EXPORT STRUCTURE AND EXPORT INSTABILITY: THE CASE OF PENINSULAR MALAYSIA

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I. INTRODUCTION

THE PRIMA FACIE case for believing that export instability is more severe for the typical developing country than for the typical developed country rests on a threefold a priori argument that the typical developing country tends to: (a) specialize in the production and export of primary commodities; (b) concentrate on a small range of commodities; and (c) concentrate on a small group of traditional export markets. In this context, Peninsular Malaysia may be termed a typical average developing country. For the 1960–73 period, over 85 per cent of the country's total export earnings were accounted for by the export of primary commodities; over 70 per cent of export earnings were derived from natural rubber, tin, timber, and palm oil; and over 65 per cent of exports were destined for the traditional export markets, the Commonwealth countries, Japan, and the United States.

This being the case, it has generally been accepted that export instability in Peninsular Malaysia is largely a by-product of specialization in the production and export of natural rubber and tin—both commodities characterized by low price elasticities of demand and supply, and rather unstable demand—and that "the search for the cause of export instability can therefore be concentrated on the supply and demand conditions for these two commodities" [8, p. 80]. This paper takes the argument a step further by examining the relationship between export instability and a set of variables that help characterize the country's export structure.

II. THE POINT OF CONTENTION

There is now hardly any argument about the extreme (above average) instability in export earnings for Peninsular Malaysia. Coppock, using the log variance method,[1] found instability indices for the 1946–58 period to be 41.9 for the total export earnings of Peninsular Malaysia and 23.1 for a group of forty-five de-

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[1] The index of instability is equal to antilog $\sqrt{V_{\log}}$, where $V_{\log}=1/(n-1)\sum[\log(X_{t+1}/X_t)-m]^2$, $m=1/(n-1)\sum\log(X_{t+1}/X_t)$, X_t=value of export earnings in period t, n=number of period.

veloping countries [2, pp. 49–79]. This extreme instability is confirmed in a study by Erb and Schiavo-Campo [3]. For the 1946–58 period, using the Coppock log variance method, they found the means (medians) of the instability indices of export earnings to be 17.6 (18.1) for eighteen developed and 23.0 (18.3) for forty-five developing countries. These values were considerably less than the 38.9 recorded for Peninsular Malaysia. For the post–Korean War years, 1954–66, the index for Peninsular Malaysia was 16.5 compared with 6.2 (6.3) for the developed and 13.4 (12.8) for the developing countries. The more recent studies by Leith [7], Ariff [1], Glezakos [4], and Lawson [6], show similar results.

If there is any difference of opinion at all, it would have to be about the causes of high export instability experienced by Peninsular Malaysia. To the extent that export instability is influenced by factors within the control of policymakers, it is relevant to estimate the relationship between these factors and export instability. Thus an approach which incorporates explanatory variables that characterize the country's export structure and that are subjected to long-run policy manipulation should prove more meaningful than an approach confined to a study of the supply and demand conditions for natural rubber and tin.

Instability is defined here as percentage deviations from the trend; this is necessary in order to avoid interpreting a constant period-to-period increase or decrease as indicating instability. In this case, the type of trend fitted to the data becomes important. For two practical reasons, an exponential trend is preferred to a linear trend. First, economic planners tend to think in terms of growth rates, and not in terms of absolute changes. Second, for the time period covered in this study an exponential trend provided better fit to the data than a linear trend.[2] Export instability is therefore defined as percentage deviations from the exponential trend. For the deseasonalized data for the 1960–73 period, the exponential trend for Peninsular Malaysia's export earnings is given by

$$\ln X_t = 6.3789 + \underset{(10.7578)}{0.0120t}. \qquad \bar{R}^2 = 0.6758. \tag{1}$$

Origin: March 1960.
t units: 1/4 year.

III. THE EXPLANATORY VARIABLES

On an a priori basis, export instability can be expected to be a function of: (a) the composition of exports, (b) the diversification of exports by commodity and by export market, (c) the country's share of world markets for its export products, and (d) the domestically consumed proportion of output of the export products.[3]

Specialization in production and export of primary commodities generally

[2] The linear trend is given by $X_t = -0.5246 + \underset{(0.6938)}{0.0779t}. \qquad \bar{R}^2 = 0.0088.$

[3] The last explanatory variable was left out of this study due to the unavailability of quarterly data on domestic consumption for the period 1960–73. Fortunately, for the major export products, domestic consumption constitutes a very small proportion of total exports.

implies a higher degree of export instability than specialization in manufactures because primary commodities tend to be characterized by low price elasticities of demand and supply, and by uncontrolled variability in demand, in supply, or both. Using the proportion of the value of exports derived from primary commodities as an explanatory variable, MacBean [9, p. 39], Massell [10] [11], and Naya [13] found from their cross-sectional correlating analyses very low correlation coefficients between export instability and specialization in primary commodities which were clearly nonsignificant at the 0.05 level. In this paper, the analysis is carried a step further by distinguishing between eight categories of products. The following explanatory variables are used. The first four are generally referred to as primary commodities and are therefore thought to contribute toward a higher degree of export instability, and the remaining variables are usually associated with a lower degree of export instability:

R_f : the proportion of total export earnings derived from food and live animals, and beverages and tobacco (SITC main divisions 0,1).

R_r : the proportion of total export earnings derived from crude materials, inedibles, except fuels (SITC main division 2).

R_L : the proportion of total export earnings derived from mineral fuels, lubricants, and related materials (SITC main division 3).

R_a : the proportion of total export earnings derived from animal and vegetable oils and fats (SITC main division 4).

R_c : the proportion of total export earnings derived from chemicals and products of the chemical industries (SITC main division 5).

R_m : the proportion of total export earnings derived from manufactured goods classified chiefly by materials (SITC main division 6).'

R_t : the proportion of total export earnings derived from machinery and transport equipment (SITC main division 7).

R_s : the proportion of total export earnings derived from miscellaneous manufactures (SITC main division 8).

Export diversification by commodity and export market is, on an a priori basis, a factor contributing toward a lower degree of export instability. Empirical studies on the relationship between export instability and commodity concentration remain inconclusive. The cross-section studies by Coppock [2], MacBean [9], Massell [10], and Naya [13], suggest very little or no effect on the stability of export earnings from commodity concentration. On the other hand, Michaely [12] and Massell [11] found significantly positive correlation in their cross-section studies, thus lending support to the hypothesized relationship between export instability and commodity concentration.

In this time-series study for Peninsular Malaysia, commodity concentration is measured by the Hirschman-Gini coefficient: a measure used rather widely in studies cited so far. The coefficient of commodity concentration for exports is defined as:

$$C_{xt}=\left[\sum_{i=1}^{n}\left(\frac{X_{it}}{X_t}\right)^2\right]^{1/2}, \qquad (2)$$

where X_{it} is the value of exports of commodity i in the tth quarter, and X_t is the total export earnings during the tth quarter, i.e., $\sum_{i=1}^{n} X_{it}=X_t$. The higher the value of C_{xt} the greater the concentration, or, in other words, the lower the degree of diversification by commodity. For practical reasons, the SITC two-digit commodity classification scheme was adopted for computation of values C_{xt}.

Studies on the relationship between export instability and geographic concentration or concentration on the few export markets remain inconclusive. The findings by Coppock [2] and Massell [10] show that, if any association exists between geographic concentration and export instability, it is negative. Naya [13] also found geographic concentration weakly and negatively correlated with export instability. Of the three explanatory variables covered in his study, MacBean [9] found that only geographic concentration appears firmly associated with export instability and that in the opposite way to a priori expectations. In his later study, Massell [11] found a positive but insignificant correlation coefficient.

Here, the measure of geographic concentration is similar to that of commodity concentration. Thus,

$$G_{xt}=\left[\sum_{j=1}^{n}\left(\frac{X_{jt}}{X_t}\right)^2\right]^{1/2}, \tag{3}$$

where X_{jt} is the value of exports of commodities to country j in the tth quarter and X_t is total export earnings during the tth quarter. This index for Peninsular Malaysia for the 1960–73 period was calculated over twenty-two countries and eight groups of "minor" countries; the twenty-two countries together accounted for over 85 per cent of Peninsular Malaysia's exports.

Assuming that price elasticity of demand exceeds unity, it has been argued that export instability is also a decreasing function of a country's share of the world market in the commodities it exports. Massell in his second study [11] included this variable in his list of eight variables and found it nearly significant at 10 per cent.

A country's importance as a supplier of the world markets depends on the size of its export sector, the extent to which its exports are concentrated on a few items, and the size of the world markets for these items. The index of the degree to which a country's exports tend to be large in world markets is defined as:

$$Z_t=\sum_{i=1}^{n}\lambda_{it}\delta_{it}, \tag{4}$$

where λ_{it} is the country's share of commodity i in world trade in the tth quarter, δ_{it} is the proportion of total exports accounted for by commodity i in the tth quarter, and $\lambda_{it}\ \delta_{it}$ is the country's share of commodity i weighted by the relative importance of commodity i in the country's exports. Calculations of Z_t would be extremely tedious, hence, for practical reasons, an approximate value of Z_t is obtained by considering the country's major export commodities. For Peninsular Malaysia this is confined to three commodities in which it is a significant exporter

in the world market. The three commodities—natural rubber, tin, and palm oil—together account for over 50 per cent of the country's exports.

Formally, the basic relationship between the economic structure of Peninsular Malaysia and the instability in export earnings experienced by the country may be presented as:

$$I_t = b_0 + b_1 R_{ft} + b_2 R_{rt} + b_3 R_{Lt} + b_4 R_{at} + b_5 R_{ct} + b_6 R_{mt} + b_7 R_{tt} + b_8 R_{st} + b_9 C_{xt} + b_{10} G_{xt} + b_{11} Z_t + e\,, \tag{5}$$

and ordinary least squares was used for estimation.

IV. EMPIRICAL RESULTS

Tests based on Frisch's confluence analysis and the Farrar-Glauber test for multicollinearity revealed a high degree of multicollinearity among some of the explanatory variables. The F-test for the location of multicollinearity with the set of explanatory variables show that R_r, C_x, and R_f are the variables most affected by multicollinearity. The Farrar-Glauber t-test for the pattern of multicollinearity revealed that the cause of multicollinearity lies mainly in intercorrelations between: (a) R_r and R_m, and R_a; (b) C_x and R_f, and Z; (c) R_f and Z, and C_x (see Table I).

Table II shows the results of estimations of equation (5) using ordinary least squares. In regression equation 1, C_x which is highly correlated with Z, and R_m which is highly correlated with R_r, were excluded. The $\overline{R}^2$, corrected for degrees of freedom, is 0.6880 which is significant at 1 per cent using the F-test. In this equation, R_r, R_s, Z, and G_x are all significant at 5 per cent. In regression equation number 2, R_m was substituted for R_r. In this equation, $\overline{R}^2$ is 0.6128 which is significant at the 1 per cent level. The variables R_m, R_s, Z, and G_x are all significant at the 5 per cent level.

The inclusion of variable C_x which is highly correlated with Z, and to a lesser extent with R_s, improved $\overline{R}^2$ without seriously affecting the signs and significance of the four initial variables (see regression equations 3 and 4). In equation 3, all variables are significant at 5 per cent except C_x which is significant at 10 per cent. In regression equation 4, all the explanatory variables are significant at 5 per cent. The addition of other explanatory variables, i.e., R_f, R_L, R_a, R_c, and R_t, either failed to improve $\overline{R}^2$ or the variables were themselves found to be insignificant at 10 per cent. The Von-Neumann ratio for equations 3 and 4 are 1.1537 and 1.2137 respectively indicating the presence of positive serial correlation. In both cases, the regression of e_t on e_{t-1}, and e_{t-2} indicated first order serial regression. Equations 5 and 6 are the estimated regression equations for the transformed data; all the explanatory variables are significant at 5 per cent.

The coefficient of R_r is consistently positive and significant at 5 per cent supporting the hypothesized relationship between export instability and specialization in the production and export of raw materials (primary commodities). This finding appears to imply that, for Peninsular Malaysia, diversification away from raw material exports, in particular natural rubber and timber which together

TABLE I

MATRIX OF PARTIAL CORRELATION COEFFICIENTS

	R_r	R_m	R_s	R_f	R_L	R_a	R_c	R_t	Z	G_x	C_x
R_r											
R_m	−0.7991 (−9.7674)										
R_s	−0.1641 (−1.2441)	−0.4328 (−3.5280)									
R_f	−0.1730 (−1.2907)	−0.1821 (−1.3609)	−0.1910 (−1.4300)								
R_L	−0.3429 (−2.6824)	−0.3708 (−2.9340)	0.4155 (−3.3568)	−0.4177 (−3.3783)							
R_a	−0.7076 (−7.3587)	−0.6124 (−5.6925)	−0.0336 (−0.2470)	0.0776 (0.5720)	−0.3338 (−2.6022)						
R_c	−0.2694 (−2.0557)	−0.1802 (−1.3462)	−0.2152 (−1.6193)	0.3757 (2.9791)	0.2740 (2.0936)	−0.2976 (−2.2907)					
R_t	−0.1172 (−0.8672)	−0.0224 (−0.1646)	0.2549 (1.9371)	−0.3290 (−2.5602)	−0.1020 (−0.7535)	−0.0043 (−0.0316)	0.2160 (1.6256)				
Z	0.0072 (0.0529)	−0.0050 (−0.0367)	−0.1515 (−1.1263)	−0.5810 (−5.2457)	−0.1108 (−0.8193)	−0.0228 (−0.1676)	0.1212 (0.8972)	−0.2897 (−2.2242)			
G_x	−0.0150 (−0.1102)	0.0628 (0.4624)	−0.8304 (−0.9665)	−0.1103 (−0.8155)	0.2025 (1.5195)	−0.0526 (−0.3871)	0.2014 (1.5109)	0.0033 (0.0243)	−0.0489 (−0.3598)		
C_x	0.2557 (1.9436)	−0.0410 (−0.3015)	−0.2837 (−2.1741)	−0.6203 (−5.8114)	−0.4074 (−3.2781)	0.0559 (0.4113)	0.1596 (1.1880)	−0.2737 (−2.0911)	−0.5744 (−5.1565)	0.1247 (0.9236)	

Note: Numbers in parentheses are the t-values for the corresponding partial correlation coefficients.

TABLE II

ESTIMATED REGRESSION COEFFICIENTS

Regression Equation Number	Explanatory Variables						$\bar{R}^2$	F-ratio	Von-Neumann
	R_r	R_m	R_s	Z	G_x	C_x			
1.	154.0562 (9.1339)		1084.1245 (7.4658)	82.6132 (2.2161)	−522.2424 (−3.4321)		0.6880	31.3152	
2.		−247.8228 (−7.5718)	421.4674 (3.1463)	90.5630 (2.1484)	−417.8053 (−2.4701)		0.6128	22.7612	
3.	86.3622 (2.0722)		1188.6516 (7.7160)	109.0987 (2.7639)	−559.0035 (−3.7138)	99.4121 (1.7693)	0.7005	26.7247	1.1537[a]
4.		−112.5325 (−2.7184)	994.4460 (5.7599)	132.1293 (3.5462)	−534.8853 (−3.6365)	142.1522 (4.4370)	0.7166	28.8185	1.2137[a]
5.	73.3942 (2.4593)		1011.4338 (6.7904)	96.8027 (2.7582)	−624.4028 (−4.0858)	86.6343 (2.1512)	0.5954	16.8934	1.5081
6.		−90.2681 (−2.6532)	904.6509 (6.0318)	120.1150 (3.5521)	−533.1238 (−3.3700)	128.8282 (4.3700)	0.6118	18.0243	1.6140

Note: Figures in parentheses are t-ratios.

[a] Positive serial correlation at 1 per cent.

account for over 80 per cent of this category of exports, may produce greater stability in export earnings.

The coefficient of R_m is significantly negative at 5 per cent supporting a priori expectations that the export of manufactures should contribute to a lower degree of export instability. However, this finding is in fact quite contrary to expectations when account is taken of the fact that over 85 per cent of this category of manufactures consists of the export of tin blocks.[4] Tin—a primary commodity and a factor often thought of as contributing to the high degree of export instability experienced by Peninsular Malaysia—is in fact a factor contributing towards a lower degree of export instability. The reason for this unexpected negative correlation may be found in the operations of the International Tin Agreements. The operations of an international buffer stock-cum-export restriction scheme tend to stabilize export earnings in both the supply shift market and the demand shift market if demand is price inelastic (see [5]). The price elasticity of demand for tin for the world has been estimated at 0.20.[5]

On the basis of t-ratios in regression equations 5 and 6, the most significant variable is R_s. The high positive correlation appears inconsistent with a priori expectations. This suggests that for Peninsular Malaysia the export of manufactures classified under SITC main division 8 tends to give rise to higher, not lower, degrees of export instability. An explanation is called for. Closer examination reveals that these exports consist primarily of small manufactures of which over 65 per cent[6] are destined for Peninsular Malaysia's nontraditional export markets. A plausible explanation for the highly significant positive correlation lies in the nature of nontraditional markets. Table III shows the instability indices[7] for these countries and groups of "minor" countries. It can be seen quite clearly that the nontraditional export markets tend to exhibit a higher degree of instability than the traditional export markets: the Commonwealth countries, Japan, and the United States. For the 1960–73 period, the mean of indices of instability for the traditional markets was 28.6535 compared with 202.8899 for nontraditional markets. For the 1960–66 period, the means were 15.3226 and 132.6227, respectively; and for 1967–73, they were 19.9063 and 58.2888, respectively.

The coefficient of Z is positive and significant suggesting that export instability is an increasing function of the country's share of the world markets in the goods it exports. This is expected since in the short-run supply tends to be price

[4] The regression equation for the export of tin blocks and export instability is given by

$$I_t = 68.7577 - 289.4117 T_t, \qquad \bar{R}^2 = 0.5738,$$
$$(-8.7429)$$

where T_t=proportion of export earnings derived from the export of tin blocks in the tth quarter.

[5] See Ariff [1, p. 57] for estimates of price elasticities of demand for tin for the world and major consuming countries.

[6] This figure includes exports to and via Singapore. It is not possible to say how much of the exports via Singapore were destined for nontraditional export markets.

[7] Instability is measured by the log variance method.

TABLE III
INSTABILITY INDICES OF PENINSULAR MALAYSIA EXPORTS (VALUE) BY REGION

	1960–73	1960–66	1967–73
Traditional markets:			
Sterling area:			
United Kingdom	15.3712	11.3587	9.8757
Hong Kong	23.5900	18.5328	13.4625
India	53.3625	18.2762	48.1885
Australia	26.8680	22.1875	13.6971
New Zealand	37.1352	23.8886	26.1165
Singapore	13.9403	10.3330	8.9593
Other Commonwealth	19.6444	16.0637	10.5038
Dollar area:			
Canada	54.2258	27.6293	43.0512
United States	16.8269	13.2749	9.7470
Far East:			
Japan	25.5700	19.3110	15.4618
Nontraditional markets:			
Non-Commonwealth sterling	79.5404	71.7081	25.1191
Middle East non-sterling	130.7768	111.9735	44.3868
Far East:			
China	1525.1400	876.2515	398.7387
Indonesia	158.9330	148.3724	32.0999
Thailand	40.2549	16.4227	35.2819
Other Far East	58.5073	39.3976	37.5944
Other dollar areas	117.3443	111.7819	22.0124
Latin American non-dollar areas	28.3571	17.8412	20.6924
Continental West Europe:			
Belgium	52.0295	46.8753	18.1110
France	23.1957	18.6375	12.7064
West Germany	23.8267	13.0272	19.1423
Italy	27.1405	20.5232	16.3042
Netherlands	44.5332	31.9990	27.7885
Sweden	42.8029	29.2467	28.0484
Other West European	28.2028	18.5716	19.8233
Eastern Europe:			
Czechoslovakia	478.3255	336.4927	59.3755
Poland	104.6981	83.8058	45.8918
USSR	83.5499	70.6009	33.5066
Yugoslavia	104.9213	78.3833	52.8060
Other East European	1072.2780	612.3997	331.3073
Others	36.3293	30.7643	16.7921

inelastic—at least for Peninsular Malaysia's major primary commodity exports, i.e., natural rubber, tin, and palm oil which were included in the computation of Z—and the demand facing an individual country tends to be more price inelastic the greater its share of the world market, assuming total demand for the export item is price inelastic.[8]

[8] See [1, pp. 33–36] for estimates of the elasticities of supply and demand for Peninsular Malaysia's exports of natural rubber, tin, and palm oil.

Geographic concentration was found to have a negative estimated coefficient significant at 5 per cent. This is contrary to the hypothesis that export diversification by country or export market tends to reduce export instability. For Peninsular Malaysia, geographic concentration of exports has meant a lower, not higher, degree of export instability. Geographic concentration for Peninsular Malaysia is in fact quite synonymous with concentration on the traditional markets of the Commonwealth countries, Japan, and the United States. Export diversification by country or export market has therefore meant diversification into the nontraditional, relatively more unstable markets. Hence, geographic concentration can be expected to be negatively correlated with export instability.

The coefficient of C_x is significantly positive at 5 per cent lending support to the hypothesized relationship between export instability and commodity concentration. This finding is also consistent with the view that shifts in foreign demand have been a major cause of export instability. Diversification by commodity may therefore be an effective way to reduce fluctuations in export earnings.

V. CONCLUSIONS

This analysis considers the contribution of several factors to export instability in Peninsular Malaysia. The results are influenced by the particular sample period chosen, the classification of commodities, and the data used. Changes in any of these variables that help characterize the country's export structure and that are subject to long-run policy manipulation may affect the results obtained; hence, the following inferences or policy implications must be taken with care.

It appears that the search for the cause(s) of export instability as experienced by Peninsular Malaysia is more meaningful when consideration is given to the set of variables that help characterize the export structure than when the study is confined only to a study of the supply and demand conditions for natural rubber and tin. If the nation's policymakers deem the potential utilities arising from a reduction in export earnings instability greater than the disutilities, then they should consider the findings of this study.

Perhaps the most significant finding of this study is that while the export of natural rubber, in the absence of international agreement, contributes to greater export instability in Peninsular Malaysia, the export of tin under an international buffer stock–cum–export restriction scheme contributes to a lower degree of export instability. If export instability has been detrimental to economic growth in Peninsular Malaysia, and if the International Tin Agreements have contributed towards greater stability in export earnings, then the country should, at least in the short run, consider similar arrangements for other major primary commodity exports. Perhaps the second most significant finding of this study is that export earnings stability is also dependent upon the nature of the export markets for commodity exports. For Peninsular Malaysia, it is perhaps best, at least in terms of export earnings stability, to concentrate on the traditional export markets of the Commonwealth countries, Japan, and the United States. Diversification by export market may be deemed synonymous with diversification into relatively

more unstable export markets. Third, this study shows that export earnings instability is also a direct function of the nation's concentration on a few commodities, in particular on natural rubber, tin, timber, and palm oil. This implies that diversification by commodity and, in particular, away from crude materials may reduce the present extreme fluctuations in export earnings. Finally, the results of this study seem to imply that it does not always pay to be the world's largest exporter of some commodities. The larger the share in the world market the higher the degree of export instability.

VI. LIMITATIONS OF THE ANALYSIS

One of the most serious deficiencies of this study arises from the need to define the commodities involved. The value of the index of commodity concentration depends, in an important way, on the commodity classification scheme employed. The index will be higher the greater the level of aggregation over commodities, for at a high level of aggregation, products which are relatively dissimilar are classified together. A serious deficiency remains even after defining the commodities; they are treated as being equally different from each other although some are close substitutes while others are not substitutes at all.

Second, on the definition of primary commodities, since almost all primary commodities entering world trade are really semi-manufactured or semi-processed, it is sometimes difficult to decide between what is a primary commodity and what is a manufactured commodity. For instance, in the case of Peninsular Malaysia, should tin blocks be classified as a primary commodity or as a manufactured item?

Third, certain groups of commodities and countries are of the catchall type, i.e., classifiable as "others." Sometimes these groups are quite large and may therefore form a bias towards a higher degree of commodity concentration and geographic concentration. For Peninsular Malaysia this problem may be minimal since these "others" category tend to amount to only a small percentage of total export.

Finally, some limitations in the quarterly data used should be noted. The trade figures for Singapore include trade with other countries via Singapore; this affects the index of commodity concentration, the index of geographic concentration, and the index of instability of each of Peninsular Malaysia's export markets. Further, trade with Sabah and Sarawak—the eastern states of Malaysia—is included under the category of "other Commonwealth countries"; this again affects the three indices used in this study.

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