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by

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# **Export Performance in Fiji, 1960 to 1999**

**Euan Fleming and Anita Blowes\*\***

## **Abstract**

Stochastic dominance analysis was used to assess export performance in Fiji from 1960 to 1999. A country with reasonably abundant resources, Fiji has made effective use of its quite substantial resources to increase total export values significantly over the study period, with an average rate of growth of 2.6 per cent per annum. Non-agricultural exports were the source of this growth, increasing annually by 7.3 per cent. Growth was particularly strong from the late 1980s despite the loss of skills and capital flight in the wake of the May 1987 coup and military takeover. The economy clearly benefited from a policy switch from a trade-protectionist policy with a high degree of government intervention to an export-oriented strategy based on private sector-led development.

The values of total exports in the 1990s were dominant overall. The values in the 1980s dominated values in the 1960s and 1970s as a result of the expansion of non-agricultural exports. The 1970s stochastically dominated the 1960s clearly and the 1980s dominated the 1970s for non-agricultural exports. Non-agricultural export values continued to expand in the final decade of the study period, rendering overall stochastic dominance of the 1990s over the 1980s and preceding decades.

The dominant decade for agricultural exports was the 1970s. However, the increase in agricultural export values during the 1970s was offset by a decline in agricultural export values in the final two decades of the study period such that there was no trend in agricultural export values over the whole study period.

**Key words:** export performance; Fiji; stochastic dominance.

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# **1. Overview of Analysis**

The question that we attempt to answer in this study is whether Fiji, a developing South Pacific island country that is comparatively well endowed with natural resources, was successful in improving commodity export performance over the final four decades of the twentieth century. Commodity export performance is analysed for Fiji from 1960 to 1999.

Stochastic dominance analysis was used to assess export performance across the four decades, which allowed a simultaneous assessment using two key criteria: the mean value of commodity exports and variability around the mean. Two analytical procedures were followed in its application. First, cumulative distribution functions were calculated and graphed for comparison between decades. This approach was useful where first-degree stochastic dominance or clear second-degree stochastic dominance prevailed. Second, the more advanced analytical procedure of stochastic dominance with respect to a function (Hardaker, Huirne and Anderson 1997, pp. 149-150) was used where stochastic dominance was not clear from a pictorial presentation.

The RISKROOT program devised by McCarl (1996a, 1996b) suited this purpose. RISKROOT was applied to two sets of data: the raw export values and trend-corrected export values within each decade. The latter approach assumes that participants in the export sector are only averse to variability around the trend in values whereas the former approach assumes they are averse to all variability. Results are reported for the approach using the raw export values as the sets of results differ only in the extent of dominance.

Measures of absolute risk aversion were estimated assuming participants in the export sector have a normal relative risk-aversion coefficient of unity. This coefficient was divided by an estimate of the wealth of the participants to derive the absolute risk aversion coefficient that could then be compared with the break-even risk aversion coefficient (BRAC) estimated in the RISKROOT program. Because the risk-aversion coefficients are estimated by a crude approximation, we decided to adopt a conservative approach and include a buffer zone 100 per cent each side of the estimates of the coefficients. If the BRAC were to fall within this zone, the values were considered too close to each other to make an informed assessment of which decade is superior in export performance. No estimate fell within this buffer zone.

It would have been useful to take the further step of decomposing export values into their price and quantity components. Unfortunately, while such decomposition would have been possible for some exports, it is not for a considerable proportion of export commodities for the full study period.

The data used are values of total domestic commodity exports, and disaggregated values of agricultural and non-agricultural exports. All series were converted into US dollars using the pertinent annual average exchange rate. The series are expressed in real terms in 1999 prices, using the world export unit value index published by the International Monetary Fund (IMF) (2002) as a deflator.

Agricultural exports are taken to include raw and processed agricultural products because it proved impossible to separate the value added by processors from that by agricultural producers of the raw material outputs. Gross export values were used instead of net value added. The latter series would have given a better picture of changes in export profitability but could not be used because cost data were almost universally unavailable.

Data were confined to annual observations because more time-disaggregated data were not available for the full study period. Quarterly data were available from 1970, and analyses undertaken on these data were helpful in confirming the results obtained using the annual data. NCDS (1995), the Bureau of Statistics (1986) and Fiji Islands Bureau of Statistics (2002) were the sources of data used in the analysis.

## 2. Analysis of Commodity Export Performance

Trends in export values in Fiji over the whole study period are presented in Table 1. Results of the stochastic dominance analysis for total exports are presented in graphical form in Figure 1 and for RISKROOT analysis in Appendix 1. Comparable results for agricultural exports are presented in Figure 2 and Appendix 2, and for non-agricultural exports in Figure 3 and Appendix 3. In addition, a specific analysis was undertaken for sugar exports, the results of which are presented in Figure 4 and Appendix 4.

**Table 1**

### **Linear Trends in Total, Agricultural and Non-Agricultural Export Values in Fiji, 1960 to 1999**

Trend coefficients in values ( <i>t</i> -ratios) and annual percentage changes					
Total exports		Agricultural exports		Non-agricultural exports	
US\$000	%	US\$000	%	US\$000	%
7168.6 (8.94)	2.6	-65.9 (-0.16)	0.0	7234.5 (9.86)	7.3

## **2.1 Overall trend**

Total export values in Fiji grew significantly over the study period by an average of US\$7.17 million per annum, significant at less than 1 per cent significance level (see Table 1). The average rate of growth was 2.6 per cent per annum. Non-agricultural exports were the source of this growth, increasing annually by US\$7.23 million (7.3 per cent), also significant at less than 1 per cent significance level. Growth was particularly strong from the late 1980s, quite an achievement given the loss of skills and capital flight in the wake of the May 1987 coup and military takeover (World Bank 1991:109-112). We could not reject the hypothesis that there was no trend in agricultural export values over the study period.

The values of total exports in the 1990s were dominant overall. The values in the 1980s dominated values in the 1960s (first-degree dominance) and 1970s (second-degree dominance) as a result of the expansion of non-agricultural exports. The 1970s stochastically dominated the 1960s clearly and the 1980s dominated the 1970s for non-agricultural exports. Non-agricultural export values continued to expand in the final decade of the study period, rendering overall stochastic dominance of the 1990s over the 1980s and preceding decades.

The 1970s dominated both the 1960s and the 1980s for agricultural exports. The 1980s were just stochastically dominant over the 1990s and the 1970s clearly dominated the 1990s, making the 1970s the dominant decade for agricultural exports over the whole study period. In essence, the increase in agricultural export values during the 1970s was just offset by a decline in values in the following two decades.

### **2.2.2 Agricultural exports**

#### ***1960s and 1970s***

The values of total and agricultural exports in the 1970s stochastically dominated their respective values in the 1960s (with second-degree dominance) principally because the values of sugar exports in the 1970s dominated those in the 1960s. The mean annual value of sugar exports increased by 37 per cent from US\$124.2 million in the 1960s to US\$170.4 million in the 1970s while the coefficient of variation decreased slightly from 0.27 to 0.25.

Sugar is by far the main agricultural product in Fiji. Sugar cane is produced by around 23 000 farmers, three-quarters of whom are ethnic Indians who farm predominantly on leasehold land. The cane is processed into sugar and its main by-product, molasses, in four mills (ADB 2000:117). Increases in areas planted and yields both contributed

to an expansion in sugar output in the 1970s. The area under cultivation rose from 56 kha in 1964 to 86 kha in 1980 (Ali and Narayan 1989:18). Output from the newly implemented Seaqaqa cane development scheme in Vanua Levu (Ali and Narayan 1989:18-19) contributed to the increase in exports, as did an increase in milling capacity in the second half of the decade. Chandra (1983:91) reported yields of 60 t/ha to 73 t/ha across mill areas in 1979 compared with 45 t/ha to 57 t/ha in 1971. Also, Fiji benefited from secure bilateral long-term contracts and a guaranteed sugar quota under the European Union (EU) Lomé Convention, thereby avoiding undue reliance on an unstable and low-priced world sugar market (Chandra 1983:90, CPO 1980:105).

By the time the study period commenced, copra had been a longstanding cash crop in Eastern Vanua Levu and the outer islands, used as an input in coconut oil milling. Coconut oil was the export commodity of choice, differing from other Pacific island countries that exported copra in the 1960s and 1970s and were to introduce (or re-introduce) coconut oil milling in the 1980s and 1990s. In contrast to sugar, the mean annual value of coconut oil exports declined by 21 per cent during the 1970s, from US\$20.6 million to US\$16.3 million, while the coefficient of variation increased from 0.22 to 0.34. The performance of the coconut industry had been impressive in the 1960s as increased oil milling capacity in the early post-war years boosted coconut oil exports (Fleming 1996:33). But this trend was not sustained during the 1970s. Exports suffered from a decline in copra output, which had averaged around 27 kt in the first half of the 1970s before falling to around 16 kt by the second half of the 1980s, a decline of around 40 per cent in 15 years (Fleming 1996:33). The decline in the 1970s was most marked in Rotuma, where copra output fell from 2208 tonnes in 1968-69 to 441 tonnes in 1973-75 and 1390 tonnes in 1976-78, the Lau island group, where output fell from an average of 6569 tonnes in 1968-69 to 5589 tonnes in 1976-78, and Kadavu, where output fell from 1069 tonnes in 1972 to 484 tonnes in 1979. These declines were due in large part to a high incidence of cyclones, low returns relative to other cash-cropping activities and shipping problems (Chandra 1983:96, McGregor and McGregor 1999:30-31). The increase in the coefficient of variation in the 1970s was largely price-induced, with the average annual copra price varying widely over the decade from a low of US\$291 per tonne in 1972 to a high of US\$1098 per tonne in 1974 (Chandra 1983:96).

Exports of feedstuffs derived mainly from coconut oil milling also declined over the 1970s, finishing at 2265 tonnes in 1979 compared with 7192 tonnes in 1970 (McGregor and Macartney 1985:5.18). Output was maintained but competition from domestic demand in the livestock industries had reduced the export potential. A comparable fall in export value also took place, from US\$1.71 million to US\$0.34 million over the same period.

Banana exports were very important in Fiji in the 1960s, and ranked as the third most valuable agricultural export after sugar and coconut products in 1970. But exports had

slumped to negligible levels by 1975 and did not recover. Chandra (1983:118) cited as evidence for the decline the heavy infestation of pests and diseases in production, such as black leaf streak, and an inability to surmount the considerable difficulties in export marketing, such as failure to meet quality standards in New Zealand and increased international competition. In these respects, the failure of the industry bears the hallmarks of similar industries in the Polynesian countries under study where bananas were a major export at the start of the study period, namely Cook Islands, Niue, Samoa and Tonga.

Some successes were recorded in the export of high-value non-traditional (HVNT) products in Fiji, such as watermelon, citrus and pineapple exports, although most were of minor importance and turned out to be short-lived (Fleming 1996:42-43). Citrus exports arose from the development of a large orchard in Batiri, Vanua Levu, in 1977 and establishment of a processing factory in 1979 held out considerable promise that was not to be fulfilled. Significant passionfruit export values were achieved in the 1960s and early to mid 1970s, when there were over 400 producers and two processing firms operating in Sigatoka Valley on the main island of Viti Levu (Fleming 1996:42). In 1966, exports were valued at an impressive US\$3.18 million (Tudor 1968). But the passionfruit industry failed to live up to its potential for the remainder of the 1970s and stagnated. There were only 215 growers by 1979 (Carter 1981:100).

Ginger was an exception to the ephemeral existence of HVNT crop exports, and has been the most successful (but not untroubled) niche export product to date. ACC (1985), McGregor (1988) and Tokalau (1993) described the development of the ginger export industry, based on production in high-rainfall areas close to the capital, Suva. Production for export began in the 1950s when initiatives were taken by private firms to export ginger to New Zealand. Penetration of the North American market followed in the early 1960s, aided by a New Zealand company and Canadian importer/wholesaler and using a market-focus export strategy aimed at the off-season for Hawaiian ginger production entering the North American market (McGregor 1988:11). The industry was able to exert a good deal of market power in this seasonal window, especially in the Los Angeles market (McGregor 1990), until the early 1990s when competition intensified (MAFF 1996:16). Exports quadrupled in value between 1973 and 1977 with the market development of processed ginger products (Chandra 1979). They then declined slightly over the remainder of the decade (CPO 1980:108).

Cocoa was another crop to contribute in a modest way to export expansion in the 1970s. The largest and oldest of three export-oriented beverage industries (the others being coffee and tea), the cocoa industry was established in the 1960s in the wetter parts of the two main islands of Viti Levu and Vanua Levu. Development of the industry in the early 1960s was attributable to government efforts to establish cocoa as a smallholder crop to be interplanted with coconuts, but exports remained at

negligible levels until the mid-1970s chiefly because of lack of smallholder interest and seed variety problems (Colonial Office 1966:35, Carter 1981:100). The platform for export growth was established in the late 1960s and early 1970s by world price rises, improved disease control, new plantings of the high-yielding and disease-resistant *Amelonado* variety, and other forms of government support. Both the volume and the value of exports had risen substantially by 1980.

### ***1980s***

In the 1980s, the value of agricultural exports experienced a reversal of the trend observed for the 1970s. Despite finishing the decade on a high with a bumper crop in 1989 (Cole, Dorrance and Weisman 1989:3), sugar exports in the 1980s were stochastically dominated by those in the 1970s, as shown in Appendix 4 and Figure 4. The mean average value of sugar exports of US\$144.6 million in the 1980s was 85 per cent of the 1970s figure of US\$170.1 million. Although the coefficient of variation also declined, more than halving from 0.25 to 0.12, this was nowhere near sufficient to offset the fall in mean value.

Average world sugar prices declined in real terms and output was static (Fleming 1996:31). The area of cane harvested declined slightly from 66 kha in 1980 to 64 kha in 1989, despite reaching 71 kha in 1987 (NCDS 1995), and cane yield increases reached their limits. Chandra (1983:94) observed that most good sugarcane lands were already under cultivation and that further expansion would be on the more marginal lands of the dry zones of Viti Levu and Vanua Levu. Sugar production experienced a period of stagnation until 1986 when a record crop was produced, enabling a build-up of stocks that were drawn upon in 1987 to meet export contracts that had been endangered by the military coups (Gannicott 1987:2). Exports gradually declined for the remainder of the decade. Climatic variations played their part, with output reduced by Cyclone Oscar in October 1982, storms in 1984 and drought in 1987, and increased by good weather in 1986 (World Bank 1991:111-112, McGregor and McGregor 1999:6-7).

Two traditional exports contributed significantly to the stochastic dominance of the 1970s over the 1980s. First, banana exports had ceased completely by the early 1980s. Second, coconut oil exports continued their descent as their mean value more than halved, from US\$16.3 million to US\$7.4 million. Compounding this decline, the coefficient of variation more than doubled from 0.34 to 0.72, chiefly because export prices for coconut oil fluctuated widely, from low levels early in the decade to very high levels during the world oils market boom of 1984-85 back to very low prices in 1986 as a consequence of large increases in world supplies of soybean and palm oil (Anon. 1986:2). Production and marketing performance continued to deteriorate. The volume of coconut oil exports in 1991 was less than one-third of what it had been a decade earlier (NCDS 1995). McGregor and Macartney (1985:5.19) cited dwindling



copra supplies, copra quality problems and excess capacity that was located outside the growing areas as major difficulties facing the coconut oil industry. In respect of the first of these difficulties, replanting brought about increased copra production in the early 1980s and enabled copra output to recover to around 25 kt by 1985 after having slumped to 20.5 kt in 1981. But the effects of inclement weather and the other difficulties facing the industry led to a reversion to export decline, and export volume had fallen to 15 kt by 1991 (World Bank 1993:72). Exports of feedstuffs had ceased by 1981 (McGregor and Macartney 1985:5.18).

Cocoa exports went against the trend largely as a result of the delayed impacts of plantings in the 1970s, a trebling of area planted between 1981 and 1985 as a result of an expansion program in the eighth development planning period (Chandra 1983:107), continued progress in disease control and improved world prices (Fleming 1996:34). But not everything went according to script. Declining world cocoa prices between 1980 and 1982 slightly delayed the expansion in export values that was in full swing by the mid-1980s. Export volume increased sharply in 1987 but declined in 1988 as a result of production problems caused by black pod disease and canker as disease control efforts faltered. In addition, world prices fell, marketing problems emerged, smoke contamination problems affected quality and political instability depressed output (Fleming 1996:35, MAFF 1996:49).

Minor contributions to export values were made in the 1980s by the other two beverage industries. A small coffee industry was initiated with the planting of 200 hectares of robusta coffee in 1978, followed by smallholder plantings of 80 ha. Coffee exports reached a value of US\$0.18 million in 1986 (Bureau of Statistics 1986) but a subsequent loss of enthusiasm and reduced effort by smallholders led to an industry decline that contrasts with the fortunes of the better-placed industry in Papua New Guinea. Planting in the tea industry commenced in the 1980s and exports reached US\$71 k by 1986 (Bureau of Statistics 1986), but the industry failed to make a substantial impact on export values.

Ginger exports stagnated after 1982 (Treadgold 1992:86). Soil degradation and disease problems were encountered that were exacerbated by poor field management practices (McGregor and Macartney 1985:2.32-2.41). McGregor (1988:14) attributed the problems of the early 1980s also to poor quality standards of large new growers and price undercutting in the niche US west coast market. The latter practice was not helped by a rapid expansion of exports by low-cost exporting countries such as the People's Republic of China.

There was an eclipse of some of the HVNT exports that had emerged so promisingly in the previous decade. Although prospects appeared reasonably bright in the early 1980s, especially for exports to New Zealand (Chandra 1983:111), passionfruit juice and pulp exports declined markedly over the decade. The government attempted to

revitalise the fruit export industry through one remaining processing firm in Sigatoka that operated a 'tightly controlled contracted outgrower programme' (CPO 1985:58). With a return to approximately the number of growers of the early 1970s, CPO (1985) forecasted a doubling in export value by the end of the 1980s but exports continued to decline slowly (Fleming 1996:42).

Small volumes of fresh pineapples were exported to New Zealand during the 1980s, with the highest value reached of US\$54 k in 1983. It was hoped to diversify exports into canned pineapples with the establishment of a cannery operated by FPF Ltd, a joint venture between Burns Philp and the National Marketing Authority (McGregor and Macartney 1985:3.49). But the pineapple industry failed to live up to its considerable potential. McGregor and Macartney (1985:3.49) identified inappropriate industry structure and lack of suitable planting material as two major constraints to export expansion.

Watermelons were another small contributor to declining agricultural export performance in the 1980s. Samoa and Tonga took over the watermelon export market to New Zealand that had existed in the 1960s and the 1970s (Chandra 1983:118) following the introduction of watermelon one virus in Viti Levu (McGregor and McGregor 1999:8).

Vegetable exports built up to quite substantial levels from the mid-1980s, especially in 1989 when they were valued at US\$2.64 million. Increased domestic demand created by growth in tourism had restricted the development potential of vegetables as an export industry, so the comparatively high levels of exports in the latter years of the decade were in part attributable to the weakness of domestic demand in the tourist sector caused by the political disturbances.

### ***1990s***

Stochastic dominance in agricultural exports between the 1980s and 1990s is close, with exports in the 1980s marginally dominant over those in the 1990s for an estimated risk-aversion coefficient of 0.00064 greater than the BRAC of 0.00022 reported in Appendix 2. The final decade was also dominated in the first degree by the 1970s. This set of results was due in part to severe droughts in 1992 and 1997-98 (McGregor and McGregor 1999:7) and the damage wrought by Cyclone Kina in January 1993 (McGregor and McGregor 1999:90). Also, agricultural policy reversals in 1995 with the introduction of the Commodity Development Framework did not favour export-oriented agriculture in the latter half of the 1990s (ADB 2000:159-162).

The main event contributing to the stochastic dominance of the 1980s over the 1990s was a slight decline in the sugar export values. The mean annual export value fell by 5 per cent from US\$144.6 million in the 1980s to US\$136.8 million in the 1990s and

was only 10 per cent above the mean value of exports in the 1960s. The bulk of the decline occurred early in the decade, despite an increase in harvested area from 64 kha in 1989 to 74 kha by 1993. A drought, technical problems associated with the emigration of skilled labour, a boycott of the cane harvest and Cyclone Kina prevented the industry from reaching its production targets in 1991 and 1993 (Falvey 1991:7, Fairbairn 1998:57, McGregor and McGregor 1999:7). This reduced volume was offset to a limited extent by a negotiated 30 per cent increase in the EU sugar price in 1991 (Dorrance and Liu 1991:48), the effects of which were curbed by a lower unit export price in 1991 caused by a fall in quality resulting from the late harvest (Fairbairn 1992:4-5). Export values recovered in 1994 and reached their highest value for the decade at US\$165.0 million in 1996. Unfortunately, the recovery was not sustained and the export value declined again from 1997. The decline was caused by a large fall in output resulting from the damaging effects of the 1997-98 drought (McGregor and McGregor 1999:8) and a late start to harvesting the 1997 crop brought about by an industrial dispute (ADB 2000:126). The sugar export value finished the study period at US\$133.6 million.

The Government of the Republic of Fiji (1993:76-85), Chand (1998:4), Reddy and Yanagida (1998:73-81), ADB (2000:118-156) and Kurer (2001) cited numerous problems afflicting the sugar industry, in addition to the obvious limitation that only parts of Fiji are suitable for sugarcane production. These problems include land tenure troubles and uncertainty about land lease renewals, falling export prices to the EU (prices declined from around US30 cents/lb in 1995 to around US22 cents/lb in 1999), land degradation with more intensive land use (not helped by the tenure insecurity), the increased practice of cane burning, declining milling efficiency and cane-to-sugar ratio, a payments system not favouring higher-yielding cane, rail transport constraints, industrial disputes and lack of industry investment. While not affecting results in the 1990s, prospects are not bright for sugar export prices in the future. Reddy and Yanagida (1998:73) observed that the 'anticipated loss of preferential treatment in export markets implies that Fiji would have to sell its sugar in the lower-priced world free market'.

In the face of such an unfavourable prognosis, it is something of a surprise to learn that sugar and molasses continue to dominate the agricultural export economy, despite early recognition of the need to diversify agriculture production (CPO 1980, 1985). The share of agricultural exports held by sugar and molasses actually increased from around 85 per cent to around 90 per cent between 1969 and 1989 (Fleming 1996:30) and remains high. The products contributed an average of 84 per cent of agricultural export value over the three-year period, 1997 to 1999.

The continued domination by sugar of agricultural exports can be partly explained by the disappointments of agricultural diversification efforts, despite the rosy view of them over the past two decades (for example, Chandra 1983:93, CPO 1980:103-104).

Three other factors are also crucial in making sugar well suited for export production in Fiji (Fleming 1996:31-32). First, favourable growing conditions in certain areas enable the industry to maintain a competitive advantage in production and milling. Second, and notwithstanding current tensions mentioned above, the land tenure system has been well adapted to commercial sugar production on smallholdings by Fiji Indians who have been proficient at growing the crop (Ali and Narayan 1989:15). Third, the Fiji Sugar Corporation has exploited scale economies in facilitating export through its functions of milling and marketing the sugar output, research, extension, input supply, harvesting schedules and transport services. These three factors would be boosted were ADB's (2000:124) estimate to be realised that yields could be raised by around one-quarter from better farming practices.

Gains in the value of agricultural exports in the 1990s came principally from taro (*dalo*) exports after 1993, kava (*yaqona*) exports and some other emerging HVNT exports (Fleming 1996:37-38). Taro had long been a minor export to the Fijian expatriate populations but, compared with the taro export industries in some Polynesian countries, its contribution to total export value had been modest and variable until recently. The government had neglected taro as an important food crop and had not really contemplated it as a major export crop until the early 1990s, as evidenced by CPO (1985:62-64). The reduced exports of taro from Samoa in 1990 due to cyclone damage provided the springboard for expanded exports, but it was the cessation of exports from Samoa as a result of taro leaf blight in 1993 that enabled taro producers in Fiji quickly to grasp a more significant opportunity to boost exports. Export volumes expanded rapidly, encouraged by an increase in the New Zealand wholesale price from around NZ\$2.00/kg in 1993 to almost NZ\$3.00/kg in 1997 (Barbour and McGregor 1998:68). Values reached US\$4.4 million in 1998 and US\$4.5 million in 1999, and even better results were reported for 2000. The industry shares the positive and negative attributes of its competitors such as Samoa. While taro producers in Fiji remain free of taro leaf blight, the papuana beetle prevents commercial taro production in most parts of Viti Levu (McGregor and McGregor 1999:30). Vigilance is of the utmost importance in ensuring that taro leaf blight does not reach the shores of any islands in Fiji, given its spread already from the north into Solomon Islands and from the east into Samoa.

The emergence of a kava export industry based on smallholder production was in stark contrast to the situation in the early 1980s when Fiji was unable to meet domestic market demand (Chandra 1983:117). Fleming (1996:38) remarked on rising expectations for a kava export industry directed at the global pharmaceutical industry, but its realisation was thwarted until recently. Low levels of exports in the 1980s were improved upon in the 1990s by increasing the planted area, and a small export industry was developed that built on the more important domestic beverage industry. High returns to labour (MAFF 1996:12, Lebot 2001:7-8) played a major part in the

development of kava as an important export activity in the second half of the decade. By 1998, kava exports were valued at US\$17.8 million but they fell back sharply to US\$3.1 million in 1999, a level that was not improved upon in 2000. The 1997-98 drought had severe and extended effects on kava production (McGregor and McGregor 1999:8). Also, exporters share the experiences of those from other South Pacific countries (Samoa, Tonga and Vanuatu) in finding it difficult to meet the requirements of consistency of quality and volume needed to supply the export market (Lebot 2001:22). Lebot (2001:15-19) described the quality problem in detail, noting that several factors can affect the quality of kava by the time it reaches the export market. McGregor and McGregor (1999:28-29) pointed to the potential danger to the industry of environmental and natural disasters. In their case study of Kadavu, a province in which kava export has become the main commercial agricultural activity, they warned that 'a combination of uncontrolled pigs, indiscriminate burning, and unsustainable cropping' threatens to have a long-term adverse effect even greater than the natural disaster of cyclones, to which the crop is also most susceptible because of wind damage.

Coconut oil export values continued to decline, with the mean annual export value in the 1990s not much more than one-third its value in the 1980s and only a fraction more than one-tenth the value in the 1960s. Copra production fell to an historic low of 10 kt in 1993 because much of the area of coconut plantations had been abandoned and the area under pure stands of coconut palms had fallen by 70 per cent since 1968 (Barbour and McGregor 1998:67). Copra producers were especially badly hit by low world prices early in the decade, and the copra industry was kept afloat largely through government price support (Barbour and McGregor 1998:66). McGregor and McGregor (1999:8) glimpsed some encouraging signs of reversal of the downward trend in copra production as the decade progressed, but this was nipped in the bud by the 1997-98 drought.

Coconut oil milling has encountered many of the same difficulties that have afflicted the copra industry, given that copra is its main input. Chandra (1983:95) claimed that no other agricultural industry in Fiji was beset by so many 'developmental problems that transcend so many different policy issues' (see also Wall 1986): low management levels; major pest and disease problems; declining tree productivity due to senility of plantations and lack of successful introduction of new high-yielding varieties; high freight charges and irregular transport, exacerbated by a locational disadvantage; high milling costs that lead to increased competition from foreign millers, especially in Asia, with much lower labour costs (and not helped by the high cost of imported inputs used in processing); low levels and non-uniformity of copra supplies; labour shortages; and declining world copra and coconut oil prices in real terms. Another short-term setback was the damage caused to coconut production by Cyclone Kina in 1993 (Fairbairn 1998:57). These problems are common to varying degrees throughout

the countries under study. The emergence of the taro and kava export industries was partly instrumental in the continued decline in copra production in some areas because of their higher profitability (McGregor and McGregor 1999:31).

In common with the sugar industry, attempts to diversify the coconut industry have met with little success (Barbour and McGregor 1998:67). Even the value of feedstuff exports comprising coconut by-products declined substantially in the 1990s, from US\$1.6 million in 1989 to only US\$0.2 million by 1995. With 60 per cent of bearing palms considered senile (Barbour and McGregor 1998:67), the future of the industry appears bleak, its manifold problems to be assuaged only by the occasional spike in world prices.

Ginger exports suffered a setback from 1991 to 1994, due in part to Cyclone Kina in 1993 destroying much of the crop and causing seed shortages in 1994. In the latter year, the export value had dropped to a little below US\$1 million, a fraction of its value of US\$3.6 million in 1990 (MAFF 1996:4). More enduring difficulties came from low-wage-cost competitors for the seasonal market niche, the need for labour input intensity and commitment in ginger production, soil erosion, continuing incidence of disease, notably *Fusarium* rot, and the chronic problem of low quality standards (CPO 1985:55-56, McGregor 1988:23, Vinning 1990:32, Tokalau 1993, MAFF 1996:4-6, Barbour and McGregor 1998:67). Export volumes briefly recovered in 1995 before falling back in 1996 to less than one-half the 1992 level. They remained around that level until 1998 when they were valued at just under US\$1 million, similar to the 1994 value.

The decline in cocoa exports from 1987, for a variety of reasons mentioned above, continued into the 1990s and meant that the contribution by the crop to agricultural export values was much less in the 1990s than in the 1980s. Cocoa output had initially picked up in 1990 as output of dry beans hit an all-time high of 406 tonnes (Barbour and McGregor 1998:67), but export volume and value then declined quite steeply until 1994. Production was badly affected by Cyclone Kina in 1993, which destroyed many trees on Viti Levu (MAFF 1996:49, Fairbairn 1998:57). Another cause of the decline in value was low producer prices, which were a combination of a depressed world market, poor bean quality, scale diseconomies brought about by low export volumes due to low yields, and inadequate and high-cost marketing processes (McGregor 1990, MAFF 1996:49, Barbour and McGregor 1998:67).

Passionfruit was no longer being mentioned as a potentially valuable HVNT export industry in the 1990s (MAFF 1996). Difficulties identified in passionfruit export included the potentially damaging effects of adverse weather conditions, relatively unattractive returns to labour, high labour demands in production and limited export market potential (Chandra 1983:112, Fleming 1996:43-44). The pineapple industry also failed to progress and the local market is now undersupplied (MAFF 1996:45).

Small quantities of papaya were air-freighted to Australia, New Zealand and Canada, peaking at US\$0.35 million in 1990. McGregor (1990) reported a number of difficulties in attempts to get a papaya export industry off the ground that included inadequate and haphazard production and marketing structures and processes, poor fruit quality at the export retail level and inadequate packaging. Cyclone Kina and the loss of fumigation facilities forced the closure of the industry by mid-decade (MAFF 1996: 45). A similar experience occurred with mango exports, which were identified by McGregor and Macartney (1985:4.7) as being ready for 'take-off' given their favourable attributes as an export crop. Exports of around 20 tonnes per annum of improved varieties had been shipped to the Japanese market (Fleming 1996:43), and values peaked at US\$0.32 million in 1986. But negligible quantities were exported in the first half of the 1990s and export ceased altogether in the mid-1990s with the loss of fumigation facilities.

ADB (2000:163-165) reported renewed efforts by the private sector to export papaya, eggplant, breadfruit and mango in the second half of the 1990s, particularly to the New Zealand market. These efforts were based on a more rigorous regime of nucleus estate production and marketing (MAFF 1996:17-18), the introduction of high-temperature forced-air treatment and a quarantine protocol with the government of the key importing country of New Zealand. Introduction of this regime was rewarded in the final years of the study period, with mango exports valued at US\$2.6 million in 1998 following a fivefold increase in the volume exported from 1997 (ADB 2000:163-164). The economics of production of the two crops seem favourable, with relatively high returns to labour. Small, scattered and irregular supplies continue to be the major constraints to expanding fruit exports, a function of the narrow base and insecurity of small export industries. A crucial next step for HVNT export crops in general is the extension of quarantine protocols with the governments of other countries that are potentially remunerative export markets, notably Australia and USA (ADB 2000:164). McGregor and McGregor (1999:96) contended that fruit fly incursion remains the greatest biological threat in Fiji. It would have calamitous consequences for the papaya, eggplant and mango export industries.

Significant but variable exports of vegetables between US\$0.3 million and US\$0.8 million were achieved in the early 1990s before quarantine problems restricted market access in 1993 in which year exports of vegetables were a paltry US\$6 k. Exports recommenced in the second half of the decade with the introduction of high-temperature forced-air treatment and a quarantine protocol with the government of New Zealand, and reached US\$0.85 million in 1998. Barbour and McGregor (1998:67) reported 'an impressive array of products traded to a range of markets'.

### **2.2.3 Non-agricultural exports**

#### ***1960s and 1970s***

Three export products dominated non-agricultural exports in Fiji in the 1970s: gold, timber and fish. All made progress during the decade, enabling non-agricultural export values clearly to dominate values in the 1960s with a 50 per cent increase in mean annual value and a decrease in the coefficient of variation.

Emperor Gold Mines Ltd had been extracting gold at Vatukoula for two decades prior to the commencement of the study period. It was by far the major source of exports in the mineral sector throughout the study period despite occasional concerns about the viability of the mine. The mean annual value of gold exports increased marginally during the 1970s while their coefficient of variation slightly decreased. After a bright start to the decade in which world gold prices rose, especially in 1973 and 1974, values fell quite dramatically in the second half as increased mining costs (CPO 1980:160-161) caused a decline in production. Export volume more than halved from 1974 to 1979 despite a substantial price rise from 1976, and the value declined on average by US\$2.54 million per annum over the five-year period.

Timber exports were marginal in the 1960s, with exports first recorded in the official trade statistics in 1963. Nevertheless, a mean export value of US\$1.14 million was achieved for the whole decade. CPO (1970:95) reported that sawn timber exports during the decade were a by-product of the local industry, and exports of unsawn timber had ceased in 1964. Limited progress was made in timber export markets in the 1970s, with a modest increase in annual export value to US\$1.61 million and a halving of the coefficient of variation to 0.41. It was estimated that around 15 per cent of the output of sawn timbers and veneers were exported in the second half of the 1970s (CPO 1980:133). Most of the exports came from joint-venture sawmills that included foreign ownership varying between 50 per cent and 95 per cent (CPO 1980:134).

Fish appeared as an export in 1975 with development of an industrial pelagic fisheries sector based on the capture, processing (canning) and export of tuna. The government played an important auxiliary role in the development of the sector but it relied heavily on outside financial and technical involvement, principally from Japan and Korea (CPO 1980:153). Although values for the first year of export were negligible, the industry soon made its mark as the export value reached US\$16.3 million in 1979. The mean value for the second half of the decade was US\$5.04 million.

#### ***1980s***

The value of non-agricultural exports in the 1980s dominated values in the 1960s (first-degree dominance) and 1970s (second-degree dominance) as a result of export



expansion in four industries: gold, fish, timber and garments. First, the mean annual export values of gold almost doubled over the decade, to US\$28.5 million from US\$14.7 million in the 1970s, primarily because a large increase in gold prices at the end of the 1970s and early 1980s reversed the declining trend in exports in the second half of the 1970s. The value of silver output also virtually doubled between 1981 and 1984 in domestic nominal values (CPO 1985:79). Over the decade, the gold export value increased by US\$4 million each year on average despite a declining price trend from 1983 (Dorrance and Liu 1991:51). The change was not uniform and the coefficient of variation increased from 0.31 to 0.48. The most spectacular increase in exports was experienced between 1985 and 1988 when export values more than doubled to US\$52.9 million. This was to be the peak year of gold exports as the export value had declined to US\$43.9 million by the end of the decade (Treadgold 1992:86). This decline in value occurred despite the fact that the gold export volume peaked for the decade at 4214 kg in 1989 (Ministry of Finance and Economic Planning 1991:66).

Second, the mean value of fish exports increased more than sevenfold during the 1980s, from US\$2.52 million in the 1970s to US\$19.17 million in the 1980s. The decade commenced with about a 40 per cent increase in export values in the first two years, after which exports stagnated until 1986. The tuna industry was operating well below capacity due to a lack of fish (CPO 1985:71). As for gold exports, the major increase in exports occurred between 1985 and 1988 when values more than doubled from US\$11.13 million to US\$25.81 million, at which level they remained for the next three years. The Ministry of Finance and Economic Planning (1991:53) summed up this successful expansion thus:

The recent growth of the industrial fisheries sector is an excellent example of private sector led export development. Although the Fiji Government is the principal shareholder in both [the Pacific Fishing Company (PAFCO)] and Ika Corporation, the companies are run as independent corporations ... . The fresh fish and marine product exporting companies, and at least 75 percent of the offshore fishing boats (excluding chartered foreign fishing vessels), are privately owned.

Third, the value of timber exports more than trebled in the 1980s, averaging US\$5.16 million compared with US\$1.61 million in the 1970s, while the coefficient of variation also increased to 0.66. A depressed world market and several cyclones had limited export growth in the first half of the decade (CPO 1985:74). Most of the increase in export value took place in the second half despite the political turmoil of 1987 and its fallout in following years, drought and forest fires that affected 12 000 hectares of pine plantation (Ministry of Finance and Economic Planning 1991:56). Export values more than doubled from US\$3.8 million in 1986 to US\$8.1 million in 1989 (Treadgold 1992:86). The main factors behind this growth were industry restructuring, upgrading of production facilities and the commencement of plantation

pine processing (CPO 1985:74), with pine chip exports beginning in 1987 and trebling in volume to 170 kt by 1989 (Ministry of Finance and Economic Planning 1991:55).

Fourth, the initial effects of a rapidly expanding garments export industry had begun to be felt in the last few years of the decade. A niche had been established in the high-value low-volume market that enabled manufacturers to compete successfully against low-cost Asian competitors (ADB 2000:27). Although exports did not commence until 1986, the sheer magnitude of the industry had a marked effect on export performance. By the end of the decade, garment exports were already contributing a healthy 18 per cent of total domestic exports (Treadgold 1992:86). Two factors combined to create this impetus. First, preferential trade agreements such as the South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA) were already in place. Second, the Tax-Free Factory/Tax-Free Zone Scheme was introduced in 1987, providing a 13-year tax holiday, duty exemptions on capital goods and raw materials, and freedom to repatriate capital and profits (Ministry of Finance and Economic Planning 1991:70-71).

A number of other industries made moderate contributions to the growth in non-agricultural export values in the 1980s. They include cement, bakery products and paints, export values of all of which more than doubled during the decade (Treadgold 1992:86). The figures published for 'other exports' further emphasise the success achieved in export diversification during the 1980s, with Treadgold (1992:86) reporting a six-fold increase in this category. These statistics confirm the observation made by Fairbairn (1985:39) that 'the degree of diversification, including development of a wide range of manufacturing items, is impressive'.

### ***1990s***

The political crisis of 2000 was yet to come and the upset caused to the economy by political unrest late in the 1980s was soon overcome in the final decade of the study period as values of non-agricultural exports in the 1990s dominated those in the 1980s and earlier decades. Embarkation by the government on an outward-looking economic development strategy, increased reliance on the private sector, a competitive wage policy and a program of deregulation in the economy in 1987 (Government of the Republic of Fiji 1993:3-8) played a crucial role in this trend. Export promotion had already figured prominently in the ninth development plan (1986-1990), particularly in exploiting the advantages offered by preferential access to the Australian market by SPARTECA (CPO 1985:99).

The growth in value of manufactured exports under SPARTECA played a major role in the overall stochastic dominance of the 1990s for total exports, given that the mean value of sugar exports in the 1990s experienced a slight decline over the mean value

in the 1980s. Treadgold (1992:59) attributed the expansion of exports to 'the extension in the mid-1980s of SPARTECA duty-free arrangements to include clothing, textiles and footwear ... and to similar access to the US market which, by 1990, already accounted for 29 per cent of sales'. By 1999, garment exports of US\$163.5 million accounted for one-third of the value of domestic exports and averaged US\$99.3 million for the decade. While of much less importance, textiles, yarn, fabrics and made-up articles contributed a significant US\$15.3 million and footwear exports contributed US\$6.9 million in 1999.

Increased contributions to mean annual export values, and declines in coefficients of variation, were also made by gold exports (mean annual value US\$36.9 million, up 29 per cent), fish exports (mean annual value US\$28.6 million, up 49 per cent) and timber exports (mean annual value US\$21.0 million, up almost fourfold). All three mean annual values for the 1990s were close to the final-year values. Gold export values declined early in the decade, a function of an industrial dispute and a boardroom battle for control of Emperor Mines Ltd (Callick 1991:13), then remained steady for the rest of the first half of the decade. An expansion of output after 1995 more than offset a steep decline in gold prices from 1996 until 1999, leading to substantial gains in export revenue.

Adoption of the EEZs under the United Nations Convention on the Law of the Sea in 1994 greatly enhanced the prospects for domestic fishing industries in South Pacific countries. Strong contributions came from chilled and fresh tuna exports in Fiji that offer scope for further growth with catches still below sustainable levels. Port facilities and infrastructure are the main constraints (Temu, Hunt and Chandra 1995:17). PAFCO, which remains more than 95 per cent government-owned (ADB 2000:174), continued to be beset by supply and production performance problems, ceasing its canning operations to become a loin producer for a US corporation (Hunt 2001:10). It continues to operate well below capacity (ADB 2000:175). The Government of the Republic of Fiji (1993:88-89) reported that it had assisted PAFCO to undertake investments in the early 1990s that expanded storage and production capacity. But it cautioned that the financial viability of the firm relied on maintaining efficient operations and continuing to receive high prices for exports to the EU under the Lomé Convention.

Exports of forestry products were set back initially in the decade by the temporary closure of Fiji Forest Industries, which was eventually rescued by the Fiji Development Bank (Callick 1991:13). Once these problems were overcome, values resumed their upward trend from the previous decades, with exports from pine plantations accounting for one-half of all timber exports by the end of the study period and driving the growth in woodchip, plywood and veneer exports (Chand 1998:4). Pine chips are easily the major export, sourced from the 40.73 kha of pine plantations on Viti Levu and Vanua Levu owned and managed by Fiji Pine Ltd. Tropik

Industries, in which Fiji Pines Ltd has 74 per cent equity (the other shareholders being the Commonwealth Development Corporation and European Investment Bank), harvests and processes the timber. Obstacles have been encountered in moving up the value chain from chips to veneer, ply, furniture and moulded products. A further matter of concern is that current pine harvesting rates are not sustainable. The average age of trees is just 7.7 years on Viti Levu and 13.8 years on Vanua Levu compared with an ideal harvesting age of 18 years (Groome Poyry 1998, cited by ADB 2000:172). An Australian review team recently submitted a report critical of operations in the pine industry in which it suggested that it is the wrong model for Fiji.

The fact that the value of non-agricultural exports continued to improve throughout the study period, with each decade stochastically dominant in the first degree over the previous decade, suggests that Fiji experienced quite a deal of success in diversifying its export sector. The 'other exports' category continued to expand, almost doubling between 1989 and 1999 (Fiji Islands Bureau of Statistics 2002), reflecting continued export diversification during the 1990s.

Yet the decade finished on a sombre note with the spoils of export progress endangered by what Chand (1998:7) termed the 'disappearing prerequisites for sustained growth'. Non-agricultural export industries face a tougher assignment in the new millennium in an economic environment of faltering economic reforms, political and industrial unrest, loss of skilled labour, declining education standards, uncertainties about property rights, low levels of domestic and foreign investment, rising unemployment and crime rates, and overall low economic growth (Treadgold 1992:56, 61-62, Chand 1998:2-7). Two industries face long-term challenges. First, despite the outstanding success of the garment industry to date, Temu et al. (1995:15) issued a timely warning about the 'footloose' nature of what is essentially a 'sunset industry', sustained by a tax-free domestic policy and a trade agreement whose advantages are gradually being eroded. Second, fish canning faces a number of chronic difficulties in the South Pacific (Maxwell and Owen 1995), as PAFCO has discovered (Hunt 2001:10-11). A major cloud on the horizon concerns the 22 per cent price premium for sales to Europe on which the canned tuna industry relies. This premium is in doubt with the erosion of preferential access to the EU market (ADB 2000:175).

### **3. Conclusions**

Stochastic dominance analysis was used to analyse commodity export performance in Fiji over the period from 1960 to 1999. The country has made effective use of its quite substantial resources to increase total export values significantly over the study period, with an average rate of growth of 2.6 per cent per annum. Non-agricultural

exports were the source of this growth, increasing annually by 7.3 per cent. Growth was particularly strong from the late 1980s despite the loss of skills and capital flight in the wake of the May 1987 coup and military takeover. The economy clearly benefited from a policy switch from a trade-protectionist policy with a high degree of government intervention to an export-oriented strategy based on private sector-led development.

The values of total exports in the 1990s were dominant overall. The values in the 1980s dominated values in the 1960s and 1970s as a result of the expansion of non-agricultural exports. The 1970s stochastically dominated the 1960s clearly and the 1980s dominated the 1970s for non-agricultural exports. Non-agricultural export values continued to expand in the final decade of the study period, rendering overall stochastic dominance of the 1990s over the 1980s and preceding decades.

The dominant decade for agricultural exports was the 1970s. However, the increase in agricultural export values during the 1970s was offset by a decline in agricultural export values in the final two decades of the study period such that there was no trend in agricultural export values over the whole study period.

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## Appendix 1 Fiji Total Exports

### SUMMARY STATISTICS ON THE DATA (US\$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	181.70	37.54	117.40	252.60	
1970s	215.30	22.99	174.00	251.20	0.00050
1980s	246.60	46.18	194.80	342.90	0.00043
1990s	402.27	88.23	304.50	609.50	0.00031

### PAIRWISE RESULTS

THE BOUND READ IN FOR THE RAC LIMITS IT TO BETWEEN +/- .100000E+00

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 2 CALLED 1970s

THE DISTRIBUTION CDFS CROSS 1 TIMES

2 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 .1000000000

2 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 -.1000000000

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 3 CALLED 1980s

THE DISTRIBUTIONS DO NOT CROSS -- 3 IS DOMINANT

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 4 CALLED 1990s

THE DISTRIBUTIONS DO NOT CROSS -- 4 IS DOMINANT

COMPARING DISTRIBUTION 2 CALLED 1970s TO DISTRIBUTION 3 CALLED 1980s

THE DISTRIBUTION CDFS CROSS 2 TIMES

3 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 .1000000000

3 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 -.1000000000

COMPARING DISTRIBUTION 2 CALLED 1970s TO DISTRIBUTION 4 CALLED 1990s

THE DISTRIBUTIONS DO NOT CROSS -- 4 IS DOMINANT

COMPARING DISTRIBUTION 3 CALLED 1980s TO DISTRIBUTION 4 CALLED 1990s

THE DISTRIBUTIONS DO NOT CROSS -- 4 IS DOMINANT

### COMPOSITE RESULTS

AT ALL RACS THE DOMINANT SET IS 4 1990s

## Appendix 2 Fiji Agricultural Exports

### SUMMARY STATISTICS ON THE DATA (US\$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	153.23	35.31	99.40	230.80	
1970s	173.68	23.70	140.90	218.90	0.00061
1980s	156.42	31.55	127.70	241.10	0.00061
1990s	156.34	16.50	135.00	191.00	0.00064

### PAIRWISE RESULTS

THE BOUND READ IN FOR THE RAC LIMITS IT TO BETWEEN +/- .100000E+00

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 2 CALLED 1970s  
THE DISTRIBUTION CDFS CROSS 1 TIMES

2 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 .1000000000

A BREAKEVEN RAC = -.0453376219 ABOVE WHICH DIST 2 DOMINATES

HERE THE UTILITY DIFFERENCE = .00000000

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 3 CALLED 1980s  
THE DISTRIBUTION CDFS CROSS 2 TIMES

3 HAS BEEN FOUND DOMINANT BETWEEN -.1000000000 .1000000000

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 4 CALLED 1990s  
THE DISTRIBUTION CDFS CROSS 3 TIMES

4 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 .1000000000

A BREAKEVEN RAC = -.0060132117 ABOVE WHICH DIST 4 DOMINATES

HERE THE UTILITY DIFFERENCE = .29042602E-15

COMPARING DISTRIBUTION 2 CALLED 1970s TO DISTRIBUTION 3 CALLED 1980s  
THE DISTRIBUTION CDFS CROSS 1 TIMES

2 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 .1000000000

A BREAKEVEN RAC = -.0335235866 ABOVE WHICH DIST 2 DOMINATES

HERE THE UTILITY DIFFERENCE = .00000000

COMPARING DISTRIBUTION 2 CALLED 1970s TO DISTRIBUTION 4 CALLED 1990s  
THE DISTRIBUTIONS DO NOT CROSS -- 2 IS DOMINANT

COMPARING DISTRIBUTION 3 CALLED 1980s TO DISTRIBUTION 4 CALLED 1990s  
THE DISTRIBUTION CDFS CROSS 1 TIMES

A BREAKEVEN RAC = .0002225467 ABOVE WHICH DIST 4 DOMINATES

HERE THE UTILITY DIFFERENCE = -.42856240E-15

### COMPOSITE RESULTS

BELOW RAC = -.0335235866 THE DOMINANT SET IS 3 1980s

ABOVE RAC = -.0335235866 THE DOMINANT SET IS 2 1970s

### Appendix 3 Fiji Non-Agricultural Exports

#### SUMMARY STATISTICS ON THE DATA (US\$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	28.48	9.71	16.50	45.80	
1970s	41.59	8.57	30.90	59.80	0.0285
1980s	90.18	48.97	46.60	205.70	0.0152
1990s	245.94	79.56	169.50	442.80	0.0060

#### PAIRWISE RESULTS

THE BOUND READ IN FOR THE RAC LIMITS IT TO BETWEEN +/- .100000E+00

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 2 CALLED 1970s

THE DISTRIBUTIONS DO NOT CROSS -- 2 IS DOMINANT

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 3 CALLED 1980s

THE DISTRIBUTIONS DO NOT CROSS -- 3 IS DOMINANT

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 4 CALLED 1990s

THE DISTRIBUTIONS DO NOT CROSS -- 4 IS DOMINANT

COMPARING DISTRIBUTION 2 CALLED 1970s TO DISTRIBUTION 3 CALLED 1980s

THE DISTRIBUTIONS DO NOT CROSS -- 3 IS DOMINANT

COMPARING DISTRIBUTION 2 CALLED 1970s TO DISTRIBUTION 4 CALLED 1990s

THE DISTRIBUTIONS DO NOT CROSS -- 4 IS DOMINANT

COMPARING DISTRIBUTION 3 CALLED 1980s TO DISTRIBUTION 4 CALLED 1990s

THE DISTRIBUTIONS DO NOT CROSS -- 4 IS DOMINANT

#### COMPOSITE RESULTS

AT ALL RACS THE DOMINANT SET IS 4 1990s

## Appendix 4 Fiji Sugar Exports

### SUMMARY STATISTICS ON THE DATA (US\$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	124.24	33.73	66.70	194.90	
1970s	170.14	41.92	118.10	253.90	0.0068
1980s	144.63	17.61	119.80	176.30	0.0064
1990s	136.83	14.60	120.50	165.00	0.0071

### PAIRWISE RESULTS

THE BOUND READ IN FOR THE RAC LIMITS IT TO BETWEEN .100000E

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 2 CALLED 1970s  
THE DISTRIBUTIONS DO NOT CROSS -- 2 IS DOMINANT

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 3 CALLED 1980s  
THE DISTRIBUTION CDFS CROSS 1 TIMES

3 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 .1000000000

A BREAK-EVEN RAC = -.0434938649 ABOVE WHICH DIST 3 DOMINATES  
HERE THE UTILITY DIFFERENCE = .00000000

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 4 CALLED 1990s  
THE DISTRIBUTION CDFS CROSS 1 TIMES

4 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 .1000000000

A BREAK-EVEN RAC = -.0246233104 ABOVE WHICH DIST 4 DOMINATES

COMPARING DISTRIBUTION 2 CALLED 1970s TO DISTRIBUTION 3 CALLED 1980s  
THE DISTRIBUTION CDFS CROSS 3 TIMES

2 HAS BEEN FOUND DOMINANT BETWEEN -.1000000000 .1000000000

COMPARING DISTRIBUTION 2 CALLED 1970s TO DISTRIBUTION 4 CALLED 1990s  
THE DISTRIBUTION CDFS CROSS 1 TIMES

2 HAS BEEN FOUND DOMINANT BETWEEN -.1000000000 .1000000000

COMPARING DISTRIBUTION 3 CALLED 1980s TO DISTRIBUTION 4 CALLED 1990s  
THE DISTRIBUTION CDFS CROSS 1 TIMES

3 HAS BEEN FOUND DOMINANT BETWEEN -.1000000000 .1000000000

### COMPOSITE RESULTS

BELOW RAC = -.0434938649 THE DOMINANT SET IS 2 1970s

BETWEEN -.0434938649 AND -.0246233104 THE DOMINANT SET IS 2 1970s 3 1980s

BETWEEN -.0246233104 AND .0000000001 THE DOMINANT SET IS 2 1970s 3 1980s 4 1990s

ABOVE RAC = .0000000001 THE DOMINANT SET IS 2 1970s

Figure 1 Cumulative density functions, total exports: Fiji

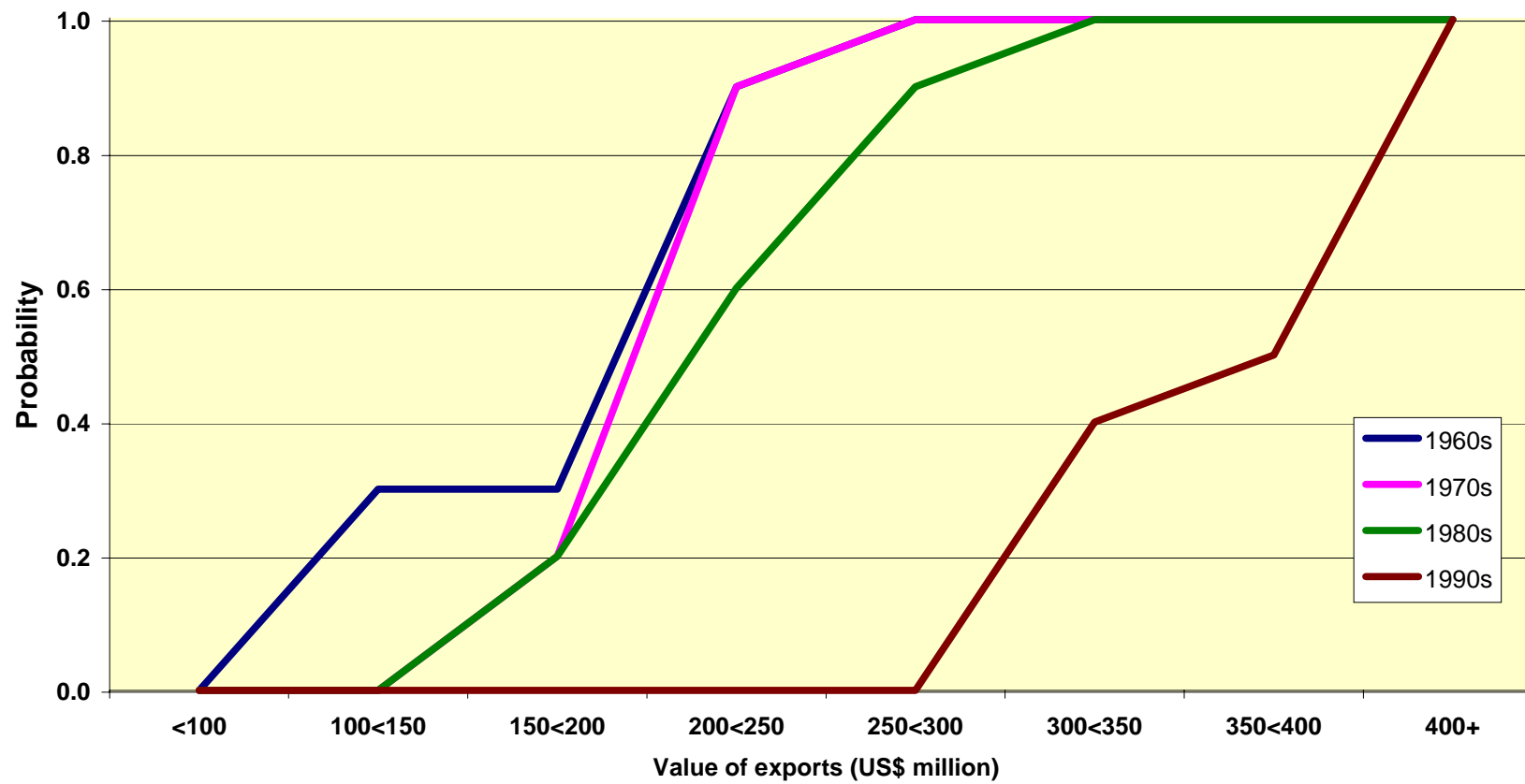
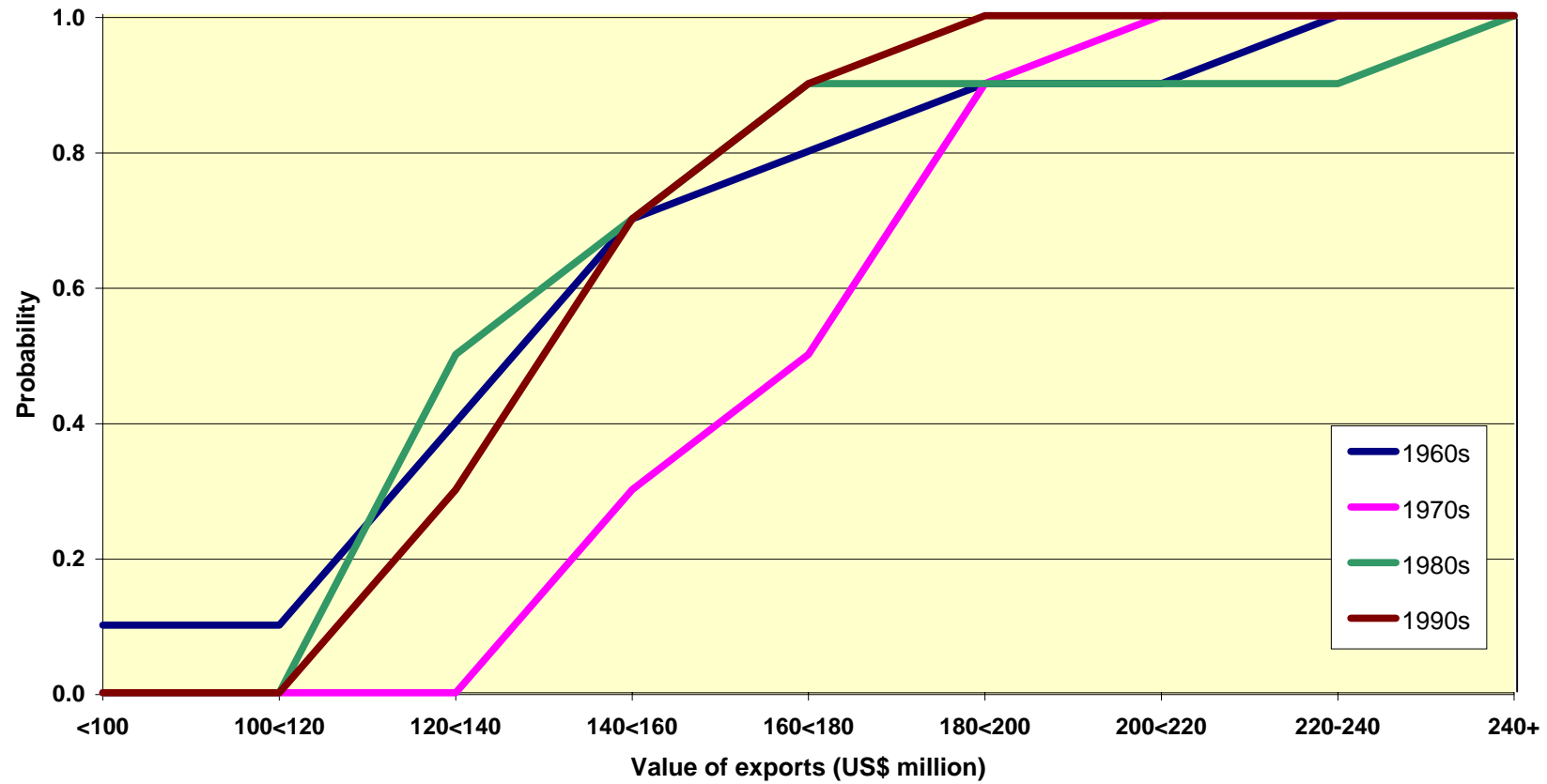


Figure 2 Cumulative density functions, agricultural exports: Fiji



**Figure 3 Cumulative density functions, non-agricultural exports: Fiji**

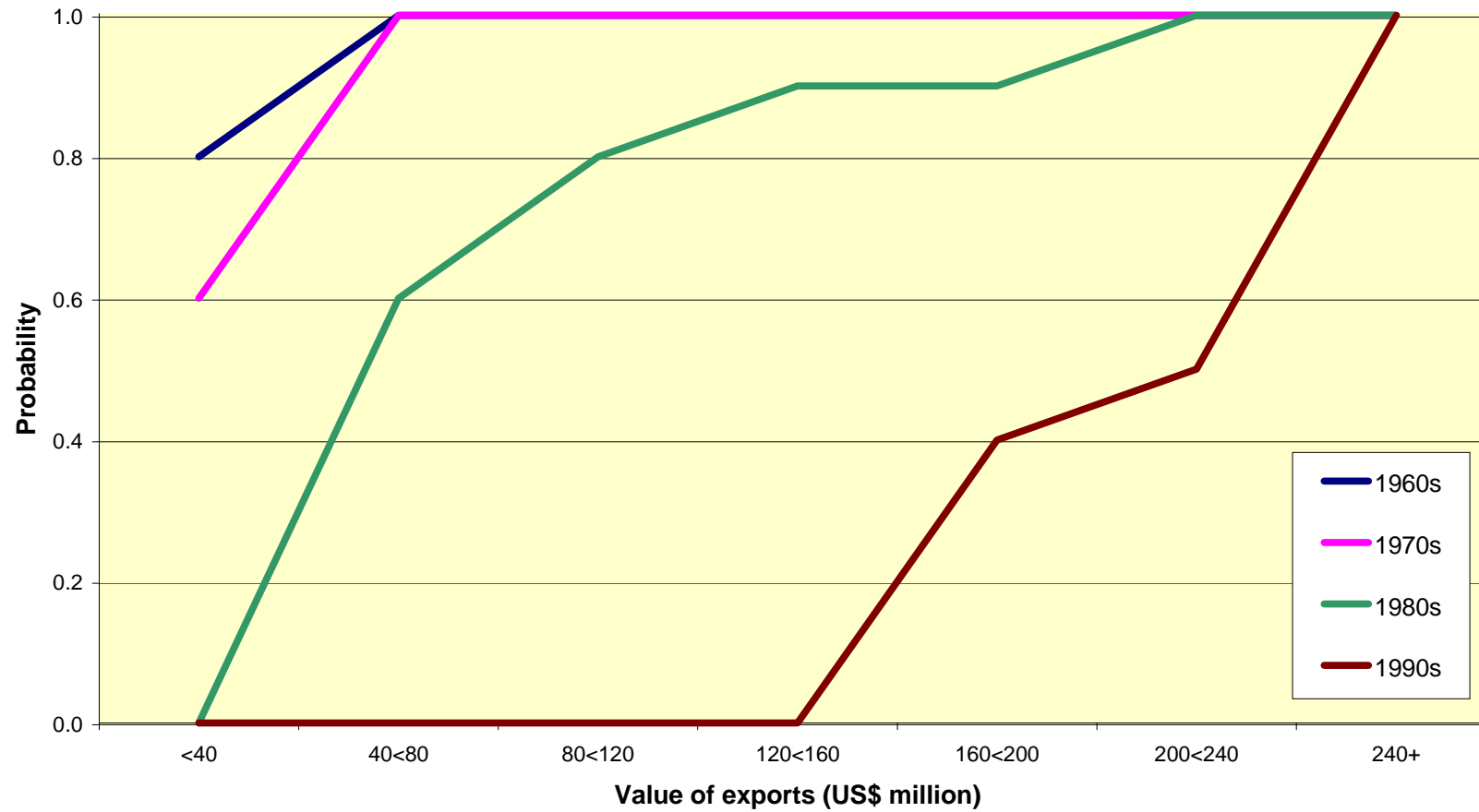




Figure 4 Cumulative density functions, sugar exports: Fiji

