Agricultural Economics, 1 (1987) 159–174
Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

Structural Change and its Impact on Traditional Agricultural Sectors of Rapidly Developing Countries: The Case of Natural Rubber

Colin Barlow and S.K. Jayasuriya

Department of Economics, Research School of Pacific Studies, Australian National University, G.P.O. Box 4, Canberra, A.C.T. 2600 (Australia)

(Accepted 8 October 1986)

Abstract

Barlow, C. and Jayasuriya, S.K., 1987. Structural change and its impact on traditional agricultural sectors of rapidly developing countries: The case of natural rubber. Agric. Econ., 1: 159–174.

Rapid structural change is now a major feature of several Southeast Asian economies. It generally involves greatly expanded exports of certain commodities and manufactures accompanied by a large growth in services, and poses serious difficulties for traditional labour-intensive sectors. One important sector affected in this way is that producing natural rubber in Malaysia, Indonesia and Thailand.

The difficulties mentioned occur through both "resource pull" effects – which are especially important in raising real wages, and "spending" effects – which tend to lead to an appreciation of the real exchange rate. These effects, and the problems arising from them, are examined and compared for each of the rubber sectors above.

While changes of this nature call for diminution in the size of traditional sectors, there is also a need to improve economic efficiency, notably by adopting new technology more appropriate to the emerging resource price configuration, and by moving to an agriculture where off-farm employment and other linkages are increasingly significant. Such adjustment may be both helped and constrained by institutional factors and official policies, which accordingly require careful review.

These crucial policy issues, and the degree to which necessary adjustments

0169-5150/87/$03.50

have been made, are investigated for the rather different contexts in each of the three natural rubber-producing countries. The analysis is thought to have wider relevance for other developing countries with traditional agricultural sectors.

Introduction

The rapid growth experienced by Southeast Asian economies during the past two decades has been associated with significant pressures on their traditional industries. The nature of these pressures and the resulting structural changes have been (and continue to be) determined by both domestic and external economic forces, operating in specific socio-institutional conditions where government interventions are pervasive.

In this paper, a basic theoretical framework relevant to the situation is reviewed, and the structural changes in three rapidly developing countries, Malaysia, Indonesia and Thailand, are identified. The impact of these changes on an important traditional industry, that producing natural rubber, is then examined.

The basic framework

Pressures for structural adjustments are generated when the relative profitability of different industries alters, requiring a reallocation of productive factors amongst them. These pressures are typically brought about by changes in a country's resource endowment, domestic demand shifts, world price movements, and new technologies. During the recent past, many developing countries have been subjected to a combination of these factors.

The "Booming Sector" literature provides a useful framework for analysis of the general equilibrium effects of these developments. Corden (1984) provides an excellent review of this literature, and examines a series of situations under various assumptions.

Consider the so-called "core-model" of an economy with three sectors, two producing tradeables and the other producing non-tradeables. Here, these sectors are called agriculture, manufacturing and services. Each produces its output with a specific factor and a mobile factor. It is assumed that capital and land are the specific factors in manufacturing and agriculture respectively, while labour is the mobile factor. For simplicity, it is taken that the agricultural produce has no signficant domestic consumption, being fully exported.

Essentially, a boom in a tradeables sector, say manufacturing, generates three important effects. There is a "resource pull" effect, where the expanding sector competes for factors whose real prices rise. These factors move out of the agriculture and service sectors, whose outputs are accordingly reduced. There is a "spending" effect, which arises out of the greater incomes in the booming sec-

tor and generates a higher demand for non-traded goods. The spending effect on the services sector may actually increase its output so much as to outweigh the contractionary influence of the resource pull effect, meaning that this sector too exerts a resource pull effect on agriculture. The higher demand for the non-traded goods in services also has an "exchange rate" effect, through raising their price relative to that of traded goods. This leads to a real exchange rate appreciation.

There is, further, a direct exchange rate effect from the manufacturing boom. To the extent that some part of the manufacturing output is exported (or replaces imports), and its value exceeds the increased imports induced by part of the higher incomes being spent on imports, the expansion will again tend to raise the real exchange rate. Any such rise will reduce (exogenously given) producer prices, and thus have an adverse influence on agriculture.

An extension of the model to include a natural resource sector, say petroleum, which uses a negligible amount of labour, may now be considered. If the resources used in this sector are not drawn from elsewhere in the national economy, then there is no resource movement effect to consider. Hence a boom in this sector influences the rest of the economy through the spending and exchange rate effects only. It should be noted that the source of the boom (price rise, discovery of a new resource, technological change) will influence the nature of effects in all cases.

The spending effect from booming sector expansion will in practice depend on who receives the income. Usually government is a major recipient through taxation, and thus official expenditure policies are crucial in evaluating the impact of the expansion. While some expenditure may be on non-tradeables, with the effects indicated, other expenditure may be on generating appropriate technical change and augmenting factors specific to disadvantaged sectors. In agriculture, for example, higher yielding and labour-saving technologies may be developed, and land infrastructures may be enhanced. Such measures will mitigate some adverse effects from the boom. They may also have good economic justification should the boom turn out to be short lasting, which may especially be the case with exhaustible natural resources.

Up to this point the agriculture sector has been assumed to be homogeneous. Now consider the case where it can be decomposed into two subsectors employing the same factors (which are mobile between them) but in different proportions. Then it can be shown that an expansion of a further sector will lead to a contraction of the agricultural sector as a whole, but that there will be a change in the relative size of its subsectors (Corden, 1984). Thus if labour moves out of agriculture as a result of a "resource pull" effect, the more land-intensive subsector will expand at the expense of the labour-intensive subsector. An increase in the labour force through immigration, for example, will have the opposite effect.

TABLE 1

Basic economic indicators, 1965–1982

		Malaysia		Indonesia		Thailand	
(a)	*Annual average real growth rates (%)*	*1965–1973*	*1974–1982*	*1965–1973*	*1974–1982*	*1965–1973*	*1974–1982*
	Gross domestic product (GDP)	6.1.	7.3	8.1	7.0	7.8	6.9
	Agriculture	n.a.	4.4	4.8	3.7	5.2	3.8
	Industry	n.a.	8.7	13.4	8.6	9.0	9.0
	Manufacturing[a]	n.a.	10.6[b]	9.0	12.6	11.4	8.9
	Services	n.a.	8.2	9.6	9.0	9.1	7.6
(b)	*Value of GDP*	*1965*	*1982*	*1965*	*1982*	*1965*	*1982*
	(Nominal million US$)	3000	29280	3630	78320	4050	40430
(c)	*Share in GPD* of:	*1965*	*1982*	*1965*	*1982*	*1965*	*1982*
	Agriculture	30	21	59	26	35	23
	Industry	24	35	12	39	23	27
	Manufacturing[a]	10	19	8	13	14	19
	Services	45	44	29	35	42	50
(d)	*Sectoral distribution of labour force (%)*	*1965*	*1981*	*1965*	*1981*	*1965*	*1981*
	Agriculture	60	50	71	58	82	76
	Industry	13	16	9	12	5	9
	Services	27	34	20	30	13	15
(e)	*Monthly agricultural wage*[c]	*1969*	*1981*	*1969*	*1981*	*1969*	*1981*
	Nominal (US$)[d]	38	125	8	41	13	56
	Real wage index (1969 = 100)[e]	100	145	100	148	100	171

[a]Included in "Industry".
[b]For 1970–1982.
[c]Malaysia – average monthly earnings of rubber tappers in Peninsular Malaysia; Indonesia – average monthly earnings of rubber tappers in Sumatra; Thailand – average monthly agricultural wage in the Central Region.
[d]Converted at the then-current exchange rates.
[e]Deflated by the most relevant available consumer price index.
Source: Barlow and Jayasuriya (1986).

Changes in the Malaysian, Indonesian and Thai economies

The last two decades witnessed unprecedentedly rapid economic growth in Malaysia, Indonesia and Thailand (Table 1), although some slowing occurred in the early 1980's. From 1965–1983, real per capita GNP grew at annual average rates of 4.5, 5.0 and 4.3%, respectively. By 1983, these countries were no longer "low income"economies as classified by the World Bank.

Accompanying this rapid growth, the production and trade patterns of the three countries changed greatly (Table 1). The share of agriculture (including rubber) declined, while the share of industry and, more significantly, that of

manufacturing, rose. The composition of exports reflected this change. Thus from 1965 to 1981 in Malaysia, the share of manufactures in exports increased from 6 to 23% (Barlow and Jayasuriya, 1986). In Thailand this share rose from 4 to 29%. Again in Indonesia, petroleum emerged as a major export, accounting for 76% of export earnings in 1983, when oil taxes contributed 64% of government revenue (Warr, 1986). In Malaysia in the same year, petroleum accounted for 24% of export earnings, and at least 23% of official revenue. The share of rubber in exports dropped greatly in all countries, with a decline in Malaysia from 71% in 1960 to 14% in 1981. On the other hand, oil palm emerged as a more profitable crop than rubber, and expanded against the trend for most agricultural subsectors. In Malaysia, where it grew fastest, the share of palm oil in export earnings advanced from 5% in 1970 to 12% in 1980.

The generally favourable economic developments in Malaysia and Thailand were tempered by adverse movements in the terms of trade. These deteriorated by 43% and 30% respectively between 1970 and 1982. In Indonesia, where oil price rises had a dominant influence, the terms of trade improved.

Despite the adverse terms of trade movements, however, the real effective exchange rate tended to appreciate in Thailand, while there was only a slight depreciation in Malaysia (Rana, 1983). In Indonesia, the rate appreciated by 50% between 1971 and 1976. As Warr (1986) pointed out, Indonesia was able to defer a massive devaluation thanks to the oil boom. Similarly, in both Malaysia and Thailand, export booms enabled real exchange rates to be maintained at a much higher level than would otherwise have been possible. These exchange rate movements had a major negative impact on the producer prices of traditional export subsectors, including rubber.

Real wages rose in all three countries during the 1970's, and despite some labour market segmentation this was reflected in the traditional agricultural sectors (Table 1). The sustained growths in size of both the industry (including manufacturing) and services (including construction) sectors caused major resource pull effects on the labour market, and influenced labour intensive industries like rubber very negatively.

On the other hand, government tax revenues derived from the various booming sectors in the three countries enabled expanded investments in rural roads, infrastructures and communications, all of which facilitated the development of new land. They also allowed expenditures on research and extension. These aspects are examined further below.

The natural rubber industry: background

Malaysia, Indonesia and Thailand are the major international natural rubber producers, and together contribute over three-quarters of world natural rubber output, almost all of which is exported. The exports of these countries have risen steadily over the last 25 years (Fig. 1), but whilst the pre-eminent

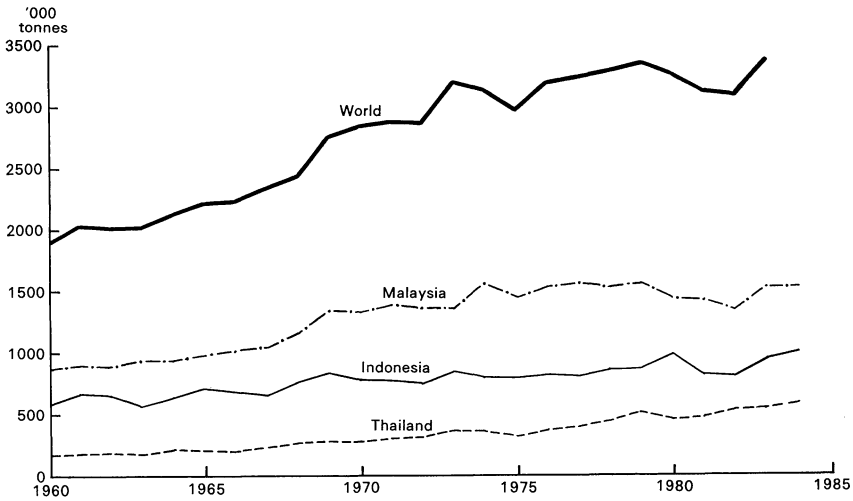

Fig. 1. Natural rubber exports, 1960–1984. (*Source*: Barlow and Jayasuriya, 1986.)

share of Malaysia has been maintained, the share of Indonesia has declined and that of Thailand has risen. The world production of natural rubber is dwarfed by a much larger output of oil-based synthetic material, which is a close substitute in many applications. Thus all natural rubber producers are essentially price takers on international rubber markets.

The circumstances of natural rubber production differ considerably between the three countries. Although the basic soils, climatic conditions, and feasible yields are similar in each of the main producing locations, the relative endowments of land, labour, capital and other resources are not. Here it should be noted that while capital (in distinction to land and most labour) is internationally mobile and available to government and large entrepreneurs in all three countries on similar terms, rural capital markets are seriously underdeveloped. Thus capital is more expensive to small local farmers in all the countries, and long-term finance in particular is virtually inaccessible. Again, although higher level management skills are also obtainable on international markets, lower level skills depend on local educational infrastructures which vary considerably.

In Peninsular Malaysia, land and labour have become scarce. Real wages have tended to rise (Table 1), while infrastructures of roads, railways, schools, welfare services and other related aspects have become increasingly abundant with advanced economic growth. In addition, lower level skills are generally well developed. Further, the rubber plantings of the peninsula are concentrated in a relatively compact area close to points of export, which reduces transport and marketing costs. On the other hand, in the huge island of Sumatra (where most Indonesian rubber is grown), land is abundant and labour far cheaper than in Malaysia, but infrastructures are poor despite recent improvements.

The rubber plantings of the island also extend over huge areas, which raises transport costs even more. Finally, the rubber-producing locations of Southern Thailand have relatively abundant land, while wages are higher than those of Sumatra but less than half those in Malaysia (Table 1). Infrastructures are only moderate, and the rubber growing regions again extend over considerable areas.

It should be noted too that the rubber sector is not homogeneous, but divided into estates, group smallholdings and independent smallholdings. The estates are often large corporate enterprises which cover several thousand hectares of planted rubber, and sustain various economies of scale within this structure. Such enterprises are not much constrained by regional scarcities of capital or managerial skills, where they have direct access to national and even international markets. The group smallholdings are government-sponsored settlement schemes, usually on new land. They provide central services which aim to secure scale economies, while the settlers either have rights to individual parcels of land or shares in the total undertaking. These schemes too are hardly constrained in their access to capital and management. In contrast, independent smallholdings are generally little private farms of a few hectares operated by family members, and are very much subject to local capital constraints. They thus tend to be more labour-intensive than estates in particular, and are especially so in Indonesia.

While independent smallholdings are the dominant international production structure for rubber, and indeed virtually the sole institutional arrangement in Thailand, estates and group smallholdings cover substantial areas in both Malaysia and Indonesia. The majority of estates in Malaysia assumed a dominant government shareholding in the early 1980's, while most estates in Indonesia were taken over by government in the late 1950's.

Effects of structural change

The experiences of each national rubber sector over the years 1960–1982 are now traced, so as to explore the effects of the economy-wide structural changes just outlined. It should be added that one further important but exogenous change was at work during this period, and was common to all situations. This was the relatively unfavourable trend in the international price of rubber (Fig. 2), which squeezed profits very considerably.

Malaysia

The greatest impact on rubber occurred in Malaysia, where the area of rubber estates and number of workers employed on them contracted sharply (Table 2). Almost all the land and some of the labour released were switched to the more profitable oil palm and cocoa, which were also less labour-intensive and

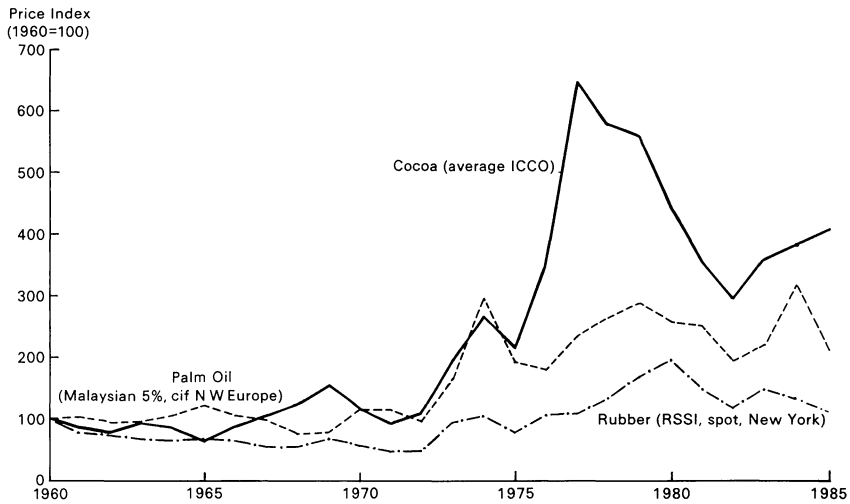

Fig. 2. Agricultural commodity prices, 1960–1985. (*Source*: Barlow and Jayasuriya, 1986).

thus economically advantageous in the situation of a rising wage. Indeed, oil palm in particular with its rapidly expanding output in the 1970's (Table 2) was a minor booming sector, exerting significant resource pull effects on both land and labour. Many workers from the estates also migrated to opportunities in manufacturing and services, although the resource pull effects from these sectors were partly countered by an influx of Indonesian workers from the mid 1970's.

The estates which continued to cultivate rubber responded to change by adopting output-increasing and management and capital-using new technology. This technology had partly emanated from the substantial official support for R & D, and basically comprised high-yielding rubber trees and new tapping methods. Its widespread use was reflected by large increases in rubber estate outputs per hectare and per worker (Table 2), and by the increased share of management and capital-using inputs as factors of production (Table 3). There was also a small increase in the hectares of rubber land farmed per worker (Table 2).

While these technical changes were helpful to maintaining the economic viability of the remaining rubber estate area, it is significant that the parallel technical advances in Malaysian oil palm were that much greater, with notably larger increases in output and area farmed per worker (Table 2). Such developments enhanced the shift from rubber to oil palm.

The Malaysian group rubber smallholdings continued to expand in face of the structural change (Table 2), but their rate of advance was reduced as the declining profitability of rubber became more apparent (Malaysia, 1971, 1986). The planting of oil palm on group smallholdings was increased, however. These units with their major subsidy element from government and pronounced wel-

TABLE 2

Development of the natural rubber and oil palm industries, 1960–1982

	Malaysia[a]			Indonesia			Thailand		
	1960	1970	1982	1960	1970	1982	1960	1970	1982
Rubber output ('000t)	718	1216	1464	620	815	880	171	287	576
Estates	425	613	558	215	237	311	—	—	—
All smallholdings	293	585	906	405	578	569	171	287	576
Rubber workers ('000 persons)									
Total	614	674	666	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Estates	285	226	167	254	202	142	—	—	—
Rubber land ('000 ha)	1549	1724	1493	1809	2317	2425	481	1276	1600
Estates ('000 ha)	783	647	492	499	504	430	—	—	—
Independent smallholdings ('000 ha)	764	837	615[b]	1302[c]	1813[c]	1811[c]	481	1276	1600
Group smallholdings ('000 ha)	2	240	386	—	—	187[d]	—	—	—
Rubber yield/mature ha (kg)									
Estates	738	1140	1428	535	710	1093	—	—	—
Independent smallholdings	521	787	1103	310[e]	313[e]	341[e]	450[e]	350[e]	410[e]
Rubber output/worker (estates) (t)	1.5	3.3[f]	3.9	0.9	1.2	2.1	—	—	—
Rubber planted area/worker (estates) (ha)	2.8	3.2[f]	3.3	2.0	2.5	3.0	—	—	—
Palm oil output ('000 t)	92	431	3512	141	217	849	—	—	60
Oil palm land ('000 ha)	55	274	1106	104	127	366	—	—	53
Estates ('000)	55	194	695	104	127	325[g]	—	—	12
Independent smallholdings ('000 ha)	—	15	65	—	—	6	—	—	12
Group smallholdings ('000 ha)	—	65	346	—	—	35	—	—	9
Palm oil/kernel[h] yields/mature ha (estates) (kg)	1850	3210	4155	1596	1709	2859	—	—	1793
Palm oil/kernel[h] output/worker (estates) (t)	7.3	10.1	22.3	4.9	4.5	8.8	n.a.	n.a.	n.a.
Oil palm planted area/worker (estates) (ha)	3.5	4.0[e]	6.8	3.6	2.7	3.1	n.a.	n.a.	n.a.

[a]Figures refer to Peninsular Malaysia, which had 83% of the total rubber area in 1980.
[b]While accurate figures of abandoned rubber areas are not available, a figure of 200 000 ha has been subtracted from what appears to be the total of 815 000 ha planted rubber on individual smallholdings in 1980, leaving 615 000 ha as actively farmed.
[c]Including a considerable "sleeping area" which was not regularly tapped. The proportion of sleeping trees is thought to have declined over time.
[d]"Actual" area planted during Repelita III, 1979–1983.
[e]Yield per planted hectare.
[f]In 1971.
[g]In 1983.
[h]Palm oil and palm kernel combined (kernel yields are about 10% of total).
Source: Barlow and Jayasuriya (1986).

TABLE 3

Malaysian and Indonesian estate production economics[a]

	Malaysia		Indonesia
	1973	1981	1981
Rubber output (kg/ha) (mature area)	1278	1450	1000
Labour input (man days/ha)	98	90	87
Revenue (1981 US$/ha)[b]	1267	1464	860
Costs (1981 US$/ha)[b]			
Labour	403 (70)[c]	446 (52)[c]	139 (60)[c]
Management	67 (12)	133 (16)	22 (10)
Other	139 (18)	267 (32)	69 (30)
Total	609 (100)	855 (100)	230 (100)
Net revenue (1981 US$/ha, farmgate)	658	609	630

[a]Estimated averages for large Peninsular Malysian estates and Indonesian government estates (PTP/PNP). Price and other assumptions are given in source below.
[b]Calculated using the most relevant consumer price index.
[c]Figures in brackets are per cents of total cost.
Source: Barlow and Jayasuriya (1986).

fare orientation had been commenced in the late 1950's and early 1960's in a situation of abundant undeveloped land, widespread rural unemployment, and continuing fears of communist insurrection. Their expansion in the 1970's was facilitated by funds derived from petroleum taxes, although by the 1980's the growing scarcities of land and labour were providing further constraints to all such tree crop development (Jamaludin, 1982). The economic rates of return from rubber in group smallholdings had now been cut to a borderline level (World Bank, 1980–1985).

The independent rubber smallholdings were much affected by structural change, which severely reduced the incomes of some operators, and impelled a polarization between "progressive" and "less progressive" farmers. The latter had very labour-intensive operations, low management skills, and particularly restricted access to capital, which were often accompanied by advancing age and low asset levels. They thus failed to adapt, either by adopting new rubber technology or by turning to other more profitable ventures. Some of the younger and most active members of this class opted to migrate to the promise of unskilled employment in urban areas, leaving considerable land idle and mainly accounting for the large drop in area of independent smallholding rubber between 1970 and 1982 (Table 2).

The most labour-intensive rubber subsector thus experienced the greatest

diminution under the labour resource pull effect, as would be theoretically anticipated. Many less progressive farmers nonetheless remained behind, with declining incomes from rubber monoculture under traditional technology. Government actually worked hard to assist such people through various measures (Malaysia, 1971, 1986), some of which involved opening new group smallholdings under rubber or oil palm. These policies had little impact on their target group, however, and tended to benefit elements not requiring assistance (Corner, 1983).

In contrast, the "progressive" independent smallholders with higher skills successfully adopted the new technologies for rubber. Here they were much assisted by the major government policy of providing "replanting" grants, which overcame the continuing capital market constraints in rural areas and financed the establishment of new high-yielding stocks of trees. The grants were funded by export taxes on all smallholding rubber output and, while available to any producer, were actually redistributive mechanisms supporting the more economically productive cultivators. These progressive farmers were also changing to oil palm (Table 2) and diversifying their activities outside agriculture, where some family members had employment in manufacturing or services. The latter were often easily accessible in the compact and infrastructurally well-developed situation of Malaysia. Such outside employment characterizes successful agricultural adjustment in other rapidly developing regions of Asia (Swapna Mukhopadhyay and Lim, 1985), and parallels earlier trends in Japan and continental Europe.

Apart from the government measures supporting R & D, group smallholdings, and replanting grants, there were other policies and institutional factors modifying the effects of structural change on rubber in Malaysia. Thus legal reservations on the ownership of substantial areas to particular ethnic groups, and the further prohibition of crops other than rubber, often prevented the transfer of land to more economic uses. Again, traditional inheritance laws tended to cause a progressive fragmentation of land ownership, and a lessened ability to reach clear decisions over its disposal. These effects together were key elements leading to the growing stock of idle rubber land in a market characterized by high land values. Moreover, government regulation of the capital market through interest rate ceilings may well have helped in closing the access of small farmers to private long term credit (Gonzalez-Vega, 1977). This situation was worsened by the absence of clear collateral under fragmented land ownership. In addition, government support for domestic manufacturing and food crops, and its taxation of agricultural exportables including rubber, caused substantial negative effective protection for the latter (Lee, 1983; World Bank, 1980–1985). Lastly, official toleration of an influx of Indonesian labour eased wage pressures and alleviated the squeeze on rubber profitability.

Indonesia

While the broad influences from structural change in Indonesia were similar to those in Malaysia, the contrasting relative resource endowments produced a rather different outcome. Thus the less sophisticated local management skills meant that the switch from rubber to oil palm was less on Indonesian than on Malaysian estates, and that the yields from both crops were lower (Table 2). The much inferior wage (Table 1) also meant that, despite its poorer yield, rubber was slightly more profitable than in Malaysia and was produced more labour-intensively in terms of the higher proportion of this input in total cost (Table 3). The comparative advantage of the Indonesian estates was likely to increase with the more widespread adoption and skilled application of output-increasing new technologies, which had already exercised their major influence in Malaysia.

Government in Indonesia gave substantial assistance to the R & D behind these technical changes (Suryatna Effendi, 1985). There was also international diffusion from earlier Malaysian research, coupled with the renting of foreign (and especially Malaysian) managerial skills. As well, the Government secured credit for tree crop improvement from the World Bank, although from the mid 1970's tax revenues from the petroleum boom became more important in financing both the government estates and the group smallholdings treated below (World Bank, 1980–1985).

The Indonesian group smallholdings were only commenced significantly in the early 1980's (Table 2), with a prime socio-political motivation arising from the programme to settle more Javanese in the vast unoccupied regions of the Outer Islands (Indonesia, 1984). These highly subsidized schemes had a somewhat better economic rate of return than those in Malaysia (World Bank, 1980–1985), although by the mid-1980's they too were largely switching to oil palm in their further expansion.

The huge Indonesian subsector of independent rubber smallholdings received little official help, except through a limited chance for farmers in some places to participate in group developments. With the lack of substantial alternative cash crops to rubber, and with the absence of private long term credit, these smallholders continued to use traditional rubber growing technology with its low yields (Table 2 and Fig. 3). They responded to higher wages (in the presence of very scarce capital) by intensifying their use of the only abundant resource, land, and by reducing more labour-intensive activities. While the official planted rubber area of independent smallholdings stayed unchanged from 1970 (Table 2), field observations suggest that a considerable increase has occurred in the area actually farmed. The smallholders also lowered their tapping frequencies, and reduced intercropping which gave especially low returns to labour (Barlow and Muharminto, 1982). With the simple and well-

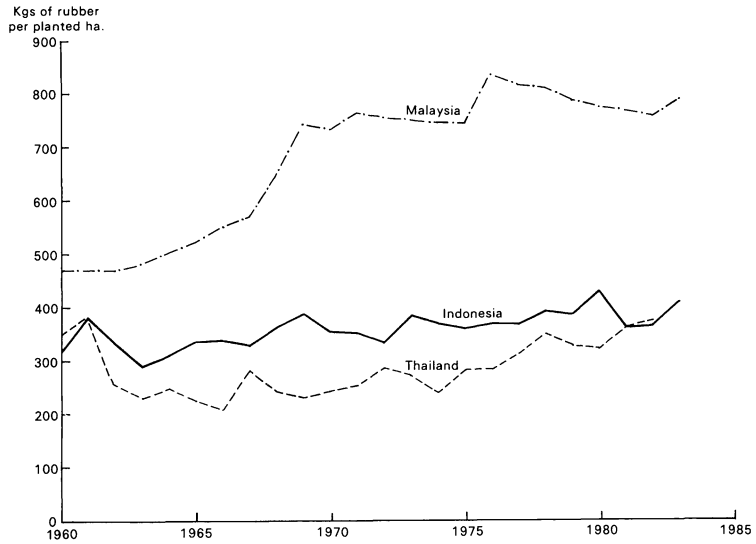

Fig. 3. Average yields of rubber, 1960–1983. (*Source*: Barlow and Jayasuriya, 1986.)

known technology involved, there was little sign of the polarization so marked in Malaysia.

Various policy and institutional factors similar to those in Malaysia again acted to modify the Indonesian adjustment to structural change. Thus official land regulations, together with customary local land rights, made it virtually impossible to expand private estates with their access to low cost capital as one means of adjustment. Again, the adverse effects of rural capital market regulations (World Bank, 1980–1985) were strengthened by the absence of collateral in circumstances where traditional land rights were not supported by legal documents. Substantial protection to the manufacturing sector once more penalized rubber and other agricultural exportables.

Thailand

The pressures from structural change in Thailand coincided with an emerging shortage of land suitable for rubber. While this would otherwise have led to a fall in real wages, there was now a substantial increase in labour demand from industry and services, which raised wages markedly (Table 1).

The land shortage and rising wages, taken with the persistent scarcity of capital, could well have led to a major decline in rubber cultivation by independent smallholders, and to a fall in wages for those unable to embrace new opportunities. This outcome was avoided, however, by a planting grant scheme similar to that in Malaysia, which once more overcame capital market problems. This scheme was funded by both export taxes and international capital, notably from the World Bank (World Bank, 1980–1985; Suchare, 1985). It was accompanied by training in management skills, and by supervision of par-

ticipants (Somboon Thuwachote and Lim, 1976). It was also underpinned by a programme of R & D, with both skills and technology again coming to some extent from Malaysia. By the late 1970's the planting scheme, which concentrated on improving existing rubber rather than on new expansion, was reflected in much higher yields per hectare (Table 2 and Fig. 3). Given these added capital and management components, Thailand now possessed a marked comparative advantage over Malaysia in rubber production, due to its lower land and labour costs. The more profitable cultivation of oil palm was also beginning in the early 1980's (Table 2).

While land allocation was officially regulated in Thailand, the flexible administration of planting policies gave scope for the majority of farmers to improve their economic conditions substantially,and the constraints in this respect were less than elsewhere. The Thai government granted substantial protection to manufacturing, however, with similar adverse effects to those in the other countries (Akrasanee and Ajanant, 1983).

Conclusions

This analysis in the booming sector framework suggests that while the forces from structural change in Malaysia, Indonesia and Thailand have been similar, their impact has varied between the differently endowed natural rubber sectors. In the more economically developed situation of Malaysia, the pressures on rubber as a traditional commodity have been most extreme, with indications that the size of the sector should be further reduced. Major social dislocation has already arisen for smallholders who have inadequate skills to adopt new technology, and who cannot transfer to new activities. In Indonesia and Thailand, however, it appears that rubber can still be economically profitable, and that these countries now have a marked comparative advantage over Malaysia in producing this crop. In all contexts, the impact of structural change means that the adoption of new output-increasing and capital and management-using rubber technology is a desirable feature of adjustment to the new conditions.

The analysis also highlights the constraints on adjustment of institutional factors, which notably affect local land and capital markets. It further indicates the important role in modifying the effects of structural change of government policies, some of which are manifestly positive in their influence, and others negative. Thus there is little doubt that expenditure on R & D, assistance in overcoming capital market problems, and help with management skills are strongly positive in easing adjustment. Indeed, the absence of assistance with long term credit in the Indonesian smallholder rubber subsector is a severe constraint in the country with the greatest comparative advantage in producing rubber. These positive policies help additionally in preventing over-contraction of the sector, pending the end of what may be temporary booms. In

contrast, land regulation in Malaysia, and protection to manufacturing in all contexts, appear as negative measures which make adjustments more difficult. As well, the continued sponsorship of group rubber smallholding development in the land- and labour-scarce situation of Malaysia seems likely to promote uneconomic enterprises. All these negative economic policies have historical socio-political justifications, which make them hard to remove.

The case of rubber also has lessons for other rapidly developing countries with traditional agricultural industries, all of which must inevitably face structural change. The lessons are that the economic mainsprings of change, and their effects on such industries, should be clearly identified, and the possibilities of economic adjustment assessed. Where economic adjustment implies a diminution in the size of an industry, the optimum policy is to allow it to contract, giving appropriate training to those who must move to new occupations. Where the adoption of new technology and an alteration in relative resource use is assessed as enabling the industry to regain relative profitability, however, the effective mix of policies to achieve the required changes should be carefully weighed. Pre-existing policies which may be obstructing change should also be identified.

It is to be hoped that these economic judgements will be given due weight against social and political requirements in formulating actual policies of adjustment to structural change.

Acknowledgements

The authors would like to thank Peter Forsyth and Brian Hardaker for general discussions, an unknown reviewer for helpful comments, and Corrine Condie for assistance in collecting data.

References

Akrasanee, N. and Ajanant, J., 1983. Manufacturing industry protection in Thailand: Issues and empirical studies. ASEAN-Australia Joint Research Project, Department of Economics, Research School of Pacific Studies, Australian National University, Canberra, A.C.T., 140 pp.

Barlow, C. and Jayasuriya, S.K., 1986. Structural change and its impact on traditional agricultural sectors of rapidly developing countries: the case of natural rubber. Department of Economics and National Centre for Development Studies, Australian National University, Canberra, Work. Pap. No. 86/3, 30 pp.

Barlow, C. and Muharminto, 1982. Smallholder rubber in South Sumatra. Towards economic improvement. Balai Penelitian Perkebunan Bogor and Australian National University, Canberra, A.C.T., 78 pp.

Corden, W.M., 1984. Booming sector and Dutch disease economics: survey and consolidation. Oxford Econ. Pap., 35: 359-380.

Corner, L., 1983. The persistence of poverty: rural development policy in Malaysia. Kajian Malaysia, 1(1): 38-61.

Gonzales-Vega, C., 1977. Interest rate restrictions and income distribution. Am. J. Agric. Econ., 59(5): 973-976.

Indonesia, 1984. Fourth five-year devlopment plan, 1984/1985-1988/89 (3 vols). Departemen Penerangan, Jakarta, 340 pp.

Jamaludin, L., 1982. Techno-economic aspects of large scale oil palm planting. In: E. Pushparajan and P.S. Chew (Editors), The Oil Palm in Agriculture in the Eighties, Volume I. Incorporated Society of Planters, Kuala Lumpur, pp. 351-367.

Lee, K.H., 1983. Malaysian manufacturing protection: ideas, structure, causes and effects. Faculty of Economics, University of Malaya, Kuala Lumpur, 130 pp.

Malaysia, 1971. Second Malaysia Plan, 1971-1975. Government Press, Kuala Lumpur, 267 pp.

Malaysia, 1986. Fifth Malaysia Plan, 1986-90. Jabatan Percetak Kerajaan, Kuala Lumpur, 578 pp.

Rana, P.B., 1983. The impact of the current exchange rate system on trade and inflation of selected developing member countries. Asian Development Bank Staff Pap. No. 18, Manila, 82 pp.

Somboon Thuwachote and Lim, P.L., 1976. Training courses for rubber farmers in Thailand. In: C. Barlow (Editor), The Progress and Development of Rubber Smallholders. Association of Natural Rubber Producing Countries, Kuala Lumpur, pp. 31-37.

Suchare, N., 1985. The rubber replanting scheme in Thailand. In: Australian Centre for International Agricultural Research, Smallholder Rubber Production and Policies. ACIAR, Proc. Ser. No. 9, Canberra, A.C.T., pp. 132-138.

Suryatna Effendi, 1985. Improvement of smallholder rubber farming productivity in Indonesia. In: Australian Centre for International Agricultural Research, Smallholder Rubber Production and Policies. ACIAR, Proc. Ser. No. 9, Canberra, A.C.T., pp. 108-114.

Swapna Mukhopadhyay and Lim, P.S., 1985. Development and Diversification of Rural Industries in Asia. Asian and Pacific Development Centre, Kuala Lumpur, 348 pp.

Warr, P.G., 1986. Indonesia's other Dutch disease: economic effects of the petroleum boom. Department of Economics and National Centre for Development Studies, Australian National University, Canberra, A.C.T., Work. Pap. No. 86/2, 52 pp.

World Bank, 1980-1985. Various reports on agriculture and tree crop development in Malaysia, Indonesia and Thailand. World Bank, Washington, DC.