A Reappraisal of the Role of Agriculture in Economic Growth in Melanesian Countries

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Abstract

Fortunes in the agricultural sectors of four of the largest South Pacific countries are traced in recent decades by estimating the single factoral terms of trade index. The single factoral terms of trade are measured for agriculture in four Melanesian countries—Fiji, Papua New Guinea, Solomon Islands and Vanuatu—over the period, 1970 to 2002. This index provides a useful method to assess changes in returns to factors employed in agricultural production in these countries. Except in Solomon Islands, farmers experienced a deteriorating index, indicating that they have reaped progressively lower returns to their resources. In Solomon Islands, returns to resources are shown to have increased slightly.

A sustained contribution by the agricultural sector to economic growth requires a major improvement in returns to farm resources. Of the three components of the factoral terms of trade index, product price increases and cost decreases are argued to be unlikely to yield great dividends in the foreseeable future. Most potential lies in increasing TFP, which will depend on more effective work from the national research and extension services, and greater transfer of improved technologies from international research centres than achieved to date.

Agriculture in economic development in Melanesian countries

It has long been an article of faith that agriculture has a key role in generating economic development in South Pacific island countries, including the four Melanesian countries under review in this study—Fiji, Papua New Guinea, Solomon Islands and Vanuatu. In these countries, the agricultural sector continues to fulfil the role as the chief source of employment of labour and provider of food, and is a significant contributor to export revenue.

The main source of employment has been self-employed smallholders producing food crops and cash crops for export, although there have been, and remain, significant estate sub-sectors in agriculture in each country. Domestic food production is overwhelmingly of root crops and bananas, and remains the dominant source of food consumed in the four countries although food imports have been gaining ground. The agricultural sector was traditionally the major source of foreign exchange through exports of commodities. The main commodity exports are: sugar and coconut products in Fiji; coffee, cocoa, coconut products, palm oil and palm kernel oil in Papua New Guinea; coconut products, cocoa, palm oil and palm kernel oil in Solomon Islands; and coconut products and cocoa in Vanuatu. Agricultural commodity exports remain significant earners of export revenue, with the commodities mentioned above accounting for virtually all agricultural exports in Papua New Guinea and Solomon Islands, around 90 per cent of total agricultural exports in Fiji and about two-thirds of total agricultural exports in Vanuatu. But their relative contribution to foreign exchange earnings has been in decline in all countries.

Despite this apparently prominent role of agriculture in economic development, doubts are being raised about the wisdom of governments attaching strategic importance to agriculture in their development programs and the ability of agriculture to generate economic growth in the South Pacific, a theme we refer to later. The difficulty countries are facing in encouraging youth to stay in agriculture (FAO 2005) is said to reflect a lack of incentives in farming.

We test this proposition by reintroducing an economic concept, the single factoral terms of trade, which has been little used in recent decades because of a lack of time series data on productivity. This concept is cast in an industry, rather than international trade, context, relying on estimates of total factor productivity change made by Fleming, Rao and Fleming (2005) in the countries under study for the period, 1970 to 2002. It has an advantage over other profit concepts in that it measures returns to all factors of production whereas other measures of profit are typically expressed as returns to a particular factor of production, such as returns to capital, or to the farm business.

Adaptation of the terms of trade concept to calculate the single factoral terms of trade

The net barter terms of trade, also known as the commodity terms of trade or simply the terms of trade, is a concept widely used in international trade analysis. It also has a long history of adaptation to sector analysis as the industry terms of trade. For example, ABARE (2004) has regularly reported the industry terms of trade for the agricultural sector in Australia as an index of prices received relative to prices paid by farmers. The obvious limitation of this concept as a measure of returns to resources in an industry or

sector is that it takes no account of changes in relations between inputs and outputs. To achieve this aim, it is necessary to expand the industry terms of trade into the single factoral terms of trade,[1] hereafter referred to simply as the factoral terms of trade.

For the purpose of this study, the factoral terms of trade is defined using the notation of Perkins, Radelet, Snodgrass, Gillis and Roemer (2001, pp. 637-641). Perkins et al. (2001, p. 637) begin by defining the net barter terms of trade (T_n) in the usual manner as the ratio of an index of export prices (P_e) and an index of import prices (P_m). They then use the net barter terms of trade to define the factoral terms of trade as $T_S = (P_e/P_m)Z_e$, where Z_e is total factor productivity. This equation simplifies to $T_S = T_nZ_e$.

> The single factoral terms of trade, T_S, measures factor income relative to factor inputs and import prices, or $T_S = (P_e/P_m)Z_e, = T_nZ_e$. Note that a rise in either the income or single factoral terms of trade implies an improvement in income or welfare relative to a country's previous situation. But if, as often is the case, [the] index rises less than export volume, this also implies that exporting countries are sharing part of the potential gains with importing countries ...
>
> (Perkins et al. 2001, p. 637)

As indicated above, we plan to overcome that deficiency for countries in this study by estimating trends in agricultural productivity to calculate their factoral terms of trade. In this way it is possible to determine whether, say, a decline in the prices farmers receive for their output is less than the percentage rise in productivity in their production. If so,

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[1] Appleyard and Field (1998, p. 121) defined the double factoral terms of trade as the single factoral terms of trade divided by the index of productivity in the industries of the trading partners. This index is of less concern than the single terms of trade for evaluating changes in farmers' welfare because productivity changes in sectors trading with agriculture do not directly affect farmers.

given the definition by Perkins et al. above, returns to the factors engaged in their production would increase. If the price decline is greater, returns to the factors engaged in their production would fall.

The factoral terms of trade covers all activities in producing a product or group of products to the point of export. As our purpose lies in examining welfare implications and incentives for farmers as a specific group in agriculture, we define the factoral terms of trade in terms of output prices (P_f) rather than export prices and farm-level productivity (Z_f). The appropriate index to use as the denominator is the consumer price index (P_c), which is the equivalent 'import price index' for participants in the agricultural economy as the import price index is for participants in the national economy. Our measure of the factoral terms of trade is therefore defined as $T_S = (P_f/P_c)Z_f$.

In estimating the factoral terms of trade in Australian agriculture, Fleming (2005) aggregated two weighted price indices for farm input prices and consumer prices. The former index was weighted as the proportion of farm costs to the total value of agricultural output and the latter as the residual, a measure of net farm profit. Fleming (2005) showed that the correlation between the two indices was exceptionally high. It meant that the use of the consumer price index as the sole price index gave virtually the same estimates for the factoral terms of trade as aggregating the weighted farm input price and consumer price indices. As farm input price indices are not available for the full period in the South Pacific countries, we rely solely on the consumer price index in this study with the comfort of knowing that it is likely to be a reliable indicator of changes in costs facing farmers in both their farm business expenditure and farm household consumption expenditure.

Model used to estimate change in total factor productivity

Most of the inputs used in developing country agriculture are fixed in the short run, offering limited opportunity to producers to alter their resource mix in production. The best examples of these types of inputs in the countries under study are operator and family labour, land and tree crop plantations. For this reason, we follow Fleming et al. (2005) in selecting an output orientation to apply data envelopment analysis, which allows the calculation of TFP indices. The calculated Malmquist indices measure changes in TFP in the agricultural sector in each of the four countries over the study period, following the same methodological path for calculating agricultural TFP change as Coelli and Rao (2004) and Fleming et al. (2005). One of the major advantages of estimating a Malmquist index is that it assumes an underlying translog production function that allows flexibility in the relations between outputs and inputs in production technology.

Data and variables

The production cycle is very long for numerous agricultural commodities in developing countries, including some of special interest in this study (coffee, cocoa, palm oil, palm kernel oil and coconut products), and is reasonably long for another of interest, sugar. Therefore, it is desirable to make the study period as long as possible to allow for changes made in agricultural technologies to take effect in these industries. The study period chosen is from 1970 to 2002 for Fiji, Papua New Guinea and Solomon Islands, corresponding to the period for which Fleming et al. (2005) estimated TFP indices. Lack of data on domestic food prices prior to independence in 1980 restricted the study period to 1981 to 2002 for Vanuatu.

Production and producer price data for commodity exports were sourced from the FAOSTAT-Agriculture website, supported by the Statistics Division of the Food and Agriculture Organization of the United Nations (FAO) (www.fao.org/faostat). Export unit value data (Fleming et al. 2005) adjusted to local currencies were used as a proxy for producer price data because of the incomplete series and unreliability of the latter. Their use requires an assumption that price movements at the producer level are the same as those at the export level, but does have the advantage that, as border prices, export unit values better represent economic values than producer prices that are typically subject to many domestic market distortions (Fleming et al. 2005, pp. 40-41). The food price component of the consumer price index was used as the index for locally produced food (there is negligible non-food agricultural production). These indices and the consumer price indices were obtained from official statistics published by national governments.

Output is measured as aggregate crops because no livestock input and output data are available for the countries. These output aggregates were obtained from Rao (1993, Table 5.4) and constructed using international 1990 prices denominated in US dollars.

Inputs included in the model are those for which data were available from the FAOSTAT-Agriculture website. Four categories were included: land area, tractors, labour and fertilizer. It would have been useful to have inputs of tree crop plantations given their prevalence in the farming systems of the countries under study. Data on the cost of seedlings are not available but, even if they were, they would not have been economic values given the widespread practice in these countries of disseminating subsidized seedlings to farmers. In any event, the two most important inputs in the

establishment and maintenance of tree crop plantations are labour and fertilizer, both of which are included in the input set.

Estimates of the factoral terms of trade

Estimates of the factoral terms of trade for the four South Pacific countries under study are presented in Figure 1. Total factor productivity change was calculated as a three-year moving average because of the substantial inter-year fluctuations in yields. This approach helped to dampen fluctuations in the factoral terms of trade and so give a clearer picture of trends. Widely fluctuating agricultural output prices over the study period nonetheless mean that the indices still fluctuate a good deal, so logarithmic trend lines are included for each country in Figure 1.

A clear downward trend is evident in the factoral terms of trade in three of the countries, Fiji, Papua New Guinea and Vanuatu. Solomon Islands went against the trend with a slight improvement in its index.

The factoral terms of trade in the agricultural sector in Fiji declined significantly ($p <$ 0.01) at an annual rate of 2.6 per cent over the 33-years period. A precipitous decline in the cumulative TFP index, from 0.86 in 1991 to 0.45 in 2002, was the cause of this decline. It was attributable to a combination of civil strife that spilt over into rural areas affecting the Indian population that provided most of the highly productive farmers, land tenure problems affecting Indian tenant farmers (Kurer 2001), and declining soil fertility. All of these factors have had especially adverse impacts on production in the dominant sugar industry. The decline might have been even more severe had Fiji, as an ACP country, not had preferential access to the European market at guaranteed high prices for

much of its sugar crop. The price index declined by just 0.7 per cent per annum ($p =$ 0.09), well below the rate experienced in Papua New Guinea and Vanuatu. The imminent loss of this privilege as part of multilateral trade liberalization processes suggests a gloomy future for much of the Fijian agricultural sector.

In Vanuatu, the decline in the factoral terms of trade was greater than that in Fiji, at 4.0 per cent per annum and highly significant ($p < 0.01$). This decline was a product of both a worsening commodity export price index by 2.4 per cent per annum ($p = 0.06$) and a fall in TFP of 1.3 per cent per annum ($p < 0.01$). The ageing of the stands of the major cash crop, coconuts, and lack of development of viable new cash crops were major causes of the decline in TFP. However, the deterioration in the factoral terms of trade is not as dire as the above statistics indicate. There are two identifiable sub-periods, with a less steep gradient of decline since the commodity boom of the mid-1980s.

A decline of 1.1 per cent in the factoral terms of trade in Papua New Guinea over the study period is highly significant ($p < 0.01$). The commodity export price index declined by 2.2 per cent per annum ($p < 0.01$) whereas TFP increased marginally by 0.02 per cent ($p < 0.01$). But there are three distinct sub-periods in which the circumstances of cash crop producers, in particular, changed dramatically. In the first sub-period until the mid-1980s, developments in the smallholder coffee and cocoa industries and the nucleus estate oil palm industry enabled the factoral terms of trade to remain fairly steady despite declining real commodity prices. In the second sub-period, deeply depressed conditions in the main commodity export industries (Fleming and Yala 2001) led to a marked deterioration in the factoral terms of trade index from 1.33 in 1988 to 1.03 in 1993. A recovery in the world commodity markets accompanied by a massive devaluation of the

local currency led to a noticeable improvement in the index until 1999, although the imported inflationary effects of the devaluation (prices almost doubled between 1997 and 2002) eventually put an end to this improvement and caused the index to decline again from 2000 onwards.

The contrasting trend in the factoral terms of trade in Solomon Islands was largely a function of three events. First, the commodity boom in the mid-1970s caused a massive increase in export revenue in the cocoa and copra industries, and encouraged new plantings of these crops and rehabilitation of existing plantations. The second factor was the advent of the oil palm plantation sector in the early 1970s that boosted TFP until 1986 when a cyclone decimated palms (Fleming 1996). In that year, the cumulative TFP index had reached 1.40, a level that remained above the end-of-period index of 1.38. Third, favourable export market conditions prevailed in the commodity industries in the final few years of the study period.

Over the whole period, an annual increase of 0.9 per cent ($p = 0.09$) was registered in the factoral terms of trade index, brought about primarily by an increase of 0.6 per cent per annum in the commodity export unit value index ($p < 0.01$). The period from the mid-1980s to the mid-1990s was characterized by a severe deterioration in the factoral terms of trade index for reasons similar to those mentioned above for Papua New Guinea. The peak-yield stage in the production cycle had been reached for a majority of perennial crop plantations and conditions in the major export commodity industries were depressed. Solomon Islands experienced a similar recovery, and improvement in the factoral terms of trade, to Papua New Guinea in the 1990s but it was more sustained due to favourable movements in commodity export prices. Between 1992 and 2002, the export unit value

index increased by almost 10 per cent per annum, admittedly from a historically low level in real terms. The future profitability of the oil palm, coconut and cocoa export industries is clouded on two counts. First, recent civil unrest that occurred after the end of the study period damaged the productive potential of tree crop plantations and export marketing channels. Although order has been restored, it is likely that a turndown has since taken place in the factoral terms of trade. Second, the TFP gains of recent decades are unlikely to be repeated in the coming decades without substantial replanting of tree crops because most existing trees and palms have reached or passed their age of peak yields.

Discussion

Strategic options

In none of the four countries under study have the returns to resource used in agriculture improved significantly over the past three decades. Declines have been registered in three countries and a slight increase of marginal significance has occurred in Solomon Islands that has almost certainly been reversed since the end of the study period. These results cast doubt on the premise that agriculture holds the key to rural and general economic development in Melanesia. There is little prospect of the sector fulfilling such a role unless returns increase substantially to encourage rural youth to pursue a farming career. The strategic options to bring this change about can be classified according to the three components of the factoral terms of trade: product prices, costs and TFP.

Improving product prices

In respect of the first component, the major challenge facing Melanesian governments lies not so much in generating higher prices as in reversing the secular decline in

commodity export prices in real terms. Domestic food prices are less of a concern than commodity export prices because they have largely maintained parity with consumer prices in the domestic economy. However, the aggregate comparison hides a dichotomy in the domestic market for food products that might limit future growth in demand. Fresh produce markets are thriving in all Melanesian countries, supplied predominantly by smallholders, but most future growth in domestic food demand is likely to be in formal retail outlets such as supermarkets, where local suppliers are struggling to compete with food imports that are growing rapidly in all countries. Hence, the challenge facing domestic food producers lies mainly in stemming their loss of competitiveness with imported food products.

A strategy to increase commodity export prices (or, at least the prevention of further erosion of export unit values) can be pursued by implementing economic diversification programs to develop higher value-adding enterprises and by participating in trade negotiations that could lead to export price increases. The scope for agricultural diversification strategies is limited in Melanesia. First, there is virtually no prospect of success from diversification through import substitution. Second, efforts to diversify into export niche markets for agricultural commodities with high income elasticities of demand and less intense competition offer some hope but have so far met with very limited success throughout the South Pacific. Indeed, Narsey (2004) identified few agricultural industries in which South Pacific countries have a comparative advantage.

Grynberg and Razzaque (2004, p. 51) highlighted the difficulties that small states encounter in attempts to diversify their economic base, given their narrow resource base, particularly in diversifying their agricultural export sector. They exhorted the

international community to 'recognise that market friendly interventions are necessary to assist small states to diversify their export base'. Otherwise, 'marginalisation will only serve to erode support for globalisation in small states'.

Melanesian farmers can expect little from any progress in world agricultural trade liberalization. To the contrary, sugar producers in Fiji stand to suffer substantially from loss of a secure European market (Grynberg and Razzaque 2004). Apart from the lack of progress currently being made in the Doha Round of Multilateral Trade Negotiations, only producers of oils commodity exports would likely benefit to any marked degree from higher world agricultural prices if, against the odds, the Round were to be successfully concluded.

Narsey (2004) examined the prospects for regional trade agreements, covering 'the recently signed regional trade agreement amongst the PICs themselves—the Pacific Island Countries Trade Agreement (PICTA), the Pacific Agreement on Closer Economic Relations (PACER)—which includes Australia and NZ—and the Cotonou Agreement, which is the successor to the Lomé Agreement between the African Caribbean Pacific States (ACP)' (Narsey 2004, p. 1). His prognoses for success are not encouraging, perhaps best summed up by his comments on the disappointing outcome for the export of one of the few agricultural products identified as having export potential, kava. Exports from Fiji were decimated by bans obtained by European pharmaceutical countries while the EU authorities stood by and took no action despite the Cotonou Agreement.

Reducing costs

Progress is likely to be slow in reducing the costs of production inputs and prices of consumption goods and services paid by farmers. Melanesian and other South Pacific countries tend to have higher production and marketing costs than many other developing countries. This situation is due in large part to smallness of size and the relatively high standards of living (by developing country standards) that make the reservation price of labour high. But the fragmented nature of internal markets also makes the costs of doing business high. The archipelagic nature of the four countries under study makes for segmented domestic markets that are not suitable stepping stones to the development of an export industry. This segmentation imposes barriers to extensive agricultural and resource-based developments, in particular, making internal transport costs high. The region is also located relatively far from the world markets, which, when combined with small export volumes, results in high external transport costs per unit of export. The constraint imposed by remoteness has become a greater relative disadvantage to countries over time as scale economies in shipping have enabled technological improvements to have a greater impact in reducing international transport costs on the major shipping routes.

Another obstacle to the attainment of cost reductions is the small population base of the countries. It leads to small domestic markets and difficulties in achieving critical mass, scale economies and agglomeration economies that constrain the development of international trade and investment flows. The costs of services provided by the private sector and public utilities to agricultural producers and marketers of their export products are high by international standards. For example, Falvey (1991, p. 3) compared the

electricity costs in Fiji, Papua New Guinea and Vanuatu with those in USA and found them to be two to three times higher.

Scale diseconomies are especially prevalent in the collection of small surpluses from many smallholders (Hardaker and Fleming 1994, p. 47. High production costs mean that Melanesian countries tend to have a comparative disadvantage in the processing of raw materials produced by their agricultural industries. Firms exporting agricultural commodities suffer twice in that they tend to be small, making it difficult to internalize agglomeration economies, and are more prone to external diseconomies in rural areas where they typically face high transaction and communication costs, and lack affordable access to venture capital. In these difficult circumstances, a strong case can be made for regional specialization to encourage international competitiveness, with a heavy reliance on products and markets for which the required knowledge and experience already exist (Fleming and Gabbott 2005).

Improving TFP

With little prospect for substantial increases in real product prices or reductions in the costs of producing and marketing agricultural products, the main avenue available to governments to improve the returns to farm resources is likely to be through methods that raise TFP. This can be achieved through the introduction of improved technologies or by increasing mean technical efficiency in agricultural production.

The fragmentary evidence that exists in Papua New Guinea (e.g. Fleming and Overfield 2002) suggests there is considerable scope to increase technical efficiency in food and cash crop production by making better use of farm resources, given existing technologies.

A focus on improving extension services is therefore warranted. However, this approach will bear fruit only until the bulk of farmers are brought up to best-practice production methods. The long-term solution lies with the adoption of improved production technologies. Here, the 'jury is out' on future prospects given the likely continued heavy reliance of tree crops and root crops in Melanesian farming systems, and sugar in the case of Fiji. Limited progress has been made in developing new high-yielding varieties that are well adapted to these systems.

Fleming et al. (2005) argue that the productivity growth of tree crops has lagged behind other crops in four ways. Perhaps the main reason is that less progress has been made internationally in genetic and other research work in tree crop production than in other types of crop production, with the possible exception of root crops. A second factor particularly pertinent to Melanesian farming systems is that crops were planted in the 1960s and 1970s on previously forested land that initially yielded high outputs from fertile soils. Yields have not been sustained as soils deteriorated with continuous production over a number of decades in humid tropical climates (Gallup and Sachs (2000). Sugarcane yields in Fiji are also declining. Third, many tree plantations are getting older and trees have not been replaced, leading to declining yields. It will occur soon with commercial oil palm plantations that have much shorter production cycles than other tree crops. Ageing trees has been a particular problem with coconut palms where replanting has long been discouraged by very low returns. Where new plantings have been of improved dwarf varieties, they often were unsuitable to local conditions. Problems have also been experienced with improved cocoa varieties in Papua New Guinea that have experienced alarming deterioration in yields after a decade (Fleming

and Yala 2002). Finally, increased incidences of pests and diseases have affected the yields of tree crops and bananas, especially among smallholders.

Perhaps the most promising way forward is through the more widespread use of highly productive intercropping systems as part of a program to replant trees and palms. Intercropping has traditionally been at the core of traditional farming systems in Melanesia, and is well suited to the production environment. Scope exists for improvement in the productivity of these systems by applying known research outputs that can result in higher farm output, reduce the reliance by small farmers on a single cash crop for export, and enable farmers to benefit from scope economies (Coelli and Fleming 2004).

Conclusion

The fortunes of farmers in agricultural sectors in four of the largest South Pacific countries are traced in this paper by estimating the single factoral terms of trade index over the period from 1970 to 2002. This index provides a useful method to assess changes in returns to factors employed in agricultural production in these countries. Farmers in three countries—Fiji, Papua New Guinea and Vanuatu—experienced a deteriorating index, indicating that farmers reaped progressively lower returns to their resources. In the fourth country, Solomon Islands, returns to resources are shown to have increased slightly.

A sustained contribution by the agricultural sector to economic growth requires a major improvement in returns to farm resources. Of the three components of the single factoral terms of trade index, product price increases and cost decreases are unlikely to yield great

dividends in the foreseeable future. Most potential lies in increasing TFP, which will depend on more effective work from the national research and extension services, and greater transfer of improved technologies from international research centres than has occurred to date.

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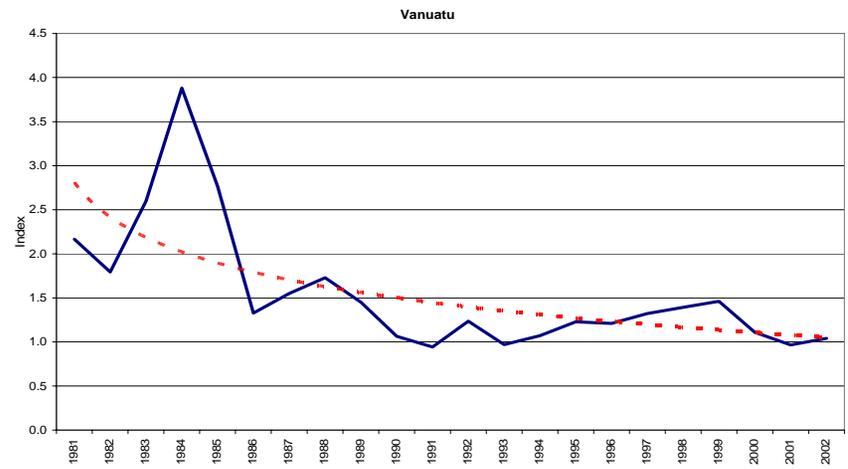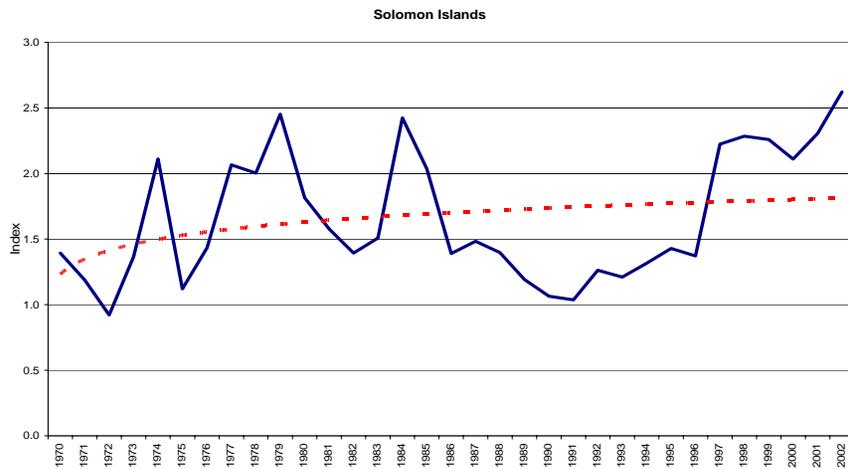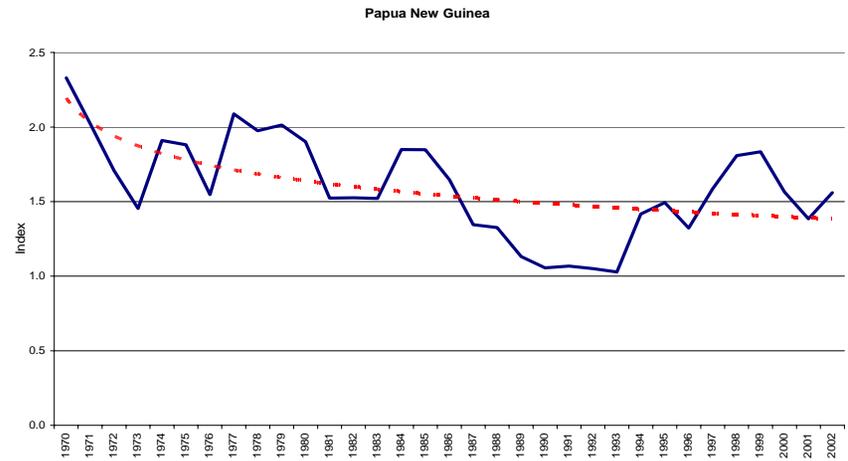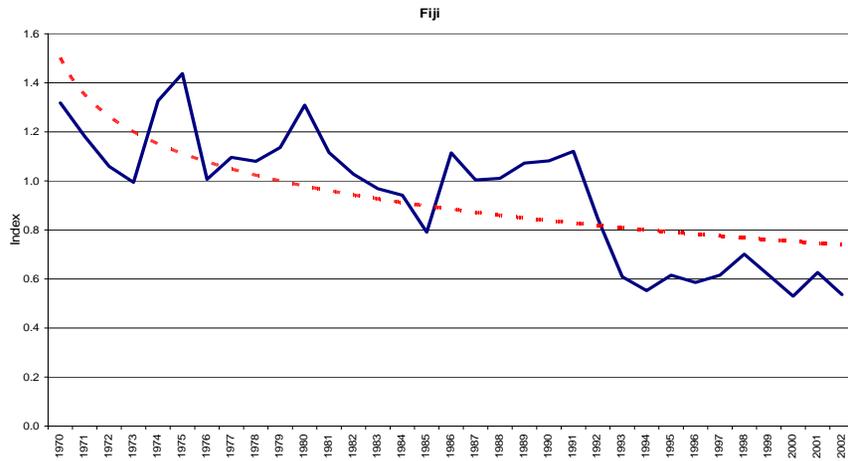
Figure 1   Estimates of the factoral terms of trade in Fiji, Papua New Guinea, Solomon Islands and Vanuatu, 1970 to 2002.