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Export Performance in South Pacific Countries Marginally Endowed with Natural Resources: Samoa and Tonga, 1960 to 1999

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Abstract

Stochastic dominance analysis was used to assess export performance in two Polynesian countries of similar size and structure that are both marginally endowed with natural resources: Samoa and Tonga. In general, total and agricultural export values declined over the study period in both countries, brought about by a significant decline in the value of agricultural exports while non-agricultural exports showed small increases. The one exception to this trend was in Tonga during the 1990s when squash exports brought about a revival in agricultural export values.

Results suggest that these countries are likely to struggle to achieve sustainable economic development, given their limited natural resource endowments. The fisheries sector holds the key to whether their economies can continue to be productive by exploiting further the fishery resources within their EEZs to develop domestic fishing industries.

Key words: export performance; stochastic dominance; Samoa; Tonga.

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1. Overview of Analysis

The question that we attempt to answer in this study is whether developing South Pacific island countries with what Mellor (1997) described as marginal endowments of natural resources were successful in improving commodity export performance over the final four decades of the twentieth century. Commodity export performance is analysed for two independent developing South Pacific island countries, Samoa and Tonga. The period of analysis of export performance, from 1960 to 1999, was dictated largely by the availability of data for a full period of four decades from the 1960s to the 1990s.

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, and then only in a couple of circumstances.

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 in either country for the full study period.

The data used are values of total domestic commodity exports, and disaggregated values of agricultural and non-agricultural exports. To enable comparisons between countries, all series were converted into US dollars using the pertinent annual average exchange rate. The series are converted to real terms in 1999 prices, using the world export unit value index published by the International Monetary Fund (IMF) (2002) as a deflator. All export values are expressed in 1999 US dollars, including values taken from reference sources other than those published by national statistics departments and central banks that were published in nominal local currency terms.

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.

In general, national statistical agencies were the chief data sources, along with central bank publications in both countries. Resort was also made to export value statistics published by IMF (2002), the National Centre for Development Studies (NCDS 1995) and ADB (2002a). The principal national sources were the Department of Statistics (1988), Central Bank of Samoa (2001), Statistics Department (1993) and National Reserve Bank of Tonga (2002).

2. Analysis of Commodity Export Performance: Samoa

Trends in export values in Samoa 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.

Table 1

Linear Trends in Total, Agricultural and Non-Agricultural Export Values in Samoa and Tonga, 1960 to 1999

Country	Trend coefficients in values (*t*-ratios) and annual percentage changes					
	Total exports		Agricultural exports		Non-agricultural exports	
	US$000	%	US$000	%	US$000	%
Samoa	-535.3 (-7.78)	-3.6	-617.8 (-11.17)	-5.0	82.5 (2.73)	3.3
Tonga	-112.8 (-2.53)	-1.0	-205.3 (-4.95)	-2.2	92.5 (9.73)	6.2

2.1 Overall trend

The trends in stochastic dominance of total and agricultural export values in Samoa were both consistently negative across decades, with first-degree dominance. They reflect the difficulties faced by a small and predominantly agrarian nation in upholding the performance of traditional export industries and introducing higher-value export products. Raw and processed agricultural products have continued to hold pride of place among commodity exports.

Export performance over the study period typified the trend in most small economies, with an expansion in non-agricultural export values insufficient to offset a decline in

agricultural export values. Agricultural export values fell annually by US$618 k, significant at less than 1 per cent significance level, an annual average rate of 5.0 per cent. Non-agricultural export values rose by US$82 k, significant at 1 per cent significance level, which was an annual rate of 3.3 per cent. Total export values declined by US$535 k per annum, significant at less than 1 per cent significance level, an annual average rate of decline of 3.6 per cent.

This trend would be quite different were non-agricultural exports to include the sizeable value added of exports of automotive component parts (wiring harnesses) manufactured by a subsidiary of a Japanese corporation, Yazaki Samoa Ltd. Yazaki set up operations in Samoa for export to Australia in the early 1990s, using an almost entirely female labour force (NPO 1992:41), with the incentive of a ten-year tax holiday (Fairbairn 1991:24). However, following the reporting policy adopted by the Central Bank of Samoa (2001), which treats their value-added inflows in the 'other services' category of the balance of payments, these operations have been excluded from domestic export figures. An idea of their influence can be gained from the fact that their net value added would contribute around 30 per cent of total domestic exports over the period 1996-1999 if they were included (Wilson 2001).

2.2 Agricultural exports

2.2.1 1960s and 1970s

Copra, cocoa and banana were traditional exports that dominated both agricultural and total exports in the 1960s. For two of these three products—copra and bananas—their strong export performance in the 1960s was not to be matched in the ensuing decades. The coconut palms providing the nuts for copra production are located immediately behind and extending inland from coastal villages; cocoa trees and banana plants are grown in the mixed-cropping zone inland from the coconut palms (McGregor and McGregor 1999:14).

Copra production was the main export industry in the 1960s and 1970s, accounting for over one-half of export revenue until 1980. Exports in the 1970s averaged US$8.81 million and marginally decreased by US$20 k per year over the decade. The industry stagnated as a result of increased senility among palms, rhinoceros beetle attacks on coconut stems and a declining interest and participation in coconut production among the rural population (Ward and Proctor 1980:398-399).

The 50 per cent decline in the mean value of total exports in the 1970s resulted mainly from the collapse of the banana export industry, which had contributed one-third of all exports at its peak in 1958 (ISNAR 1983:99). Banana exports contracted dramatically during the decade from 1960 levels as production and marketing problems became endemic. Average annual export values in the 1970s were US$0.63 million compared with US$6.18 million in the 1960s. The industry was profitable until 1965, when export values were US$7.3 million, after peaking at US$11.4 million in 1962. Thereafter, production suffered from disease, cyclones and the pervasive marketing problems of supplying the New Zealand market, similar to those experienced by other Polynesian countries. The export value plummeted to US$0.9 million in 1966 before an attempt to revive the industry in the late 1960s led to a recovery to US$3.5 million in 1969.

In contrast to the decline in copra and banana export values in the 1970s, the cocoa export value expanded over the decade, with average receipts of US$5.83 million per year that increased annually by US$152 k. It had declined from the early 1960s until 1972, when the industry was stirred from its torpor by a sevenfold increase in world cocoa prices from 1971 to 1977 (IMF 2002) that reversed its fortunes. Increased unit export values encouraged greater export volumes, and export receipts peaked in 1977 at a level that was never to be achieved again. Although the industry was seemingly prospering, yield declines had already begun in the early 1960s (ISNAR 1983:59), attributable to the widespread adoption of poor planting material (Sumbak 1980:250).

Taro production occurs mainly in areas extending to the forest boundary beyond the mixed-cropping zone that includes cocoa trees and banana plants (McGregor and McGregor 1999:14). The taro export industry commenced on a very small scale in the 1960s, and exports were quite haphazard until the early 1970s by which time taro was included in the official export statistics. In 1971, the value of taro exports was US$0.78 million and it increased to US$2.23 million by 1979, making it the third largest export industry in the country.

Coconut cream exports began in 1975 and reached the respectable level of US$1.20 million by the end of the decade. Dominated by private firms, it was to prove one of the more durable export industries.

2.2.2 1980s

The virtual disappearance of the copra, banana and cocoa industries by the end of the 1980s more than offset a brief period in the 1980s when taro exports expanded

impressively. Exports of the value-adding coconut products of coconut oil and coconut cream also flourished during the decade, the former from 1982 to 1990 and the latter from the mid-1980s. As a result, the decline in the mean annual values of total and agricultural exports over the study period was least during the 1980s.

Coconut oil milling began in 1980 and reached full operating capacity by 1983. It was introduced as a way of adding value to copra and was almost immediately successful; no copra was exported in 1984. The industry was to experience oscillating fortunes over the next 15 years. Success was initially short-lived because operating difficulties with the coconut oil mill led to the resumption of small but nevertheless significant exports of copra from 1985 to 1990. Copra export earnings in 1989 were US$1.31 million compared with US$2.84 million for coconut oil. The export performance of copra and coconut oil exports was hampered by a decline in copra production from its all-time high of 43.1 kt in 1982, which in turn reflected the continuation of a downward trend in world copra and coconut oil prices. A bonus scheme, various subsidies and several major projects had failed to deflect output from this trend (NPO 1992:39). A by-product of coconut oil, copra meal exports began in 1982 and ranged in value between 3 per cent and 10 per cent of the value of coconut oil exports over the rest of the decade, the proportion determined largely by fluctuations in coconut oil world prices. The highest value reached was US$0.49 million in 1983.

Coconut cream overtook copra as the second main user of coconuts for export after coconut oil during the 1980s. Unlike the rollercoaster experiences of the latter, coconut cream processing has been a reasonably stable export industry since affirming its major export presence in 1985 with US$1.55 million of exports. Private processors made these quite impressive gains, despite having to export into a very competitive world market, by adopting product differentiation and market segmentation strategies (Fleming 1996:125-126). The export value of coconut cream reached US$2.07 million in 1989, contributing 20 per cent of agricultural exports.

Cocoa export values declined during the early 1980s with falls in prices and yields, but a recovery began in 1983 as the effects began to be felt of a rehabilitation program in the 1970s and early 1980s that entailed replanting areas with high-yielding *Amelonado* varieties. The volume of cocoa bean exports almost trebled and their unit value almost doubled (NCDS 1995). Despite a decline in volume in 1984, cocoa export values remained above US$1 million until 1987. For the remainder of the decade, however, falling world prices led to a rapid decline in cocoa export values that were only US$0.26

million in 1989. The substantial premium traditionally earned by Samoan cocoa in world markets when *Trinitario* cocoa dominated, making it eligible for sale as 'fine or flavour' cocoa, had disappeared. Samoan beans were being sold at an appreciable discount by 1982-83 (ISNAR 1983:97) and quality continued to deteriorate throughout the 1980s. Toelupe and Coulter (1992:224) and ADB (1985: 170) attributed this decline to poor fermentation, drying and storage practices, and increased plantings of the lower-value *Amelonado* cocoa varieties.

Government attempts to revive the banana export industry in the 1970s and 1980s failed to have any noticeable effect on agricultural export values in the 1980s. The most expensive of these attempts, following a plantation model, began exporting in 1980 (Fairbairn 1985:315) and resulted in an increase in export values from US$0.39 million in 1979 to US$0.53 million in 1982. By 1983, however, this venture had failed and its plantation was abandoned. Banana exports fell to just US$16 k by 1985, and remained around that level for the remainder of the 1980s. Another attempt was made in the late 1980s to rehabilitate the industry based on a small number of specialist producers, but this attempt also failed for reasons apparent as long ago as the late 1960s (Fleming 1996:130). Overall, banana export values averaged US$0.17 million in the 1980s, compared with US$0.63 million in the 1970s, and declined on average by US$51 k per year over the decade.

The taro export industry dominated agricultural exports in the 1980s without government assistance in a difficult trading environment, building on the export potential it had demonstrated in the 1970s. It was based on a market focus strategy directed towards an identifiable market segment in specific Pacific rim markets: those with large expatriate Polynesian populations (Fleming 1996:131). The industry achieved what superficially appeared an unlikely success given the commercial disadvantages identified by Brown (1995:79) as a low value-weight ratio, short shelf life and price volatility. This success was to be sustained over two decades because these commercial disadvantages were offset by many positive attributes: production and product characteristics intimately understood by smallholders and exporters in Samoa and importers in key markets; a strong domestic market base; year-round production; resilience to pests and diseases; low purchased input requirements; low technology requirements at the post-harvest stage; and relatively high returns to labour (World Bank 1991).

Impressive as they are, the official figures used for taro export values in this study under-report taro exports to a major extent. If we had used the probably more accurate World

Bank Mission estimates of the value of exports in the second half of the 1980s (unfortunately the only period for which they are available), taro exports increased massively in value throughout the decade. They reached US$5.59 million in 1989 on the basis of World Bank estimates, more than double the 1979 and 1989 figures of US$2.23 million and US$2.37 million, respectively, using official estimates.

An aid-funded project established a fruit juice processing plant in the mid-1970s to develop a fruit export industry centred on passionfruit juice and pulp. Passionfruit production expanded quickly in the early 1980s after commencing in 1977. Export values of passionfruit juice and pulp reached US$0.6 million in 1985 but alarm bells were already ringing about processing constraints and export marketing difficulties, and the unsustainability of industry subsidies (ISNAR 1983:102). These factors caused a decline in output beyond 1985 as swift as its rise. Exports had contracted to negligible levels by 1987, never to recover, and only US$30 k worth of exports were recorded in 1989.

Kava was exported in the early 1980s, mainly to Fiji, following the development of a small export market during the 1970s. The establishment of a large-scale kava-producing business enterprise in the mid-1980s led to an expansion in exports in the latter half of the 1980s. Export values nevertheless remained at quite low levels throughout the decade.

2.2.3 1990s

Devastating natural and biological disasters largely explain why the 1980s stochastically dominated the 1990s for agricultural exports. They included Cyclone Ofa in February 1990 and Cyclone Val in December 1992, the latter being the most devastating cyclone to hit the country in a century, and the fungal disease of taro leaf blight in 1993 (McGregor and McGregor 1999:11). Despite major aid-funded efforts in the 1980s to rehabilitate the formerly major export industries of cocoa and bananas, chronic problems evident in previous decades persisted into the final decade in these industries.

The taro export industry was at its peak as the major export earner when Cyclone Ofa devastated the agricultural sector in 1990. To make matters worse, it was preceded by an extended dry season in 1989 and followed by a three-month drought (McGregor and McGregor 1999:17). Exports declined sharply as output was diverted to meet domestic market requirements (Clarke 1990:7). The industry nevertheless briefly recovered fully from these setbacks. Official statistics show that the value of exports increased to US$2.45 million in 1991, similar to export values prior to 1990. Taro exports were still buoyant in the first six months of 1993 (McGregor and McGregor 1999:21), when

exports were valued at US$2.65 million, but the onset of taro leaf blight from July of that year decimated the industry.

Unlike most export failures afflicting high-value agricultural industries in the South Pacific, the downfall of the taro industry in 1993 was not due to the pervasive marketing difficulties (Fleming 1996:131). Rather, the production system failed despite the vast experience of growers, although the introduction of taro leaf blight was outside their control. But growers were indirectly responsible for the rapid spread of leaf blight because they had changed from a mixed cropping system with long rotations to more intensive taro cultivation with fewer rotations and more monocropping, making them more susceptible to the damaging effects of pest and disease outbreaks. McGregor and McGregor (1999:10) reported that, prior to the incursion of taro leaf blight, producers were clearing 2400 hectares of forest each year to plant taro.

Taro leaf blight eroded two of the crop's advantageous attributes listed above, namely low use of purchased inputs and resilience to pests and diseases. Leaf blight now compels taro producers to become heavy users of plant protection inputs, placing the taro industry in the high-input category and putting it at a disadvantage to other South Pacific exporters free of leaf blight. The taro export industry thus struggled to regain its former export status in the latter years of the study. By 1999, however, the introduction of new disease-resistant varieties was starting to pay dividends (Central Bank of Samoa 2001:4) and, valued at US$143 k, exports had finally started to return to some significance.

Cyclones Ofa and Val badly damaged coconut production but the full extent of the damage is difficult to assess because of differences in tree loss estimates (McGregor and McGregor (1999:18). Losses were probably in the range from 10 per cent to 15 per cent, but were as high as 80 per cent in some areas and were especially high in areas planted to hybrid palms (McGregor and McGregor (1999:18-19). Along with weak export prices and management problems (Fairbairn 1991:24), the cyclones put an end to significant exports of either copra or coconut oil exports from 1991 until 1995 when production capacity of existing palms was restored (McGregor and McGregor (1999:19).

Increased coconut oil prices between 1993 and 1995 encouraged a private company to lease the existing milling facilities and export US$1.70 million of coconut oil in 1995. Export values were drastically reduced to US$34 k in 1996, but recovered to US$2.16 million in 1997 before declining quite steeply to just US$0.79 million in 1999 as the industry struggled for survival. Exports of coconut oil ceased in October 1998 'pending

resolution of some financial and corporate issues relating to the coconut oil mill' (Central Bank of Samoa 2001:10) before resuming in mid-1999. Copra meal exports waxed and waned with coconut oil exports. Negligible exports were recorded until 1996, when they were valued at US$0.15 million, after which they tailed off for the remainder of the decade.

Copra exports revived along with coconut oil as profitability returned to copra production following a world price recovery in the mid-1990s and loss of the more profitable alternative of taro production. Exports were valued at US$0.67 million in 1995, peaked at US$2.51 million in 1997 and were valued at US$1.63 million in 1999, more than double the value of coconut oil exports and slightly higher than coconut cream exports.

Coconut cream export values were maintained at reasonable levels during the 1990s, despite all the dramas that visited the agricultural sector, although some coconuts had to be imported to maintain output following the cyclone damage (World Bank 1993:7). The industry finished the decade at US$1.53 million, increasing from US$1.25 million in 1998 despite a fall in export price.

The recovery in the export of coconut products in the second half of the 1990s is testimony to the resilience of the production base of the industries involved. But it also reflects a dearth of profitable alternative export industries for smallholders in the absence of taro production (McGregor and McGregor 1999:19). The prospects for supplying coconuts into value-adding industries in the future are still clouded by many difficulties despite the recovery. Fairbairn (1991:18) chronicled the woes of Samoan agriculture in the 1990s: low labour productivity; poor export marketing; falling soil fertility; declining labour supply, volatile and declining export prices; and disease. The coconut oil mill in Samoa is afflicted by many of the disadvantages documented for the oil milling industry in the neighbouring country of Fiji. These disadvantages include low management levels, pest and disease problems, declining tree productivity, high freight charges and irregular transport, high milling costs, low levels and non-uniformity of copra supplies, labour shortages, susceptibility of palms to cyclone damage, and declining world copra and coconut oil prices.

The devastating effects of Cyclones Ofa and Val, and the drought that followed Cyclone Ofa, compounded the negative impact of an extended period of low world prices and virtually destroyed the cocoa industry from 1990 until the present (Fairbairn 1998b:56). Tree losses were heavy due to the long duration of the cyclones and the long exposure to

salt spray, especially after Cyclone Val (McGregor and McGregor 1999:19, 22). Clarke (1992:76) estimated that Cyclone Ofa caused tree losses varying from 10 per cent to 50 per cent from area to area, with an average loss between 20 per cent and 30 per cent. Trees older than 10 years were the most affected. After virtually no exports to 1996, cocoa export values at least recovered to US$44 k in 1996, but exports remained at negligible levels throughout the decade.

As indicated above, the future for banana exports looked bleak at the beginning of the 1990s, their problems aggravated by the cyclones early in the decade. Banana output was confined to supplying the domestic market. A small export recovery ensued in 1993 when bananas valued at US$ 87 k were exported. The export value rose to US$223 k in 1996 after which it fell back to US$136 k in 1999. This brief revival in export activity was in part a response to the need to find alternative export outlets to taro.

The kava industry continues to provide moderate values of exports from a small number of farms. Adverse climatic conditions inhibited substantial export expansion in the early 1990s, but the value of exports rose to US$0.33 million in 1995 and then increased sharply to US$1.72 million in 1998 on the back of a rise in unit export value from US$3844 per tonne in 1995 to US$8578 per tonne in 1998. This rapid export growth was made possible by expanding kava production onto areas previously assigned to taro production that had been abandoned following the outbreak of taro leaf blight (McGregor and McGregor 1999:14, 16). Kava export values declined to US$0.35 million at the end of the decade due to a substantial decline in export price in 1999, a reflection of the precarious nature of access to the pharmaceutical export market, notably in meeting the rigorous quality demands (ADB 2000b:143). While kava plants are susceptible to cyclones, net returns from their cultivation are considered by McGregor and McGregor (1999:22) to be at least sufficient to sustain the loss of a crop at intervals much shorter than the usual incidence of cyclones.

2.3 Non-agricultural exports

Non-agricultural export values showed consistent improvement throughout the study period with later decades dominating earlier ones. Hence, some diversification is evident in the export sector, through timber, veneer and soap exports in the 1970s and 1980s, beer and cigarette exports in the 1980s and 1990s, and fish and garment exports in the 1990s. Unfortunately, these improvements were from a low base, and had minimal effects on

total export performance except for fish exports in the last couple of years of the study period.

2.3.1 1960s and 1970s

While non-agricultural export values in the 1970s stochastically dominated the 1960s in the second degree, the margin was quite small. The mean value increased from US$1.47 million to US$1.69 million while the coefficient of variation also increased slightly. The timber industry had become more important in the economy following the initiation of a plantation forestry program in the late 1960s (World Bank 1995:84). While it contributed significantly to the stochastic dominance of the 1970s early in the decade, its performance later in the decade did not live up to its promise. The value of timber exports declined from US$1.8 million in 1973 to US$0.21 million in 1979 despite the fact that the unit export value increased over the same period. The volume of timber exported in 1979 was less than one-third the volume exported in 1973, partly because of an upsurge in domestic demand for timber during the 1970s (Fairbairn 1985:312-316). Other products, such as soap and handicrafts, helped boost export value in small ways and beer exports commenced in 1979 at US$0.37 million.

2.3.2 1980s

The stochastic dominance of the 1980s over the 1970s for non-agricultural exports owed much to the exports of beer and cigarettes. Foreign corporations, which made their first investments in the country late in the 1970s and at the beginning of the decade, produced these products mainly for the domestic market, with excess supply destined for the export market valued between US$0.46 million and US$0.99 million from 1980 to 1989.

Veneer sheets began to be exported in 1982, contributing US$0.28 million in that year and US$0.23 million in 1986 but no other values of note. As in the 1970s, timber exports were prominent in the first half of the 1980s, peaking at US$0.9 million in 1982. ADB (1985:85) attributed the increased export values to 'increases in prices for timber but also the growing added value of manufactured timber products'. Unfortunately, this trend was not maintained in the second half of the decade and the industry contributed exports valued at only US$55 k in 1989. The decline was due in large part to growing concern about, and action taken to prevent, environmental degradation from logging (Fairbairn 1991:23), increased domestic demand for timber products and a limited supply of the high-quality logs needed for veneer production.

2.3.3 1990s

Events in the 1990s provided some glimmer of hope for diversification as new export opportunities emerged. Fresh fish output grew rapidly towards the end of the 1990s. Its growth was based on a rapid expansion in longline fishing vessels catching predominantly albacore tuna supplied to the two fish canneries in American Samoa, plus some yellowfin and bigeye destined for the US sashimi market. Fish was to become the dominant export industry by 1997 and, by 1999, exports were valued at US$10.8 million, or 60 per cent of total domestic exports, a relative contribution they were to maintain into the new millennium (Central Bank of Samoa 2002). Expansion of volume accounted for this increase in export value as the amount of fish exported increased spectacularly from 212 tonnes in 1995 to 4408 tonnes in 1999. The private sector was the driving force behind the growth of the industry (ADB 2000b:171). This development was something that had not been anticipated. Less than a decade earlier, for example, Fairbairn (1991:22-23) had not been greatly optimistic about export prospects, declaring that 'opportunities [for large-scale ventures] are limited by the extent of deep-water resources, by large capital requirements, and by poor market prospects'. But research work undertaken by the South Pacific Commission from 1977 to 1981 had indicated reasonable potential for a skipjack tuna industry given underutilised resources in the EEZ (ADB 1985:95-96).

In contrast to the growth in fish exports, the exports of forest products remained at negligible levels throughout the decade, with an average annual value of less than US$10 k, as difficulties persisted in forest management and conservation (Fairbairn 1991:21). The sector was now playing a declining role in economic development (ADB 2000b:159). Major cyclone damage to the tree plantations in 1990 and 1992 reduced the forested area from 4500 hectares in 1989 to 2200 hectares in 1992 (World Bank 1995:84).

Beer exports continued to contribute between 5 per cent and 10 per cent of domestic exports during the decade. Cigarette exports, however, lost ground and had become a negligible contributor by the end of the study period.

As mentioned above, inclusion of the net value added by exports of automotive component parts by Yazaki Samoa Ltd to Australia would alter this picture, making the 1990s the dominant overall decade. The sustainability of this industry depends on it retaining duty-free status to enter the Australian market, no certainty in the future. This very narrow export market would disappear with the removal of duty-free status.

Removal was scheduled for 2000 because of a failure to meet rules of origin criteria, but Yazaki obtained a reprieve through a derogation under SPARTECA (Malua 2001).

Garments also emerged as a new non-agricultural export industry late in the decade. They were to become the second most valuable export in the years succeeding the study period, contributing 19 per cent of total export value, behind the fish export contribution of 62 per cent, in August 2002 (Central Bank of Samoa 2002).

3. Analysis of Commodity Export Performance: Tonga

Trends in export values in Tonga 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 4 and for RISKROOT analysis in Appendix 4. Comparable results for agricultural exports are presented in Figure 5 and Appendix 5, and non-agricultural exports in Figure 6 and Appendix 6.

3.1 Overall trend

Total export values in Tonga declined annually by US$112.8 k, or 1.0 per cent, over the study period. This decline was significant at the 2 per cent significance level. A small but highly significant annual increase of US$92.5 k in non-agricultural exports was more than offset by a significant (at less than 1 per cent significance level) annual decline in agricultural exports of US$205.3 k. This is despite the fact that the rate of growth of 6.2 per cent in the former was almost three times the rate of decline of 2.2 per cent in the latter.

The trends in export performance in Tonga are similar to those in the country it most resembles in structure and size, Samoa, with one notable exception. To begin with, the 1960s strongly dominated the 1970s for both total and agricultural exports. Mean annual values of total exports declined by almost one-third in the 1970s and by the same proportion again in the 1980s. The declines in coefficients of variation in succeeding decades did little to offset these falls in mean export values.

So far, so similar to Samoa; but the trend in the 1990s departed conspicuously from that in Samoa, with the 1990s stochastically dominating the 1970s and 1980s in the first degree for total exports. The mean annual value of total exports increased by over one-half in the 1990s while the coefficient of variation declined. The 1990s also stochastically dominated the 1980s in the first degree for agricultural exports, but the 1970s stochastically dominated the 1990s.

Non-agricultural export values were quite small throughout the study period and had little effect on stochastic dominance for total exports despite their steady growth from decade to decade. The 1990s were dominant overall, stochastically dominating the 1980s in the first degree. In turn, the 1980s stochastically dominated the 1970s, but not in the first or second degree, and the 1970s stochastically dominated the 1960s, in the first degree.

3.2 Agricultural exports

3.2.1 1960s and 1970s

Early post-war success achieved by Tongan smallholders with raw material exports, notably bananas, and processed coconut products did not last, and exports of these products followed the same trend as in a number of other South Pacific countries. Nevertheless, they were still the principal exports in the 1960s and into the 1970s until the emergence of a couple of important non-traditional agricultural exports and non-agricultural exports.

Copra exports began the study period as the chief earner of foreign exchange, accounting for 84 per cent of total exports (Kingdom of Tonga 1970). During the 1960s, their export value declined on average by US$0.38 million per year, beginning the decade at US$13.9 million and ending it at US$9.6 million. Copra export share had declined to below 40 per cent in 1967-68 at the height of the boom in banana exports, but recovered to 62 per cent by the end of the decade (Kingdom of Tonga 1970). Copra continued to supply between one-half and three-quarters of the value of total exports for much of the 1970s. It was not until the late 1970s and early 1980s that its proportion of exports began to decline substantially. Even then, this relative decline in importance was due largely to a redirection of coconut output into the production of desiccated coconut and coconut oil.

The copra industry began the 1970s with a sharp drop in export value from US$9.6 million in 1969 to US$5.83 million in 1970, before recovering to US$8.55 million in 1974 during the mid-decade world commodity boom. The export value was still US$7.01 million in 1977. As might be expected with falling world prices and a coconut oil mill coming on stream, copra export revenue declined substantially after 1977 and was US$2.30 million in 1979. Coconut oil exports, which began in 1979, were US$2.55 million in that year.

Desiccated coconut production began in 1962 as a way to add value to coconut products. The highest export value in the 1960s was US$1.79 million in 1968 (Kingdom of Tonga

1970). Exports were at their zenith in the 1970s and early 1980s, with the value of exports peaking in 1970 at US$2.00 million and averaging US$1.18 million throughout the 1970s. At the end of the decade they stood above that average, at US$1.48 million, but the industry was destined never to experience export values in that realm again. The combined value of exports of processed coconut products at the end of the decade was US$6.47 million, two-thirds the value of copra exports a decade earlier.

Dry and green coconuts were exported in unexceptional amounts to Australia and New Zealand during the 1960s. The highest value was achieved in 1963 at US$110 k. Their export was quite a valuable sideline in the coconut industry in the mid-1970s, valued at around US$100 k, but values declined thereafter to US$45 k in 1979.

The history of the banana industry in Tonga is similar to that of other Polynesian countries supplying bananas to the New Zealand market. Banana exports commenced in 1953 and were successful until black leaf disease, irregular shipping, drought and cyclones damaged production late in the 1960s (CPD 1981:136). Banana export values averaged US$3.92 million from 1960 until 1968. They had grown over this period by an imposing annual average of US$0.9 million and the export value achieved at its end was a global high for the industry of US$8.23 million (Kingdom of Tonga 1970). Export volume reached its highest level in 1967 when just under 20 kt were exported (CPD 1981:136). With the onset of production and marketing problems, the export value was reduced to US$3.13 million in 1969 by which year the export share of bananas had fallen to 20 per cent from 45 per cent in the previous two years (Kingdom of Tonga 1970).

The banana export industry had fallen into disrepair by the 1970s, and export values oscillated between US$0.84 million and US$2.02 million in the first half of the decade, well below levels of the 1960s. The first of two unsuccessful attempts was made to revive the industry in the latter half of the 1970s. Named the Banana Rehabilitation Project, it focused on disease control and fertiliser use (Felemi 1991), with the aim of boosting export volume from 110 000 cases in 1974 to 400 000 cases by 1980. In the event, only 87 057 cases were exported in 1980, slightly down on the 1979 level and a disappointing 22 per cent of the target (CPD 1981:137). The banana export value in 1979 was US$114 k, 37 per cent of the value of US$309 k prevailing prior to implementation of the Banana Rehabilitation Project.

Numerous minor exports of high-value non-traditional (HVNT) crops did not reach such significant proportions that they could replace traditional exports, but watermelons

deserve special mention if only to highlight some of the hazards in HVNT export development. Some success was achieved in the export of watermelons during the 1960s. Although a minor export, values increased by almost US$15 k per year and averaged US$0.15 million annually over the whole decade. Export quantities grew in the 1970s and were valued at around US$0.5 million in the middle of the decade before declining to US$0.18 million in 1980. This expansion in watermelon production for export to the New Zealand market reflected the fact that it was, and remains, a potentially profitable activity (Gyles, Hardaker, Felemi and Verspay 1989). But its potential has not been fully realised, as is demonstrated below in the discussion of export experience in the 1980s and 1990s.

Like watermelon exports, root crop exports were at modest but promising levels in the 1960s, peaking at US$0.19 million in 1963. They expanded after 1974 from their low levels in the 1960s and early 1970s, reaching US$0.34 million in 1976 and US$0.67 million by 1980.

Various other fruits and vegetables were exported in small and variable quantities throughout the 1960s and 1970s, chiefly to New Zealand. Export values were very small in the 1960s although they increased as the decade drew to a close. By 1969, the combined export value of various fruits and vegetables, excluding watermelons and root crops, had reached US$0.36 million but was still only 2.3 per cent of the total export value in that year. Values continued at modest levels in the early 1970s although buoyant sales to New Zealand in 1971, dominated by tomatoes and capsicums, were valued at US$0.54 million. The export value fell below US$0.2 million in the mid-1970s, a consequence of low prices in New Zealand and quality problems (CPD 1976:181), before increasing to US$0.40 million by 1980.

Vanilla has been something of an enduring success story in the export of HVNT crops in the South Pacific, its success in large part attributable to the key role that women play in its activities (Felemi 2001:3-4). Over 2000 farmers have participated in its production, especially in Vava'u. Exports began in 1968 but were valued at only US$32 k in 1969. They grew slowly in the early 1970s, initiated by a few private individuals who were assisted by a non-government organisation in linking growers to foreign buyers. By 1978, vanilla exports were worth US0.30 million. They declined steeply to US$64 k at the end of the decade, but fortunes were to be quickly revived early in the following decade.

Kava began to show promise as an export crop based on the Fijian market in the early 1970s, when agricultural planners were forecasting that it would become a valuable niche

export because of its high returns to labour, multiple market outlets, easy integration into the farming system and high value-weight ratio (Rathsmann 1981). Exports were first recorded in the early 1970s but at negligible levels. This situation changed in 1974 when the export value jumped to US$0.13 million and then peaked at US$0.42 million two years on. It declined to less than one-half this figure for the remainder of the decade.

3.2.2 1980s

The 1980s followed a similar course to previous decades, being stochastically dominated by the 1970s in the first degree, despite some success with exporting an HVNT crop in vanilla. Sturton (1992:9) was moved to describe the performance of the agricultural sector in this decade as 'dismal'. The decade did not get off to a very good start, with a cyclone in 1982 suppressing agricultural output for two years (Anon. 1986:2). Exports of coconut products continued to decline despite efforts to rejuvenate the industry in the second half of the 1970s by replanting 11.52 kha, or around one-quarter of the area under palms (CPD 1981:132). Twenty six per cent of palms were still senescent or senile in the mid-1980s (Fairbairn 1985:73).

The government held out the hope that the introduction of coconut oil milling in 1979 would usher in renewed prosperity for participants in the coconut industry. The auguries were good a few years into the decade when the value of coconut oil exports rose to US$5.1 million in 1984 and US$4.4 million in 1985, stimulated by high world prices. But the value had fallen swiftly to US$0.7 million by 1989.

Copra export should have ceased soon after the commencement of oil milling, but it continued at low levels throughout the 1980s and into the early 1990s. Prior to the milling of coconut oil, copra production had already begun to suffer from an increasing proportion of low-yielding palms, and falling real world prices and profits, exacerbated by drought conditions in 1987-88 (World Bank 1991:248). Copra export volume in 1989 (2003 tonnes) was a mere 38 per cent of the 1985 volume (5288 tonnes) despite an average annual decline of 18 per cent in coconut oil exports in the second half of the decade.

Desiccated coconut exports initially increased to US$0.89 million in 1981, after dipping in 1980 to well below the 1979 level, but thereafter went into rapid descent and negligible values were recorded for the remainder of the decade except for a brief recovery in 1984 when exports were valued at US$0.75 million. The factory closed in early 1989 (Sturton

1992:10). 'Akolo (1992:205) ascribed industry failure to labour shortcomings, difficulties in maintaining a consistent quality and technical problems in processing.

A second attempt to revive export banana production was put in place in 1982 (MAFF 1981:17). It had some initial success, with export volume more than quadrupling from 595 tonnes in 1982 to 2579 tonnes in 1985 and peaking at 3431 tonnes in 1987. To put this increase in perspective, however, the 1987 volume was a trifling 17 per cent of the maximum quantity exported 20 years earlier. The value of exports reached US$0.97 million in 1987, but Felemi (1991) showed that the revitalisation effort was really doomed from the start, maintained only by large project subsidies. Not only was there a failure to solve earlier problems, but changed marketing conditions, cessation of a New Zealand aid program for the industry (World Bank 1991:251), poor disease control resulting in discovery of fruit fly in a consignment of plantain to New Zealand (World Bank 1990:15) and adverse climatic conditions made it ever more difficult for Tongan producers to compete. By 1989, the value of banana exports had fallen to US$0.15 million, a victim of strong winds (Sturton 1992:9), and once again the industry had reverted to a shadow of its former prosperous self in the 1960s.

The modest progress made in vanilla exporting in the 1970s changed dramatically at the beginning of the 1980s when world prices more than quadrupled from 1978 to 1980 (Menz and Fleming 1989:28). A cyclone in 1976 in the major vanilla-producing country, Madagascar, led to a rundown of US stocks of vanilla in the late 1970s and combined with other factors constraining exports in Madagascar to raise prices to record levels (Menz and Fleming 1989:28). Significant area and supply response to price by Tongan producers (Fleming 1988), facilitated by a development project (Fleming and Hardaker 1992), caused the vanilla export volume to increase from 1.9 tonnes in 1979 to 13.2 tonnes in 1984 (Menz and Fleming 1989:29). Export value almost quadrupled from US$0.30 million in 1980 to US$1.10 million in 1984. After an abrupt decline in export value in 1985 in response to a lower world price, the industry picked up to end the decade at US$1.60 million, thanks mainly to a doubling of export volume between 1985 and 1989 brought about by new plantings (World Bank 1991:252). This increase took place despite a hiccup in 1987-88 caused by drought and heavy cropping that stressed the plants (World Bank 1991:249).

Tongan exporters have diversified their root crop exports without achieving any great gains in export values. Exports varied between US$0.2 million and US$0.7 million from 1980 to 1985, with major variations in product mix. Taro exports declined during the late

1980s in favour of yam exports, only to recover impressively by 1989 when their export value was US$0.41 million out of total root crop exports of US$1.15 million.

A harbinger of a massive change that was to make itself felt in farming systems in Tonga appeared in 1987 with the initial export of squash pumpkin (or buttercup squash, hereafter referred to simply as squash) from Tonga to Japan during the December-January seasonal window. This was quite a feat as Japan is one of the most difficult agricultural markets in which to satisfy quality standards. The industry was established by a private firm from New Zealand whose activities were critical to achieve early market penetration (World Bank 1990:15). Control over exporting activities passed to the Tonga Growers Association in 1989, which distributed export licences. Various government agencies provided assistance in the areas of credit provision, production and market research support, negotiation of forward contracts, quality control, assistance with packing and shipping, setting and distributing quotas to limit export volumes, and the execution of what was in effect a program for guaranteeing grower price (Fleming 1996:97). Exports commenced in 1987 with 153 tonnes and by 1989 had reached 3013 tonnes, valued at US$0.88 million. As an indication of the rapidity with which the export market opened up, the export volume in 1989 overshot the target volume of 2000 tonnes by more than 50 per cent. As in vanilla production, women quickly assumed an important role in squash production (Tau'felangiki 1991, cited by Ironmonger and Hill 1998:21).

Kava exports initially recovered from their low value in 1979 (CPD 1981:141) and were quite substantial in the early 1980s, reaching US$0.30 million in 1981. But they declined quickly with greater incidence of wilt. No export of note was achieved for the rest of the decade despite considerable effort to establish the complex causes of the disease.

The value of exports of dry and green coconuts, mainly to Australia, rose quite sharply in the latter half of the 1980s after declining to trivial volumes in the early 1980s. Values reached US$0.14 million in 1986.

A mini boom in watermelon exports to New Zealand occurred in the early 1980s, led primarily by private exporters (Rathey 1984:157). Watermelon exports were valued at US$0.65 million in 1983, making them the second most important agricultural export after coconut oil. But success was not maintained due to the presence of fruit fly, with larvae found in a shipment of watermelons to New Zealand in 1985 that stopped melon exports and resulted in an embargo on all other fruit and vegetable exports (Sturton 1992:9). The embargo was lifted in 1989 and a start was made to export melons again

through registered growers, subject to regular inspections domestically and monitoring by New Zealand quarantine officials at the point of import (Fleming and Hardaker 1995:52).

Values of other fruits and vegetables reached US$0.21 million in 1983, capsicum the major contributor with US$79 k, but had plunged to negligible quantities by 1988. The contraction was due to domestic competition for resources from the squash and other industries, fruit fly problems in other exports to New Zealand, and limited export market potential (World Bank 1990:16). A passionfruit project in 1982 led to the construction of a processing factory and a modest export industry was established. But a plethora of production, processing and marketing problems meant that export values never reached sizeable levels.

3.2.3 1990s

Export values of agricultural exports in the 1990s stochastically dominated those in the 1980s in the first degree, but they were still dominated by values in the 1960s and 1970s. Perhaps agricultural export performance in Samoa would have matched that in Tonga had taro leaf blight not occurred. This comparison indicates how vulnerable small countries with a narrow export base can be to a single natural, environmental or biological disaster, or loss of a market niche.

The stochastic dominance over the 1980s was due to the continued success of an HVNT industry that commenced in the 1980s: the export of squash to Japan. These exports overshadowed all other exports, heralding one of the most outstanding success stories of the study period across all South Pacific countries. It demonstrates 'how quickly and energetically smallholders will respond to economic incentives when production and marketing circumstances are propitious' (Fleming 1996:97). The number of squash exporters rose rapidly from 2 in 1989 to 13 in 1996, before settling back to 7 in 1999 (Felemi 2001:7).

The average annual squash export value was US$5.2 million in the 1990s, with a moderate coefficient of variation of 0.34. Revenue variability was mainly caused by extremes in seasonal conditions, from excellent seasons in 1991, 1993 and 1994 (Manu 2001) to poor seasons in 1995 and 1998, causing large variations in export volumes. But these volume fluctuations were counteracted to some extent by price movements in the opposite direction caused by the price-inelastic demand of Japanese buyers. The high volume and low price that occurred in 1994 exemplifies this situation (Temu, Hunt and Chandra 1995:19).

A taste of what might transpire if the squash industry were to experience difficulties occurred in 1998 when drought and Cyclone Cora (Felemi 2001:2) resulted in agricultural exports sinking to their lowest value (US$5.1 million) for a decade. A number of analysts have posed the question whether the industry can last or is another example of the 'boom-bust' syndrome that is part way through the process. Felemi (2001:9-12) outlined the constraints and prospects for the squash industry in the future. He covered key issues such as production research and development, access to credit and the heavy reliance on purchased production inputs, labour constraints, organisation and regulation of the industry, land tenure and use, environmental degradation and export marketing. Fleming (1996:98) concluded that conditions are favourable for defence of the niche but dangers exist. They include foreign competition, conflict with the traditional farming system, greater exposure to the incidence of pests and diseases, soil degradation, politicisation and bureaucratisation of the industry, threats to the maintenance of quality and increasing farm debt. The substantial fall in price received for the 1994 crop as a result of the increased supply of a lot of poor-quality produce in that year was a 'wake-up' call to the industry on how sensitive profitability is to inadequate marketing management processes. Fortunately, to their credit, participants in the industry have so far heeded the call.

While squash, root crop and kava activities lifted export performance in agriculture in the 1990s, other factors militated against agricultural exports, notably droughts in 1995 and 1998. Also, three traditionally prominent exports—coconut products, bananas and watermelons—continued their secular decline for reasons already mentioned, to the extent that their export values had become negligible by the end of the study period.

Coconut oil ceased to be a significant export. Fleming (1996:92) identified four contributory factors to the downfall of the coconut oil industry: a depressed world market and declining margin between copra and coconut oil; poor mill management, resulting in low productivity; uneconomic levels of mill throughput; and competition for agricultural labour from the squash export industry. Add the fact that 40 per cent of coconut palms are to become senescent in the next decade (ADB 2002b:153) and there is little prospect of revival of the coconut products export sector, despite what ADB (2002b) viewed as misplaced government efforts to revive the industry that are currently under way.

Fleming and Hardaker (1995) attributed stagnant vanilla export values in the early 1990s to a shift by many growers into squash production and marketing difficulties created by ill-managed vanilla buying by the Tonga Commodities Board. Dire conditions in 1997

and 1998, brought on by a severe weakening of world vanilla prices (Fairbairn 1998a:27), resulted in negligible exports of vanilla beans. A limited recovery occurred in 1999 when the export value increased to US$0.63 million but, despite this recovery, vanilla exports in 1999 were only one-third their value at the beginning of the 1990s.

The future of the vanilla export industry in Tonga depends on the relative strengths of a number of opportunities and threats. On the positive side, adaptability, ease of production, absence of major pests and diseases, simple and cheap value-adding processing activities, a skilled and knowledgeable industry workforce, storability of beans, easy transportability, affinity with traditional agriculture and sound prospects for profitable production favour continuing success (Menz and Fleming 1989:7-9, Vinning 1990:33). Another positive feature is the presence of a good deal of entrepreneurship among participants in the industry. Witness the current efforts to develop tissue culture (ADB 2002b:153). Against these advantages, four potential dangers are the pressures from high labour commitment in production and curing, difficulties in maintaining quality, the lingering threat of a major outbreak of disease and, paradoxically, the attractiveness of vanilla as an export crop to many governments throughout the developing world, including other South Pacific countries, that could lead to a substantial increase in world supply and plummeting profits for vanilla producers in Tonga (Menz and Fleming 1989, Vinning 1990:32).

Three other agricultural products traditionally grown in farming systems but mainly for domestic consumption—root crops, kava and nonu leaves—experienced increased export values in the 1990s. While their contributions were minor relative to squash, they helped in a small way to establish stochastic dominance for the 1990s over the 1980s. The importance of root crop exports continued into the 1990s with their total export value in 1996 matching the 1989 figure of US$0.7 million, a level they failed to reach again during the remainder of the decade. The export value of all root crops was just US$0.4 million in 1999, most of which was contributed by cassava; taro contributed only US$19 k. Tongan taro has generally been much less prominent than taro exports from other Polynesian countries because their varieties are less preferred and marketing methods applied in penetrating the New Zealand market have been inferior (Fleming and Hardaker 1995:225).

After overcoming the effects of kava wilt, exports of kava were once again generated in reasonable quantities late in the study period, notably US$1.8 million in 1998 and US$0.4 million in 1999, partly as a response by growers to reduced returns in vanilla production

(ADB 2002b:153). ADB pointed out that Tongan exporters were experiencing difficulty in meeting the requirements of consistency of quality and supply in the German pharmaceutical market.

The export of nonu leaves commenced only in 1998, at a negligible level. But they quickly gained prominence, with the export value reaching US$0.80 million in 1999, higher than the vanilla export value in that year.

The export of watermelons and rockmelons had recommenced late in the 1980s, and reached a value of US$103 k in 1993. But values remained below US$100 k for the remainder of the decade, well short of their levels of the early 1980s despite their potential. Production and marketing management, especially the eradication of fruit fly and effective implementation of quarantine protocols, are the keys to market recovery (World Bank 1990:16).

3.3 Non-agricultural exports

The outcomes for non-agricultural exports in Tonga mirror those in Samoa. There was a consistent improvement in export performance, with successive decades stochastically dominating the previous one, but from a very low base. The mean annual non-agricultural export value in the 1960s was only US$0.47 million. Nevertheless, it suggests a minor success in diversifying the export sector, in two main directions.

First, this success was most notable in the fishing industry, which performed satisfactorily (Sturton 1992:37). Marine exports first started to increase in value in the early 1980s with frozen fish exports increasing to US$0.43 million in 1984 and US$0.54 million in 1986. Fairbairn (1998a:27) related how commercial fishing for export began to grow in the late 1980s, with emphasis on the sale of high-grade tuna and snapper to USA, Fiji and American Samoa. The off-shore tuna industry comprises mainly medium-scale longlining vessels that are privately owned (ADB 2002b:171). Fresh, frozen and chilled fish exports initially peaked in 1988 at US$1.67 million, treble the 1986 figure, then halved to US$0.80 million in 1989. They accomplished a new high in 1995 at US$2.6 million, due to greater private sector involvement following the removal of a government monopoly, before drifting downwards over the three years to 1998. Fairbairn (1998a:27) attributed this fall to reduced production of bêche-de-mer and lower export prices. But export values recovered to a new high of US$3.7 million in 1999, due in part to the growth of exports of aquarium fish, coral, giant clam and invertebrates that were valued at US$0.5 million in that year (ADB 2002b:170). The key tuna industry faces two major

problems despite the recent implementation of a National Tuna Management Plan (ADB 2002b:182-183): concentration of industry power in the hands of a small group and the typical open-access problem of an incentive to expand fishing effort beyond its sustainable level. Resolution of these problems is not helped by government neglect to declare its EEZ so far (ADB 2002b:190).

The second story has to be heavily qualified because it does not have a very happy ending, although it does provide a couple of useful lessons. Manufactured exports excluding processed coconut products increased in the 1990s. They were produced mainly by industries operating in the Small Industries Centre, which was established in the 1980s. Manufacturing firms, of which there were 120 in 1987, were provided a range of fiscal and other special incentives by the government ('Ata'ata 1987:27) to overcome land and infrastructure constraints (ADB 1996:79). Their employees had responded well to an upgrading of their skills (Siwatibau 1989:7). The 'high water mark' in manufactured exports was reached in 1989 when they were valued at US$2.2 million, comprising mainly knitwear exports (World Bank 1991:246). This value was more than double the export value two years earlier. McGregor (1989:16-18) summarised the history of the development of the knitwear export industry, dominated by the New-Zealand-owned South Pacific Manufacturing Company, and the factors behind its success. Women comprised most of the workers in the industry (Ironmonger and Hill 1998:25). McGregor (1989) also highlighted the limiting factors of identifying suitable investors and their accommodation by appropriate administrative systems, but did not foresee how large the problems facing the industry would loom by the early 1990s. Export values declined just as dramatically as they had risen, falling to US$0.42 million by 1995/96. This decline was due mainly to three factors: the closure of South Pacific Manufacturing Company in 1993 (ADB 1996:21) and other export-oriented factories, the gradual erosion of trade preferences under SPARTECA (Fairbairn 1998a:27, Ironmonger and Hill 1998:25) and high labour turnover (Hess 1996:6, cited by Ironmonger and Hill 1998:25). By this time, only four of the firms operating at the Small Industries Centre were exporting (ADB 1996:59).

Tonga does not have the considerable forest resources of many other South Pacific countries, and tends to be a net importer of forest products. Nevertheless, exports of sandalwood fetched decent values in the 1970s, 1980s and 1990s, sporadically surpassing US$100 k. The year of highest export value was 1995, at US$0.33 million. But sandalwood scarcely rated a mention as a forestry resource by the World Bank (1990,

Annex 5) and Central Planning Department (1991:153:154) and exports were negligible in the final two years of the study period. ADB (2002b:166) mentioned it as just one of many species in a timber plantation on 'Eua.

4. Conclusions

Stochastic dominance analysis was used to assess export performance in Samoa and Tonga, which are two South Pacific island countries that are of similar size and structure, marginally endowed with natural resources. In general, total and agricultural export values declined over the study period in both countries, brought about by a significant decline in the value of agricultural exports while non-agricultural exports showed small increases. The one exception to this trend was in Tonga during the 1990s when squash exports brought about a revival in agricultural export values.

The trends in stochastic dominance of total and agricultural export values in Samoa were both consistently negative across decades, with first-degree dominance. They reflect the difficulties faced by a small and predominantly agrarian nation in upholding the performance of traditional export industries and introducing higher-value export products. Raw and processed agricultural products still dominate commodity exports. Agricultural export values fell by an annual average rate of 5.0 per cent. Non-agricultural export values rose by an annual rate of 3.3 per cent.

Total export values in Tonga declined over the study period by 1 per cent per annum. An annual increase in non-agricultural exports of 6.2 per cent was more than offset by a 2.2 per cent annual decline in agricultural exports because of the very low base from which non-agricultural exports began in the 1960s.

Results suggest that these countries are likely to struggle to achieve sustainable economic development, given their limited natural resource endowments. The fisheries sector holds the key to whether their economies can continue to be productive by exploiting further the fishery resources within their EEZs to develop domestic fishing industries.

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Appendix 1 Samoa Total Exports

SUMMARY STATISTICS ON THE DATA (US$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	26.05	5.54	17.60	34.60	
1970s	18.55	4.24	11.80	24.10	0.0448
1980s	14.52	4.01	10.30	22.30	0.0605
1990s	8.62	4.81	2.90	17.60	0.0864

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 -- 1 IS DOMINANT

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

THE DISTRIBUTIONS DO NOT CROSS -- 1 IS DOMINANT

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

THE DISTRIBUTIONS DO NOT CROSS -- 1 IS DOMINANT

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

THE DISTRIBUTIONS DO NOT CROSS -- 2 IS DOMINANT

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 DISTRIBUTIONS DO NOT CROSS -- 3 IS DOMINANT

COMPOSITE RESULTS

AT ALL RACS THE DOMINANT SET IS 1 1960s

Appendix 2 Samoa Agricultural Exports

SUMMARY STATISTICS ON THE DATA (US$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	24.58	5.30	15.70	31.80	
1970s	16.87	4.42	10.30	22.80	0.0483
1980s	12.27	3.28	8.20	17.80	0.0686
1990s	4.87	1.48	1.80	7.10	0.1167

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 -- 1 IS DOMINANT

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

THE DISTRIBUTIONS DO NOT CROSS -- 1 IS DOMINANT

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

THE DISTRIBUTIONS DO NOT CROSS -- 1 IS DOMINANT

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

THE DISTRIBUTIONS DO NOT CROSS -- 2 IS DOMINANT

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 DISTRIBUTIONS DO NOT CROSS -- 3 IS DOMINANT

COMPOSITE RESULTS

AT ALL RACS THE DOMINANT SET IS 1 1960s

Appendix 3 Samoa Non-Agricultural Exports

SUMMARY STATISTICS ON THE DATA (US$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	1.47	1.00	.06	3.12	
1970s	1.69	1.04	.51	3.80	0.6329
1980s	2.24	.95	1.20	4.48	0.5089
1990s	3.74	3.99	1.05	12.60	0.3344

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 2 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 DISTRIBUTION CDFS CROSS 2 TIMES
4 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 .1000000000
4 HAS BEEN FOUND DOMINANT BETWEEN .0000000000 -.1000000000

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 DISTRIBUTION CDFS CROSS 1 TIMES
4 HAS BEEN FOUND DOMINANT BETWEEN -.1000000000 .1000000000

COMPOSITE RESULTS

BELOW RAC = .0000000001 THE DOMINANT SET IS 3 1980s 4 1990s

ABOVE RAC = .0000000001 THE DOMINANT SET IS 4 1990s

Appendix 4 Tonga Total Exports

SUMMARY STATISTICS ON THE DATA (US$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	13.95	3.30	8.40	18.20	
1970s	9.76	1.88	6.60	12.50	0.0844
1980s	6.91	1.66	3.90	10.20	0.1200
1990s	10.82	2.13	7.90	14.70	0.1128

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 -- 1 IS DOMINANT

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 3 CALLED 1980s
THE DISTRIBUTIONS DO NOT CROSS -- 1 IS DOMINANT

COMPARING DISTRIBUTION 1 CALLED 1960s TO DISTRIBUTION 4 CALLED 1990s
THE DISTRIBUTIONS DO NOT CROSS -- 1 IS DOMINANT

COMPARING DISTRIBUTION 2 CALLED 1970s TO DISTRIBUTION 3 CALLED 1980s
THE DISTRIBUTIONS DO NOT CROSS -- 2 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 1 1960s

Appendix 5 Tonga Agricultural Exports

SUMMARY STATISTICS ON THE DATA (US$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	13.46	3.34	7.60	17.80	
1970s	8.81	2.00	5.50	11.70	0.0898
1980s	5.33	1.71	3.30	8.60	0.1414
1990s	7.54	1.94	5.10	10.90	0.1554

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 -- 1 IS DOMINANT

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

THE DISTRIBUTIONS DO NOT CROSS -- 1 IS DOMINANT

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

THE DISTRIBUTIONS DO NOT CROSS -- 1 IS DOMINANT

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

THE DISTRIBUTIONS DO NOT CROSS -- 2 IS DOMINANT

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 DISTRIBUTIONS DO NOT CROSS -- 4 IS DOMINANT

COMPOSITE RESULTS

AT ALL RACS THE DOMINANT SET IS 1 1960s

Appendix 6 Tonga Non-Agricultural Exports

SUMMARY STATISTICS ON THE DATA (US$ M)

Distribution	Mean	Std dev	Min	Max	RAC
1960s	.47	.15	.30	.81	
1970s	.95	.21	.64	1.31	1.4085
1980s	1.58	1.06	.37	3.58	0.7905
1990s	3.28	.82	2.60	5.50	0.4115

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 DISTRIBUTION CDFS CROSS 1 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

Figure 1 Cumulative density functions, total exports: Samoa

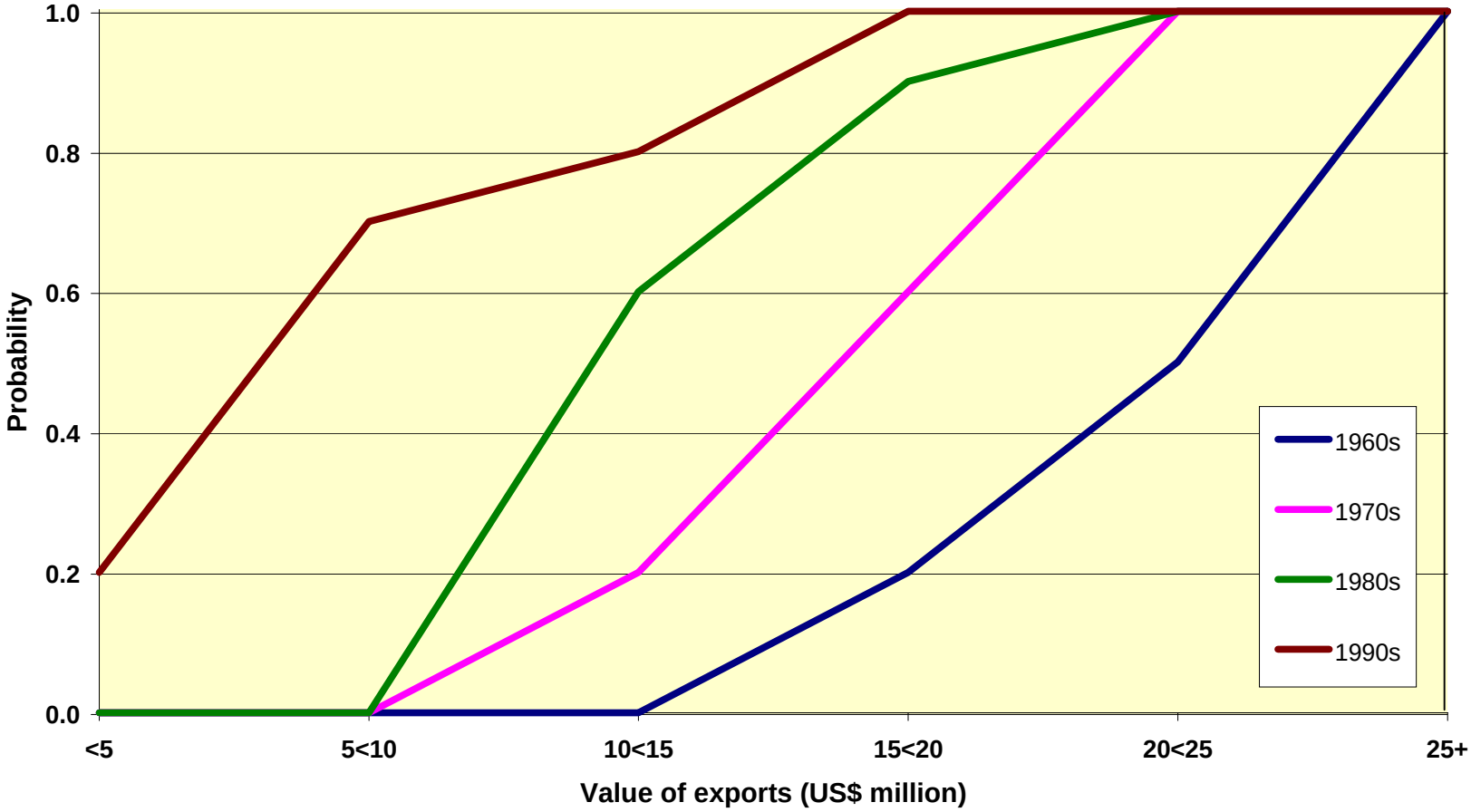

Figure 2 Cumulative density functions, agricultural exports: Samoa

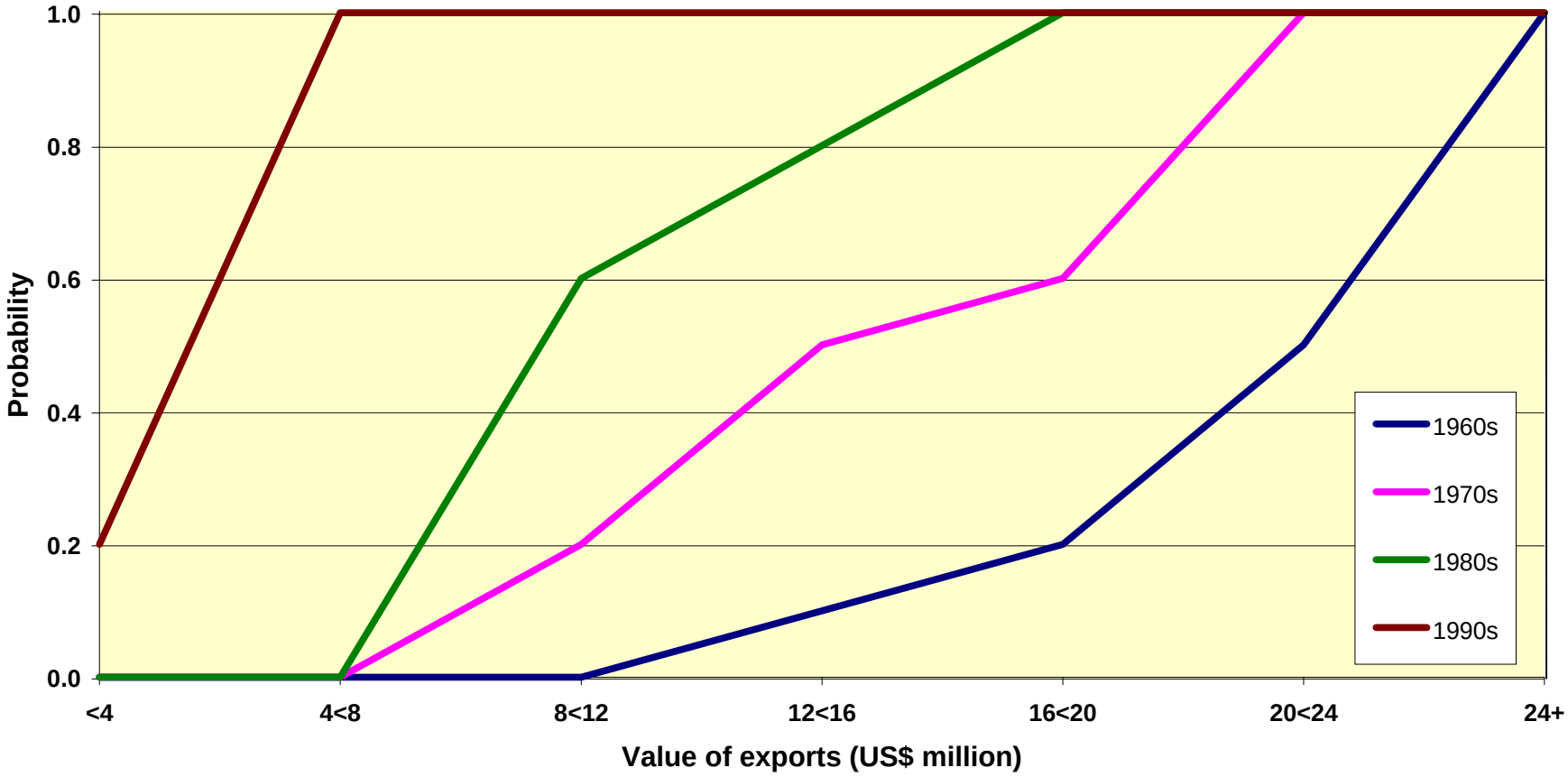

Figure 3 Cumulative density functions, non-agricultural exports: Samoa

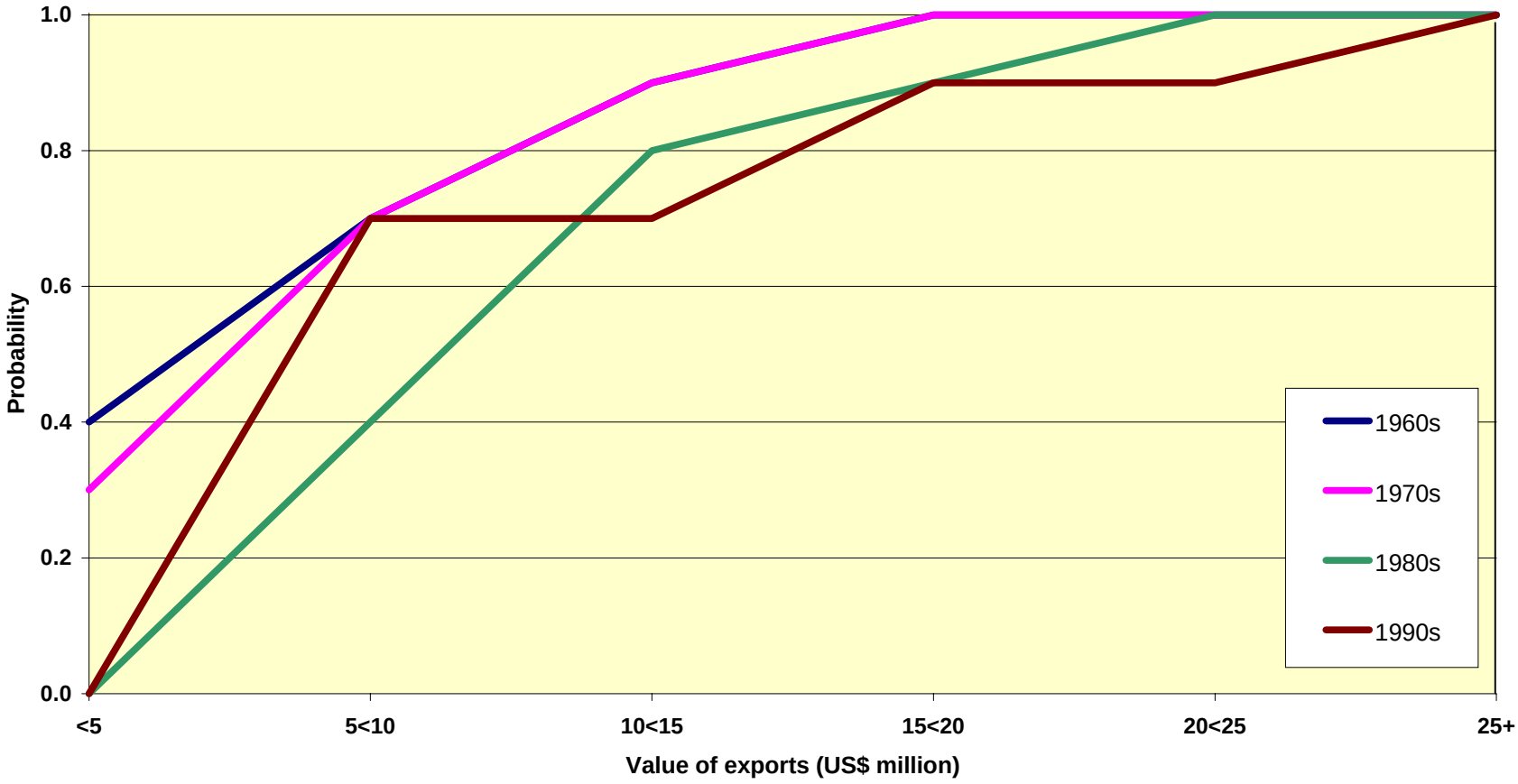

Figure 4 Cumulative density functions, total exports: Tonga

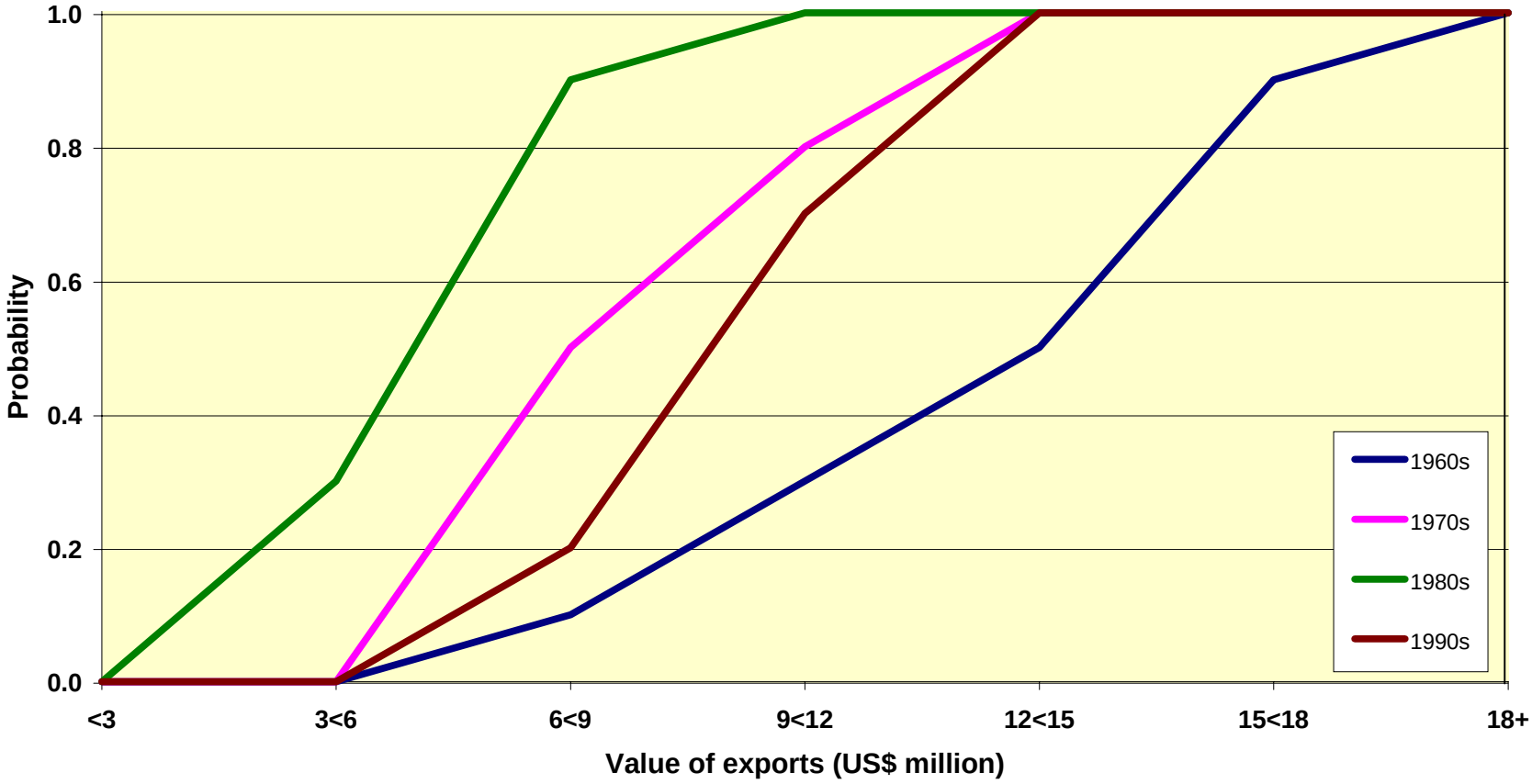

Figure 5 Cumulative density functions, agricultural exports: Tonga

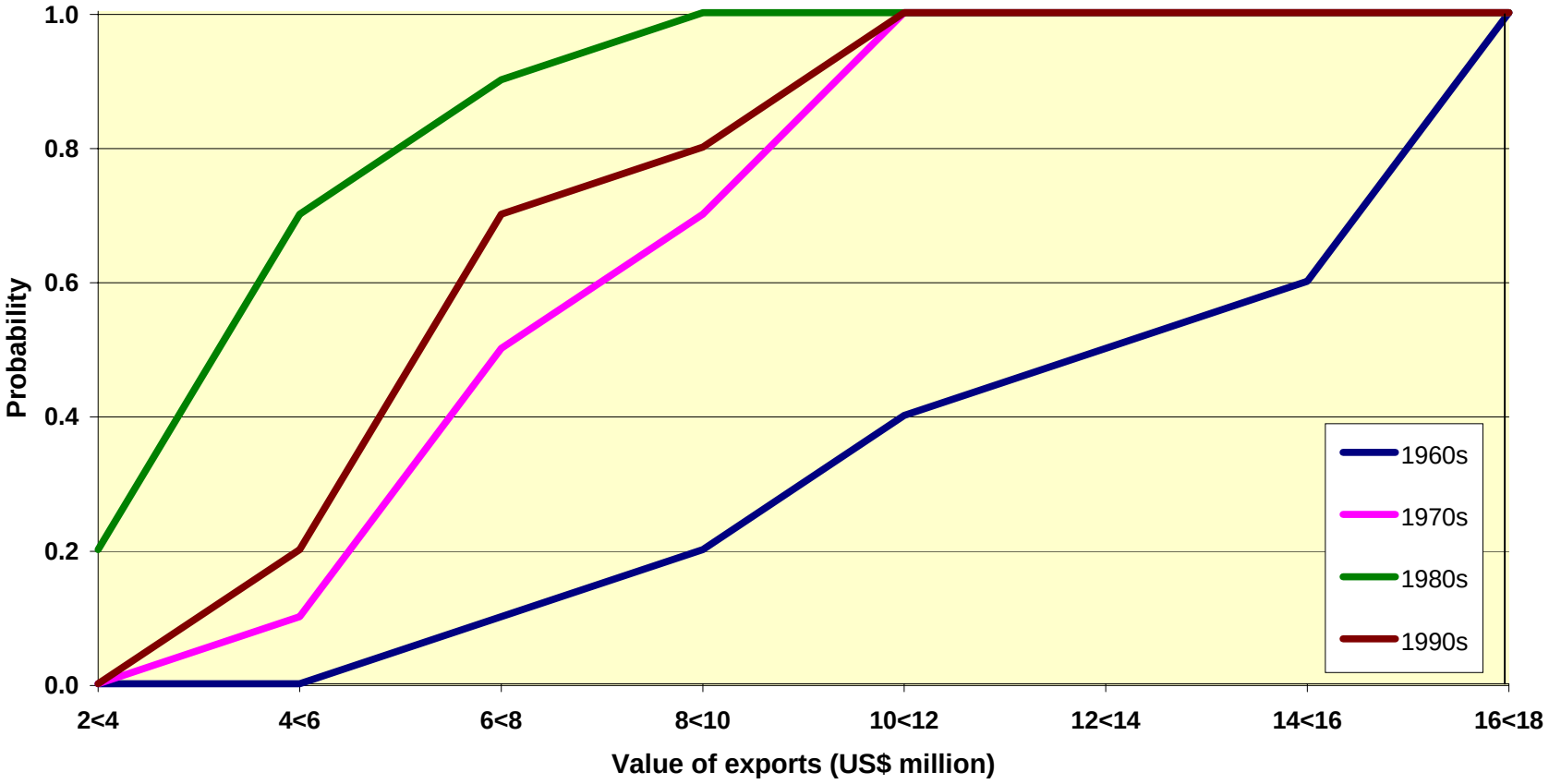

Figure 6 Cumulative density functions, non-agricultural exports: Tonga