

THE SOURCES OF EXPORT COMPETITIVENESS: THE CASE OF MALAYSIAN ESTATE NATURAL RUBBER SECTOR, 1970-1990

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ABSTRACT

The inherent limitation of the Constant Market Share (CMS) approach in analysing relative export competitiveness is recognised. This paper instead explains export competitiveness in terms of four industry characteristics namely, investment in R & D, and measures of labour, physical and human capital intensities. The analysis leads to two policy conclusions. First, the critical role of labour in Natural Rubber(NR) cultivation and extraction and the urgent need for the development of labour saving technologies. Second, the marginal return of R & D to a matured industry suggests great potential in the export of R & D stock to rapidly growing low cost NR producing countries.

ABSTRAK

Artikel ini mengiktiraf terdapatnya kekangan semulajadi dalam pendekatan Syer Pasaran Konstan dalam menganalisis keupayaan persaingan eksport. Malah kertas ini menerangkan keupayaan persaingan eksport dari segi empat ciri industri iaitu; pelaburan dalam R & D dan ukuran bagi buruh, intensiti modal, manusia dan fizikal. Analisis ini adalah dirumuskan dalam dua kesimpulan. Pertama, peranan kritikal bagi buruh dalam penanaman getah asli dan penurihan serta kegentingan keperluan terhadap pembangunan teknologi penjimatan buruh. Kedua, pulangan marginal bagi R & D kepada sebuah industri yang matang menunjukkan potensi besar didalam export stok R & D kepada negara pengeluar getah asli yang tumbuh dengan pesatnyanya serta mempunyai kos yang rendah.

Key words : Natural Rubber Competitiveness, Constant Market Share Factor Intensities and Extraction

INTRODUCTION

Earlier studies have analysed the relative competitiveness of Malaysia's export of natural rubber (NR) using the constant market share (CMS) approach (Fatimah and Roslan, 1988, Mohammad and Habibah, 1993). Competitiveness is analysed in terms of export market shares. An increase (decrease) in market share may indicate an improvement (deterioration) in competitiveness. The CMS model decomposes the actual gain in exports into four components: size of market, commodity composition, market distribution and competitiveness (which is essentially captured as a residual) (Bowen and Palzman, 1984).

One of the limitations of the CMS approach however, is that the reasons for changes in export competitiveness cannot be evaluated. This is because the equation used as the basis for decomposing export growth is an identity. As such the CMS analysis needs to be supplemented by an analysis of supply and demand factors that may impact on the NR sector's competitiveness.

The main objective of this paper is to consider an alternative approach to investigate the sources of export competitiveness of the Malaysian NR estate sector. The paper focusses only on the upstream activities i.e production and processing. In this approach we attempt to explain export competitiveness, proxied by the share of the estate sector in world NR exports, by investment in research and development (R & D), and by measures of labour, physical and human capital intensities. The study cannot be extended to the whole industry due to data limitations pertaining to the small holder sector. The approach adopted is capable of explaining the sources of competitiveness. It is in this sense an improvement over the CMS approach.

The present study is motivated by the following consideration. The estate sector has experienced marked structural change in terms of area planted, production and exports. Total area has declined progressively from 677,000 hectares in 1970 to 351,700 hectares in 1990. During the same period, total estate production declined from 631,000 tonnes to 396,000 tonnes. Lower production means lower supply available for exports. The decline in estate hectarage and production is due to a variety of factors. Competition for land use by more remunerative crops such as oil palm, and from non-agricultural use such as industrial estate and residential housing, has resulted in the decline in estate hectarage. Rising cost of production due to upward pressures on wages especially from the late 1970s, compounded further by labour shortage faced by the plantation sector, accelerated the decline of the industry. The slow pace in the discovery of new clones with significantly higher yields as reflected in the plateauing of yield level (Table 1) and cost effective labour saving technologies, has not helped the industry either. The competitiveness, and invariably, the sustainability of the estate sector, is therefore in question.

The paper is structured as follows. Trends in estate sector's market share will be discussed in the section following the introduction. This will be followed by a discussion of the analytical framework and the data used. The empirical results obtained are presented and discussed. The concluding section gives the policy implications of the study and the concluding remarks.

Table 1: Average Rubber Yield in the Estate Sector
(Peninsular Malaysia)

Year	Yield (Kg/hect)
1961	758.3
1962	807.6
1963	836.5
1964	876.0
1965	917.4
1966	952.5
1967	1006.4
1968	1031.9
1969	1152.2
1970	1188.8
1971	1287.5
1972	1322.9
1973	1377.3
1974	1388.8
1975	1271.7
1976	1459.7
1977	1429.9
1978	1439.0
1979	1439.3
1980	1427.7
1981	1431.5
1982	1425.5
1983	1423.0
1984	1387.2
1985	1418.9
1986	1497.0
1987	1506.0
1988	1490.2
1989	1376.5
1990	1334.7
1991	1295.9
1992	1222.8

Source: Malaysian Rubber Research and Development Board

EXPORT MARKET SHARE TRENDS

Estate sector's market share shows a declining trend during the study period (Table 2). Market share increased from 24.8% in 1970 to 26.7% in 1971, but thereafter declined steadily to reach

Table 2: Estate Sector and Overall Export Market Share: Malaysia, 1970-1990

Year	Estate Sector ¹	Overall ²
1970	24.8	49.8
1971	26.7	52.5
1972	26.5	51.5
1973	23.6	53.3
1974	23.7	54.0
1975	19.1	47.2
1976	21.4	52.1
1977	21.9	54.5
1978	21.2	53.6
1979	19.9	50.6
1980	18.5	47.5
1981	18.9	49.0
1982	17.2	45.7
1983	16.4	46.9
1984	14.3	42.5
1985	14.6	42.7
1986	13.4	41.5
1987	12.9	41.5
1988	11.2	38.7
1989	10.7	34.9
1990	10.0	32.7

¹Estate sector's exports as a proportion of world exports (in value terms) of natural rubber.

²Malaysian exports of rubber as proportion of world exports.

Source: Computed based on data from IRSG Rubber Statistical Bulletin.

10.0% in 1990. Between 1970 and 1990, marketshare declined by almost 60 per cent. A sharp dip in the estate sector's market share was recorded in 1975 as a result of a unilateral programme to control production in response to the steep NR price decline following the first oil shock. Estates were barred from using chemical stimulants and Sunday tapping, and ordered to replant within 2 years estate areas yielding less than 800 kg. per hectare (Lim, 1976). It should be noted that the data on estate market share used in this study are estimates. Actual figures for estate exports are not available. We assumed that all estate production are exported.

The Malaysian export market share behaved differently to that of the estate sector. The overall market share showed an upward trend with fluctuations around the trend, from 1970 to 1977. The upward trend reflected the rising importance of the smallholding sector both in terms of production and hectareage planted. After 1977 the overall market share followed a declining trend, reaching 32.7% in 1990. This was due to both internal and external factors. Internally, the NR industry was affected by the successful implementation of the crop diversification policy in the 1960s and the Industrial Master Plan (IMP) in the second half of the 1980s. Export of NR was affected by the decline in production especially from the estate sector, brought by the diversification of resources to other economic undertakings such as other plantation crops (oil palm and cocoa), development of industrial and housing estates etc. The second half of the 1980s witnessed an unprecedented growth in domestic consumption of natural rubber with the development of rubber products manufacturing. Externally, the 1980s saw tremendous growth of NR exports from other producing countries. Between 1977 and 1990 export from Thailand increased by more than 180% from 404,000 tonnes to 1,151,000 tonnes. During the same period, Indonesia recorded an export growth rate of 45% increasing from 800,000 tonnes to slightly over a million tonnes. In the 1980s, export of NR from the African countries also increased; up from 156,000 tonnes in 1977 to 307,000 tonnes in 1990.

EXPLAINING THE COMPETITIVENESS OF THE ESTATE SECTOR

This study attempts to explain the competitiveness of the Malaysian estate sector as an industry and not the differences among estates within the industry. Export market shares are related to four industry characteristics representing the contributions to the value of total output of inputs of physical and human capital, labour and research and development (R & D). We follow the approach adopted by Lipsey and Kravis (1985 and 1987) and Kravis and Lipsey (1992). Each of these inputs is measured relative to the value of sales as is done in most comparative advantage studies (Bowen et al., 1987; Sveikauskas, 1983).

The Kravis and Lipsey approach needs to be modified when applied to analyse the market share of natural rubber producers. Rubber is a perennial crop. Two characteristic features of natural rubber supply that are relevant in the specification of the market share equation are the long gestation period, and a lengthy period before the impact of any agronomic technological progress can be felt (Tan, 1984, p. 57).

A rubber tree requires about six years from initial planting to first commercial production. Current new planting or replanting would only add to productive capacity after a lag of six years. The stock of mature trees is the main capital stock besides the land input. Physical capital inputs may be measured by the value of mature stock of trees inclusive of land, plant and equipment.

As data on these are not available, the estate sector capital expenditure lagged six periods is used as a proxy for physical capital inputs. This of course ignores the contribution to current production of past plantings beyond six periods. Capital expenditure lagged six periods is measured relative to current estate sales.

The R & D input is specified in the same manner. The effects of technological progress brought about by R & D are felt relatively slowly in the natural rubber industry. Experimentation to discover high yielding materials takes time; there are further delays in the diffusion and adoption of the new technologies. The gestation period determines the timing of the final effect on production. The appropriate variable to represent the R & D input is a measure of R & D stock. The R & D input used in this study is the Rubber Research Institute of Malaysia total expenditure lagged six periods measured relative to current estate sales.

The remaining inputs viz. labour and human capital inputs are treated as current inputs, measured relative to current estate sales. Human capital refers to administrative staff employed by estates. Their employment require a higher level of education attainment compared to that required of estate and factory workers. The latter constitute labour input.

On the basis of the previous analysis, the estate sector market share equation to be estimated is written in general functional form as follow:-

$$EMS_t = f(HUEXPRT_t, LBR_t, EXPRT_{t-6}, KEXPRT_{t-6}) \quad (1)$$

where

EMS_t = ratio of estate exports to world exports of natural rubber at time t (%)

$HUEXPRT_t$ = ratio of total salaries of administrative staff to estate sales

LBR_t = ratio of total salaries of labour (estate and factory workers) to estate sales

$EXPRT_{t-6}$ = ratio of Rubber Research Institute of Malaysia total expenditure lagged six years to current estate sales

$KEXPRT_{t-6}$ = ratio of estate sector capital expenditure lagged six years to current estate sales

DATA SOURCES AND DEFINITIONS

The basic data used to calculate labour, physical and human capital intensities have been obtained from the annual Rubber Statistics Handbook published by the Statistics Department. Physical capital inputs are measured by the annual expenditure (in million RM) of the estate sector on new planted areas, replanted areas, other capital expenditure items, expenditure on repair and maintenance and rental. Data on the initial expenditure for the purchase of capital items such as land, machinery, building etc. are not available.

Wages and salaries paid to the estate and factory workers are used to proxy the labour input. The total wage bill covers both the directly employed and contract labour. Human capital input is proxied by the wage bill of administrative staff.

For the 1960-1986 period, data on the estate sector's expenditure refer to Peninsular Malaysia. From 1986 onwards the data are for Malaysia. Generally one can safely assume that the earlier data are representative of the whole industry considering that the NR industry in East Malaysia is small particularly during the 1960s and 1970s.

Physical capital, labour and human capital inputs and expenditure on R & D are measured relative to the value of estate sales. The variable estate sales is proxied by the estate sector's NR export. Data on exports by the estate sector is estimated by multiplying aggregate exports with the estate sector's share in total production. The underlying assumption is that all estate production is assumed to be exported. This is a reasonable assumption for the 1970s when domestic consumption of NR was low. But an overestimate of estate sector's exports is likely, especially after the middle of the 1980s, with increased consumption of NR domestically. Second, to obtain the value of estate sector's exports, export volume is multiplied with the export unit value (MR per tonne) for natural rubber.

The expenditure on R & D is proxied by the total expenditure of the Rubber Research Institute of Malaysia (RRIM). R & D activities of the NR industry are undertaken mainly by the public sector and complemented by some activities of big plantation companies. The research activities of RRIM are financed from the collection of research cess, currently at 3.85 sen/kg, levied on every kilogram of rubber that is exported. The estate sector, being more modern and organised, has benefitted from the research findings of the RRIM. This is reflected in the high proportion of area (about 99% of planted area) that has been replanted with high yielding materials, the higher yield level vis-a-vis the small holder sector and the export of high quality NR (in the form of technically specified rubber ie. SMR) by the sector.

The dependent variable is estate market share in world exports measured by estate sales as a ratio to world net exports of NR. Data on the value of world NR exports are obtained from the UNCTAD Commodity Yearbook (various issues). Conversion to domestic equivalent is done by using the Malaysian ringgit exchange rate vis-a-vis the US dollar.

EMPIRICAL RESULTS

The OLS regression results of the linear version of equation (1) are reported in equation (2). Annual time series data for the period 1970-1990 have been used. The first six observations were used to create values of the lagged variables. A dummy variable DUM = 1 for 1986-1990 and 0 otherwise is added to represent the impact of the implementation of the Industrial Master Plan on domestic consumption of NR, and hence on exports.

$$\begin{aligned}
 \hat{EMSt} = & 17.16 - 1246.8 \text{ HUEXPR}_t + 378.23 \text{ LBR}_t \\
 & (5.6) \quad (1.492) \quad (2.384) \\
 & - 222.43 \text{ EXPR}_{t-6} \\
 & (1.648) \\
 & - 16.814 \text{ KEXPR}_{t-6} \\
 & (1.082) \\
 & - 2.328 \text{ DUM} \\
 & (1.494) \quad (2) \\
 & n = 15 (1976-1990) \\
 & R^2 = 0.865 \quad DW = 1.77
 \end{aligned}$$

Figures in parentheses are t-ratios

The goodness of fit of the estimated equation based on the coefficient of determination adjusted for degrees of freedom R^2 is relatively high. A test of the presence of first order serial correlation based on the Durbin-Watson test is inconclusive (at the 5% significance level with $K' = 5$ and $n = 15$, $d_l = 0.56$ and $d_u = 2.21$). First order serial correlation is not detected using Durbin's alternative test. (See end note 1).

The positive influence on the competitiveness of the estate sector is the labour intensity. The coefficient of the variable LBR is significant at the 5% level of significance (the critical value of $t_{0.05,9} = 2.262$, two-sided test). Human capital, capital expenditure and R & D intensities and the dummy variable all have negative but insignificant coefficients at conventional significance level (ie. 5%).

The positive and significant coefficient on the labour intensity variable attests to the importance of labour input in determining the competitiveness of the industry. NR extraction is still essentially labour intensive. Labour costs constitute about two-thirds of cost of production. The positive coefficient may be justified by looking at the role of the labour input in the production

process. Labour in this case is the skilled category, required in the tapping activity. As the tapping task is still labour intensive, the labour input is crucial. It is base labour; without it there will be no production.

The negative but insignificant coefficient (at the 5% level) of the R & D variable needs elaboration. Malaysia holds a premier position in R & D especially in the production of new technologies for upstream activities (eg. development of new clones). The lack of significance can be explained as follows. First, a new technology such as high yielding materials takes a long time to impact significantly on production. There are numerous problems associated with the transfer of technology. The six period lag assumed may not be sufficient to pick up the response of production to adoption of a new technology. Second, there has been a lack of significant discoveries and commercial applications of new high yielding clones. The major discoveries were made in the 1960s. This is reflected in the trend of average yields in estate sector. Average yields reached a plateau from the mid-1970s (Table 1), in fact declining after 1988 because of declining prices.

The negative (although insignificant) impact of lagged capital expenditure can be explained by the decline in newplanting and replanting areas. With the crop diversification policy, rubber areas were converted to oil palm cultivation particularly in the 1970s and 1980s. This resulted in a rapid decline of rubber planted area and inevitable reduction in output. For example, in 1960 area replanted to rubber in the estate sector was 30 000 hectares; it declined to 14 000 hectares by 1986.

POLICY IMPLICATIONS

Labour is a critical input in NR cultivation and extraction. In this context, the labour shortage problem and rising labour costs currently faced by the industry need to be urgently addressed lest output will be severely affected. The labour shortage problem is particularly felt by the plantation industry, though in the short term, softened somewhat by the use of foreign labour. In the short-run, new exploitation techniques, such as the less intensive tapping system, developed by the RRIM can be commercially adopted. However, in the long-run R & D efforts need to be focussed on technologies that not only augment labour efficiency but also transform the industry into a less labour dependent one.

R & D have played an important if not a critical role in the development of the industry. Although results obtained suggest its negative albeit insignificant contribution to the sector's competitiveness, the existing stock of expertise and findings can be used to advantage. Being a matured industry, the returns from R & D appear to be marginal. But to a new and emerging NR industry such as the one in Vietnam, Papua New Guinea and African countries, the benefits are tremendous. It is in this respect that the industry can consider "exporting" its stock of R & D. The industry not only has a pool of scientific, technological, management and marketing know-how but also an established R & D network which could be judiciously exploited. Judicious exploitation of this expertise could contribute to the invisible earnings of the country; this is one area where Malaysia has an advantage over the other NR producers.

CONCLUSION

The investigation on the sources of NR export competitiveness for the estate sector found that. first, labour intensity contributes positively to export competitiveness. Secondly, R & D, human and capital expenditure inputs and a dummy variable to represent the impact of the implementation of the Industrial Master Plan, have negative coefficients but statistically not significant at conventional levels. Recognizing the importance of labour in the upstream activity, there is an urgent need for a new exploitation technique which is labour saving. The sustainability of the estate sector depends on this. With the erosion of competitiveness in the upstream activity for the estate sector, exporting of R & D stock to rapidly growing low cost NR producing countries would make economic sense. This reverse investment strategy would provide the requisite linkages to meet the growing demand from the downstream or rubber product manufacturing sector in terms of raw material supply.

End note

1. We computed the residuals U_t from the OLS estimation of the linear version of equation (1). Regress U_t on U_{t-1} and $HUEXP_{t-6}$, LBR_t , $EXPR_{t-6}$, $KEXPR_{t-6}$ and DUM . The estimated equation is

$$\begin{aligned}
 U_t = & 2.805 - 115.81 \text{HUEXP}_{t-6} - 62.332 \text{LBR}_t \\
 & (0.61) \quad (0.13) \qquad \qquad (0.35) \\
 & - 16.153 \text{EXPR}_{t-6} + \quad 2.3912 \text{KEXPR}_{t-6} \\
 & (0.12) \qquad \qquad \qquad (0.15) \\
 & - 0.068 \text{DUM} - 0.59 U_{t-1} \\
 & (0.043) \qquad (0.85)
 \end{aligned}$$

Number in parentheses are t-ratios.

The test of the null hypothesis $H_0 : \rho = 0$, the absence of first order serial correlation, is based on the significance of the coefficient of U_{t-1} using t-test.

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