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A Translog Cost Estimation of Capital-labour Substitubility in Malaysian Manufacturing Sector

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ABSTRAK

Tujuan utama kajian ini ialah untuk mengemukakan bukti empirik tambahan tentang keanjalan penggantian antara modal dan buruh bagi industri pembuatan di Malaysia pada peringkat 5-digit dengan menggunakan fungsi kos translog. Keanjalan penggantian separa Allen telah dianggar pada pembahagian kos min di awal tahun (1968), tahun asas (1980) dan tahun akhir analisis (1984). Adalah didapati bahawa nilai keanjalan ini tidak jauh berbeza antara tahun-tahun yang dianggar dan umumnya nilai ini didapati kurang daripada satu. Implikasi dasar daripada hasil kajian ini juga turut dibincangkan.

ABSTRACT

The principal aim of this study is to provide further empirical evidence of the elasticity of substitution between capital and labour in 5-digit Malaysian manufacturing industries using the translog cost function. The Allen partial elasticity of substitution was calculated at the mean cost shares at the beginning year (1968), base year (1980) and at ending year of analysis (1984). The elasticities evaluated at the mean cost shares in different years show insignificant variations and generally lower than unity. Policy implications were then drawn from the empirical findings

INTRODUCTION

The case of substitution between labour and capital is an important determinant of the elasticity of demand for labour and thus of the economic effects on employment. Information about the elasticity of substitution between capital and labour is relevant in LDCs for a number of other reasons as well. A high elasticity of substitution indicates that there exists flexibility in the face of external changes such as those which occur in international markets, and that prospects for output growth are relatively good, since the faster growing primary factor, i.e. labour, can be substituted relatively easily for the slower growing one.

The principal aim of this study is to provide further empirical evidence of the elasticity of substitution between capital and labour in 5-digit Malaysian manufacturing industries using the translog cost function. Specifically, the objectives are (1) to provide the theory, specification and the estimation procedures for the elasticity of substitution between capital and labour in the Malaysian manufacturing sector, and (2) to evaluate and draw policy implications from the empirical findings.

In recent years, the application of the duality theory has become increasingly popular among economists in applied analysis. This is because the methodology not only allows researchers greater flexibility in the specification of factor demand and output supply equation, but also permits a very close relationship between economic theory and practice.

The development of literature of the cost-function approach has taken two trends: (1) application of the translog cost approach and (2) further testing and development of improved functions forms and improved data spesifications. The translog cost function has been applied to various fields including the manufacturing sector (Berndt & Christensen 1973; Halvorsen 1977; Wills 1979; Rushdi 1982; Tsao Yuan 1986), energy sector (Berndt & Wood 1975; Fuss 1977; Field & Grebenstein 1980; Vashit 1985), agricultural sector (Biswanger 1974; Lopez 1980; Ray 1982) and other branches of economics such as natural resources (Halvorsen & Smith 1986) and labour economics (Freeman and Medoff 1982)

Development of new functional forms and improved data specifications include works by Pollack, Sickles & Wales (1984), Elbadawi, Gallant & Souza (1983) and Jae Wan Chung (1987).

METHODOLOGY

The translog cost function can be expressed as

$$\text{In } C^* (P_{K'} P_{L'} Y) = a_0 + a_y \text{ In } Y + \frac{\theta}{2} - \text{In } Y^2 + \sum_i a_i \text{ In } P_i$$

$$+\frac{1}{2}\sum \beta_{ij} \ln P_i \ln P_j + \frac{1}{2} \beta_{iy} \ln Y \ln P_j \qquad (1)$$

where i, j = K, L

and In C* is the logarithm of total cost,

In P_i is the logarithm of the ith input price, and

In Y_i is the logarithm of output.

By shephard's lemma, factor shares are derived by differentiating equation (1) with respect to each logged input price. Then

$$\frac{\partial \ln C}{\partial \ln P_i} = P_i \frac{Xi}{C^*} = S_i$$

and the input demand functions, in terms of cost shares, take the form

$$S_i = a_i + \sum_i \beta_{ij} \ln P_j + \beta_{iy} \ln Y \qquad (2)$$

where i, j = K, L

The popularity of the translog cost function is due to the ease of estimation. Furthermore, the translog cost function allows arbitrary configurations of the matrix of elasticities of substitution. It also permits variations in these elasticities across input pairs of prices. Unlike elasticities derived from Cobb-Douglas or CES production functions, the translog cost function permits complementarities.

Mundlak (1968) provides three alternative measures of substitutability between pairs of inputs X_i, X_j. When the elasticity of substitution is positive, inputs are considered as substitutes and if the elasticity of substitution is negative, inputs are complements. Uzawa (1962) has measured the Allen partial elasticity of substitution between inputs i and j as

$$\sigma_{ij} = \frac{C^* \dfrac{\partial^2 C^*}{\partial P_i \ \partial P_j}}{\dfrac{\partial C^*}{\partial P_i} \quad \dfrac{\partial C^*}{\partial P_j}} \qquad (3)$$

Berndt-Wood (1975) show that for the translog cost function, the Allen partial elasticity of subsitution is

$$\sigma_{ij}^{A} = \frac{\beta_{ij} + S_i S_j}{S_i S_j} \tag{4a}$$

$$\sigma_{ii}^{A} = \frac{\beta_{ii} + S_i^2 - S_i}{S_i^2} \tag{4b}$$

where σ_{ij} = cross partial elasticity of substitution between inputs i,j
σ_{ii} = own partial elasticity of substitution between inputs i,j.

The Morishima elasticity of substitution is written by Koizimi (1976) as

$$\sigma_{ij}^{M} = S_j (\sigma_{ij}^{A} - \sigma_{jj}^{A}) \tag{5a}$$

and the shadow elasticity of substitution by McFadden (1963) is

$$\sigma_{ij}^{S} = \frac{S_i S_j (2\sigma_{ij}^{A} - \sigma_{ii}^{A} - \sigma_{jj}^{A})}{S_i + S_j} \tag{5b}$$

Further, it has been shown by Biswanger (1974) that the elasticity of substitution between pairs of inputs can be calculated as

$$\sigma_{ij}^{B} = \frac{\beta_{ii}}{S_i S_j} + 1 \tag{6a}$$

$$\sigma_{ij}^{B} = \frac{\beta_{ii}}{S_i} - \frac{1}{S_i} + 1 \tag{6b}$$

DATA AND ESTIMATIONS

This section consists of discussion of the data and related problems concerning the operational definition of variables for the translog cost estimation, the estimation procedures and the discussion of results of the translog cost function.

SOURCES OF DATA AND MEASUREMENT OF VARIABLES

All data for the estimation of the translog cost function are from the Surveys/Censuses of Manufacturing Industries, West (Peninsular) Malaysia, the Industrial Surveys of Malaysia and the Manufacturing Division of theDeparment of Statistics, Malaysia. However, data for value of fixed assets and value of depreciation are available for only a number of years beginning in 1969. As such, the estimation of the translog cost function are based on a time-series from 1969 to 1984 for fifty 5-digit Malaysian manufacturing industries.

The chief sources of data are the Surveys/Censuses of Manufacturing Industries which have been conducted annually up to 1986. The surveys/censuses are followed by the Industrial Surveys of Malaysia from 1978 to 1984. The information in the Surveys and Censuses includes value-added (VA), number of workers employed (L), wages and salaries (W), cost of inputs (C), and value of fixed assets (FA). There were no surveys for 1977 and 1980. Furthermore, the information on value of fixed assets are not consistently given for the whole period 1970-1984.

Information on value of depreciation (D), value of fixed assets (FA) and the breakdown for cost of inputs are derived from the Manufacturing Division, Department of Statistics, Malaysia. Consumer Price Index, (CPI) and Industrial Production Indiex (IPI) are taken from Bank Negara Annual Report, 1985.

The final data required for the estimation of the translog cost function are the cost share of capital (Sk), the cost share of labour (S_L), the service price of capital (Pk) and the service price of labour (P_L).

The estimation of the translog cost function for Malaysia would be most fitting if data on cost shares advice prices of capital and labour can be constructed following procedures outlined by Christensen-Jorgenson (1969, 1970) and Berndt & Christensen (1970). Such procedures however would require extra information on variations of effective tax rates, rates of return, capital gains, years of education of labour force and others in order to construct the divisia quality indices for capital and labour. The estimation in this study is however based on less sophisticated procedures of constructing the final data for S_K, S_L, P_K and P_L.

Following Wills (1979) and Vashist (1985), the cost shares of capital and labour are constructed as follows,

$$S_K = (VA - S_L)/TC$$

$$S_L = W/TC$$

and following procedures by Ionnides and Caramanis (1979) and Vashist (1985), the service prices of capital and labour, P_K and P_L are constructed as follows,

$$P_K = S_K/K$$

$$P_L = S_L/L$$

where

VA	=	value-added
L	=	number of full-time workers plus half of part-time workers
W	=	total wages and salaries
TC	=	total cost to industry measured as total cost of inputs + fixed cost + wages and salaries
K	=	value of fixed assets + value of circulating capital (materials + electricity, fuel, lubricants and water + intermediate supplies). Initially, it was intended to construct the capital stock series by the well-known perpetual inventory method (Christensen & Jorgenson, 1969). However, there is no benchmark available and there is also a serious deficiency of information on the age structure of existing capital stock.

Another problem in the measurement of capital is related to the computation of total cost and hence the service prices of capital and labour. Total cost includes cost of circulating capital and fixed cost as the cost of capital while the wage bill is the cost of labour. Thus, despite various limitations, such as reconciling stock and flow concepts, the value of fixed assets and value of circulating capital is taken to represent our capital data, K. Another reason is that the objective of the research is to calculate the substitution possibilities between capital and labour only. As such capital should be the residual of labour inputs (Fuss 1977).

ESTIMATION OF THE TRANSLOG COST FUNCTION

Assume that there exist in Malaysian manufacturing sector a twice differentiable aggregate production function relating the flow of gross output to the services of capital and labour. Further, assume that production is characterised by the constant returns to scale and that any technicalchange affecting capital and labour is Hicks-neutral. For purposes of estimation, the set of simultaneous equations (7a) and (7b) can be used.

$$S_K = a_K + \beta_{KK} \text{ In } P_K + \beta_{KL} \text{ In } P_L \tag{7a}$$

$$S_L = a_L + \beta_{LK} \text{ In } P_K + \beta_{LK} \text{ In } P_L \tag{7b}$$

However, data from Surveys and Censuses of Manufacturing in West Malaysia and the Industrial Surveys of Malaysia are subject to errors. These errors can result in deviations of the actual cost shares from the cost minimising shares. Kulatilaka (1985) shows that stochastic specifications introduce additive errors due to errors in measurement of output and cost shares. These errors are specified in the error term (e_i), and the estimating equation takes a stochastic form:

$$S_i = a_i + \sum_i \beta_{ij} \text{ In } P_j + e_i \tag{8}$$

In a two-factor case, the estimating equations are sets of simultaneous equations in the following stochastic form:

$$S_K = a_K + \beta_{KK} \text{ In } P_K + \beta_{KL} \text{ In } P_L + e_K \tag{9}$$

$$S_L = a_L + \beta_{LK} \text{ In } P_K + \beta_{LL} \text{ In } P_L + e_L \tag{10}$$

The parameters of the translog cost function in Malaysian manufacturing sector can be estimated by using equations (9) and (10). For the system of share equations (9) and (10), the disturbances are likely to be correlated across equations. Therefore e_K and e_L will be correlated. This suggests that the Iterative Zellner Efficient Method or Seemingly Unrelated Regression (SUR) method will give efficient parameter estimates. Zellner (1962) has shown that when disturbances across equations are correlated, and if the correlation is known, then the parameters can be estimated more efficiently by taking this information into account.

Firstly, alternative versions of Model (B1) to Model (B6) are estimated without restrictions using the Seemingly Unrelated Regression method from time-series data 1969-1984 in 5-digit Malaysian manufacturing industries.

$$\text{B1:}\quad S_K = a_K + \beta_{KK}\ \text{In}\ P_K + \beta_{KL}\ \text{In}\ P_L + e_K$$

$$S_L = a_L + \beta_{LK}\ \text{In}\ P_K + \beta_{LL}\ \text{In}\ P_L + e_L$$

$$\text{B2:}\ S_K\ (\text{AR1}) = a_K + \beta_{KK}\ \text{In}\ P_K + \beta_{KL}\ \text{In}\ P_L + e_K$$

$$S_L\ (\text{AR 1}) = a_L + \beta_{LK}\ \text{In}\ P_K + \beta_{LL}\ \text{In}\ P_L + e_L$$

$$\text{B3:}\ SKR = a_K + \beta_{KK}\ \text{In}\ P_{KR} + \beta_{KL}\ \text{In}\ P_{LR} + e_K$$

$$SLR = a_L + \beta_{LK}\ \text{In}\ P_{KR} + \beta_{LL}\ \text{In}\ P_{LR} + e_L$$

$$\text{B4:}\ SKR(\text{AR1}) = a_K + \beta_{KK}\ \text{In}\ P_{KR} + \beta_{KL}\ \text{In}\ P_{LR} + e_K$$

$$SLR(\text{AR1}) = a_L + \beta_{LK}\ \text{In}\ P_{KR} + \beta_{KL}\ \text{In}\ P_{LR} + e_L$$

$$\text{B5:}\ SK1 = a_K + \beta_{KK}\ \text{In}\ P_{K1} + \beta_{KL}\ \text{In}\ P_{L1} + e_K$$

$$SL1 = a_L + \beta_{LK}\ \text{In}\ P_{K1} + \beta_{LL}\ \text{In}\ P_{L1} + e_L$$

$$\text{B6:}\ SK1(\text{AR1}) = a_K + \beta_{KK}\ \text{In}\ P_{K1} + \beta_{KL}\ \text{In}\ _{L1} + e_K$$

$$SL1(\text{AR1}) = a_L + \beta_{LK}\ \text{In}\ P_{K1} + \beta_{LL}\ \text{In}\ P_{L1} + e_L$$

where

SK	is cost share of capital
SL	is cost share of labour
P_K	is service price of capital
P_L	is service price of labour
SK(AR1)	is cost share of capital corrected for autocorrelation
SL(AR1)	is cost share of labour corrected for autocorreclation
SKR	is real cost share of capital with CP1 as deflator, 1980 = 100

SLR	is real cost share of labour with CP1 as deflator, 1980 = 100
SKR(AR1)	is real cost share of capital (CP1) corrected for auto-correlation
SLR(AR1)	is real cost share of labour (CP1) corrected for auto-correlation
SK1	is real cost share of capital with Industrial Production Index (IPI) as deflator, 1980 = 100
SL1	is real cost share of labour with Industrial Production Index (IPI) as deflator, 1980 = 100

Such Zellners' generalised least squares (GLS) estimation procedure yields estimators which are sensitive to which cost share equation is deleted from the system of equations. A maximum likelihood procedure would provide parameter estimates which are invarient to the choice of equations to be actually estimated (Barten 1969). However, Kmenta and Gilbert (1968) have demonstrated that Full Information Maximum Likelihood (FIML) and Iterated Zellner Efficient Estimation (IZEF), commonly known as Seemingly Unrelated Regression (SUR), lead to identical estimates. Rubble (1968) has also shown the computational equivalence of IZEF and FIML estimators.

DISCUSSION OF EMPIRICAL RESULTS

The most appropriate equation to estimate the elasticity of substitution between capital and labour in the Malaysian manufacturing sector is chosen based on statistical reasons. A statistical search for the best fitting equation based on parameter estimates, the conventional R and the Durbin-Watson statistics is carried out for 50 5-digit industry groups. Models (B4) and (B6) exhibit superior statistical properties. The differences in the results of these two Models however are very small. For example, for Pineapple Canning industries in Model (B4), R^2 = 0.96 and D-W statistic is 1.8 while in Model (B6), R^2 = 0.96 and D-W statistics is 1.6. Similarly, for Cement and Concrete Manufacturing in Model (B4), R^2 = 0.96 and D-W statistics is 1.1 while for Model (B6), R^2 = 0.95 and D-W statistics is 1.2.

Theoretically, in Model (B4), the variables are real values deflated by the consumer price index which will eliminate biases due to inflation and cyclical price movements. In Model (B6), on the other hand, the variables are also real values deflated by the industrial production index which take into account biases due to under-utilisation of capacity. In this study, the results are reported based on Model (B4). This is because real values deflated by the CPI would eliminate greater bias in the estimates compared to real values deflated by the IPI. In Model (B4), the data have been corrected for auto-correlation. Of the 300 estimated parameters, more than 75 per cent are statistically significant at the 95% confidence level and the standard errors are small (Maisom Abdullah 1989). These statistical results indicate a good fit for the systems of share equations for the translog cost estimation in the Malaysian manufacturing sector. For a model of this magnitude, the results are very encouraging.

Slope parameters in the cost share equations reflect changes in the cost shares resulting from changes in logarithmic prices in real terms. The slope coefficients may either be positive or negative, since the second derivatives of ln C with respect to ln P_i and ln P_j may be of either sign. If the cost share is inversely related to ln P_j i.e. $\beta_{ij} < 0$, this suggests that i and j are substitute inputs. If the cost share increases with a rise in the real price, i.e. $\beta_{ij} < 0$, this suggests that input substitution is limited. From the empirical findings in this study, the cost share of the labour parameter estimates (β_{LK}) show that substitution between capital and labour is rather limited in 36 out of the 50 industries studied.

The primary objective in this study is to measure the elasticities of substitution between capital and labour in 5-digit Malaysian manufacturing industries. Basing on Model (B4), the Allen partial elasticity of substitution between capital and labour is calculated at the mean cost shares, at beginning year of analysis (1968), base year (1980) and at ending year of analysis (1984). The elasticity of substitution estimates are reported in Table 1.

Interestingly, the elasticities evaluated at the mean cost shares and in different years show insignificant variations. In 16 cases, the elasticity increased very slightly between 1969 and 1984. Evaluated at mean cost shares, more than half of the elasticities are less than unity. In 32 percent of the cases, the value of the elasticity is less than 0.8. In 14 per cent of the cases, it exceeds 1.10 while in more than 50 percent of the cases, it lies between 0.8 and 1.10. The elasticity of substitution between labour and capital in 5-digit Malaysian manufacturing industries ranged between -3.716 for clothing industries to 4.649 for petroleum refining.

The estimates of the elasticity of substitution between capital and labour in the Malaysian manufacturing sector are however subject to bias due to the problems of measurement and specification of the variables, especially capital. The data that we are obliged to work with

TABLE 1. Elasticity of Substitution in Malaysian Manufacturing Industries: A Translog Cost Function Approach

	TLC(M)	TLC(68)	TLC(80)	TLC(84)
Slaughtering, Preparing & Preserving Meat	3.540	0.925	0.615	0.645
Ice Cream Manufacturing	0.965	0.995	0.923	0.925
Other Dairy Products	0.812	0.966	0.464	0.395
Pineapple Canning	1.335	1.064	1.309	1.406
Other Canning and Preserving of Fruits & Vegetables	1.000	1.000	1.000	1.000
Coconut Oil Manufacturing	2.922	1.055	1.128	1.328
Palm Oil Manufacturing	0.950	0.968	0.852	0.582
Palm Kernel Oil manufacturing	0.679	0.501	- 1.941	-1.478
Vegetable and Animal Oils & Fats	0.772	0.961	0.525	0.446
Rice Milling	1.019	1.018	1.027	1.044
Biscuit Factories	0.667	0.869	0.537	0.200
Sugar Factories & Refineries	0.664	0.910	0.256	0.335
Manufacture of Cocoa, Chocolate & Confectionery	0.970	0.987	0.953	0.884
Ice Factories	0.938	1.000	0.996	0.995
Coffee Factories	0.223	0.614	0.268	0.243
Meehon, Noodles & Related Products	0.371	0.936	0.572	9.545
Manufacture of Prepared Animal Feeds	1.089	1.006	1.017	1.030
Soft Drinks & Carbonated Beverages	1.339	1.012	1.073	1.087
Tobacco Manufacturing	1.325	1.051	1.136	1.271
Manufacture of Leather & Leather Products	0.980	0.986	0.987	0.937
Sawmilling	0.955	0.849	0.180	0.134
Planing Mills & Joinery Works	0.952	0.992	0.976	0.964
Manufacture of Furniture & Fixtures	1.014	1.002	1.007	1.074
Clothing Factories	-3.716	0.660	0.843	- 1.034
Paper & Paper Products	1.015	1.010	1.038	1.076
Printing, Publishing & Allied Industries	0.230	0.180	- 2.044	-2.284
Manufacture of Basic Industrial Chemicals	0.853	0.936	0.788	0.782
Manufacture of Chemical Fertilizer & Pesticides	0.110	1.000	0.679	0.128
Manufacture of Paint, Varnishes & Lacquers	0.943	0.988	0.953	0.937
Manufacture of Drugs, Medicine & Pharmaceutical	1.041	1.016	1.055	1.550
Manufacture of Soaps & Cleaning Preparations	1.157	1.016	1.073	1.802
Preparations of Perfumes, Cosmetics & Toiletteries	1.324	0.839	0.170	0.012
Petroleum Refineries	4.649	1.022	1.057	1.263

continued to next page

TABLE 1. *(continued)*

Petroleum and Coal Products	1.051	1.000	1.131	1.485
Rubber Products	1.000	1.000	1.000	1.000
Plastic Products	0.321	0.933	0.636	0.441
Pottery, China & Earthware	-0.396	- 0.360	- 1.896	-3.290
Hydraulic Cement	1.535	1.026	1.164	1.251
Cement & Concrete	1.051	1.137	1.070	1.106
Primary Iron & Steel Industries	0.083	0.550	0.468	1.241
Non-Ferrous Metal Products	1.013	1.007	1.040	1.043
Wire Products Manufacturing	1.000	1.000	1.000	1.000
Brass, Copper, Pewter & Alluminium Prod.	0.889	0.965	0.845	0.767
Industrial Machinery & Parts	0.462	0.975	0.697	0.287
Electrical Machinery, Appar. & Appliances	0.670	0.914	0.575	0.272
Shipbuilding, Boatmaking & Repairing	1.039	1.009	1.031	1.054
Manufacture of Motor Vehicle Bodies	0.017	0.959	0.749	0.585
Manufacture of Motor Vehicle Parts & Accessories	0.681	0.828	0.320	0.435
Assembly of Motor Vehicle	1.026	1.006	1.006	1.050
Manufacture of Professional & Scientific Equipment	1.085	1.019	1.132	1.098

Notes: TLC(M) is elasticity of substitution calculated at mean real cost shares;
TLC(M) (68) is elasticity of substitution calculated at beginning year of analysis (1968);
TLC(80) is elasticity of substitution calculated at base year (1980); and
TLC(84) is elasticity of substitution calculated at end year of analysis (1984).

have a number of shortcomings. No account is taken of the quality of management, existence of different qualities of labour and different types of capital equipment. Furthermore, no account is taken of the capacity utilisation over time.

Taking into account these potential biases due to errors in the measurement of variables, the "actual" estimates of the elasticity of substitution are expected to be lower than the reported estimates. Allowing for a correction of these biases in measurement of variables, would imply that the majority of the elasticity estimates are much lower than unity. This interpretation concur with similar findings based on Constant Elasticity of Substitution (CES) production analysis for the Malaysian manufacturing sector (Maisom Abdullah 1989).

CONCLUSIONS AND POLICY IMPLICATIONS

A number of major conclusions related to the utility of the elasticity of substitution for policy making may be distilled from this study. Firstly, attempts to estimate elasticities of substitution using econometric methods suffer from a number of shortcomings. Among the most important of these is the assumption of homogeneous inputs to produce a single homogeneous output. No account is taken of other factors such as the quality of management, existence of different qualities of labour and different types of capital equipment. Econometric measurements also suffer from the difficulties of incorporating technical change, working capital and varying rated of capital utilisation over time. Attempts are made in this study to overcome possible biases from aggregation problem and the effects of inflationary changes. The estimates are however subject to bias as discussed earlier.

In light of these empirical problems, the utility of the substitution-possibility indicator could be greatly reinforced by estimates based on better quality firm level data based on empirical surveys, field investigations and interviews with entrepreneurs. Since Morawetz's criticisms of the elasticity estimated by econometric methods, there have been substantial developments and improvements in estimation procedures and econometric techniques especially for improving the quality of data for estimation purposes. Being relatively less costly, econometric measurements can still be useful.

Alternatively, detailed product-by-product or process-by-process engineering analysis studies have to be carried out to investigate the degree of factor substitutability and the extent to which the adoption of appropriate techniques can be expected to absorb employment. Such microeconomic tasks can be undertaken only for a number of products since such detailed investigations are costly and time consuming.

The second significance of this study is the role of substitution elasticities with respect to employment generation in the Malaysian manufacturing industries. In the short-term, the possibilities for substitution between capital and labour in the majority of industries appear to be rather limited. Thus, factor price policies are not likely to result in important changes in the techniques of production and employment in the Malaysian manufacturing sector. In the long-term, however, the establishment of proper factor prices to reflect the true scarcities of capital and labour is very important. This has been a familiar refrain from economists over the past ten years, but it can still bear repeating. Efforts must be made to reduce the subsidies to capital use. The cumulative employment effect of setting factor prices right can be quite substantial. The new prices would favour the investment of new capital in more labour-intensive industries although the degree of labour intensity in future is expected to be generally lower due to the rapid change toward the utilization of more capital-and-skill-intensive technologies. Furthermore, where alternative technologies are available, each industry would be encouraged to use the more labour-intensive techniques of production. Moreover, increasing the price of capital relative to labour would induce an increase in the prices of capital-intensively produced goods. This will in turn result in shifting the composition of output in favour of goods with a higher employment content.

Limited factor substitution is due to the limited range of alternative technologies available. An obvious policy implication to increase employment generation is to expand the range of appropriate technologies available to the firms. This involves not only improving the information and technology networking systems, but also determining the channels and types of investments associated with the transfer of technology from industrialised countries, and improving local scientific research and technologies development.

The correct choice of technique and appropriate factor proportions can positively influence employment generation in the manufacturing sector. However, changing one policy in isolation may not provide the impact on the demand for labour as envisaged. As such, other policies which affect employment need to be addressed simultaneously. These policies include the output composition or the product-mix to be manufactured, the types and scale of industries to be promoted, the increase in productivity and capacity utilisation of the manufacturing sector.

With respect to be choice of technique, the policy implication is the possibility for the government to intervene by influencing the country specific production function. In the short run, the government can modify the product-mix of industries. Product composition has obvious effects on the magnitude of employment opportunities which can be generated with a given level of output. Some products require more labour per unit of output than do others and, if total costs are comparable, more labour per unit of capital employed in production. Thus, present efforts to increase exports of labour-intensive products such as textiles, footwear, handicrafts and light engineering products must be intensified. Considerations however must also be given to secondary effects of manufacturing activities. Each product requires other material and capital inputs and may itself be an input in the production of other goods. When these secondary employment effects are taken into account, product preferences may have to be reordered. Another issues is the argument that employment considerations tend to favour import substitution over export promotion since import-substitutes are produced to meet lower income needs. It is argued that production of such goods may on average employ more labour. This argument is less persuasive when secondary employment effects are introduced, that is, when it is applied to intermediate goods. More careful study is necessary to determine these effects on employment in the manufacturing sector.

Product composition has obvious effects on the magnitude of employment opportunities which can be generated with a given level of output. The composition of output at the industry level is determined by the structure of aggregate demand which is consisting of demand by domestic consumers, foreign consumer in the export market, the government sector and private investors. For each of these sectors, the policy implication is to influence the demand for goods which are produced labour-intensively.

Another area of interest which has employment implications is the intra-industry-mix. In addition to the possibility that more labour-intensive industries are encouraged, it may also be possible to encourage more labour-intensively produced goods within each industry. For example, the production of soap is more labour-intensive relative to the production of detergent, and the production of leather or canvas footwear is similarly more labour-intensive relative to the production of rubber-moulded footwear.

Another policy implication is related to the rate of capacity utilisation in the manufacturing sector. Utilising the existing capital stock more intensively will lower the capital-labour ratio, and at the same time, increase employment in the industry. Furthermore, as capital utilisation in increased, the subsequent increased need for maintenance will add further to total employment.

On the whole, therefore, our estimates do not provide a very optimistic outlook on manufacturing employment possibilities and it underscores the need for a more cogent employment-oriented industrialization policy. Factor price policies are not likely to result in important changes in technique and employment in Malaysian manufacturing sector. Nonetheless, policies to increase labour absorption through price incentives, though limited, can still be important. Getting factor product and foreign exchange prices right is very important in an open competitive economy such as Malaysia. The practice of reducing import duties on capital goods for certain industries can result in the negative impact on labour absorption. As such, more equal treatment of exports and import substitutes will ensure that countries produce according to comparative advantage.

The third and perhaps the most important policy implication of this study is that the problem of employment absorption in developing countries such as Malaysia is mainly structural in nature. The eventual resolution of the employment problem depends not only on the direct employment effects of the year-to-year choice of techniques but more importantly on the general development strategies in the country. The issues related to employment absorption are multi-faceted. Besides the choice of techniques, other aspects of importance are output and industry-mix, scale of production, growth rate of industry, the rate of population growth, the location of resources, the behavioural and cultural characteristics of households and communities, the organisation and capacity to plan and implement, international trade, capital flows and transfer of technology, the ownership and management of resources and the structure of political and economic power. Long term labour absorption in manufacturing as well as other sectors require policies which are intended to affect these conditions. They involve technical as well as social and political considerations.

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