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SOURCES OF LABOR GROWTH IN MALAYSIAN MANUFACTURING SECTOR

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The manufacturing sector plays an important trole in Malaysian industrial development. High growth rates and technology expansion in the manufacturing sector resulted in a substantial increase in demand for labor. This process of rapid growth and changes in the demand for labor were also accompanied by changes in labor structure and skills. At the same time, the range of activities and products became more diversified and, correspondingly the composition of manpower sub sectors changed significantly. This study employed the input-output Structural Decomposition Analysis (SDA). The analysis computed the compositional manpower change as a result of decomposition. The result of this study indicates that sources of labor growth in the manufacturing sector were favored by changes in the final demand structure. Within the changes in the final demand structure, changes in domestic demand structure were the dominant source of employment growth between 1978 and 1991 and the overall period 1978-2000. However, from 1991 to 2000, employment change was due mainly to changes in export structure. Changes in the structure of domestic demand had a relatively strong and increasing effect on service workers, production and related workers, transport equipment operators, laborers, and clerical and related workers during the 1978-1991 period. Changes in the export structure were the main factor that had an increasing effect on the

employment of high skill workers and sales workers. However, during the second subperiod of 1991-2000, manpower growth was exports structure driven.

Keywords: input-output; labor; manufacturing; structural decomposition analysis

Introduction

The Malaysian economy has undergone a significant structural transformation from a basic agrarian-based economy to an industrialized one. Malaysia experienced four major phases of industrialization, with import substitution or export orientation dominating each phase alternately. The Malaysian manufacturing sector has become increasingly important since independence in 1957, registering rapid growth in the 1970s and late 1980s. The decrease in the contribution of the agriculture sector to Gross Domestic Product (GDP) in terms of percentage and absolute value has been overtaken by an increase in the manufacturing sector. Manufacturing's share of GDP rose from only 18.5 percent in 1980 to 31.9 percent in 2006. This sector grew at an annual rate of 17.0 percent in 1988 and 7.0 percent in 2006, and its share in GDP increased from RM10,274 million to RM88,542 million (Malaysia Economic Statistics-Time Series 2005 and 2007). This demonstrated the continuous expansion of the manufacturing sector, and reflected the rapid rate of industrialization of the country. The structural changes in the Malaysian economy also transformed the country from an exporter of primary commodities into an exporter of high value-added manufactured products.

As for the structural transformation, the manufacturing sector was found to play a more dynamic role in contribution to labor compared to agriculture. The declining role of the agricultural sector is evident from a decline of labor working in this sector. The contribution of the agriculture sector to total labor decreased from 1,653.8 thousand persons in 1982 to only 1,503.50 thousand persons in 2006. At the same time, the share of total labor in the agriculture sector decreased from 31.5 percent in 1980 to only 14.6 percent in 2006. Most new labor came from the rapidly expanding manufacturing sector, whose total labor force climbed from 816.0 thousand persons in 1982 to 2,024.7 thousand persons in 2004. In 1992 manufacturing's share of all labor first overtook that of agriculture. The percentage contribution of the manufacturing sector to the total labor increased from 15.5 percent in 1982 to 20.3 percent 2006 (Malaysia Economic Statistics-Time Series 2005 and 2007).

The development of the manufacturing sector become more important when "Vision 2020" proposed that Malaysia become fully industrialized nation. At the same time, integration

of the Malaysian economy into global and advanced technology economy prompted structural changes, not only in output composition, but also in labor structure and skills. Indeed, currently the economy is experiencing further structural adjustments in output and employment as the degree of integration with world markets increases and changes in technology deepen. Naturally, as a small open economy, Malaysia's domestic demand, exports, imports, economic growth and technological change has certainly affected directly and indirectly changes in manpower structure, especially in the manufacturing sector.

Technological progress in an economy certainly also changes the requirements for the economy's labor force in terms of the combination of knowledge and skill levels and causes replacement of some occupation by others. The present study would like to investigate the sources of manpower changes in the manufacturing sector as it moves towards a more high skilled, high-technology and capital-intensive method of production in order to remain competitive, especially in broad sectors like electronics and electrical goods. The continuation of economic transformation in the era of industrialization will undoubtedly create new demands for high level technical skills, managerial and entrepreneurial capabilities as well as increased technological development and improved capital utilization. Hence it is important to undertake new research on labor issues in the manufacturing sector because the sector is anticipated to become a major absorber of manpower. Failure to take these matters into consideration in the promotion of national development may severely affect the economy because the national development plan aims to ensure sustainable economic growth. It would be interesting to study whether there was any significant shift in labor structure and, if there was, what the sources of labor change during the industrialization process were?. As a result, it is important to understand and identify the sources of growth that would give strongest impetus to this transition.

In addition, structural decomposition analysis, which is employed in this research has the capability to decompose changes in the manpower of an economy into the effect of technical change, the effect of changes in final demand structure, the effect of economic growth, as well as the capability to identify explicitly the manpower substitution effect and the manpower productivity effect of technical change.

Literature Review

Manpower input-output structural decomposition analysis is the extension of the Structural Decomposition Analysis (SDA) and input-output labor models. Moore and Peterson (1955) were among the first to identify the capability of an input-output model to be useful in analyzing the labor impacts of changes in final demand. They utilized what has become known as the

'labor requirement function' in conjunction with the I-O transactions matrices to illustrate the relationship between sectoral labor and the value output. Richardson (1972), Gould and Kulshreshtha (1985), Groenewold et al. (1987) develop models that incorporate these types of equations to estimate the labor impacts of changes in final demand. Diamond (1975) and Bathelt (1991) employed an input-output model for analyzing labor changes and linkages within an economy. While Holub and Tappeiner (1989) introduced an extension of input-output labor models to overcome the weaknesses in the traditional model.

A number of recent studies on labor input-output include study done by Leclair (2002) which examined the effect that export composition had upon manufacturing labor in the United State during the 1991 recession. This analysis estimated the labor effects of manufacturing exports by utilizing an input-output model to measure direct and indirect effects. The results demonstrated that export composition has reduced and strengthened demand for labor. By using two input-output tables, Guncavdi et al. (2003) calculated the labor demand of the Turkish industries and analyzed the changes in labor demand. Their findings showed that foreign trade in intermediate goods creates extra use of domestic labor.

Napoles (2004) measured the impact of Mexico exports both on gross output (production for intermediate and final demand) and labor through input–output analysis, which includes the technical coefficients matrix, the direct labor vector, and the final demand vector (in this case, of exports). The results of this analysis concluded that the positive effect of increasing manufacturing exports on production is limited and offset by manufacturing imports, thus displacing domestic production. The positive effect of exports on direct and indirect labor is not as important as that of domestic production. The direct impact of exports on labor has increased as a percentage of total labor; it is still low when compared to the rapid growth of total exports. This may be due, at least in part, to the fact that manufacturing exports are increasingly less labor intensive and more capital intensive.

The above input-output labor studies, however, have a serious weakness which restricts their use for analyses of concrete labor problems. Labor is assumed to be absolutely homogeneous. Therefore it is not possible to treat problems which arise from the different qualifications of labor. More recently, Gu and Rennison (2005) used an input-output model to examine the effect of trade integration on demand for skilled workers and productivity growth in Canada for 1981-1997. They found that trade integration had a positive effect on both total factor productivity and labor productivity. Total factor productivity and labor productivity grew faster in import and export industries than in the total business sector over this period, and this productivity growth gap has widened over time. Canada is found to have a comparative

advantage in natural resource-intensive industries and capital, although it has reduced over time. They also found that trade integration had little effect on the demand for unskilled and skilled workers in Canada.

As mentioned earlier, input-output structural decomposition analysis has been used to observe other effects of economic change on independent and dependent variables. Although the predominant objective of most studies has been to examine change in trade, investigating energy use and economic growth follow close behind. Other key dependent variables to which SDA has been applied include labor requirements. Forssell (1990), for example, has analyzed the changes in the use of labor according to educational attainment in the Finnish economy by using an input-output framework. The educational level of the population is classified according to the amount of education received (level 1 until level 9). The shifts in the use of labor input between the initial year and the terminal year are decomposed into the effect of structural change on final demand, the effect of growth, the effect of changes on intermediate input-output coefficients, the effect of changes on labor coefficients themselves. The two last stated effects are measures of technical changes. The result of the study indicated that the changes due to intermediate input-output coefficients are small compared to other changes. Most of the changes are due to the labor input coefficient, which has decreasing effects on the use of labor with education level 2 and 9 but zero increasing effects on the use of labor in education levels 3-8. However, the changes in the structure of final demand categories usually have decreasing effects on the use of labor input.

Input-output tables are used to examine output and labor growth patterns in Japanese industries between 1980-85 and 1985-88 by Fujita and James (1991). The objective is to measure if substantial structural change in labor and output had occurred following the sharp real appreciation of the yen against the dollar and other currencies in 1985. The results indicate Japan had shifted from export-led growth between 1980-85 to domestic-demand-driven growth between 1985-1988. Whereas factors of labor growth in the manufacturing sector are decomposed into the domestic final demand expansion effect (DF), labor productivity effect (LP effect), import substitution effect (IS effect), export expansion effect (EE effect) and technological change effect (TC). During 1980-85, labor productivity increased in most manufacturing sectors. However, this was not accompanied by unemployment because the expansion of export and domestic final demand largely offset negative effects from the increase in the labor productivity.

Instead of focussing on the output and labor growth patterns, Betts and McCurdy (1993) decomposed labor changes in each industry-occupational group (manpower) in the Canadian private sector by combining an input-output table and census information

data from 1961, 1971 and 1981. Industries are grouped into services, manufacturing /construction and primary. Following Wolff and Baumol's study, labor occupations are divided into five groups; data services workers, goods workers, services workers, knowledge workers and n.e.c. (occupations not elsewhere classified). Labor in each occupation and industry are expressed as a function of (i) the number of hours worked by labor in each industry, (ii) the occupational mix of labor by industry, (iii) the labor productivity by industry in terms of output per person per hour, (iv) the level of consumption, (v) each industry's input-output vector and the components of final demand for each industry's commodities, (vi) the level of private investment, (vii) the level of government spending on goods and services, (viii) the level of exports and lastly (ix) level of imports.

On the other side, Lakshmanan et al. (1993) tracked the progression of knowledge levels in the labor force in the Japanese economy. By using the SDA method, changes in the levels of knowledge embodied in all workers in the different industries are decomposed into their sources: changes in the structure of final demand, changes in labor productivity, technical changes and lastly changes in the component structure of occupation.

Unlike previous studies, which analyze the labor requirement as a small part of their study, Han (1995) employs the labor requirement model by extending the framework of input-output decomposition analysis into a model which decomposes changes in the labor requirement of the Japanese economy into effects of technical change, effects of changes in the structure of final demand, interaction of technical change and changes in final demand, and effects of economic growth. Production in 28 industries is differentiated, while labor is disaggregated into 5 categories: professional and technical, manager and officials, white collar workers, blue collar workers and services workers. The empirical study indicated that Japanese labor force experienced the replacement of blue collar workers by highly skilled professionals and technicians in the period 1975-85. Both technical change and changes in the structure of final demand fostered the increasing demand for professionals and technicians. Furthermore, when the total labor intensiveness of the Japanese economy decreased, its high quality labor intensiveness increased. However, this study will be more comprehensive if the author classified the labor by skill levels.

Ruiz and Wolff (1996) utilized the input-output structural decomposition analysis to analyze the sources of labor growth in Puerto Rico, 1967-1987. The sources of labor growth are decomposing to the technical change effect, final demand effect and the import leakage effect. They find that labor growth was led primarily by a rapid increase in final output (5.1% per year) although labor productivity growth was also substantial at 3.7 per-

cent per year. Import leakages also fell over the period, but had little impact on labor growth. Employment generated by local absorption was more successful than exports, even though the increase in export demand was more than local demand. There was also a notable shift in the occupational structure toward white-collar labor (professional, technical, managerial, sales and clerical) and away from blue-collar jobs (operative, craft, labor and service). The main reason for this was the changes in the composition final demand toward a greater reliance on white-collar workers. The second reason was due to bias in technological change, which favored white collar-collar over blue-collar workers.

In this line of research, Cheon's (1999) study focuses on the labor and skill effects of increasing global competition and technological innovations in the Korean manufacturing sector. In order to investigate the effects of technology, domestic demand and trade on employment, the researcher decomposed labor changes into three sectors such as net trade (export-import), domestic consumption and technical change. Results showed that a 3.3 million increase in the labor force occurred between 1970 and 1990, which resulted from a net addition of an estimated 15.9 million gain due to domestic economic growth, and 0.1 million gain due to net trade (3.3 million due to exports minus 3.2 million due to imports), offset by net losses of 12.7 million from implementation of change in the labor-output ratio (labor-saving technological changes). However, the effects of foreign trade and technology on labor varied from industry.

Wolff (2006) examined the effect of technological change, computerization and structural change on the growth in the number of information workers in the US economy. He constructs matrices of employment by 64 industries and 267 occupations. He then aggregates the occupations into four categories namely; data processors, knowledge producers, service workers and good-processing workers. By using input-output decomposition analysis, he noticed that growth in the number of information workers was driven not by a shift in tastes toward information-intensive goods and services (as measured by the composition of final demand) but rather by a roughly equal combination of the substitution of information workers for goods and service workers within the unbalanced growth effect (from differential rates of industry productivity growth) and the structure of production of industries. Finally, on the basis of regression analysis, he found that computer investment and R&D expenditures are negatively associated with the growth of data workers but positively associated with the growth in knowledge workers.

More recently, Jenkins (2008) used Chenery type decomposition analysis of employment change for different types of labor in South Africa. The researcher decomposed labor changes into five components such as exports, import substitution, do-

mestic demand, productivity growth (peroxide for technological change) and net trade. Both technology and trade are found to have had a negative impact on employment. The decomposition analysis would appear to suggest that technological changes are a more significant cause of job losses than trade, and trade only had a negative impact on employment during a relatively brief period of sharply raised import penetration during the early 1990s. In the case of skilled workers, technological change has also tended to have a negative effect, except in the 1980s. A rather different pattern appears in the case of highly skilled labor where technology increased demand until the mid 1990s, reflecting the skill-biased nature of technological change.

The above manpower input-output SDA analysis describes the structural development of a production system by separating certain components and thus it helps to explain better what has happened to the structure of manpower. As such, SDA does not explain why structural changes have occurred. Furthermore, the SDA technique relies on comparative static analysis which implies that the driving forces behind structural changes and dynamic process of development are not analyzed.

Methodology

In the input-output approach, the balance equation can be written as:

$$X = AX + F \quad \text{.....(1)}$$

where,

F is the vector of final demand;

X is the vector of sectoral output; and

A is the technical coefficient matrix.

Solving the balance equation for X, we obtain

$$X = (I - A)^{-1}F$$

$$\text{Let } R = (I - A)^{-1}$$

where $R = (r_{ij})$ is Leontief inverse matrix.

We may write Equation (1) as

$$X = RF \quad \text{.....(2)}$$

The labor requirement equation of an I-O production system of *n* sector is

$$L = l(I - A)^{-1}F \quad \text{.....(3)}$$

The theoretically and empirically most serious supposition in the I-O labor model is the assumption of a single type of labor per sector (labor is homogenous). By ironing out all differences between types of employed labor this assumption directly violates the basic idea of I-O economics, i.e. structural differentiation (Holub and Tappeiner 1989). The most important of these structural differentiations is certainly based on the different categories of labor. The model of manpower structural decomposition analysis begins with the labor requirement equation of an input-output production system with n sectors and m labor occupations or manpower. Labor row vector coefficients l_i have to be extended to an m x n matrix or manpower

coefficient matrix *(H)*. Thus, the replacement of labor vector coefficient *(l)* with manpower coefficient matrix *(H)* yield Equation 4;

$$L=H(I-A)^{-1}F \quad \text{.....(4)}$$

where

$$H=\begin{bmatrix} h_{11} & h_{12} & h_{13}\text{.....} & h_{1n} \\ h_{21} & h_{22} & h_{23}\text{.....} & h_{2n} \\ h_{31} & h_{32} & h_{33}\text{.....} & h_{3n} \\ M & M & M\text{.....} & M \\ . & . & . \ . & . \\ . & . & . \ . \ . & \\ . & . & . \ . \ . & \\ h_{m1} & h_{m2} & h_{m3} & h_{mn} \end{bmatrix}$$

where L is a total manpower requirement column vector by occupations ($m \times 1$), measured in workers; H is a manpower coefficient matrix by occupation and by sector ($m \times n$) with the coefficients measured in terms of workers required per unit output; F is a final demand vector ($n \times 1$) measured in value terms; A is a technical coefficient matrix ($n \times n$), which measures the input requirements per unit output in value terms; and I is an identity matrix ($n \times n$).

From Equation 4, the present study defines $R=(I-A)^{-1}$, and then Equation 4 can be expressed as,

$$L=HRF \quad \text{.....(5)}$$

From Equation 5, thus sources of manpower change for n sectors can be express as (Han 1995):

$$L=HR(F)^{\wedge} \quad \text{.....(6)}$$

$(\ )^{\wedge}$ denotes the diagonal matrix of the F vector in the parentheses and let

$$\theta=\frac{GDP_t}{GDP_0}$$

is the expansion rate of the gross domestic product (GDP) between terminal year and initial year.

Then the change in the manpower requirement of an economy between the two years (years 0 or initial and year 1 or terminal) can be decomposed into;

$$\begin{aligned}\Delta L &= L_t - L_0 \\ &= H_tR_tF_t - H_0R_0F_0 \\ &= H_tR_tF_t - H_0R_0F_t + H_0R_0F_t \\ &\quad - H_0R_0\phi F_0 + H_0R_0\phi F_0 - H_0R_0F_0 \\ &= (H_tR_t - H_0R_0)F_t + H_0R_0(F_t \\ &\quad - \phi F_0) + H_0R_0(\phi - 1)F_0 \\ &= (H_tR_t - H_0R_0)F_t - (H_tR_t \\ &\quad - H_0R_0)F_0 + (H_tR_t - H_0R_0)F_0 \\ &\quad + H_0R_0(F_t - \phi F_0) \\ &\quad + H_0R_0(\phi - 1)F_0\end{aligned}$$

or

$$\begin{aligned}\Delta L &= (H_tR_t - H_0R_0)F_0 + H_0R_0(F_t - \phi F_0) \\ &\quad + H_0R_0(\phi - 1)F_0 \\ &\quad + (H_tR_t - H_0R_0)(F_t - F_0)\end{aligned} \quad \text{.....(7)}$$

From Equation 7, the sources of manpower change are summarized as Table 1.

Table 1. **Sources of Labor Change**

First Term	$(H_tR_t - H_0R_0)F_0$	The first term is the effect of technical change on the labor requirement of the economy, which includes both the direct effect of technical change on the labor requirement, through changing direct labor input coefficients, and the indirect effect of technical change on the labor requirement, through changing intermediate input coefficients.
Second Term	$H_0R_0 (F_t - \phi F_0)$	The second term is the effect of changes in the structure of final demand.
Third Term	$H_0R_0 (\phi - 1)F_0$	The third term is the effect of economic growth.
Fourth Term	$(H_tR_t - H_0R_0)(F_t - F_0)$	The final term is the effect of interaction between technical change and changes in the final demand.

Note: F vector is in the form of diagonal matrix for n sectors manpower

Technical Change

We shall assume that the technical change within each sector can be broken into two separate parts, i.e. changes in intermediate input using technology and changes in manpower using technology, and denoting as a hypothetical direct manpower coefficient matrix (m x n) with the labor intensity of each sector the same as that of , but the occupation mix of each sector manpower the same as that of , which is mathematically defined as,

$$H^* = H_0(vH_t)^{\wedge}(vH_0)^{\wedge -1} \quad \ldots\ldots\ldots(8)$$

is a unit row vector (1 x m) and $(\ )^{\wedge}$ denotes the diagonal matrix of the vector in the parentheses.

$$\begin{aligned}
&(H_tR_t - H_0R_0)F_0 = \\
&(H_tR_t - H_0R_t + H_0R_t - H_0R_0)F_0 = \\
&(H_t - H_0)R_tF_0 + H_0(R_t - R_0)F_0 = \\
&(H_t - H_0)R_tF_0 - (H_t - H_0)R_0F_0 + \\
&(H_t - H_0)R_0F_0 + H_0(R_t - R_0)F_0
\end{aligned}$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(9)$$

Then, the effect of technical change (first term) can be further decomposed in Equation 9.

Base on Equation 9, the effect or technical change is summarized as Table 2.

Table 2. **Structural Decomposition of Technical Change for Labor**

1 $(H_t - H^*)R_0F_0$	Effect of inter –occupation substitution
2 $(H^* - H_0)R_0F_0$	Effect of changes in labor productivity
3 $H_0(R_t - R_0)F_0$	Effect of changes in intermediate input
4 $(H_t - H_0)(R_t - R_0)F_0$	Effect of interaction between changes in manpower coefficient and changes in intermediate input coefficients

Note: *F* vector is in the form of diagonal matrix for *n* sectors manpower

Final Demand

Final demand comprises of domestic consumption, government expenditure, investment, stock change, exports and imports. The effect of changes in the structure of final demand also can be further decomposed. Let us suppose that the final demand is decomposed into domestic final demand (including domestic consumption, government consumption (federal, state, local), changes in inventory, gross fixed capital formation), exports and imports, and let

$$\gamma^d=\frac{\mu F_t^d}{\mu F_0^d} \qquad \gamma^e=\frac{\mu F_t^e}{\mu F_0^e} \qquad \gamma^m=\frac{\mu F_t^m}{\mu F^m{}_0}$$

where

F^d= Domestic final demand (n x 1)

F^e= Exports (n x 1)

F^m= Imports (n x 1)

μ= Unit row vector (1 x n), and

f= $(F^dF^eF^m)$ (n x 3)

$$\bar{\gamma} = \begin{pmatrix} \gamma^d \\ \gamma^e \\ \gamma^m \end{pmatrix} \qquad \bar{\phi} = \begin{pmatrix} \phi \\ \phi \\ \phi \end{pmatrix}$$

(3 x 1) (3 x 1)

Then, the effect of changes in the structure of final demand can be further decomposed in Equation 10.

Based on Equation 10, the effect or final demand is summarized as Table 3.

$$\begin{aligned} H_0R_0(F_t-\phi F_0)= {} & H_0R_0[F_t^d+F_t^e+ \\ & F_t^m-\phi_t(F_0^d+F_0^e+F_0^m)]= \\ & H_0R_0(F_t^d+F_t^e+F_t^m- \\ & \gamma^dF_0^d-\gamma^eF_0^e-\gamma^mF_0^m+ \\ & \gamma^dF_0^d+\gamma^eF_0^e+\gamma^mF_0^m- \\ & \phi F_0^d-\phi F_0^e-\phi F_0^m)= \\ & H_0R_0[(F_t^d-\gamma^dF_0^d)+ \\ & (F_t^e-\gamma^eF_0^e)+(F_t^m-\gamma^mF_0^m) \\ & + f_0\,(\bar{\gamma}-\bar{\phi})] = \\ & H_0R_0(F_t^d-\gamma^dF_0^d)+ \\ & H_0R_0(F_t^e-\gamma^eF_0^e)+ \\ & H_0R_0(F_t^m-\gamma^mF_0^m)+ \\ & H_0R_0f_0\,(\bar{\gamma}-\bar{\phi}) \end{aligned}$$

……(10)

Table 3. **Structural Decomposition of Final Demand for Labor**

1.	$H_0R_0(F_t^d - \gamma^d F_0^d)$	Effect of changes in domestic demand structure
2.	$H_0R_0(F_t^e - \gamma^e F_0^e)$	Effect of changes in export structure
3.	$H_0R_0(F_t^m - \gamma^m F_0^m)$	Effect of changes in import structure
4.	$H_0R_0\, f_0(\gamma - \phi)$	Effect of changes in final demand component structure

Note: F vector is in the form of diagonal matrix for n sectors manpower

Table 4. **Structural Decomposition of Interaction between Technical Change and Changes in the Final Demand for Labor**

1.	$(H_tR_t - H_0R_0)(\phi - 1)F_0$	Growth multiplied technical change effect
2.	$(H_tR_t - H_0R_0)(F_t - \phi F_0)$	Effect of interaction between technical change and changes in final demand structure

Note: F vector is in the form of diagonal matrix for n sectors manpower

Interaction between Technical Change and Changes in the Final Demand

The effect of interaction between technical change and changes in the final demand also can be further decomposed into:

$$(H_tR_t - H_0R_0)(F_t - F_0) = (H_tR_t - H_0R_0)(F_t - \phi F_0 + \phi F_0 - \phi F_0) = (H_tR_t - H_0R_0)(\phi - 1)F_0 + (H_tR_t - H_0R_0)(F_t - \phi F_0) \quad \text{...(11)}$$

Based on Equation 11, the effect or final demand is summarized as Table 4.

This study applied two types of data. The first set of data used three sets of Malaysia's I-O tables for 1978, 1991 and 2000 published by the Department of Statistics Malaysia. The presented structure of national income account classification has administered the possible maximum size of the Malaysian Input Output Tables. Basic sets of symmetric tables published by Department of Statistic (DOS) were offered at the 60 x 60 level of industries (commodities) aggregation for I-O table 1978, 92 x 92 level of industries (commodities) for I-O table 1991 and 94 x 94 level of industries for I-O Table 2000. We have reduced the tables to 32 by 32 sub-sectors, covering all 31 manufacturing sub-sectors/commodities and single sectors which represent "other sectors" that includes the services, agriculture, mining, construction, and the rest of public sectors. While the second group of data used different categories of workers (unpublished data) for manufacturing in-

dustries for 1978, 1991 and 2000 at 5 digits Malaysian Industrial Classification 1972 (MIC) and Malaysian Standard industrial Classification 2000 (MSIC). The data are taken from the Industrial Production and Constructions Statistic Division, Department of Statistics Malaysia (DOS). In order to make all the I-O table comparable, the nominal values of 1991 and 2000 have been deflated into their 1978 constant price. This conversion is necessary to present the real changes in the variables. The present study used producer prices indices (PPI) for local production by commodity group and import price indices (IPI) to deflate some of the variables to reflect the real change in the variables.

Results and Discussion

This section presents the results of manpower composition at a highly aggregated level in order to give an overall picture of manpower structure in the manufacturing sector. As illustrated in Appendix 1, Malaysian manufacturing's total level of employment increased by 596.272 thousand workers during first sub-period 1978-1991. As for the highly aggregated six categories of manpower, the high skill workers (professional, technical and related workers, and administrative and managerial) increased most rapidly, with an annual growth rate of 9.47 percent during this period. One thing worth mentioning is that the annual growth rate of high skill workers in the heavy industry was higher than that in light industry in 1978-1991. The main body of the Malaysian manufacturing sector labor force, namely production and related workers, transport equipment operators and laborers, was the second fastest growing manpower with an annual growth rate of 7.75 percent, followed by clerical and related workers (6.74 percent) and service workers (3.65 percent).

In contrast to the rapid growth of the above four groups of manpower, the number of sales workers decreased, with a negative growth rate of 3.66 percent. A possible explanation might be the inclusion of working proprietors and active business partners and unpaid family workers as sales workers in the manufacturing sector. According to the Dictionary of Occupation of Classification 1980, sales workers refers to those engaged in, or indirectly associated in conducting business on their own behalf or managing them on behalf of others. Related to this, another possible explanation is that sales workers in the manufacturing sector might be those who are involved in the small-and medium scale industries (SMIs) or SMI entrepreneurs. In the first sub-period 1978-1991, SMIs contribution in terms of employment, especially sales worker job creation, was insignificant. Since 1970, those operating with little capital and outmoded technology have declined in operation as a result of strong competition. They subsist in harsh conditions as most of them do not survive into the fifth year of operation (Chee 1987).

During second sub-period 1991-2000, the growth of Malaysian manufacturing employment differed in two aspects from that in the previous period. One dissimilarity was that the growth in the number of production and related workers, transport equipment operators and laborers, slowed down, which was the main body of the manufacturing sector labor force (4.83 percent). The other difference was that the annual growth of sales workers increased sharply (22.02 percent). The significant growth of sales workers might be the development of SMIs for the duration of 1991-2000.

During the overall period 1978-2000, Malaysian manufacturing sector employment grew by 6.80 percent. High skill workers, namely (i) professional, technical and related workers, and (ii) administrative and managerial workers, grew most rapidly, at a rate of 9.28 percent. One important phenomenon revealed in Appendix 1 is the consistently high growth rates of high skill workers for both sub-periods 1978-1991, 1991-2000 and over the period 1978-2000. The growth rate of high skill workers was about 1.37 times the growth rate of Malaysian manufacturing sector employment over the period 1978-2000. As a result of this growth, the share of the high skill workers in Malaysian manufacturing sector increased from 10.13 percent in 1978 to 16.69 percent in 2000, while the share of the main body of the Malaysian manufacturing sector labor force, namely production and related workers, transport equipment operators and laborers, decreased from 75.24 percent to 72.63 percent. At the same time, changes in the shares of the other four groups of manpower in Malaysian manufacturing sector were relatively low during the overall period 1978-2000. Consequently, the most significant aspect of the growth of the Malaysian manufacturing sector labor force in 1978-2000 was the increasing number of the high skill workers such as professional, technical and related workers and administrative and managerial workers.

The result of this study indicates that causes of structural changes on labor increasing effect are driven by shifts in final demand structure. Beside capital, labor is one of the important inputs in the production process. In general, when output increases, the amount of labor will also increase. As shown in Appendix 2, the current study found that during both sub-periods, the sources of labor growth in the manufacturing sector, either in light or heavy industry, are favored by changes in the final demand structure. As presented in Appendix 2 and Appendix 3, within the changes in the final demand structure, the analysis by sub-periods, 1978-1991 and 1991-2000 show that there is a switch in the role of changes in domestic demand structure, and changes in export structure. The underlying factors that contribute towards employment increasing effect in the manufacturing sector for the period 1978-1991 are mostly changes in domestic demand structure (87.37 percent), and changes in export structure

(53.80 percent). Employment changes that were driven by domestic demand structure during 1978-1991 could be attributed to the emphasis on import substitution policies through government sponsored heavy industries. During the second stage of import-substituting industrialization, priorities on industrial development are given to manufacturers of capital and intermediate goods for export oriented industries. The strengthening of macroeconomic fundamentals and the financial sector together with prudent fiscal policy management have contributed to the expansion in aggregate domestic demand after the global recessionary years of 1985-1986.

However, in the second sub-period, 1991-2000, changes in export structure increased to 168.14 percent and changes in domestic demand structure only 33.36 percent (Appendix 3). Employment changes were driven by export demand during the second sub-period 1991-2000, resulting from greater promotion of export orientation strategy (1985 onwards). Expansion of labor-intensive exports stimulated strong growth in employment in sub-sectors such as electrical and non electrical machinery. During the period 1990-1997, employment growth in export oriented sub-sectors slowed down due to the tight labor market and rising production. However after the East Asian financial crisis 1997-1998, manufacturing exports especially the labor-intensive exports began to grow again impressively, thus stimulating strong growth in employment in the export oriented sub-sectors.

In terms of manpower, changes in the structure of domestic demand had relatively strong and increasing effect on (i) service workers, (ii) production and related workers, transport equipment operators and laborers, and (iii) clerical and related workers during the first sub-period 1978-1991. Changes in the export structure were the main factor that had an increasing effect on employment of high skill workers and sales workers. It is interesting to note that changes in the structure of imports had employment-increasing effects on all categories of manpower particularly on high skill workers.

However, during the second sub-period 1991-2000, changes in the export structure appear to have been the major employment increasing effect for all categories of manpower. These imply that manpower growth was structurally exports driven during second sub-period. In the first sub-period, the results of this investigation also show that changes in the structure of import had employment-increasing effects on all categories of manpower particularly on high skill workers. Conversely, changes in the structure of imports had reducing effects on all categories of manpower during the second sub-period.

If compared to previous studies on sources of output growth by Hoffman and Tan (1975) for the year 1959-1968, Zakariah and Ahmad (1999) for the year 1978-1987 and

Rohana et al (2008) for the year 1978-2000, the findings of this study suggest that, given the current economic structure, the sources of output growth is parallel with sources of employment growth which relied on changes in final demand structure. Even though the current study has used different dependent variables (labor and manpower) and methodology, generally the determinants of sources of the changes are the same, namely the changes in the components of final demand structure (changes in domestic demand structure, changes in export structure, changes in import structure, and changes in final demand component structure).

As can be seen from the Appendix 2 and Appendix 3, another important finding was that economic growth was the second factor that contributed to the employment increasing effect for both sub-periods. In the first sub-period, the estimated result across the effects of different changes on all manpower reveals that economic growth was the second factor underlying the increasing effect of all categories of manpower, particularly on clerical and related workers (55.96 percent) and high skill workers (54.90 percent). However, during the second sub-period, the employment increasing effect for all categories of manpower due to economic growth was smaller than the first sub-period. A possible explanation for this might be due to the East Asian financial crisis in 1997/1998.

Technical change is one of the important factors of output growth as well as a source of labor growth even though the overall net effect of technical change on labor is decreasing employment for both sub-periods and overall period. These may be due to labor saving technological progress. Technological progress since the late nineteenth century consisted largely of rapid advances in labor saving technologies such as computers, the internet and many other kinds off modern machinery and equipment for the production process. From the results in Appendix 2 and Appendix 3, the evidence from this study also suggests that effect of technological change on employment was smaller than other factors.

At a highly aggregated manpower level, changes of technology have increased demand for high skill workers. This is evidenced by the result that showed favorable inter-occupation substitution and manpower increasing effect due to changes in intermediate input for both sub-periods and overall periods. These imply that more high skill workers (human capital accumulation) were employed in the manufacturing sector especially in heavy industry. Additionally, these findings suggest that in general, the skill structure of the labor market in the manufacturing sector between 1978 and 2000 favored high skill biased technological change. This study can conclude that even though changes in the final demand structure and economic

growth were the two main sources of manpower change, technological change still has high potential to influence changes of manpower. The initial effect of technological change is to lower the production cost by substituting labor with machinery and equipment. However, in the long run, technological change and productivity growth also lead to jobs creation in the economy because they result in lower prices and greater income, fuelling an increase in product and labor demand.

Conclusion

In general, the results of present study indicate that the amount of employment changes (increasing effect) was determined by both changes in the structure of domestic demand and exports. These two factors were found to exert a positive and an almost equal effect on manufacturing employment. In other words, an emphasis on domestic demand expansion is constructive in terms of employment creation. In a situation of poor export performance, the domestic market should be promoted rigorously to achieve sustainable employment in the manufacturing sector. In order to complement this effect, the government can introduce a more caring policy towards the society by implementing some reduction and incentives on income tax, so that it can boost domestic spending successfully.

The evidence from this study also suggests that the effect of technological change was smaller (reducing effect) than the effect of other factors on employment. However, even as technological change reduces the amount of labor needed per unit of output, it can be compensated by an expansion in total output that requires more labor. Technological progress is one of the important components of economic growth besides capital accumulation and population and labor force growth. Furthermore, technological progress in an economy certainly changes the requirements for the economy's labor force in terms of knowledge level and skill combination. Therefore, technological change may have an adverse impact on workers in certain occupations by making their particular skills obsolete. Based on the above reasons, government should increase human resource development through training and upgrade research and development (R&D). An appropriate strategy and choice of human resource development and innovation are also crucial in improving labor productivity. Higher labor productivity brings lower production costs, higher product quality, and better wages for workers and better investment returns for investors.

The findings of the Structural Decomposition Analysis (SDA) also indicate that higher growth of high skill workers in the manufacturing sector especially in heavy industry in both sub periods and overall period. In order to respond to this high demand, additional administrative and managerial workers, professional, technical and related workers have got to be supplied from either the local educational institutes or/and repatriate them

from abroad. Hence, the aspect of manpower must be given due priority in the development planning of the economy so as to ensure that the manufacturing sector continues to contribute towards maintaining Malaysia's overall global competitive position. Manpower planning is an important step that should precede, or at least run parallel to any plan for a country's overall development. Planning the supply of labor, particularly highly trained labor, to meet the requirements of future economic growth and development, is essential not only in developing countries but also developed countries. The rapid economic growth in a particular nation causes the manpower planning to become more important. Malaysia is also one of the nations that experienced this situation.

Strong evidence of human capital accumulation was found in this study when the amount of high skill workers increased due to a favorable inter-occupation substitution. Additionally, human capital accumulation occurred in the heavy industry sector and was higher than in the light industry sector. Human capital is crucial for the development of a country. Investment in human capital ranges from basic needs expenditure to education. Therefore, another challenge that the country is now, and will be, facing is in the area of education. The country's education system is now being challenged by the changing environment of the economy's labor market. One popular view is that an education system should be consistent with the country's aspiration in terms of national development. Thus, it has to be market-driven with regards to designing a creative curriculum, supporting the country to move to an era of K-economy. Education serves national socioeconomic development through its academic curricula and content. Higher education systems, private and local universities in particular, are aware of the need to respond constructively with more creative curricula that can support the aspiration to move towards a K-economy. Basically, the major challenge in the education system now is to train teachers that are more innovative and computer-literate so that they can produce quality human resources. The country also needs to identify subsectors' skill requirements and improve training and education programs. Malaysia needs to have the right kind of labor in place, especially world-class knowledge workers, if she wants to move up the ladder of competitiveness and produce higher value-added goods. Workers not only have to be equipped with the right skills and training but also need to be in an environment that enables them to change their ways of thinking when needed.

However, there are two major sources of limitation for this study, namely data limitations and model assumptions. A study of this magnitude requires a vast amount of data which, in most cases, is unpublished. Time and funds constrain the collection of primary data to fill in the gaps, and the researcher has to 'make do' with what is available in the expanse of less de-

tailed and maybe less accurate results. For example, the economic activities in this study were divided into 31 manufacturing sub-sectors and one other sector due to unavailability of more detailed manpower data for the services sector and agriculture sector. Manpower was divided into seven categories, which is highly aggregated. Those levels of aggregation were imposed on the study because of a lack of more detailed data for manpower, especially by educational levels. The second source of limitation, the model's assumptions, is the result of building this model around the input-output technique. This means that the Structural Decomposition Analysis will be subject to the assumptions of the input-output model. Firstly, in IO models, it is also assumed that the economy operates with spare capacity: there always are under utilized resources in the sectors wherein the multiplier effects are supposed to occur. In other words, supply effects in IO models are virtually ignored, suggesting that the supply curve is perfectly elastic. Second, IO models generate the values endogenous variables (for example: output, income, value added, employment and prices), but only for an initial equilibrium and a new equilibrium after shocks are imposed. In other words, the IO table represents a comparative static situation of the economy at a point in time or it provides only snapshot of the structural characteristics of the economy. This means that IO analysis does not convey information on the dynamic adjustment process.

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APPENDIX 1. The Results of Manpower Changes in Malaysian Manufacturing Sector, 1978-2000

Total Manufacturing	1978		1991		2000		1978-1991 Annual growth (%)	1991-2000 Annual growth (%)	1978-2000 Annual growth (%)
	Workers	Share (%)	Workers	Share (%)	Workers	Share (%)			
High Skill Workers	37973	10.13	122953	12.65	261274	16.69	9.47	8.73	9.28
Clerical and Related Workers	28064	7.48	65463	6.74	98967	6.32	6.74	4.69	5.97
Sales Workers	3640	0.97	2243	0.23	13475	0.86	-3.66	22.02	6.21
Service Workers	23175	6.18	36907	3.80	54903	3.51	3.65	4.51	4.05
Agriculture, Animal Husbandry and Forestry Workers, Fishermen and Hunters	0	0.00	0	0	0	0.00	0.00	0.00	0.00
Production and Related Workers, Transport Equipment Operators and Laborers	282085	75.24	743643	76.6	1137127	72.63	7.75	4.83	6.62
Total Manufacturing	**374937**	**100.00**	**971209**	**100**	**1565746**	**100.00**	**7.60**	**5.44**	**6.80**

Continued from APPENDIX 1

Total Manufacturing	1978		1991		2000		1978-1991 Annual growth (%)	1991-2000 Annual growth (%)	1978-2000 Annual growth (%)
	Workers	Share (%)	Workers	Share (%)	Workers	Share (%)			
Light Industry									
High Skill Workers	16923	9.18	41127	10.91	62098	11.98	7.08	4.68	6.16
Clerical and Related Workers	15309	8.31	30224	8.02	36411	7.02	5.38	2.09	4.07
Sales Workers	2044	1.11	1177	0.31	8843	1.71	-4.16	25.09	6.97
Service Workers	13825	7.50	20529	5.45	26143	5.04	3.09	2.72	2.97
Agriculture, Animal Husbandry and Forestry Workers, Fishermen and Hunters	0	0.00	0	0.00	0	0.00	0.00	0.00	0.00
Production and Related Workers, Transport Equipment Operators and Laborers	136157	73.89	283776	75.31	384835	74.25	5.82	3.44	4.90
Total	**184258**	**100.00**	**376833**	**100.00**	**518330**	**100.00**	**5.66**	**3.60**	**4.87**

Continued from APPENDIX 1

Total Manufacturing	1978		1991		2000		1978-1991	1991-2000	1978-2000
	Workers	Share (%)	Workers	Share (%)	Workers	Share (%)	Annual growth (%)	Annual growth (%)	Annual growth (%)
Heavy Industry									
High Skill Workers	21050	11.05	81826	13.77	199176	18.97	11.02	10.38	10.89
Clerical and Related Workers	12755	6.69	35239	5.93	62556	5.95	8.14	6.58	7.59
Sales Workers	1596	0.70	1066	0.18	4632	0.47	-3.06	17.71	5.02
Service Workers	9350	4.90	16378	2.73	28760	2.79	4.41	6.45	5.30
Agriculture, Animal Husbandry and Forestry Workers, Fishermen and Hunters	0	0.00	0	0.00	0	0.00	0.00	0.00	0.00
Production and Related Workers, Transport Equipment Operators and Laborers	145928	76.65	459867	77.39	752292	71.81	9.24	5.62	7.84
Total	**190679**	**100.00**	**594376**	**100.00**	**1047416**	**100.00**	**9.15**	**6.49**	**8.15**

APPENDIX 2. **The Results of Sources of Manpower Change in the Manufacturing Sector in the First Sub-period 1978-1991**

Sources of change	Effects on: High Skill Workers (Professional & technical and Administrative and Managerial Workers)	Clerical and related workers	Sales workers	Service workers	Agricultural Animal husbandry and forestry workers, fishermen and hunters	Production and related workers, transport equipment operators and laborers	Total
Total Manufacturing Sector							
Technical Change	**-1122** *(-1.32)*	**-1015** *(-2.71)*	**-53** *(-3.79)*	**-59** *(-0.43)*	**0**	**-6342** *(-1.37)*	**-8591** *(-1.44)*
Inter-occupation substitution*	404 *(0.48)*	494 *(1.32)*	-3 *(-0.21)*	28 *(0.20)*	0	-923 *(-0.20)*	0 *(0.00)*
Changes in labor productivity	-2425 *(-2.85)*	-1785 *(-4.77)*	-52 *(-3.72)*	-91 *(-0.66)*	0	-7261 *(-1.57)*	**-11614** *(-1.95)*
Changes in intermediate input	1687 *(1.99)*	539 *(1.44)*	8 *(0.57)*	14 *(0.10)*	0	2562 *(0.56)*	4810 *(0.81)*
Interaction of changes in labor input and changes in intermediate input	-788 *(-0.93)*	-263 *(-0.70)*	-6 *(-0.43)*	-10 *(-0.07)*	0	-720 *(-0.16)*	-1787 *(-0.30)*
Changes in final demand structure	**58374** *(68.69)*	**27404** *(73.27)*	**362** *(25.91)*	**13315** *(96.96)*	**0**	**421527** *(91.33)*	**520982** *(87.37)*
Changes in domestic demand structure	10855 *(12.77)*	11845 *(31.67)*	117 *(8.38)*	11317 *(82.41)*	0	286681 *(62.11)*	320815 *(53.80)*
Changes in export structure	24417 *(28.73)*	7714 *(20.63)*	141 *(10.09)*	955 *(6.95)*	0	67892 *(14.71)*	101119 *(16.96)*
Changes in import structure	20212 *(23.78)*	961 *(2.57)*	25 *(1.79)*	345 *(2.51)*	0	28367 *(6.15)*	49910 *(8.37)*
Changes in final demand component structure	2890 *(3.40)*	6884 *(18.41)*	79 *(5.65)*	698 *(5.08)*	0	38587 *(8.36)*	49138 *(8.24)*
Interaction of technical change and changes in final demand	**-18926** *(-22.27)*	**-9917** *(-26.52)*	**-2064** *(-147.75)*	**-382** *(-2.78)*	**0**	**-41656** *(-9.03)*	**-72945** *(-12.23)*
Growth multiplied technical change effect	-4341 *(-5.11)*	-1454 *(-3.89)*	-888 *(-63.56)*	-204 *(-1.49)*	0	-18027 *(-3.91)*	-24914 *(-4.18)*
Interaction of technical change and changes in final demand structure	-14585 *(-17.16)*	-8463 *(-22.63)*	-1176 *(-84.18)*	-178 *(-1.30)*	0	-23629 *(-5.12)*	-48031 *(-8.06)*
Economic growth	**46654** *(54.90)*	**20927** *(55.96)*	**358** *(25.63)*	**858** *(6.25)*	**0**	**88029** *(19.07)*	**156826** *(26.30)*
Total	84980 *(100.00)*	37399 *(100.00)*	-1397 *(-100.00)*	13732 *(100.00)*	0	461558 *(100.00)*	596272 *(100.00)*

Sources of change	Effects on						
	High Skill Workers (Professional & technical and Administrative and Managerial Workers)	Clerical and related workers	Sales workers	Service workers	Agricultural Animal husbandry and forestry workers, fishermen and hunters	Production and related workers, transport equipment operators and laborers	Total
Light Industry							
Technical Change	**-305** *(-1.26)*	**-390** *(-2.61)*	**-18** *(-2.08)*	**-13** *(-0.29)*	**0**	**-2013** *(-1.36)*	**-2739** *(-1.42)*
Inter-occupation substitution	115 *(0.48)*	197 *(1.32)*	-2 *(-0.23)*	14 *(0.21)*	0	-295 *(-0.20)*	29 *(0.02)*
Changes in labor productivity	-676 *(-2.79)*	-697 *(-4.67)*	-17 *(-1.96)*	-29 *(-0.43)*	0	-2307 *(-1.56)*	**-3726** *(-1.93)*
Changes in intermediate input	480 *(1.98)*	215 *(1.44)*	5 *(0.58)*	7 *(0.10)*	0	819 *(0.55)*	1526 *(0.79)*
Interaction of changes in labor input and changes in intermediate input	-224 *(-0.93)*	-105 *(-0.70)*	-4 *(-0.46)*	-5 *(-0.07)*	0	-230 *(-0.16)*	-568 *(-0.29)*
Changes in final demand structure	**16636** *(68.73)*	**10938** *(73.34)*	**236** *(27.22)*	**6510** *(97.11)*	**0**	**134827** *(91.33)*	**169147** *(87.83)*
Changes in domestic demand structure	3092 *(12.77)*	4724 *(31.67)*	73 *(8.42)*	5525 *(82.41)*	0	91689 *(62.11)*	105103 *(54.58)*
Changes in export structure	6994 *(28.90)*	3116 *(20.89)*	128 *(14.76)*	506 *(7.55)*	0	21754 *(14.74)*	32498 *(16.88)*
Changes in import structure	5757 *(23.79)*	383 *(2.57)*	16 *(1.85)*	168 *(2.51)*	0	9073 *(6.15)*	15397 *(8.00)*
Changes in final demand component structure	793 *(3.28)*	2715 *(18.20)*	19 *(2.19)*	311 *(4.64)*	0	12311 *(8.34)*	16149 *(8.39)*
Interaction of technical change and changes in final demand	**-5470** *(-22.60)*	**-4035** *(-27.05)*	**-1361** *(-156.98)*	**-267** *(-3.98)*	**0**	**-13403** *(-9.08)*	**-24536** *(-12.74)*
Growth multiplied technical change effect	-1316 *(-5.44)*	-660 *(-4.43)*	-631 *(-72.78)*	-180 *(-2.68)*	0	-5846 *(-3.96)*	-8633 *(-4.48)*
Interaction of technical change and changes in final demand structure	-4154 *(-17.16)*	-3375 *(-22.63)*	-730 *(-84.20)*	-87 *(-1.30)*	0	-7557 *(-5.12)*	-15903 *(-8.26)*
Economic growth	**13343** *(55.19)*	**8402** *(56.33)*	**276** *(31.83)*	**474** *(7.07)*	**0**	**28208** *(19.11)*	**50703** *(26.33)*
Total	24204 *(100.00)*	14915 *(100.00)*	-867 *(-100.00)*	6704 *(100.00)*	0	147619 *(100.00)*	192575 *(100.00)*

Sources of change	Effects on: High Skill Workers (Professional & technical and Administrative and Managerial Workers)		Clerical and related workers		Sales workers		Service workers		Agricultural Animal husbandry and forestry workers, fishermen and hunters		Production and related workers, transport equipment operators and laborers		Total	
Heavy Industry														
Technical Change	**-817**	*(-1.34)*	**-625**	*(-2.78)*	**-35**	*(-6.60)*	**-46**	*(-0.65)*	**0**		**-4329**	*(-1.38)*	**-5852**	*(-1.45)*
Inter-occupation substitution	289	*(0.48)*	297	*(1.32)*	-1	*(-0.19)*	14	*(0.20)*	0		-628	*(-0.20)*	-29	*(-0.01)*
Changes in labor productivity	-1749	*(-2.88)*	-1088	*(-4.84)*	-35	*(-6.60)*	-62	*(-0.88)*	0		-4954	*(-1.58)*	**-7888**	*(-1.95)*
Changes in intermediate input	1207	*(1.99)*	324	*(1.44)*	3	*(0.57)*	7	*(0.10)*	0		1743	*(0.56)*	3284	*(0.81)*
Interaction of changes in labor input and changes in intermediate input	-564	*(-0.93)*	-158	*(-0.70)*	-2	*(-0.38)*	-5	*(-0.07)*	0		-490	*(-0.16)*	-1219	*(-0.30)*
Changes in final demand structure	**41738**	*(68.68)*	**16466**	*(73.23)*	**126**	*(23.77)*	**6805**	*(96.89)*	**0**		**286700**	*(91.33)*	**351835**	*(87.15)*
Changes in domestic demand structure	7763	*(12.77)*	7121	*(31.67)*	44	*(8.30)*	5792	*(82.48)*	0		194992	*(62.11)*	215712	*(53.43)*
Changes in export structure	17423	*(28.67)*	4598	*(20.45)*	13	*(2.45)*	449	*(6.96)*	0		46138	*(14.70)*	68621	*(17.00)*
Changes in import structure	14455	*(23.78)*	578	*(2.57)*	9	*(1.70)*	177	*(2.52)*	0		19294	*(6.15)*	34513	*(8.55)*
Changes in final demand component structure	2097	*(3.45)*	4169	*(18.54)*	60	*(11.32)*	387	*(5.51)*	0		26276	*(8.37)*	32989	*(8.17)*
Interaction of technical change and changes in final demand	**-13456**	*(-22.14)*	**-5882**	*(-26.16)*	**-703**	*(-132.64)*	**-115**	*(-1.64)*	**0**		**-28253**	*(-9.00)*	**-48409**	*(-11.99)*
Growth multiplied technical change effect	-3025	*(-4.98)*	-794	*(-3.53)*	-257	*(-48.49)*	-24	*(-0.34)*	0		-12181	*(-3.88)*	-16281	*(-4.03)*
Interaction of technical change and changes in final demand structure	-10431	*(-17.16)*	-5088	*(-22.63)*	-446	*(-84.15)*	-91	*(-1.29)*	0		-16072	*(-5.12)*	-32128	*(-7.96)*
Economic growth	**33311**	*(54.81)*	**12525**	*(55.71)*	**82**	*(-15.47)*	**384**	*(5.46)*	**0**		**59821**	*(19.05)*	**106123**	*(26.29)*
Total	60776	*(100.00)*	22484	*(100.00)*	-530	*(-100.00)*	7028	*(100.00)*	0		313939	*(100.00)*	403697	*(100.00)*

Appendix 3. **The Results of Sources of Manpower Change in the Manufacturing Sector in the Second Sub-period 1991-2000**

Sources of change	Effects on: High Skill Workers (Professional & technical and Administrative and Managerial Workers)		Clerical and related workers		Sales workers		Service workers		Agricultural animal husbandry and forestry workers fishermen and hunters	Production and related workers, transport equipment operators and laborers		Total	
Total Manufacturing Sector													
Technical Change	**-11693**	*(-8.45)*	**-6952**	*(-20.75)*	**157**	*(1.40)*	**-4613**	*(-25.63)*	**0**	**-51257**	*(-13.03)*	**-74358**	*(-12.51)*
Inter-occupation substitution*	1605	*(1.16)*	-451	*(-1.35)*	-129	*(-1.15)*	913	*(5.07)*	0	-1938	*(-0.49)*	0	*(0.00)*
Changes in labor productivity	-13131	*(-9.49)*	-6465	*(-19.30)*	278	*(2.48)*	-5515	*(-30.65)*	0	-48619	*(-12.36)*	-73452	*(-12.35)*
Changes in interm ediate input	14	*(0.01)*	30	*(0.09)*	-1	*(-0.01)*	80	*(0.44)*	0	-733	*(-0.19)*	-610	*(-0.10)*
Interaction of changes in labor input and changes in interm ediate input	-181	*-0.13*	-66	*(-0.20)*	9	*(0.08)*	-91	*(-0.51)*	0	33	*(0.01)*	-296	*(-0.05)*
Changes in final demand structure	**169328**	*(122.42)*	**53873**	*(160.80)*	**1484**	*(13.21)*	**38830**	*(215.77)*	**0**	**515727**	*(131.07)*	**779242**	*(131.07)*
Changes in domestic demand structure	42463	*(30.70)*	13283	*(39.50)*	492	*(4.38)*	9484	*(52.70)*	0	132694	*(33.72)*	198366	*(33.36)*
Changes in export structure	213913	*(154.65)*	70610	*(210.75)*	1375	*(12.24)*	57472	*(319.36)*	0	656310	*(166.79)*	999680	*(168.14)*
Changes in import structure	-72752	*(-52.60)*	-24758	*(-73.90)*	-243	*(-2.16)*	-23591	*(-131.09)*	0	-236238	*(-60.04)*	-357582	*(-60.14)*
Changes in final demand component structure	-14296	*(-10.34)*	-5212	*(-15.56)*	-140	*(-1.25)*	-4535	*(-25.20)*	0	-37039	*(-9.41)*	-61222	*(-10.30)*
Interaction of technical change and changes in final demand	**-27767**	*(-20.07)*	**-16564**	*(-49.44)*	**9476**	*(84.37)*	**-18576**	*(-103.22)*	**0**	**-96115**	*(-24.43)*	**-149546**	*(-25.15)*
Growth multiplied technical change effect	-2804	*(-2.03)*	-2098	*(-6.26)*	2165	*(19.28)*	-2226	*(-12.37)*	0	-10767	*(-2.74)*	-15730	*(-2.65)*
Interaction of technical change and changes in final demand structure	-24963	*(-18.05)*	-14466	*(-43.18)*	7311	*(65.09)*	-16350	*(-90.85)*	0	-85348	*(-21.69)*	-133816	*(-22.51)*
Economic growth	**8453**	*(6.11)*	**3147**	*(9.39)*	**115**	*(1.02)*	**2355**	*(13.09)*	**0**	**25129**	*(6.39)*	**39199**	*(6.59)*
Total	138321	*(100)*	33504	*(100)*	11232	*(100)*	17996	*(100)*	0	393484	*(100)*	594537	*(100)*

Continued from Appendix 3

Sources of change	Effects on: High Skill Workers (Professional & technical and Administrative and Managerial Workers)		Clerical and related workers		Sales workers		Service workers		Agricultural animal husbandry and forestry workers fishermen and hunters	Production and related workers, transport equipment operators and laborers		Total	
Light Industry													
Technical Change	**-1673**	*(-7.98)*	**-1183**	*(-19.12)*	**207**	*(2.70)*	**-1338**	*(-23.83)*	**0**	**-13065**	*(-12.93)*	**-17052**	*(-12.05)*
Inter-occupation substitution	243	*(1.16)*	-83	*(-1.34)*	-88	*(-1.15)*	285	*(5.08)*	0	-498	*(-0.49)*	-141	*(-0.10)*
Changes in labor productivity	-1991	*(-9.49)*	-1194	*(-19.30)*	190	*(2.48)*	-1720	*(-30.64)*	0	-12487	*(-12.36)*	-17202	*(-12.16)*
Changes in intermediate input	2	*(0.01)*	6	*(0.10)*	-1	*(-0.01)*	25	*(0.45)*	0	-188	*(-0.19)*	-156	*(-0.11)*
Interaction of changes in labor input and changes in intermediate input	73	*(-0.35)*	88	*(1.42)*	106	*(1.38)*	72	*(1.28)*	0	108	*(0.11)*	447	*(-0.32)*
Changes in final demand structure	**25693**	*(122.52)*	**9969**	*(161.15)*	**1032**	*(13.46)*	**12134**	*(216.14)*	**0**	**132475**	*(131.09)*	**181303**	*(128.13)*
Changes in domestic demand structure	6338	*(30.22)*	2344	*(37.89)*	236	*(3.08)*	2859	*(50.93)*	0	33980	*(33.62)*	45757	*(32.34)*
Changes in export structure	32432	*(154.65)*	13039	*(210.75)*	938	*(12.24)*	17929	*(319.36)*	0	168561	*(166.79)*	232899	*(164.60)*
Changes in import structure	-10910	*(-52.02)*	-4452	*(-71.96)*	-46	*(-0.60)*	-7239	*(-128.95)*	0	-60553	*(-59.92)*	-83200	*(-58.80)*
Changes in final demand component structure	-2167	*(-10.33)*	-962	*(-15.55)*	-96	*(-1.25)*	-1415	*(-25.20)*	0	-9513	*(-9.41)*	-14153	*(-10.00)*
Interaction of technical change and changes in final demand	**-4290**	*(-20.46)*	**-3138**	*(-50.72)*	**6388**	*(83.39)*	**-5875**	*(-104.65)*	**0**	**-24765**	*(-24.51)*	**-31680**	*(-22.39)*
Growth multiplied technical change effect	-425	*(-2.03)*	-387	*(-6.26)*	1478	*(19.28)*	-694	*(-12.36)*	0	-2765	*(-2.74)*	-2793	*(-1.97)*
Interaction of technical change and changes in final demand structure	-3865	*(-18.43)*	-2751	*(-44.46)*	4910	*(64.05)*	-5181	*(-92.29)*	0	-22000	*(-21.77)*	-28887	*(-20.42)*
Economic growth	**1241**	*(5.92)*	**539**	*(8.71)*	**39**	*(0.51)*	**693**	*(12.34)*	**0**	**6414**	*(6.35)*	**8926**	*(6.31)*
Total	20971	*(100)*	6187	*(100)*	7666	*(100)*	5614	*(100)*	0	101059	*(100)*	141497	*(100)*

Continued from Appendix 3

Sources of change	Effects on: High Skill Workers (Professional & technical and Administrative and Managerial Workers)		Clerical and related workers		Sales workers		Service workers		Agricultural animal husbandry and forestry workers fishermen and hunters	Production and related workers, transport equipment operators and laborers		Total	
Heavy Industry													
Technical Change	**-10020**	*(-8.54)*	**-5769**	*(-21.12)*	**-50**	*(1.40)*	**-3275**	*(-25.45)*	**0**	**-38192**	*(-13.06)*	**-57306**	*(-12.65)*
Inter-occupation substitution	1362	*(1.16)*	-368	*(-1.35)*	-41	*(-1.15)*	628	*(5.07)*	0	-1440	*(-0.49)*	141	*(0.03)*
Changes in labor productivity	-11140	*(-9.49)*	-5271	*(-19.30)*	88	*(2.47)*	-3795	*(-30.65)*	0	-36132	*(-12.36)*	-56250	*(-12.42)*
Changes in intermediate input	12	*(0.01)*	24	*(0.09)*	0	*(0.00)*	55	*(0.44)*	0	-545	*(-0.19)*	-454	*(-0.10)*
Interaction of changes in labor input and changes in intermediate input	-254	*(-0.22)*	-154	*(-0.56)*	-97	*(-2.72)*	-163	*(-1.32)*	0	-75	*(0.03)*	-743	*(-0.16)*
Changes in final demand structure	**143635**	*(122.40)*	**43904**	*(160.72)*	**452**	*(12.68)*	**26696**	*(215.60)*	**0**	**383252**	*(131.06)*	**597939**	*(131.98)*
Changes in domestic demand structure	36125	*(30.78)*	10889	*(39.86)*	256	*(7.18)*	6625	*(53.51)*	0	98714	*(33.76)*	152609	*(33.69)*
Changes in export structure	181481	*(154.65)*	57571	*(210.75)*	437	*(12.25)*	39543	*(319.36)*	0	487749	*(166.79)*	766781	*(169.25)*
Changes in import structure	-61842	*(-52.70)*	-20306	*(-74.33)*	-197	*(-5.52)*	-16352	*(-132.06)*	0	-175685	*(-60.08)*	-274382	*(-60.56)*
Changes in final demand component structure	-12129	*(-10.34)*	-4250	*(-15.56)*	-44	*(-1.23)*	-3120	*(-25.20)*	0	-27526	*(-9.41)*	-47069	*(-10.39)*
Interaction of technical change and changes in final demand	**-23477**	*(-20.01)*	**-13426**	*(-49.15)*	**3088**	*(86.60)*	**-12701**	*(-102.58)*	**0**	**-71350**	*(-24.40)*	**-117866**	*(-26.02)*
Growth multiplied technical change effect	-2379	*(-2.03)*	-1711	*(-6.26)*	687	*(19.27)*	-1532	*(-12.37)*	0	-8002	*(-2.74)*	-12937	*(-2.86)*
Interaction of technical change and changes in final demand structure	-21098	*(-17.98)*	-11715	*(-42.89)*	2401	*(67.33)*	-11169	*(-90.20)*	0	-63348	*(-21.66)*	-104929	*(-23.16)*
Economic growth	7212	*(6.15)*	2608	*(9.55)*	76	*(2.13)*	1662	*(13.42)*	0	18715	*(6.40)*	30273	*(6.68)*
Total	117350	*(100)*	27317	*(100)*	3566	*(100)*	12382	*(100)*	0	292425	*(100)*	453040	*(100)*