays-skilled	21.42	10.62	29.3	32.2	38.5
Urban-Chinese-unskilled	1.28	0.83	−3,063.8	2,314.1	849.7
Urban-Chinese-skilled	20.49	8.14	−33.3	92.0	41.4
Urban-Indians-unskilled	0.55	2.05	−873.7	583.1	390.6
Urban-Indians-skilled	4.47	8.53	−12.9	55.5	57.3
Urban-others-unskilled	0.48	6.17	−55.3	99.0	56.3
Urban-others-skilled	1.03	3.41	−300.1	325.1	75.0
Total labor	65.5	4.68	−151.9	172.7	79.2
Total capital	218.0	9.07	2.2	73.6	24.2

Notes: (2) indicates the average annual growth rates. (3) $\Delta\mathbf{A}_{21}$ = changes in the compensation of labor and capital. (4) $\Delta\mathbf{x}_e$ = changes in exports. (5) shows the total contribution of the other eight components. (3) + (4) + (5) = 100.

These outcomes can be explained from the shift in employment from unskilled to skilled labor. Is this shift due to significant changes in the production technologies from traditional activities (which are essentially labor-intensive) to "modern" activities (which are essentially capital-intensive)? As indicated in an earlier stage, our model cannot examine explicitly to what extent the employment shift is due to the effects of technological change and to what extent to import substitution. Nevertheless, our data do indicate that it is a mix of both underlying causes. A comparison of the import requirements per unit of output (obtained from vector $\mathbf{T}_{7,1}$) during 1970–2000 shows that imports for almost all sectors (with the exception of Oils and fats, Meat and dairy, Mining products, Petroleum products, and Private sector services) have increased with an average of 65%. For the matrix $\mathbf{T}_{2,1}$, we find that the coefficient for capital income has increased by an average of 35% whereas that for labor income has decreased by 51%. Note, however, that there is a sharp distinction between unskilled labor (the income coefficient of which has reduced on average by 85%) and skilled labor (with an average increase of 18%). These observations suggest that labor income for unskilled workers was reduced due to both import substitution and "skill biased technological change". The increases in the incomes for capital and skilled labor (which are complementary factors) are in line with this technological change.

Using Malaysian manufacturing data, Tan (2004) confirms that technological change is biased toward the use of skilled workers such as professionals, technicians and managers. Our findings are also in line with the recent consensus that skill-biased technological change is considered as the main explanation for income inequality (see for example, Bernard & Jensen, 1997; Kijima, 2006). Moreover, the "modern" activities are mostly concentrated in urban areas as industrial development in Malaysia is closely related to the transformations of urban areas (see Institute of Developing Economies, 1997). Urban skilled labor thus benefitted the most from the structural change in production technology.

In line with the "skill-biased technological change", column (3) indicates that the changes in the compensation of labor and capital inputs led to substantial decreases in the labor incomes of all groups of unskilled workers. For the groups of skilled workers, the decreases were much smaller (not only in terms of percentages but also in money terms). Note that the labor income of Malay skilled workers even increased (both in rural and in urban areas). Export growth led to large labor-income increases, as was the case for household incomes. However, where the positive influence of export growth was able to offset the negative influence of changes in labor and capital input compensation in the case of household incomes, this does not apply to labor incomes. For the three major ethnic groups, we see that the combined effect on labor income is negative for (both rural and urban) unskilled workers. For the groups of skilled workers the combined effect is always positive. Our results suggest that an export promotion strategy in developing countries could potentially generate income and reduce inequality (see for example, Meschi & Vivarelli, 2009; Mohammad, 1981). But our results also show that the net effect of export growth depends on two aspects: technological intensity (i.e., labor-intensive *versus* capital-intensive) and import requirements. A capital-intensive technology benefits skilled labor and a large reliance on imports generate leakages of the effects.

In summary, household income of the Malays and the labor income of skilled workers (and the Malays in particular) grew the most during 1970–2000. Export growth had a huge positive influence on this outcome. A very large negative influence was exerted by the changes in the compensation of labor (and capital) inputs. Whereas total gross output increased from 90.2 billion MR in 1970 (in 2000 prices) to 888.5 billion MR in 2000 (as follows from Table 6, which will be discussed later), labor payments grew only from 22.3 billion MR in 1970 to 87.7 billion MR in 2000. As a consequence, the average labor coefficient in $\mathbf{A}_{21}$ thus decreased from 0.25 in 1970 to 0.10 in 2000. Appendix A contains the employment figures and shows

Table 6. *Decomposition of changes in production (gross outputs, in billion MR)*

		1970 output (1)	Changes (2)	$\Delta\mathbf{A}_{11}$ (3)	$\Delta\mathbf{A}_{21}$ (4)	$\Delta\mathbf{A}_{inc}$ (5)	$\Delta\mathbf{A}_{13}$ (6)	$\Delta\mathbf{A}_{34}$ (7)	$\Delta\mathbf{x}_g$ (8)	$\Delta\mathbf{x}_s$ (9)	$\Delta\mathbf{x}_e$ (10)	$\Delta\mathbf{x}_f$ (11)	$\Delta\mathbf{x}_h$ (12)
Production sectors													
Other agricultural products	(1)	5.06	4.14	−1.55	−15.75	−1.21	−7.25	−1.52	3.33	3.10	24.06	0.48	0.47
Rubber products	(2)	9.14	3.26	−2.14	−2.47	−0.11	−0.78	−0.25	0.64	1.12	7.11	0.07	0.07
Oils and fats	(3)	2.09	35.63	11.18	−2.83	−0.26	0.60	−0.25	1.06	0.13	25.65	0.17	0.17
Meats and dairy	(4)	4.53	4.96	1.22	−15.66	−1.13	−7.38	−1.63	3.36	3.70	21.53	0.48	0.47
Wood and furniture	(5)	5.05	27.62	−1.51	−2.01	−0.10	−0.88	−0.18	0.74	5.55	25.89	0.06	0.07
Fish	(6)	1.77	3.49	1.11	−6.47	−0.37	−1.74	−0.85	1.28	1.35	8.79	0.20	0.18
Mining products	(7)	8.33	35.38	−22.11	−3.29	−0.18	0.49	−0.32	1.38	9.10	50.01	0.15	0.16
Food, drink and tobacco	(8)	10.48	4.82	−0.95	−32.42	−2.93	−16.51	−2.93	6.77	5.96	45.92	0.96	0.93
Other manufactured goods	(9)	9.09	106.70	8.87	−23.23	−0.87	−6.66	−2.47	6.84	15.61	106.98	0.81	0.83
Petroleum products	(10)	7.96	24.14	−17.68	−10.79	−0.66	5.39	−1.04	3.64	4.64	39.73	0.44	0.47
Machinery and vehicles	(11)	6.08	253.73	−0.73	−10.52	−0.57	−1.42	−1.03	3.60	6.39	257.21	0.39	0.41
Electricity and water	(12)	1.10	15.92	3.36	−2.61	−0.13	1.22	−0.23	1.56	1.54	10.92	0.15	0.14
Construction	(13)	4.54	40.51	−6.80	−1.54	−0.08	1.66	−0.16	1.69	38.52	7.10	0.06	0.05
Trade, transport and comm.	(14)	1.96	101.15	26.66	−7.18	−0.12	5.49	−0.76	4.11	7.88	64.11	0.47	0.50
Private sector services	(15)	5.80	104.83	12.64	−17.71	−1.03	22.87	−1.73	10.58	9.75	67.20	1.17	1.09
Education and health	(16)	2.61	18.08	−0.01	−0.88	−0.05	2.49	−0.08	13.59	0.40	2.47	0.08	0.08
Government services	(17)	4.56	13.95	−0.49	−0.56	−0.03	−0.25	−0.06	14.02	0.14	1.13	0.02	0.02

Notes: computed from Eqns. (9) and (10); $\Delta\mathbf{A}_{11}$ = changes in intermediate inputs; $\Delta\mathbf{A}_{21}$ = changes in the compensation of labor and capital; $\Delta\mathbf{A}_{inc}$ = changes in income coefficients; $\Delta\mathbf{A}_{13}$ = changes in consumption coefficients; $\Delta\mathbf{A}_{34}$ = changes in distributed profits; $\Delta\mathbf{x}_g$ = changes in government consumption; $\Delta\mathbf{x}_s$ = changes in investments; $\Delta\mathbf{x}_e$ = changes in exports; $\Delta\mathbf{x}_f$ = changes in factor income transfers; $\Delta\mathbf{x}_h$ = changes in institutional transfers.

that employment increased from 2.8 million people in 1970 to 8.8 million in 2000. The output per worker therefore increased from 32.4 thousand MR per worker in 1970 to 100.7 in 2000. [12] This, however, did not lead to a substantial increase in the annual wage rate, which was 8.0 thousand MR per worker in 1970 and 9.9 in 2000. This explains why the changes in the labor compensation coefficients had such an enormous effect.

The figures in the previous paragraph were all at the national level (or overall averages) and thus hide information on shifts between ethnic groups, between rural and urban areas, and between skilled and unskilled labors. The figures in Appendix A show that in particular the employment for urban Malays has increased very much (both in absolute and in relative sense). The coefficients in $\mathbf{A}_{21}$ decrease less (or increase more) for urban than for rural workers, less for skilled than for unskilled workers, and less for Malay than for Chinese or Indian workers.

The results in Tables 4 and 5 also showed that the export growth had a relatively small percentage effect on income growth of the Malays when compared to the Indians and the Chinese. It appears from Appendix A that a large share of the Malays is employed in the public sector, which is focused primarily on the domestic market and is thus rather insensitive to changes in export demand. The share of Malay workers in the public services sectors (Education and health, and Government services) has increased from 15% in 1970 to 22% in 2000. The opposite holds for the Chinese and Indians. Their small share of employment in the public sector declined further—from 7% to 6% for the Chinese and from 17% to 12% for the Indians. Within the public services, the share of skilled employment has risen from 25% in 1970 to 90% in 2000.

The changes in Malaysia's employment structure were a result of a mix of policy measures that erected direct and indirect barriers among ethnic groups, preventing long-run equalizing tendencies in the market to occur over time. On one hand, the NEP strategy for restructuring the society was implemented through an expansion of the public services sectors where the priority had been given to the Malays. On the other hand, export-oriented industrialization was performed to achieve the NEP strategy for eradication of poverty. The output growth in the public services sectors was not as large as in other sectors because the public sector did not have an export orientation. These two aspects (public services favoring the employment of Malay workers and the lack of export orientation) explain why our results show that the changes in exports and in the compensation of labor and capital inputs generate relatively small percentage effects on income for the Malays when compared to the Chinese and the Indians.

(b) *Decomposing changes in production and employment*

Section 5(a) pointed at the importance of the changes in Malaysia's employment structure. This section thus focuses on the decomposition of employment for which the decomposition of gross outputs is an important determinant (and which is therefore discussed first). The production figures for 1970 (in prices of 2000) are given in Table 6, together with the changes (in billion MR) over the period 1970–2000. National gross output increased from 90.2 billion MR to 888.5 billion MR. Industries that have witnessed an enormous growth (in both absolute and relative sense) are Machinery and vehicles (industry 11), Trade, transport and communication (14), Private sector services (15), and Other manufactured goods (9). The results show that their growth is strongly linked to the growth in exports. Other findings that are in line with the intuition are: transfers have little effect; government consumption is an important factor for the growth in Education and health (industry 16) and Government services (17); investments determine to a large part the output growth of Construction (13); and the consumption pattern shows a clear shift with a negative effect on the output of food-related industries (Other agricultural products, industry 1; Meats and dairy, 4; Food, drink

and tobacco, 8) and a positive effect on Private sector services (15).

For well-developed economies it is a common finding in structural decomposition analysis that changes in the intermediate input coefficients generate little or no effect. This is because input coefficients reflect the domestic part of the production structure and are found to be fairly stable in developed economies. For countries that are in the middle of a developing process, input coefficients may be expected to change over time. This is also observed for Malaysia, where the effects in column $\Delta\mathbf{A}_{11}$ are found to be substantial for some industries. The results indicate that Malaysia's production uses less inputs of (domestically produced) Mining (industry 7) and Petroleum (10) products and more inputs from the Trade, transport and communication (14) sector and Private sector services (15).

Another important role is for the changes in the compensation of labor and capital inputs (i.e. $\mathbf{A}_{21}$). It should be stressed that the elements of the matrix $\mathbf{A}_{21}$ give the labor costs (in MR) of employing, for example, an unskilled rural Malay worker per MR of gross output of, say, industry 2 (Rubber products). In Section 5(a), we have already observed that the average labor productivity (gross output per worker) increased substantially, whereas the average wage rate increased only marginally. As a consequence, the labor costs per MR of gross output have—on average—seriously declined. The working of the SAM multipliers is that an exogenously given final demand (such as exports) leads to production, which requires labor. The corresponding labor income flows to households, which affects their consumption. A decrease in the labor costs implies a lower income for households and thus less consumption. In its turn, this induces less production, less labor use, less income, less consumption, and so forth. Table 6 shows that the gross output in each and every industry is negatively affected. Note that some industries are struck very hard, which holds for the food-related industries 1, 4, 6 and 10, but also for the Private sector services (15).

The decomposition of the changes in employment was given by Eqn. (11), where (11b) is further split according to Eqn. (10). The changes in employment depend on the changes in the labor coefficients (workers per unit of gross output) and changes in the gross outputs (which can be split into the 10 determinants as in Table 7). This implies that the changes in the labor productivity play a double role when decomposing employment changes in Table 7. First, by changing the compensation of labor and capital inputs (i.e.) $\Delta\mathbf{A}_{21}$. Second, by changing the direct labor coefficients (i.e.) $\Delta\mathbf{L}$. Our results should be interpreted with caution, however. As previously mentioned in Section 5(a), the role of imports may affect the use of labor and/or the output of a sector, and thus the change in the direct labor coefficient. We may therefore not be able to justify explicitly the extent to which the change in labor coefficients reflects the "true" changes in productivity.

In part (a) of this section, we have also seen that major shifts have taken place in Malaysia: from rural to urban areas; from unskilled to skilled labor; and the expansion of the public services sector favoring Malay workers. Note that these shifts are clearly reflected by the changes in labor productivities. These shifts show up as negative effects of $\Delta\mathbf{A}_{21}$ in row (4) of Table 7. Note that the changes in $\mathbf{A}_{21}$ have a substantial but indirect effect on gross outputs and employment. The shifts in labor productivities also correspond with the effects of $\Delta\mathbf{L}$on employment changes. This effect is more direct and therefore larger in absolute size. The results in rows 2 and 4 show that the decline of the labor coefficients (which is the reciprocal of the productivity) and the compensation to labor inputs exert a clear negative effect, which appears to be less for Malays than for the Indians and the Chinese and appears to be less in urban than in rural areas.

6. CONCLUDING REMARKS

In this paper we have examined the sources of income growth for all ethnic groups in Malaysia in the period 1970–2000. We have used a decomposition framework that splits the income growth into its underlying sources and applied this technique to the social accounting matrices of 1970 and 2000. Expansion of exports and the changes in the compensation of labor and capital are found to be the main determinants for the income changes.

If only the exports had changed in the way they actually have (and all other things would have remained unchanged) the household incomes would have largely increased. In the same fashion, changes in the compensation of labor and capital inputs had a large negative impact on all household incomes. Recall that the decline in the compensation of labor and capital may have had two causes that we could not discern

Table 7. *Decomposition of changes in employment, 1970–2000*

		Rural Malays	Rural Chinese	Rural Indians	Rural others	Urban Malays	Urban Chinese	Urban Indians	Urban others
A. Sources of change in employment (%)									
Total change (million workers)	(1)	1.29	0.11	0.06	0.55	1.85	1.56	0.40	0.22
Contribution (%) of changes in:									
Labor coefficients ($\Delta\mathbf{L}$)	(2)	−239.6	−3,590.7	−1,150.1	59.7	−36.7	−352.3	−258.7	27.8
Intermediate inputs ($\Delta\mathbf{A}_{11}$)	(3)	39.2	637.1	188.9	−2.7	20.5	83.9	71.1	6.9
Compensation of labor and capital ($\Delta\mathbf{A}_{21}$)	(4)	−130.6	−578.6	−253.2	−47.4	−17.5	−47.9	−37.0	−12.2
Income coefficients ($\Delta\mathbf{A}_{inc}$)	(5)	−8.7	−29.2	−14.1	−3.5	−0.9	−2.0	−1.5	−0.7
Consumption coefficients ($\Delta\mathbf{A}_{13}$)	(6)	−30.1	74.7	5.7	−18.8	5.2	20.8	19.7	1.8
Distributed profits ($\Delta\mathbf{A}_{34}$)	(7)	−13.1	−59.6	−25.4	−4.6	−1.8	−4.9	−3.7	−1.2
Government consumption ($\Delta\mathbf{x}_g$)	(8)	65.3	268.3	152.5	16.5	26.3	31.6	38.0	15.7
Investments ($\Delta\mathbf{x}_s$)	(9)	54.8	464.3	150.2	13.6	14.4	53.9	34.2	11.7
Exports ($\Delta\mathbf{x}_e$)	(10)	353.4	2,861.2	1,024.0	84.3	88.7	311.7	233.8	49.2
Factor income transfers ($\Delta\mathbf{x}_f$)	(11)	4.7	26.1	10.7	1.5	0.8	2.5	2.0	0.5
Institutional transfers ($\Delta\mathbf{x}_h$)	(12)	4.6	26.5	10.8	1.5	0.9	2.6	2.1	0.5

Sources: the results in Panel A are obtained by applying Eqns. (11).

in our analysis. These are import substitution effects (because exports mostly are offshoring activities that rely heavily on imported inputs, which substitute domestic value-added), and skill-biased technological change effects. For most ethnic groups, the combination of these two strong but opposing forces—i.e., changes in exports and changes in factor compensations—explained some 40% of the increase in household incomes.

The decomposition of labor incomes provided additional details and pointed at differences between skilled and unskilled workers. Due to skill-biased technological change in activities concentrating in rural areas, the changes in the compensation of labor and capital inputs led to large decreases in the labor incomes for all unskilled workers, to modest decreases for skilled workers, and even to increases for Malay skilled workers. Export growth led to large income increases for unskilled workers and modest increases for skilled workers. The combination of these two forces had a positive effect on the incomes of skilled workers but a negative effect for the unskilled workers.

For the three major ethnic groups, we found that the export growth and changes in the compensation of labor and capital inputs had relatively small percentage effects on income growth of the Malays when compared to the Indians and the Chinese. The underlying reason is that a large share of the Malays is employed in the public sector, with its focus on the domestic market and with a large share of skilled employment. This was a clear result of the policy to restructure the society through an expansion of the public services sectors where the priority had been given to skilled Malay workers and through the promotion of exports of labor-intensive products (which rely on unskilled workers). All unskilled workers benefited greatly from export growth but suffered more from the changes in the compensation of capital and labor inputs, Chinese and Indian skilled workers suffered slightly from the changes in compensation of capital and labor inputs but benefited more from export growth, and Malay skilled workers benefited slightly from both types of changes. Altogether, the policy reforms (i.e., expansion of the public services sector and export promotion for the private sector) have had limited effect in terms of reducing income inequality across ethnic groups.

NOTES

1. The Malaysian citizens are divided into ethnic Malays (53% in 2000), Chinese (26%), Indians (8%), and a group of other minority ethnics (13%). Next to the citizens, there is also the group of non-citizens, which is approximately 21% smaller than ethnic Indians.

2. Although processed foods contribute largely to exports, it has limited backward linkages with the agricultural sector because it depends substantially on imported inputs. This explains why a growing share of manufacturing exports is not contradicted by the declining share of agriculture in the generation of value added.

3. Saari, Dietzenbacher, and Los (2014) show that labor participation rates and numbers of working hours vary substantially across ethnic groups, as a consequence of which labor incomes would have differed considerably even if wage rates would have been identical.

4. The 1970 SAM includes separate accounts for Peninsular Malaysia in the west and the states of Sabah and Sarawak in east Malaysia. For this study, we have aggregated them so as to yield a single national SAM that is comparable to the 2000 SAM.

5. The inclusion of an account with so-called "wants" is not a standard practice in the construction of a SAM. In the past, however, several SAMs (see, e.g., Perkins, 1978; Pyatt & Round, 1984; Kouwenaar, 1988) introduced wants for the purpose of reclassifying commodities according to household purposes. This reflects a policy interest during the 1970s and 1980s in the issue of basic household needs.

6. The sectors are: (1) food and livestock; (2) beverages and tobacco; (3) inedible crude materials except fuels; (4) mineral fuels, lubricants, and related materials; (5) animal and vegetable oils and fats; (6) chemicals and related products; (7) manufactured goods classified chiefly by material; (8) machinery and transport equipment; (9) miscellaneous manufactured goods; and (10) other commodities and services.

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

8. Matrices denoted by bold capital symbols, column vectors are represented by lowercase bold symbols, while scalars are indicated by lowercase italics. Primes denote transposition, and hats refer to diagonal matrices with the elements of a vector on the main diagonal.

9. Recently, de Boer (2008) proposed the use of the so-called Montgomery decomposition as an alternative for the average of the polar decompositions or the average of all decompositions. His results, however, show only modest differences between the three alternatives.

10. The household income survey (HIS) for 2000 is a multi-purpose household-based survey. It is conducted to gather detailed information on income and some expenditure components (such as direct taxes and transfer payments) of households (and its household members), taking demographic and labor force characteristics into account. This HIS includes a sample of 170,903 randomly selected households throughout the nation. It has been used as the main dataset for the estimation of household and factor accounts in the 2000 SAM (see Saari *et al.*, 2014). In the present study, the HIS is used to estimate the employment by ethnic groups across sectors and the summary is given in Appendix A.

11. The institutional transfers in cell ($T_{3,5}$) of Table 3 consist of payments for pensions and other periodical payments received from the government. The results in Table 4 show that changes in these institutional transfers only explain 4.4% to the total household income. It is common in developing countries that secondary income sources (essentially transfers) contribute a smaller share to the total household income while primary income sources (factor incomes) contribute the largest share. In the 2000 Malaysian SAM, factor incomes are 91% of total household income. In Indonesia (Thorbecke, 1991) and Vietnam (Tarp, Roland-Holst, and Rand, 2002) factor incomes contribute 93% and 80%, respectively. This, however, does not imply that institutional transfers are insignificant for poverty reduction (Agostini & Brown, 2011; Galasso & Ravallion, 2005). We are unable to examine the role of institutional transfers for poverty reduction (and income inequality) because the data in our SAMs group income by ethnic groups. Data by income class or at the individual level are not available.

12. In the presence of a large import dependency in 2000, one should be very careful in interpreting this change in output per worker as pure labor productivity growth. The large change in output per worker is partly caused by the growth in imports. At the same time, however, processing trade activities are not very dominant and only account for 2% of total exports in 2000 (see DOSM, various years).

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APPENDIX A.

See Table 8

APPENDIX B. HARMONIZATION AND DEFLATION PROCEDURES

An overview of the original accounts in the two SAMs is given in Table 9. It can be observed that there are four differences that require somewhat more explanation. First, the difference—during 1970–2000 SAMs—in the treatment of the consumption of commodities by households. In the 2000 SAM, this consumption is (as usual) listed directly in the household account as an expenditure to the production account. In the 1970 SAM, however, household needs (e.g., for food, clothing, housing, education, medical services) appear in a special account that lists 20 of such wants. Each of these wants requires a bundle of commodities. For example, the want for medical services is fulfilled by the commodities other agricultural products, books, chemicals, other manufactured goods, education and health, and government services. To ensure the comparability of the 1970 and 2000 SAMs, the wants account has been removed and household consumption has been converted into the typical consumption of commodities. The conversion procedure was as follows. The 1970 SAM lists a 20×21 matrix **C** and its element c_{ij} gives the expenditures of household group j (= 1, ..., 21) on want i (= 1, ..., 20). From the SAM, we have obtained the 26×20 shares matrix **H**, with typical element h_{ki} indicating the amount of Malaysian *Ringgit* (MR) spent on commodity k (= 1, ..., 26) for each MR spent on want i. The 26×21 matrix

Table 8. *Employment in public and private sectors by ethnic groups*

	Rural Malays	Rural Chinese	Rural Indians	Rural others	Urban Malays	Urban Chinese	Urban Indians	Urban Others
Employment in 1970 ('000)								
Public sector	131	23	19	4	83	54	31	4
Private sector	1,111	530	172	13	112	427	66	5
Total	1,242	553	191	16	195	481	97	9
Employment in 1990 ('000)								
Public sector	281	18	14	68	471	120	70	46
Private sector	1,097	368	163	514	802	1,220	254	122
Total	1,378	386	177	231	1,273	1,340	324	168
Employment in 2000 ('000)								
Public sector	428	31	20	75	584	140	69	48
Private sector	2,101	627	236	493	1,458	1,901	426	183
Total	2,529	658	256	568	2,042	2,041	495	232

Sources: Pyatt and Round (1984) for 1970 and Department of Statistics Malaysia (2001) for 2000.

Table 9. *Classification of accounts for the 1970 and 2000 SAMs*

Classification of the 1970 SAM		Classification of the 2000 SAM	
1. Wants	20 commodities		
2. Factors	East Malaysia—four factors: labor; unincorporated business capital; corporate business capital; and housing West Malaysia—nine factors: six categories of labor (two geographical locations × 3 education levels); three types of capital (unincorporated business capital, corporate business capital, and housing)	1. Factors	27 factors: 24 categories of citizen labor (two geographical locations × 4 ethnic groups × 3 education levels); one category of non-citizen labor; two types of capital (unincorporated business capital and corporate business capital)
3. Households	East Malaysia—one household West Malaysia—20 households: two geographical locations × 3 ethnic groups × 3 employment status; two for other ethnic groups (rural and urban)	2. Households	Nine households: eight for citizen households (two geographical locations × 4 ethnic groups); one for non-citizens
4. Production (commodities)	26 types of commodities	3. Production	92 commodities/industries
5. Production (activities)	21 types of activities		
6. Companies	One account	4. Companies	One account
7. Government	One account	5. Government	One account
8. Consolidated capital	One account	6. Consolidated capital	One account
9. Rest of the world (current)	One account	7. Rest of the world (current)	One account
10. Rest of the world (capital)	One account	8. Rest of the world (capital)	One account
11. Indirect taxes	One account	9. Indirect taxes	One account

Sources: Pyatt and Round (1984) for the 1970 SAM and Saari *et al.* (2014) for the 2000 SAM.

HC then gives the consumption of the 21 household groups on each of the 26 commodities.

Second, the two SAMs differ in the way they treat production. The 2000 SAM includes a symmetric input–output table, which implies that it is assumed that each industry produces only one commodity and each commodity is produced by only one industry. Under this assumption, it is not necessary to make a distinction between commodities and activities (or industries). The 1970 SAM, on the other hand, includes make and use matrices and thus, do not require that each industry produces one and only one commodity. In general, they are rectangular and the make matrix gives for each industry the output of all the different commodities it has produced domestically and it also records the imported commodities. The use matrix indicates the intermediate use of commodities by each industry and the consumption of commodities by final demand components. The use of commodities in the use matrix includes both domestically produced and imported commodities. The derivation of a symmetric input–output table requires that imports are filtered out, so that the technology matrix only represents the domestic intermediate commodities. In the absence of an import matrix, the following approach is taken for the estimation of domestically produced commodity inputs. For each commodity, the share of imported commodities to the total supply in the make matrix is calculated. This share is then used as a basis for the separation of imported commodities from the total intermediate inputs and also from the total final demand consumption in the use matrix. Next, the 1970 make and use matrices have been converted into a symmetric input–output table using the industry technology assumption (see e.g., Miller & Blair, 2009, Chapter 5). We have applied the industry technology assumption because it is consistent with the assumption used by the Department of Statistics Malaysia (DOSM).

A third aspect is that the data for the two SAMs are not entirely comparable because certain data for 1970 are lacking and thus not included in the 1970 SAM. Information for income disaggregated according to ethnic groups is for 1970 only available for west Malaysia, but not for east Malaysia. The 2000 SAM disaggregates income according to ethnic groups but no distinction is made between east and west Malaysia. For the harmonization of the two SAMs, the income of east Malaysia is distributed over the ethnic groups by assuming that the composition of ethnic groups in east Malaysia is the same as in west Malaysia. A similar approach is used in the case of the factors of production (in particular labor). Although income in west Malaysia contributes about 84% to total income in Malaysia, this assumption may not be taken for granted. Because data for the distribution of income across ethnic groups in east Malaysia in 1970 are completely unavailable the assumption is hard to validate. The "best" available data for east and west Malaysia that can used for validation of the assumption is the distribution of employment by age groups and occupations, as given in Table 10. It can be clearly observed that the distribution of employment for west Malaysia adequately represents the distribution for total Malaysia, both for age groups and for occupations. In addition, data for non-citizen households are not available for 1970 and thus we have left the non-citizen households also out of the 2000 dataset.

Fourth, differences also exist in terms of classifications and definition of production sectors, factors of production and households. For the purpose of consistency, the 1970 SAM was reconciled and reclassified by following closely the design and classification of the 2000 SAM. In its turn, the 2000 SAM had to be considerably aggregated in its production accounts. As a result of the aggregation, 17 production activities are distinguished. Table 3 outlines the harmonized versions of 1970 and 2000 SAM.

After harmonizing the SAMs, the next step is to express the harmonized version of the 1970 SAM in 2000 constant prices. Producer price indices (PPI), import price indices (IPI) and 'indirect price deflators' for value-added and for certain types of GDP expenditures are the main price indices used in the deflation procedures. As previously mentioned in Section 3, the available price indices for the deflation are limited and thus each transaction in Table 3 is deflated using different approaches. For the production activities (in account 1), the transactions in row 1 contain the intermediate demands ($T_{1,1}$), household consumption ($T_{1,3}$), government consumption ($T_{1,5}$), investment expenditures ($T_{1,6}$) and exports ($T_{1,7}$). They are deflated using the PPIs, which gives the total gross output (y_1) in constant prices. This total gross output is equal to the total gross input (y_1'), because in a SAM, the corre-

Table 10. *Employment by age groups and occupations, 1970*

	West Malaysia		East Malaysia		Malaysia	
	('000)	(%)	('000)	(%)	('000)	(%)
Age groups						
15–24	1,018.9	32.9	178.0	30.5	1,196.9	32.5
25–39	1,115.3	36.0	222.7	38.1	1,338.0	36.3
40–49	520.8	16.8	100.6	17.2	621.4	16.9
50–59	337.6	10.9	64.2	11.0	401.8	10.9
60–64	105.4	3.4	18.4	3.2	123.8	3.4
Total	3,098.0	100.0	583.9	100.0	3,681.9	100.0
Occupations						
Professional and technical	157.7	4.6	136.7	4.8	294.4	4.7
Administrative and managerial	36.5	1.1	30.7	1.1	67.2	1.1
Clerical workers	167.7	4.9	142.5	5.0	310.2	5.0
Sales workers	283.9	8.4	258.4	9.1	542.3	8.7
Services workers	252.3	7.4	225.8	7.9	478.1	7.7
Agricultural workers	1,641.6	48.3	1,278.8	44.9	2,920.4	46.8
Production workers	856.2	25.2	777.4	27.3	1,633.6	26.2
Total	3,395.9	100.0	2,850.3	100.0	6,246.2	100.0

Sources: Economic Planning Unit (various years).

sponding row (income) and column (expenditure) totals of the matrix must be equal to each other. For transactions in column 1, the imports ($T_{7,1}$) are deflated by applying the IPIs. The commodity taxes ($T_{9,1}$) are adjusted proportionately to the gross output. That is, we apply the sectoral shares of these taxes in the gross output (all in current prices) to the sectoral gross output in constant prices. Note that the sum of these commodity taxes is equal to the indirect taxes as indicated in ($T_{5,9}$). This procedure is indicated by the superscript S (i.e., using current value shares). Given the total gross input and all but one input component, the totals of the sectoral values added (i.e., the column sums of $T_{2,1}$) are obtained as residuals. Next, these totals are distributed over the 18 value-added categories (i.e., 16 labors and 2 capital inputs) using current value shares (additional information on, for example, indexes of wage rates is lacking). These two steps are indicated in Table 3 by the superscripts R (i.e., residuals) and S.

For the factors of the production account (account 2), transactions in row 2 contain factor incomes for 18 value-added categories ($T_{2,1}$) and the vector with factor incomes received from abroad ($T_{2,7}$). In 1970 SAM, vector $T_{2,7}$ contains only corporate business profits. That is, no transactions for compensation of employees and unincorporated business profits were recorded, implying that the first 17 elements of vector $T_{2,7}$ are zero. Consequently, the first 17 elements of the vector y_2 with total factor incomes are known. Element 18 (for corporate business profits) in y_2 is deflated with the IPD for value added, after which the corporate business profits from abroad are then obtained residually.

For the transactions in column 2, the compensation of employees and the unincorporated business profits for households ($T_{3,2}$) are obtained as follows. In 1970 SAM, there is no compensation of employees and the unincorporated business profits paid abroad (implying that the first 17 elements in the row vector $T_{7,2}$ are zero). This implies that the total incomes for the compensation of employees and the unincorporated business profits are redistributed according to the ownership of the factor. The labor income earned by, for example, rural skilled Malay employees and rural unskilled Malay employees goes entirely to the rural Malay households. The procedure is the same for the compensation of employees in the other seven household groups and is indicated in Table 3 by superscript D. The unincorporated business profits are essentially income from self-employment and they are distributed over the household groups using current value shares. Finally, the corporate business profits are divided over the companies ($T_{4,2}$) and the rest of the world (as factor incomes paid abroad, $T_{7,2}$), using current value shares.

Next, the net investments abroad ($T_{8,6}$) in the consolidated capital account (account 6) are determined residually. Because aggregate savings (y_6) in constant prices are obtained from applying the appropriate IPD, also the aggregate investments (y'_6) in constant prices are known. Subtracting the deflated investment expenditures ($T_{1,6}$) yields the net investments abroad. It is important to note that net investments abroad and the current account deficit of the rest of the world ROW (i.e., $T_{7,8}$) are the same. If Malaysian exports are larger than its imports, the balance on the current account will show a surplus for Malaysia and a deficit for the ROW (i.e., $T_{7,8} > 0$). The balance on the capital account will thus show a deficit for Malaysia and a surplus for the ROW. It is recorded in the SAM as a transaction from the capital account of the ROW to its current account (and equals the deficit on the ROW's current account). The deficit of the Malaysian capital account implies that Malaysian net investments abroad are positive. Hence, $(T_{8,6}) = (T_{7,8})$ which implies that the total capital paid abroad (y_8) is now also known.

The final step in the deflation process is to determine the remainder. Note that by applying the appropriate IPDs, we have the total, $y_3 \ldots, y_7$ (and thus, $y'_3 \ldots, y'_7$) in constant prices. The deflated transactions that are still unknown are in the 12×12 matrix formed by the intersection of the rows and columns of the accounts 3, …, 7. Because all other transactions are known (as are the totals), we can calculate the margins (i.e., row sums and column sums) of this 12×12 matrix. The final step then is to apply the RAS updating procedure to this 12×12 matrix in current prices, given its margins in constant prices (see Dietzenbacher & Hoen, 1998). It should be stressed that also other balancing techniques could have been used, such as cross entropy methods (see Robinson, Cattaneo, & El-Said, 2001). Such alternative methods are typically more general than RAS, in the sense that they allow the use of all sorts of additional information and can deal with scattered and inconsistent data. If such "extras" do not apply (as in our case) RAS and its generalizations yield very similar results.