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ANOTHER LOOK AT THE EFFECT OF CAPITAL SUBSIDIES ON CAPITAL-INTENSITY *

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INTRODUCTION

In an earlier paper in this journal [3] I examined the effect that the provision of capital subsidies, in the form of tax holidays whose duration depends on the level of capital investment, had on the capital-intensity of manufacturing in Peninsular Malaysia. The following basic equations were estimated, by ordinary least squares, for twelve industry-groups for 1972:

$$\text{CAP. INT.} = f(PS) \qquad (1)$$

$$\text{CAP. INT.} = f(PS, S, S^2, N) \qquad (2)$$

CAP. INT., the capital-intensity of the industry-group, was measured by *K/L*, the capital-labour ratio, and *VA/L*, the value added per worker, in Malaysian dollars. *PS* was the dummy variable used to estimate the effect of granting investment-based incentives on capital-intensity. It was measured by the labour force employed by the 'pioneer' (incentive-receiving) firms as a percentage of the total labour force employed by the industry-group concerned (*PSL*) and by the value added of the 'pioneer' firms as a percentage of the industry-group's total value added (*PSV*). S, the sales per firm in the industry-group (M$'000), was used to estimate the influence of the scale of operation on capital-intensity, *N*, the fixed assets of foreign owned and controlled firms in the industry-group as a percentage of the total fixed assets of the industry- group, was included to test the hypothesis that foreign firms preferred using the technology they were familiar with, regardless of relative factor costs and scale considerations.

The regression coefficients of PS came out with the expected positive sign and were statistically significant in all four versions of the basic estimating equation (1). However, when the basic equation (2) was used, the coefficients of *PS* in the two equations with *K/L* as the dependent variable came out positive but not statistically significant. This suggests that the positive and significant coefficients obtained for *PS* in equation (1), when *K/L* was used as the dependent variable, was due to the presence of scale and nationality effects on capital-intensity and not to the provision of investment-based incentives as such. On the other hand, the coefficients of PS, when *VA/L* was used as the dependent variable, were positive and significant. It was then concluded that, on balance, there was some, but not strong, support for the contention that investment-based incentives encouraged a higher level of capital-intensity in Peninsular Malaysian manufacturing.

This was a tentative conclusion because: (a) the results obtained for the basic equation (2) were mixed, with half of them suggesting that the incentives encouraged a higher level of capital-intensity and the other half not; and (b) the sample of twelve industry-groups might have been too small to produce meaningful results. Since the publication of the above results two different sets of data have become available, which enable a more detailed analysis to be carried out. The first is the data from the 1973 Census of Manufacturing

Industries for Peninsular Malaysia [4]. This new government publication provides data on the variables used in the earlier study for a bigger sample of (twenty-six) industry groups.[1] Its complete coverage is also superior to the 75 per cent coverage of the 1972 Survey of Manufacturing Industries, from which the data for the earlier study was taken. The second is data for 350 manufacturing establishments in Peninsular Malaysia for 1972. This sample of establishments represented 10 per cent of the total number of manufacturing establishments in 1972 and is the same as the one used for a World Bank study on capital utilisation [1]. Information on the pioneer status of each establishment in 1972 and on the percentage of the establishment's equity that was under foreign ownership were obtained from the Registry of Companies subsequent to the World Bank study. Information on the other variables were available from the World Bank study. The 1973 Census data would obviously be preferred to either the 1972 Survey data or the 1972 World Bank Sample data, in view of its superior (complete) coverage of the number of industry-groups and the number of establishments within each industry- group. By implication, most reliance should be placed on the results obtained with the use of the 1973 Census data. The purpose of this paper is to re-examine the effect that the provision of investment-based incentives had on capital-intensity in Peninsular Malaysian manufacturing, using the newly available sets of data. In the process it is hoped that a firmer conclusion on this important question can be reached.

EMPIRICAL RESULTS: 1973 CENSUS DATA

Equations (1) and (2) were estimated, by ordinary least squares, for the I973 data for twenty six industry-groups. CAP. INT. was measured by *K/L* and *VA/L* in Malaysian dollars (M$). *PS* was measured in three ways: as *PSL* and *PSV*, as previously, and as the fixed assets owned by 'pioneer' firms as a percentage of the total fixed assets in the industry-group (*PSK*). S was approximated by the sales per firm in the industry-group (M$'000). The 1973 Census does not provide data on fixed assets by nationality so that *N* had to be measured differently from that of the earlier paper. It was presented as the labour force employed by foreign firms as a percentage of the total labour force employed by the industry-group (N_I) and as the value added of the foreign firms as a percentage of the total value added of the industry-group (N_V).[2]

TABLE I

Linear Regressions Explaining Capital-Intensity (K/L) of Peninsular Malaysian Manufacturing, 1973: 26 Industry-Groups

Independent Variables	Dependent Variables (M$)					
	K/L (1.1)	*K/L* (1.2)	*K/L* (1.3)	*K/L* (2.1)	*K/L* (2.2)	*K/L* (2.3)
Constant	-10.608 (-0.925)	-5.319 (-0.465)	-6.139 (-0.622)	0.188 (0.053)	2.595 (0.789)	2.583 (0.801)
PSK (%)	0.544 (2.618)*			0.109 (1.794)**		
PSV (%)		0.465 (2.372)*			0.059 (0.953)	
PSL (%)			0.537 (2.679)*			0.070 (1.055)
S (M$'000)				0.027 (17.666)*	0.027 (17.330)*	0.028 (17.019)*
N_v (%)				0.022 (0.476)	0.023 (0.439)	0.021 (0.398)
$\bar{R}^2$	0.190	0.156	0.198	0.945	0.939	0.948
F-ratio	6.854 *	5.626 *	7.178 *	143.073 *	129.293 *	130.521 *

Note: Figures in parentheses are *t* values. Statistical significance at the 0.01 and 0.025 confidence levels are indicated by * and ** respectively.

Both the linear and the logarithmic forms of equations (1) and (2) were estimated, with the former producing the better results. It was also found that the results for equation (2) were better when S^2 was excluded. Tables I and I1 therefore show the results obtained for equation (2) without S^2 as an independent variable.[3]

PS came out with positive and significant coefficients in all the six equations estimated for the basic equation (1). However, with the exception of the result for equation (1.1), this could have been due to the fact that the *PS* variable had incorporated the positive effect that the scale of operation had on capital-intensity. When the basic equation (2) was used, only one of the six coefficients of the *PS* variable, [that for *PSK* in equation (2.1)] came out positive and significant.

The nationality variable did not appear as a determinant of capital-intensity, in contrast to the earlier finding. This is probably due to the fact that it was measured differently in the two studies. There is no ambiguity about the positive effect that the scale of operation had on capital-intensity. It came out as the most important influence, its inclusion as a determining variable having increased the coefficient of determination very markedly. It appears, therefore, that the capital-intensity of Malaysian manufacturing in 1973 was determined basically by the scale of operation, with the provision of capital subsidies and the extent of foreign presence exerting no influence at all.

TABLE II

Linear Regressions Explaining Capital-Intensity (VA/L) of Peninsular Malaysian Manufacturing, 1973: 26 Industry-Groups

Independent Variables	Dependent Variables (M$)					
	VA/L (1.4)	*VA/L* (1.5)	*VA/L* (1.6)	*VA/L* (2.4)	*VA/L* (2.5)	*VA/L* (2.6)
Constant	-0.798 (-0.113)	1.357 (0.222)	0.797 (0.145)	4.912 (2.146)*	5.378 (2.618)*	5.277 (2.622)*
PSK (%)	0.275 (2.243)*			0.016 (0.398)		
PSV (%)		0.247 (2.164)*			0.004 (0.105)	
PSL (%)			0.288 (2.467)*			0.009 (0.221)
S (M$'000)				0.016 (15.798)*	0.016 (16.036)*	0.016 (15.724)*
N_v (%)				0.030 (0.971)	0.031 (0.965)	0.030 (0.919)
$\bar{R}^2$	0.139	0.128	0.169	0.929	0.938	0.928
F-ratio	5.030 *	4.684 *	6.088 *	109.392 *	108.617 *	108.816 *

Note: As in Table I.

EMPIRICAL RESULTS: 1972 SAMPLE DATA

The following equations were estimted, by ordinary least squares, at the 3-digit level of the Malaysian Industrial Classification/ U.N. International Standard Industrial Classification, where there are 28 industry groups:

CAP. INT. $=f(PS)$ (1)

CAP. INT. $= f(PS, S, S^2, N, A)$ (3)

CAP. INT. was measured by *K/L* (M$) and *K/E* (M$). *E* was the number of production workers on the biggest shift, normally the day shift, so that *K/E* measured the amount of capital that a production worker handled while at work during the main shift, regardless of the fact that another worker might have operated the same equipment on another but minor shift [2].

TABLE III

Linear Regressions Explaining Capital-Intensity of Peninsular Malaysian Manufacturing, 1972: 28 Industry Groups

Independent Variables	Dependent Variables (M$)			
	K/L (1.1)	K/L (3.1)	K/E (1.2)	K/E (3.2)
Constant	9.286 (0.168)	1.544 (0.093)	19.508 (0.203)	3.373 (0.093)
PSK (%)	0.492 (2.083)*	0.195 (1.851)**	0.661 (1.564)	0.346 (1.051)
S^2 (M$m.)		0.031 (19.263)*		0.095 (19.928)*
N_i (%)		0.055 (4.517)*		0.064 (2.753)*
A (years)		0.012 (0.201)		0.027 (0.014)
$\bar{R}^2$	0.17	0.867	0.10	0.770
F-ratio	6.377 *	90.115 *	5.245 **	78.823 *

Note: As in Table I.

PS and *S* were measured as previously but *N* was presented differently. The first measure of *N* was $N_{e'}$, which showed the percentage of the industry-group's equity which was foreign owned, while the second was N_i, the percentage of the inputs used by the industry-group which was imported. N_i may be a more appropriate measure for testing the familiarity hypothesis. Foreign control of the operation of an industry- group, and hence of its choice of technique, may be possible with only a minority ownership of the industry-group's equity. The possession of specialised technical and management skills may be a more important requirement. A more reliable measure of foreign control may be the extent to which the operation of the industry-group is dependent on foreign inputs. An industry-group which is really under foreign control will use foreign technology and will therefore have a high dependence on foreign inputs.

A is the average age of the plants in the industry-group. Most of the equipment used in Malaysian manufacturing is imported from advanced industrial countries. As research and development in these countries is geared toward the introduction of more and more capital-intensive technology, we would expect that, *ceteris paribus*, the newer the plant the more capital-intensive the technology embodied would be. A negative relationship is thus expected between the age and the capital-intensity of the industry-group.

Both the linear and the logarithmic forms of equations (1) and (3) were estimated, with the former producing the better results. It was also found that the results were better when *S* was excluded from the estimating equation (3). At the same time the results obtained with *PSK* as the measure of the PS variable were better than those obtained with the use of *PSV*

and *PSL*. Table III therefore shows the results obtained with the linear formulation of equations (1) and (3), with *S* excluded from the estimation, and with the use of PSK as the measure for *PS*.

The coefficients of *PSK* came out with the expected positive sign in all the four equations but were statistically significant in only equations (1.1) and (3.1). In addition, none of the coefficients of *PSV* and *PSL* (not shown in this paper), though positive, was significant.

The scale of operation was the main determinant of capital-intensity. The results also show that the positive relationship between scale of operation and capital- intensity was not a linear one.

There was also support for the contention that foreign firms preferred using the technology they were familiar with, regardless of other considerations. N_i appeared with positive and statistically significant coefficients. The appearance of N_i and not N_e, as a determinant also lent support to the argument that a majority ownership of the firm's equity on its own did not necessarily bring about executive control of the establishment.

There was no support for the hypothesis that the age of the industry-group had a bearing on the capital-intensity of the operation. This is really not surprising in view of the newness of the Malaysian industrial sector. Firms were set up at more or less the same time so that there was little or no difference in the vintages of the machinery used.

INTERPRETATIONS AND CONCLUSIONS

It would appear that the results obtained with the use of the newly available data show very strongly that the provisions of capital subsidies had no influence on the capital-intensity of manufacturing in Peninsular Malaysia. The results, therefore, seem to contradict those presented in an earlier paper.

However, a closer look at the results show that there may not be such a contradiction. Of the three measures of the *PS* variable, *PSK* was the most appropriate for our purposes. If the provision of investment-based incentives had resulted in the establishment of a few capital-intensive firms in an industry-group, then this would have produced a high level of capital-intensity in the industry-group concerned. However, this effect on capital-intensity would not have been captured by the use of *PSL* for the *PS* variable as the large number of workers employed by numerous labour-intensive 'non-pioneer' firms would have produced a low value for *PSL*. The same criticism could be made of the use of *PSV* for the *PS* variable, unless capital-intensive activities were also ones with high value added, an assumption that could not necessarily be made. On the other hand, the use of *PSK* for the *PS* variable would have captured the desired effect because of its directness. A large value for *PSK* because of the presence of a few capital-intensive 'pioneer' firms in the industry-group would have meant a correspondingly high value for the capital-intensity of the industry-group.

In view of this, the results obtained may not be inconsistent with those obtained earlier because some of the coefficients of PSK, the most meaningful measure of the PS variable, were positive and significant. However, it should be said that our aim of producing an unambiguous result on the effect of investment-based incentives on capital-intensity was not achieved. The results were still a bit too diverse for such a conclusion to be made.

There is no ambiguity at all about the effects of the scale of operation on capital- intensity. The scale of operation came out as, by far, the most important determinant of capital-intensity. The significance of this finding is not reduced in any sense by the fact that there are differences in the results concerning the exact nature of the relationship between scale of operation and capital-intensity (that is, whether it is linear or non-linear).

There is some support for the hypothesis that foreign firms preferred using the technology they were familiar with, regardless of other considerations. A reluctance to get too involved with the social and political problems associated with the employment of local labour may be the reason behind this preference.

The age of the operation had no effect on its capital-intensity. However, this result must be interpreted with care as the newness of manufacturing in Peninsular Malaysia did not permit much variation in the vintages of the manufacturing operation.

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[Footnote]

* I have benefitted from the comments of an anonymous referee.

1. Actually the data were available only for twenty industry-groups (food, tobacco, textiles, footwear, wood, furniture, paper, printing. industrial chemicals, other chemicals. rubber products, plastics, glass, non-metallic mineral products, iron and steel products. fabricated metal products. machinery except electrical machinery, transport equipment, and professional equipment). However, it was possible, from returns submitted to the Registry of Companies in Kuala Lumpur, to derive accurate figures for six more industry-groups (beverages. wearing apparel, leather, petroleum refineries. miscellaneous petroleum products, and pottery).
2. Singaporean firms were considered to be local firms.
3. The results were also those obtained when N was measured by N_v. This was done to reduce the number of equations presented but made no difference to the results as the coefficients of N_v, and N_l, were both equally statistically insignificant.