Chapter 9

DEMAND AND SUPPLY SOURCES OF CERV IN THE SELECTED SPINS

In this chapter[38], a variance decomposition method is used to decompose aggregate CERV for various primary export commodities covering a period of three decades for the Melanesian countries (Fiji, PNG, SI and Vanuatu). By using the VDM, variability contributions to CERV by individual sectors[39] and commodities, and sources of CERV in terms of demand, supply and demand–supply interaction variability, are investigated. The VDM analyses were undertaken for 10– and 30–year subperiods. Results of these analyses indicate that the sources of CERV vary across countries, sectors, commodities and time periods. This makes stabilisation policy a very complex issue in the SPINs. In general, the results obtained here support the findings of a previous study by Fleming and Piggott (1989).

9.1 Introduction

This chapter is mainly concerned with the decomposition of CERV into various components for selected SPINs consisting of all the four Melanesian countries, namely, Fiji, PNG, SI and Vanuatu. These components are demand, supply, demand–supply interactions, and pairs of individual sector and commodity interaction effects. The VDM approach suggested by Piggott (1978, 1981) is used.

The collected data are analysed in three parts. In the first part, the contributions of individual sectors and their pairwise interactions are examined. In the second part, a similar examination is made of individual commodities and their respective pairwise interactions. One reason behind the examination of the variability contribution of individual sectors and commodities to aggregate CERV is to show empirically how variability could be concentrated in a few sectors and commodities. In part three, the sources of CERV are decomposed into demand, supply and demand–supply interaction components. In this part, investigations are conducted to obtain empirical evidence either to support or reject commodity price stabilisation schemes. Given that the current stabilisation schemes mainly address the sources of CERV from the demand side only, the empirical analysis in this chapter is designed to show which source of CERV is predominant – demand or supply?

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38 Author's contributions to Onchoke and Fleming (1994) form the basis of parts for this chapter.

39 Sector is used here to mean a group of commodities closely related in their production and/or utilisation processes; e.g., agriculture, fishery, forestry and mining are all used separately as individual sectors.

In all three cases, the analyses are performed in subperiods. First, data for 10–year subperiods are analysed. The first 10–year subperiod (1961–70) represents the decade before political independence, the second 10–year subperiod (1971–80) represents the independence decade while the last subperiod (1981–90) represents the decade after independence. It is thought that expectations for political independence could, in one way or another, influence the sources of CERV in the SPINs. Finally, all the data for three decades are analysed together by using 30–year period analyses. The results obtained from the above analyses are used to address the commodity–specific price stabilisation schemes which have now been in operation in the SPINs for almost 40 years.

The remaining part of this chapter is organised as follows. Section 9.2 covers some views and problems associated with CERV. The method of analysis is explained in section 9.3. Results and discussion are in section 9.4, while a summary and some conclusions are presented in section 9.5.

9.2 CERV – An Overview

Some material covered in this section have been mentioned elsewhere in this thesis (see, for example, Chapters 1 and 3). But, for the sake of greater clarity, it seems useful to review some of this material as it relates to the empirical analyses that follow.

While CERV is prevalent in most countries exporting primary commodities, it is generally acknowledged that the magnitudes of CERV are greater, and its impacts felt more severely, in LDCs which have a heavy dependence on commodity exports than in DCs (Coppock 1962, Michaely 1962, Erb and Schiavo–Campo 1969, Massell 1970, Glezakos 1973, Murray 1978). It is claimed that CERV affects the economic growth of LDCs even to the extent of causing some countries to become politically unstable (Brainard and Cooper 1968, Maizels 1968b, Massell 1970, Kenen and Voivodas 1972, Glezakos 1973, Lim 1976, Balassa 1978). MacBean (1966) observed that demand and supply forces for most primary commodities, both in international and domestic markets, are characteristically unstable with high degrees of price and quantity variability. One explanation for this is that primary commodities have low price elasticities of demand and supply.

Fleming and Piggott (1989) indicated that there have been substantial fluctuations in agricultural export earnings (both in aggregate and on an individual commodity basis) in all SPINs for the past three decades. Most of the variability could be attributed to price fluctuations although export volume fluctuations are also important. One reason given for the substantial CERV in the SPINs is that exports from the SPINs have been narrowly based on

An alternative way to decompose the direct and interactive contributions of sector or commodity variability to aggregate CERV, is to assume that TR from equation (1) is composed of export revenues from n sectors/commodities (R_1, ..., R_n), simply expressed as:

$$TR = R_1 + ... + R_{n-1} + R_n \qquad (2)$$

The variance decomposition of TR from equation (2) above can then proceed as follows:

$$var\,(TR) = var(R_1) + ... + var\,(R_n) + ... + 2\,cov\,(R_{n-1}, R_n) \qquad (3)$$

Using the rationale of either equation (1) or equation (3), variability in TR is decomposed into relative contributions of individual and pairs of individual sector/commodity components. On the basis of this decomposition procedure, it can be shown in which individual or pairs of individual sector(s) or commodity(ies) variability in TR is most concentrated.

In order to decompose the variance of key market variables into demand, supply and demand–supply interaction effects, the commodity export markets are assumed to be represented by linear demand and supply functions whose slopes are also assumed to be constant over time. That is:

$$Q_t^d = a_t + bP_t \quad \text{(demand)} \qquad (4)$$

$$Q_t^s = c_t + dP_t \quad \text{(supply)} \qquad (5)$$

$$Q_t^d = Q_t^s \quad \text{(equilibrium)} \qquad (6)$$

where: Q_t^d = quantity demanded in period t, Q_t^s = quantity supplied in period t, a_t = net demand intercept in period t, c_t = net supply intercept in period t ($c_t < a_t$), b = constant demand slope parameter (negative), d = constant supply slope parameter, P_t = price in period t.

Note that a_t and c_t are referred to as net intercepts because they embody effects of several exogenous demand and supply shifters (e.g., income and technology, respectively.

$$
\begin{aligned}
\mathrm{var}(R_t^*) &= \pi_4{}^2\mathrm{var}(a_t{}^2) + \pi_5{}^2\mathrm{var}(c_t{}^2) \\
&\quad + (\pi_4 + \pi_5)^2\mathrm{var}(a_tc_t) + 2\pi_4\pi_5\mathrm{cov}(a_t{}^2, c_t{}^2) \\
&\quad - 2\pi_4(\pi_4 + \pi_5)\mathrm{cov}(a_t{}^2, a_tc_t) \\
&\quad - 2\pi_5(\pi_4 + \pi_5)\mathrm{cov}(c_t, a_tc_t) \\
&= \pi_{12}\mathrm{var}(a_t{}^2) + \pi_2{}^2\mathrm{var}(c_t{}^2) \\
&\quad + (\pi_1 + \pi_2)^2\mathrm{var}(a_tc_t) \\
&\quad + 2\pi_1\pi_2\mathrm{cov}(a_t{}^2, c_t{}^2) \\
&\quad - 2\pi_1(\pi_1 + \pi_2)\mathrm{cov}(a_t{}^2, a_tc_t) \\
&\quad - 2\pi_2(\pi_1 + \pi_2)\mathrm{cov}(c_t{}^2, a_tc_t) \qquad (13)
\end{aligned}
$$

where:

$$\pi_4 = \pi_1\pi_2 \qquad (14a)$$

$$\pi_5 = \pi_1\pi_3 \qquad (14b)$$

Using Bohrnstedt and Goldberger's (1969) formula for the variance of a product [applied to the first three terms on the right hand side (RHS) of (13)] and the covariance between two product variables [applied to the last three terms on the RHS of (13)], Piggott (1978) showed that the terms on the RHS of (13) could be written in terms of the intercepts a and c. Letting Δa and Δc denote $[a - E(a)]$ and $[c - E(c)]$, respectively, (E = expectations operator), the following expressions hold:

$$
\begin{aligned}
\mathrm{var}(a^2) &= 4E^2(a)\mathrm{var}(a) - \mathrm{var}^2(a) + 4E(a)E(\Delta a)^3 \\
&\quad + E(\Delta a)^4 \qquad (15)
\end{aligned}
$$

$$
\begin{aligned}
\mathrm{var}(c^2) &= 4E^2(c)\mathrm{var}(c) - \mathrm{var}^2(c) + 4E(c)E(\Delta c)^3 \\
&\quad + E(\Delta c)^4 \qquad (16)
\end{aligned}
$$

$$
\begin{aligned}
\mathrm{var}(ac) &= E^2(c)\mathrm{var}(a) + E^2(a)\mathrm{var}(c) \\
&\quad + 2E(a)E(c)\mathrm{cov}(a, c) + E[(\Delta a)(\Delta c) \\
&\quad - \mathrm{cov}(a, c)]^2 + 2E(a)E[(\Delta a)(\Delta c)^2] \\
&\quad + 2E(c)E[(\Delta a)^2(\Delta c)] \qquad (17)
\end{aligned}
$$

$$\begin{aligned} cov(a^2 c^2) = {} & 4E(a)E(c)cov(a, c) + E[(\Delta a)^2(\Delta c)^2] \\ & + 2E(a)E[(\Delta a)(\Delta c)^2] \\ & + 2E(c)E[(\Delta a)^2(\Delta c)] \\ & - var(a)var(c) \end{aligned} \tag{18}$$

$$\begin{aligned} cov(a^2 ac) = {} & 2E^2(a)cov(a, c) + 2E(a)E(c)var(a) \\ & + 3E(a)E[(\Delta a)^2(\Delta c)] + E(c)E(\Delta a)3 \\ & + E[(\Delta a)^3(\Delta c)] - var(a)cov(a,c) \end{aligned} \tag{19}$$

$$\begin{aligned} cov(c^2 ac) = {} & 2E^2(c)cov(c, a) + 2E(c)E(a)var(c) \\ & + 3E(c)E[(\Delta c)^2(\Delta a)] + E(a)E(\Delta c)^3 \\ & + E[(\Delta c)^3(\Delta a)] - cov(c)cor(c,a) \end{aligned} \tag{20}$$

The terms in equations (15) to (20) that are directly attributable to variability in the demand intercept alone are the terms in (15), first terms in (17) and the second and fourth terms in (19). Similarly, the terms directly attributable to variability in the supply intercept alone are the terms in (16), the second term in (17) and the second and fourth terms in (20). The remaining terms are attributable to inseparable interaction between variability in the demand and supply intercepts.

Thus, the variance (R^*) is attributable to a demand effect (DE), a supply effect (SE) and an interaction effect between demand and supply (IE). This is defined as:

$$var(R^*) = DE + SE + IE \tag{21}$$

and

DE = direct demand effect which is = $D_1 + D_2 + D_3$,

where:

$$\begin{aligned} D_1 = {} & var(a)[4E^2(a)\pi_4^2 + (\pi_4 + \pi_5)^2(c) \\ & - 4\pi_4(\pi_4 + \pi_5)E(a)E(c)] - var^2(a)\pi_4^2 \end{aligned} \tag{22}$$

$$D_2 = E(a)^3[4E(a)\pi_4^2 - 2E(c)\pi_4(\pi_4 + \pi_5)] \tag{23}$$

and

$$D_3 = E(a)^4\pi_4^2 \tag{24}$$

Similarly, from (21), SE = direct supply effect which is = $S_1 + S_2 + S_3$,

where:

$$S_2 = var(c)[4E^2(c)\pi_4^2 + (\pi_4 + \pi_5)^2(a) - 4\pi_4(\pi_4 + \pi_5)E(c)E(a)] - var^2(c)\pi_4^2 \quad (25)$$

and

$$S_2 = E(c)^3[4E(c)\pi_4^2 - 2E(a)\pi_4(\pi_4 + \pi_5)] \quad (26)$$

$$S_3 = E(c)^4\pi_4^2 \quad (27)$$

The interaction term, IE in (21) may be calculated as:

$$IE = var(R^*) - DE - SE. \quad (28)$$

As pointed out by Piggott (1978) and Myers and Runge (1985), D_1 is due to the variance of a_t, D_2 to its skewness, and D_3 to its kurtosis. The interaction term is composed of second, third and fourth order mixed central moments of a_t and c_t.

Piggott's (1978, 1981) method has limitations. The interaction terms and the skewness and kurtosis terms are difficult to interpret. Moreover, a large interaction term reflects correlation between a_t and c_t, implying that both supply and demand effects are important sources of variability. The assumption of linear and static supply and demand models is restrictive.

VDM usually requires the use of a structural econometric model. However, this requirement could be waived if prior estimates of elasticities of supply (e^s) and demand (e^d) at price and quantity data means are available (Myers and Runge 1985). Based on equations (4) and (5), the formula for elasticity is:

$$b = e^d(\overline{q} / \overline{p}) \quad (29)$$

$$a_t = q_t - bp_t \quad (30)$$

$$d = e^s(\overline{q} / \overline{p}) \quad (31)$$

$$c_t = q_t - dp_t \quad (32)$$

where:

$\overline{q}$ = mean quantity over study period

$\overline{p}$ = mean price over study period.

Thus, all the information needed to complete the decomposition exercise is computed from quantity and price data and the elasticities of supply and demand at the data means. The above model was run in a SHAZAM instruction program (see the listed sample instructions in Appendix 9.1) whose results are discussed below.

9.4 Results and Discussion

9.4.1 Data and data sources

Data and data sources have been described in detail in Chapter 5. Data for these analyses were the annual fob commodity export values and quantities covering a period of 30 years, approximately ranging from 1961 to 1990. Data on fob export prices for all commodities were computed by dividing the annual fob export values by the respective export quantities. All data were utilised at their current levels.

To encompass the most important primary export commodities of the selected SPINs, six commodities were chosen for Fiji (sugar, molasses, coconut oil, gold, forestry and marine), twelve commodities for PNG (coffee, cocoa, copra, coconut/copra oil, rubber, tea, palm oil, logs, forestry, marine, copper and gold), seven commodities for SI (copra, forestry, cocoa, marine, fish, gold and palm oil and kernel) and six commodities for Vanuatu (copra, cocoa, coffee, fish, beef and timber).

9.4.2 Variance contribution to CERV by individual sectors

(a) Fiji

Agriculture contributed most to CERV throughout the 10– and 30–year subperiods (Table 9.1), although its influence has been declining. The variability for the agricultural sector was greatest in the 1960s, decreasing towards the 1970s and was least in the 1980s when other new sectors such as mining and fisheries emerged. In the 1960s and 1970s the direct agricultural variability was over 85 per cent of the total CERV, falling to about 48 per cent in the 1980s. The contributions based on the 30–year period appears as the average contribution for the three 10–year subperiods. Evidently most of the variability has been most concentrated in the agricultural sector in Fiji for the past three decades.

In all of the subperiods, the contribution of pairwise sectoral interaction was positive. The direct sectoral effects reinforced each other in increasing the overall CERV. This was the case in Fiji in all the subperiods. Further, it can be observed that the contribution of sectoral interaction to CERV has been increasing over time.

Table 9.1: Percentage variance contribution to CERV by individual sectors for 10– and 30–year subperiods, Fiji

	Subperiods			
Sectors	1961–70	1971–80	1981–90	1961–90
Direct				
Agriculture	95.90	86.86	47.75	59.59
Mining	0.24	0.27	10.69	5.75
Forestry	0.05	0.05	0.59	0.26
Marine	–	0.74	2.15	1.66
Subtotal	*96.19*	*87.92*	*59.17*	*67.26*
Interactive				
Agriculture–Mining	2.91	3.81	19.54	15.72
Agriculture–Forestry	0.83	1.80	4.52	3.30
Agriculture–Marine	–	6.14	8.75	8.98
Mining–Forestry	0.07	0.08	2.45	1.20
Mining–Marine	–	0.12	4.52	2.93
Forestry–Marine	–	0.13	1.05	0.61
Subtotal	*3.81*	*12.08*	*40.83*	*32.74*
Total	**100.00**	**100.00**	**100.00**	**100.00**

(b) PNG

While the contribution of variability in earnings from agriculture to CERV was the dominating (90 per cent) influence in the 1960s, variability in earnings from mining became dominant thereafter (Table 9.2).

Table 9.2: Percentage variance contribution to CERV by individual sectors for 10– and 30–year subperiods, PNG

Sectors	Subperiods 1961–70	1971–80	1981–90	1961–90
Direct				
Agriculture	90.64	31.02	9.26	10.48
Mining	–	39.81	81.57	59.41
Forestry	0.43	0.26	1.00	0.90
Marine	0.18	0.36	0.07	0.06
Subtotal	*91.25*	*71.45*	*91.90*	*70.85*
Interactive				
Agriculture–Mining	–	19.72	1.38	18.71
Agriculture–Forestry	5.66	2.26	1.22	2.39
Agriculture–Marine	2.88	2.17	–0.25	0.47
Mining–Forestry	–	2.20	6.95	6.79
Mining–Marine	–	1.94	–1.06	0.72
Forestry–Marine	0.23	0.26	–0.14	0.07
Subtotal	*8.75*	*28.55*	*8.10*	*29.15*
Total	**100.00**	**100.00**	**100.00**	**100.00**

In all cases, the total direct contributions of variability in earnings of individual sectors to CERV were over 70 per cent. Direct contributions of variability to CERV over the 30–year period show that the mining sector was dominant followed by agriculture. Indirectly, agriculture and mining interactions contributed the highest variability to CERV, followed by mining and forestry interactions over the 30 years. Some covariances were negative, mainly in the 1980s, but most of them were positive, thereby reinforcing direct contributions of variability to increasing the overall CERV. Negative covariances offset each other, ending up decreasing the overall CERV.

This analysis shows that CERV was most concentrated in the agricultural sector (about 91 per cent) during the 1960s. This dwindled to 31 per cent and 9 per cent in the 1970s and 1980s, respectively. During the latter two decades, variability of earnings from mining became prominent, contributing about 40 per cent and 82 per cent to total CERV in the 1970s and 1980s, respectively.

(c) SI

In SI, the direct contribution of variability in earnings from individual sectors to CERV was different from Fiji and PNG (Table 9.3). Forestry earnings variability was dominant in the 1960s, contributing over 51 per cent of total CERV. This trend changed drastically in the 1970s when the contribution of variability from forestry revenues became less than 1 per cent of total CERV. In the 1970s direct contributions of variability in agricultural earnings to CERV became prominent (about 29 per cent), followed by that of marine sector (about 28 per cent). In the 1980s, the dominance of sectoral earnings variability changed to marine sector with about 38 per cent contribution to CERV, followed by agriculture (15 per cent) and forestry (12 per cent). Over the 30 years, the direct contributions of variability from sectoral earnings to CERV, in a descending order of importance, were marine (29 per cent), forestry (13 per cent) and agriculture (11 per cent).

Interactive contributions of variability in earnings between sectoral pairs were more substantial in SI than in the other countries examined. As shown in Table 9.3, the indirect contributions of variability in sectoral revenues to total CERV were about 37, 43, 33 and 46 per cent for 1961–70, 1971–80, 1981–90 and 1961–90, respectively. Although there were a few negative covariances, most of them were positive.

In summary, concentration of revenue variability from direct contributions was distributed to different sectors over the different decades in SI. During the 1960s most revenue variability was concentrated in forestry, in the 1970s in agriculture and marine, and in the 1980s in the marine sector.

Table 9.3: Percentage variance contribution to CERV by individual sectors for 10– and 30–year subperiods, SI

	Subperiods			
Sectors	1961–70	1971–80	1981–90	1961–90
Direct				
Agriculture	10.57	28.95	15.13	11.76
Mining	0.00	0.02	0.03	0.02
Forestry	51.89	0.13	12.92	13.09
Marine	0.09	27.60	38.20	29.38
Subtotal	*62.55*	*56.70*	*66.28*	*54.25*
Interactive				
Agriculture–Mining	0.02	0.40	–0.03	0.32
Agriculture–Forestry	37.47	0.18	6.76	10.72
Agriculture–Marine	–0.21	23.55	9.44	15.26
Mining–Forestry	0.10	0.35	0.33	0.44
Mining–Marine	–0.00	0.56	0.74	0.69
Forestry–Marine	0.07	18.26	16.48	18.32
Subtotal	*37.45*	*43.30*	*33.48*	*45.75*
Total	**100.00**	**100.00**	**100.00**	**100.00**

(d) Vanuatu

In the 1960s, direct contribution of sectoral revenue variability to total CERV was dominated by the marine sector (41 per cent), followed by agriculture (34 per cent) (Table 9.4). In the 1970s and 1980s, the major sector contributing variability to total CERV was agriculture which contributed about 72 per cent and 82 per cent of total CERV, respectively. Throughout, forestry revenue variability was a minor contributor to total CERV. The total direct contributions of sectoral revenue variability were substantial in Vanuatu. These were about 75, 87, 98 and 78 per cent for the 1961–70, 1971–80, 1981–90 and 1961–90 subperiods, respectively.

Total interactive sectoral revenue variability contributions to CERV were 25 per cent in the 1960s and 22 per cent in the 30–year period. These interactive contributions became less substantial in the 1970s (13 per cent) and minor in the 1980s (2 per cent). In all the subperiods, revenue variability in agriculture–marine sectoral interactions were the highest contributors to total CERV.

In summary, while most sectoral revenue variability is contributed from total direct sources, the indirect contributions are also important in Vanuatu. During the 1960s, most revenue variability was concentrated in the marine sector, followed by agriculture. In the 1970s and 1980s, a very high variability concentration was found in the agricultural sector.

Table 9.4: Percentage variance contribution to CERV by individual sectors for 10– and 30–year subperiods, Vanuatu

	Subperiods			
Sectors	1961–70	1971–80	1981–90	1961–90
Direct				
Agriculture	33.83	72.15	82.53	59.43
Marine	41.19	14.58	14.30	17.32
Forestry	0.27	0.29	1.01	1.44
Subtotal	*75.29*	*87.02*	*97.84*	*78.19*
Interactive				
Agriculture–Marine	19.46	9.20	7.87	14.99
Agriculture–Forestry	2.35	3.04	–2.98	5.23
Marine–Forestry	2.90	0.74	–2.73	1.59
Subtotal	*24.71*	*12.98*	*2.16*	*21.81*
Total	**100.00**	**100.00**	**100.00**	**100.00**

9.4.3 Variance contribution to CERV by individual commodities

(a) Fiji

Throughout the 30–year period and within all the 10–year subperiods (Tables 9.5), sugar was by far the single most important contributor of variability to overall CERV. Variability in sugar revenues contributed about 54, 88, 77, and 44 per cent to total CERV in the 1960s, 1970s and 1980s, respectively.

The direct contribution of commodity variability to CERV predominated throughout the subperiods, although the variability was more substantial during the 1960s and 1970s with over 90 per cent and 78 per cent, respectively, of the total CERV than in the 1980s. As mentioned, most of this variability was contributed by sugar. Contributions of individual commodity revenue variability to total CERV from molasses, coconut oil, gold, forestry and marine were relatively minor. During the 1960s, however, coconut oil was the second most important direct contributor of revenue variability to total CERV, but in the 1980s contributions of gold revenue variability to total CERV also became important.

The total indirect contributions of variability in individual commodity revenues to total CERV were most substantial in the 1980s (42 per cent) and in the whole 30–year period (38 per cent). These indirect contributions were about 21 per cent in the 1970s and 10 per cent in the 1960s.

In summary, direct contributions of individual commodity revenue variability to total CERV were concentrated most in sugar throughout all the subperiods in Fiji. Among the interactive contributions of individual commodity revenue variability to total CERV, most of that variability was concentrated in sugar–coconut oil (5 per cent) in the 1960s, sugar–molasses (6 per cent) in the 1970s, and sugar–gold (19 per cent) in the 1980s and sugar-gold (15 per cent) in the whole 30–year period (1961–90).

Table 9.5: Percentage variance contribution to CERV by individual commodities for 10– and 30–year subperiods, Fiji

Commodities	Subperiods 1961–70	1971–80	1981–90	1961–90
Direct				
Sugar	88.54	76.73	43.99	53.50
Molasses	0.03	0.58	0.23	0.25
Coconut oil	1.20	0.38	0.31	0.14
Gold	0.24	0.30	10.78	5.98
Forestry	0.05	0.05	0.59	0.27
Marine	–	0.81	2.17	1.73
Subtotal	*90.06*	*78.85*	*58.07*	*61.87*
Interactive				
Sugar–Molasses	0.88	5.99	2.88	3.51
Sugar–Coconut oil	4.97	2.34	–1.97	0.52
Sugar–Gold	2.84	3.79	19.45	15.42
Sugar–Forestry	0.86	1.75	4.46	3.23
Sugar–Marine	–	5.78	8.63	8.71
Molasses–Coconut oil	0.04	0.18	–0.12	0.03
Molasses–Gold	0.07	0.26	1.20	0.99
Molasses–Forestry	0.03	0.17	0.28	0.21
Molasses–Marine	–	0.06	0.53	0.58
Coconut oil–Gold	0.18	0.09	–0.97	–0.05
Coconut oil–Forestry	–0.01	0.04	–0.19	–0.01
Coconut oil–Marine	–	0.34	–0.34	0.05
Gold–Forestry	0.08	0.10	2.47	1.25
Gold–Marine	–	0.12	4.56	3.05
Forestry–Marine	–	0.14	1.06	0.64
Subtotal	*9.94*	*21.15*	*41.93*	*38.13*
Total	**100.00**	**100.00**	**100.00**	**100.00**

(b) PNG

On disaggregating total CERV into contributions by individual commodity revenue variability in PNG, its contributions were found to be widely spread compared with similar contributions from the other Melanesian nations. This is because of the more varied export base in PNG, with 12 individual commodities which gave rise to 66 paired commodity interactions considered worth analysing. Hence, contributions of individual commodity revenue variability to total CERV look relatively small (Table 9.6).

In the 1960s, coffee was the predominant contributor of direct individual commodity revenue variability to total CERV, followed by cocoa and copra, respectively. During the 1970 and 1980 decades, commodity revenue variability contributions from coffee to gross CERV diminished when the newly emerging commodities, copper and gold, took the lead in contributing revenue variability to overall CERV. Copper became the most important individual commodity revenue variability contributor to total CERV in the 1970s followed by variability in gold and coffee revenues, while gold revenue variability took the lead in the 1980s, followed by variability in copper and coffee revenues.

Total direct contributions of individual commodity revenue variability to gross CERV were about 45 per cent in the 1960s, increasing to about 61 per cent and 60 per cent in the 1970s and 1980s, and total interactions of individual commodity revenue variability were therefore about 55, 39 and 40 per cent over the same decades (Table 9.6).

During the 30–year period, contributions from total covariances of individual commodity revenues were higher (57 per cent) than those from total direct contributions (43 per cent), reflecting the importance of variability in commodity revenue interactions in PNG. Only a few interactions made negative contributions, thereby resulting in positive total indirect contributions of individual commodity revenue variability to total CERV.

In summary, in almost all cases, greatest covariabilities came from pairs of individual commodities involving coffee, cocoa, copra, palm oil, copper and gold revenue combinations (for these details see Table 9.6). Most variability is highly concentrated in these same pairs of individual commodities. In terms of direct contributors of variability in individual commodity revenues to total CERV in PNG, most variability was concentrated in gold, copper and coffee.

Table 9.6: Percentage variance contribution to CERV by individual commodities for 10– and 30–year subperiods, PNG

Commodities	Subperiods			
	1961–70	1971–80	1981–90	1961–90
Direct				
Coffee	26.60	9.71	3.31	3.04
Cocoa	13.32	2.33	0.37	0.50
Copra	3.29	0.37	0.33	0.09
Coconut oil	0.92	0.10	0.16	0.05
Rubber	0.04	0.00	0.00	0.00
Logs	0.33	0.26	1.10	0.99
Forestry	0.56	0.03	1.10	0.94
Marine	0.23	0.36	0.08	0.07
Tea	0.09	0.05	0.03	0.02
Palm oil	–	0.90	0.78	0.36
Copper	–	25.44	28.78	15.08
Gold	–	21.36	24.21	21.58
Subtotal	*45.38*	*60.91*	*60.25*	*42.72*
Interactive				
Coffee–Cocoa	17.01	4.21	0.62	1.09
Coffee–Copra	7.08	0.96	–0.18	0.20
Coffee–Coconut oil	3.51	0.57	–0.08	0.24
Coffee–Rubber	–0.06	0.07	0.02	0.01
Coffee–Logs	2.51	0.98	0.96	1.30
Coffee–Forestry	3.49	1.20	0.96	1.31
Coffee–Marine	1.87	1.23	–0.19	0.25
Coffee–Tea	1.32	0.57	–0.02	0.19
Coffee–Palm oil	–	0.78	0.18	0.67
Coffee–Copper	–	–3.17	0.73	3.99
Coffee–Gold	–	11.52	5.41	6.55
Cocoa–Copra	4.11	0.57	0.23	0.14
Cocoa–Coconut oil	1.83	0.29	0.16	0.12
Cocoa–Rubber	–0.09	0.02	0.01	0.01
Cocoa–Logs	1.61	0.35	0.27	0.41
Cocoa–Forestry	2.28	0.48	0.27	0.42
Cocoa–Marine	0.90	0.43	–0.03	0.11
Cocoa–Tea	0.77	0.27	0.06	0.08
Cocoa–Palm oil	–	0.36	0.39	0.27
Cocoa–Copper	–	–0.29	–0.56	1.46
Cocoa–Gold	–	4.57	0.68	2.00
Copra–Coconut oil	1.37	0.19	0.22	0.06
Copra–Rubber	–0.05	0.02	0.00	0.00
Copra–Logs	0.68	0.20	–0.06	0.08
Copra–Forestry	0.95	0.23	–0.06	0.08
Copra–Marine	0.50	0.17	0.02	0.04
Copra–Tea	0.28	0.07	0.09	0.03

Table 9.6: continued – (PNG)

Commodities	Subperiods 1961–70	1971–80	1981–90	1961–90
Interactive				
Copra–Palm oil	–	0.14	0.40	0.11
Copra–Copper	–	1.37	−1.13	0.30
Copra–Gold	–	1.88	−1.13	0.30
Coconut oil–Rubber	–0.04	0.01	0.00	0.00
Coconut oil–Logs	0.42	0.12	0.02	0.14
Coconut oil–Forestry	0.55	0.14	0.02	0.14
Coconut oil–Marine	0.38	0.11	−0.01	0.03
Coconut oil–Tea	0.17	0.04	0.06	0.03
Coconut oil–Palm oil	–	0.08	0.31	0.12
Coconut oil–Copper	–	0.68	−0.53	0.43
Coconut oil–Gold	–	1.12	−0.66	0.58
Rubber–Logs	–0.04	0.01	0.01	0.01
Rubber–Forestry	–0.04	0.01	0.01	0.01
Rubber–Marine	–0.02	0.01	0.00	0.00
Rubber–Tea	0.00	0.00	−0.00	0.00
Rubber–Palm oil	–	0.01	0.00	0.00
Rubber–Copper	–	0.11	0.07	0.03
Rubber–Gold	–	0.11	0.08	0.03
Logs–Forestry	0.43	0.25	1.10	0.97
Logs–Marine	0.23	0.25	−0.15	0.06
Logs–Tea	0.13	0.07	−0.04	0.08
Logs–Palm oil	–	0.12	0.18	0.47
Logs–Copper	–	0.00	3.83	2.81
Logs–Gold	–	2.10	3.80	4.38
Forestry–Marine	0.29	0.26	−0.15	0.07
Forestry–Tea	0.17	0.08	−0.04	0.08
Forestry–Palm oil	–	0.14	0.18	0.46
Forestry–Copper	–	0.08	3.83	2.82
Forestry–Gold	–	2.13	3.80	4.27
Marine–Tea	0.12	0.08	−0.00	0.02
Marine–Palm oil	–	0.15	−0.06	0.04
Marine–Copper	–	−0.23	−0.55	0.36
Marine–Gold	–	2.18	−0.63	0.39
Tea–Palm oil	–	0.05	0.12	0.07
Tea–Copper	–	–0.11	−0.44	0.26
Tea–Gold	–	0.74	−0.37	0.39
Palm oil–Copper	–	0.14	−0.44	1.19
Palm oil–Gold	–	1.18	−0.15	2.03
Copper–Gold	–	−3.37	18.31	12.69
Subtotal	*54.62*	*39.09*	*39.75*	*57.28*
Total	**100.00**	**100.00**	**100.00**	**100.00**

(c) SI

The contribution of variability in individual commodity revenues to overall CERV in SI was largely distributed amongst forestry, copra, marine and fish exports. Forestry revenue contributed the highest variability (about 77 per cent) to total CERV during the 1960 decade, followed by copra with about 15 per cent revenue variability (Table 9.7). With almost equal magnitudes during the 1970s and 1980s, variability of marine and fish revenues became the two leading contributors to total CERV, followed by forestry and copra, respectively.

The total direct variability contribution to gross CERV from individual commodities was slightly over 93 per cent during the 1960s. This contribution decreased drastically to slightly below 40 per cent and 50 per cent during the 1970s and 1980s, respectively, thus reflecting the importance of commodity interactions in the 1970s and 1980s when their total variability contributions to gross CERV were slightly over 60 per cent and 50 per cent, respectively.

The importance of individual commodity interactions is also reflected by total contributions over the 30–year period where about 40 per cent and 60 per cent of CERV was contributed by direct and interactive ways, respectively. As in PNG, in SI total CERV is largely distributed over variability in commodity interactions.

In summary, except for the 1960 decade when CERV was concentrated directly in individual commodities, most CERV in SI became concentrated in commodity interactions during the 1970s and 1980s. The largest interactions came from the various paired combinations of forestry, copra, marine and fish exports.

Table 9.7: Percentage variance contribution to CERV by individual commodities for 10– and 30–year subperiods, SI

	Subperiods			
Commodities	1961–70	1971–80	1981–90	1961–90
Direct				
Copra	15.42	4.75	3.01	1.39
Forestry	77.66	5.89	6.90	7.18
Cocoa	0.02	0.02	0.50	0.29
Marine	0.13	12.67	20.40	16.10
Gold	0.00	0.01	0.02	0.01
Fish	–	12.09	17.16	14.25
Palm oil & Kernel	–	2.18	1.16	1.12
Subtotal	*93.23*	*37.61*	*49.15*	*40.34*
Interactive				
Copra–Forestry	4.32	4.37	0.29	1.94
Copra–Cocoa	0.19	0.24	0.04	0.32
Copra–Marine	–0.32	5.62	0.26	2.75
Copra–Gold	0.02	0.09	–0.06	0.05
Copra–Fish	–	5.50	0.24	2.61
Copra–Palm oil	–	2.75	1.32	1.05
Forestry–Cocoa	1.29	0.28	1.76	1.36
Forestry–Marine	1.13	8.38	8.51	10.04
Forestry–Gold	0.14	0.16	0.18	0.24
Forestry–Fish	–	8.18	7.72	9.40
Forestry–Palm oil	–	3.39	1.75	2.57
Cocoa–Marine	0.01	0.40	2.68	2.00
Cocoa–Gold	0.00	0.01	0.06	0.05
Cocoa–Fish	–	0.38	2.44	1.87
Cocoa–Palm oil	–	0.19	0.38	0.46
Marine–Gold	–0.01	0.26	0.40	0.38
Marine–Fish	–	12.36	18.68	15.14
Marine–Palm oil	–	4.80	2.10	3.62
Gold–Fish	–	0.26	0.38	0.36
Gold–Palm oil	–	0.09	–0.03	0.07
Fish–Palm oil	–	4.68	1.75	3.38
Subtotal	*6.77*	*62.39*	*50.85*	*59.66*
Total	**100.00**	**100.00**	**100.00**	**100.00**

(d) Vanuatu

It is observed (see Table 9.8) that most CERV was contributed directly by variability in individual commodity revenues in Vanuatu. Specifically, it is shown that during the 1960s, 1970s and 1980s, about 74, 80 and 97 per cent, respectively, of gross CERV was directly contributed by total variability from individual commodity revenues. This means that during the same period, about 26, 20 and 3 per cent of CERV was contributed through the interactions between the individual commodity revenues.

Table 9.8: Percentage variance contribution to CERV by individual commodities for 10– and 30–year subperiods, Vanuatu

	Subperiods			
Commodities	1961–70	1971–80	1981–90	1961–90
Direct				
Copra	27.64	62.88	82.13	49.16
Cocoa	0.50	0.87	0.58	0.87
Coffee	0.01	0.01	0.01	0.00
Fish	45.54	16.08	12.74	19.31
Beef	0.31	0.32	0.91	1.60
Timber	–	0.08	0.94	0.68
Subtotal	*74.00*	*80.24*	*97.31*	*71.62*
Interactive				
Copra–Cocoa	1.96	4.19	–1.83	2.82
Copra–Coffee	0.23	0.49	0.35	0.23
Copra–Fish	14.97	7.15	10.46	13.13
Copra–Beef	2.05	2.62	–3.97	3.21
Copra–Timber	–	1.31	1.18	2.52
Cocoa–Coffee	–0.01	0.04	0.00	0.01
Cocoa–Fish	3.40	2.05	–1.13	1.73
Cocoa–Beef	0.24	0.38	0.42	1.01
Cocoa–Timber	–	0.13	0.25	0.52
Coffee–Fish	–0.05	0.14	0.12	0.07
Coffee–Beef	0.01	0.03	–0.02	0.01
Coffee–Timber	–	0.02	0.02	0.01
Fish–Beef	3.20	0.81	–2.43	1.77
Fish–Timber	–	0.26	–1.03	0.53
Beef–Timber	–	0.14	0.30	0.81
Subtotal	*26.00*	*19.76*	*2.69*	*28.38*
Total	**100.00**	**100.00**	**100.00**	**100.00**

When the total direct contributions of variability in individual commodity revenues to gross CERV are disaggregated, it is shown (Table 9.8) that fish export revenue (about 45 per cent), followed by copra revenue (about 28 per cent), predominated in 1960s. These commodities changed places during 1970s and 1980s where variability in copra revenue led with about 63 per cent of total CERV contribution in the 1970s and 82 per cent in the 1980s, while variability in fish revenue followed with 16 per cent and 13 per cent during the same periods.

Thus, most CERV was concentrated in copra and fish revenues variability over most of the 10–year subperiods in Vanuatu. This fact is confirmed by the contributions of revenue variability to total CERV from the same commodities over the 30–year period. During the 30–year period, revenue variability from individual copra and fish commodities and copra–fish interactions contributed about 49, 19 and 13 per cent of gross CERV in Vanuatu, respectively.

9.4.4 Sources of variability in the major export market variables

(a) Best guess elasticity estimates

Best `guess elasticity' estimates are used in this study to overcome some limitations in previous similar studies where demand and supply were assumed to be perfectly elastic and inelastic, respectively. As mentioned earlier in this chapter, the VDM method did not allow for any interactions among commodities such as the substitution in production of one crop for another in response to changes in relative prices. Therefore, only own-price supply and demand elasticities are needed. These estimates, presented in Appendix 9.2 (Fleming and Piggott 1989), are utilised across the countries with similar commodities. Relevant elasticities are incorporated in the SHAZAM instruction programs used for estimating sources of commodity revenue variability in terms of demand, supply and demand–supply interaction effects (see SHAZAM sample instruction program in Appendix 9.1).

The main consideration taken into account when estimating the elasticities is the availability of substitutes for the SPINs' commodities. Not only is substitutability of one commodity for another within the SPINs taken into account but, more importantly, the substitutability of the competitor countries' exports of commodities against those from the SPINs are of crucial consideration. The more the substitutes within and outside the SPINs, the greater the price elasticity of demand. Likewise, the ease with which a commodity is substituted at the production and/or supply level, the greater the price elasticity of supply (Fleming and Piggott 1989).

(b) Fiji

The sources of commodity variability, decomposed into demand, supply and demand–supply interaction variability, for the major market variables (price, quantity and revenue) for each selected commodity over 10– and 30–year subperiods are summarised in Tables 9.9a and 9.9b for Fiji. Instability in supply was the major source of variability in both price and quantity for sugar and molasses throughout the subperiods. This is contrary to what Fleming and Piggott (1989) found during the 1970–83 subperiod.

For the other commodities (cocoa, gold, forestry and marine), fluctuations in demand were the main sources of price variability while fluctuations in supply were dominated in quantity variability throughout the subperiods. In all cases, fluctuations in demand–supply interactions made an important source of variability contribution to both price and quantity variability. It should be noted that positive interactions imply that the direct demand and supply effects reinforce each other to increase overall variability. On the other hand, negative interactions work in such a way that the demand and supply effects offset each other to decrease overall variability (Piggott et al. 1986, Fleming and Piggott 1989).

When the sources of revenue variability were examined, it was found that the major sources of variability varied across the commodity revenues and subperiods. For example, in sugar and molasses revenues, demand–supply interaction contributed more variability toward revenue variability than either demand or supply separately in most of the subperiods. This implies that both demand and supply variability are important sources of variability for sugar and molasses revenues variability. However, of the direct effects, supply contributed more variability than demand during the 1960s while demand variability was greater than supply variability in the 1970s and 1980s. In addition, demand variability dominated over supply variability in the 30–year period (1961–90) as well.

Table 9.9a: Percentage contribution of demand, supply and demand–supply interaction effects to price, volume and revenue variability for 10–year subperiods, Fiji

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1961–70)			10–years (1971–80)		
(1) Sugar						
DE[b]	1.80	0.00	1.13	9.62	0.00	3.97
SE[c]	93.81	100.00	10.59	98.66	99.99	5.86
IE[d]	4.39	–0.00	88.28	–8.28	0.01	90.17
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(2) Molasses						
DE	0.86	0.00	0.58	312.48	0.00	60.66
SE	106.00	99.99	29.99	593.78	99.94	29.57
IE	–6.86	0.01	69.43	–806.26	0.06	9.77
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(3) Cocoa						
DE	69.77	0.01	32.93	86.77	0.12	308.05
SE	6.52	101.09	302.34	0.69	105.69	308.82
IE	23.71	–1.10	–235.27	12.54	–5.81	–516.87
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(4) Gold						
DE	99.61	1.31	76.80	99.00	4.38	214.99
SE	0.01	103.41	51.19	0.00	137.58	57.20
IE	0.38	–4.72	–27.99	1.00	–41.10	–172.19
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(5) Forestry						
DE	101.35	6.15	52.64	101.30	1.53	20.00
SE	0.01	69.04	34.18	0.07	92.28	65.70
IE	–1.36	24.81	13.18	–1.37	6.19	14.30
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9a: continued – (10–year subperiods, Fiji)

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1961–70)			10–years (1971–80)		
(6) Marine						
DE[b]	–	–	–	102.52	0.48	25.55
SE[c]	–	–	–	0.03	89.94	40.66
IE[d]	–	–	–	–2.55	9.58	33.79
Total	–	–	–	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.9b: Percentage contribution of demand, supply and demand–supply interaction effects to price, volume and revenue variability for 10– and 30–year periods, Fiji

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1981–90)			30–years (1961–90)		
(1) Sugar						
DE[b]	16.79	0.00	6.18	36.45	0.00	15.33
SE[c]	99.77	99.98	3.56	125.35	99.95	6.91
IE[d]	−16.56	0.02	90.26	−61.80	0.05	77.76
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(2) Molasses						
DE	21.84	0.00	9.06	141.22	0.00	44.52
SE	99.70	99.99	6.10	281.73	99.94	19.42
IE	−21.54	0.01	84.84	−322.95	0.06	36.06
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(3) Cocoa						
DE	90.40	0.08	71.78	83.49	0.05	326.57
SE	1.07	102.37	149.15	1.42	103.25	526.02
IE	8.53	−2.45	−120.93	15.09	−3.30	−762.59
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(4) Gold						
DE	104.23	0.19	11.68	99.71	5.53	105.97
SE	0.06	92.54	48.80	0.00	109.58	17.81
IE	−4.29	7.27	39.52	0.29	−15.11	−23.78
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(5) Forestry						
DE	100.07	6.84	56.67	100.98	7.65	49.62
SE	0.02	91.39	41.21	0.01	69.91	25.64
IE	−0.09	1.77	2.12	−0.99	22.44	24.74
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9b: Continued – (10– and 30–year subperiods, Fiji)

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1981–90)			30–years (1961–90)		
(7) Marine						
DE[b]	101.89	0.80	30.45	102.25	0.90	31.63
SE[c]	0.02	87.17	27.87	0.02	83.21	25.02
IE[d]	−1.91	12.03	41.68	−2.27	15.89	43.35
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Similarly, cocoa revenue variability was dominated by sources from demand–supply interaction variability, especially during the whole 30–year period and in the 1970s. In all the subperiods, variability in supply sources contributed more than sources in demand variability to cocoa revenue variability. For gold and forestry revenue variability, demand effects dominated during the whole 30–year period, but demand–supply interactions dominated for marine revenue variability. In the 1960s, demand variability was dominant in both the gold and forestry revenue variability. The same effect continued for gold and forestry revenue variability in the 1970s and 1980s, respectively. During the later subperiods, supply variability was greater than demand variability in forestry and gold export revenue variability. Likewise, supply variability was more important than demand variability in the 1970s, while demand–supply interaction variability dominated in the 1980s for the marine export revenue variability.

In summary, the evidence indicates that demand, supply and demand–supply interaction effects were all important sources of variability in commodity export revenues in Fiji. However, the relative importance of the different factors kept shifting across the variables and subperiods.

(c) PNG

The sources of variability in the major commodity export market variables in PNG during the 10– and 30–year subperiods are presented in Tables 9.10a and 9.10b. During the 30–year period, demand effects were the main sources of variability in price while supply effects contributed most variability in quantity for all the primary commodities in PNG. Supply was the major source of variability in coffee, marine, tea and palm oil revenues, followed by either demand or demand–supply interaction effects. Demand effects contributed most to variability in cocoa and coconut oil export revenues while demand–supply interaction effects contributed most to variability in copra, rubber, logs, forestry, copper and gold export revenues – again, followed by contributions from demand effects.

During the 10–year subperiods, demand was the dominant source of price variability of most export commodities (except in coffee and copra where demand–supply interactions dominated), while supply effects dominated in the quantity variability of all the commodities. In the 1960s, coffee, cocoa, logs, marine and tea export revenues were disturbed most by supply side variability while demand variability dominated coconut oil revenues only. Demand–supply interaction variability was dominant in revenues of the rest of the commodities (copra, rubber and forestry).

In the 1970s, demand was to price variability as supply was to quantity variability in all the commodities. Except for tea, palm oil and copper export revenues, whose variability was contributed mostly by supply effects, demand effects were the major sources of revenue variability in all the remaining commodities (coffee, cocoa, copra, coconut oil, rubber, logs, forestry, marine and gold). The results for coffee, cocoa, copra and coconut oil confirm those found by Fleming and Piggott (1989) during the 1970s decade.

In the latest decade (the 1980s), the sources of price and quantity variability remained approximately the same as in the 1970s, when demand effects dominated in price variability and supply dominated in quantity variability for all the analysed commodities. However, variability in commodity export revenues changed quite substantially. Demand–supply interaction effects became the dominant sources of variability in coffee, cocoa, copra and marine export revenues. Demand effects dominated in coconut oil, logs, forestry, tea, palm oil and copper revenues variability, while supply dominated only in rubber and gold revenues variability.

Table 9.10a: Percentage contribution of demand, supply and demand–supply interaction effects to price, volume and revenue variability for 10–year subperiods, PNG

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1961–70)			10–years (1971–80)		
(1) Coffee						
DE[b]	22.90	0.00	4.21	121.72	0.00	87.60
SE[c]	35.48	100.06	290.01	7.67	99.81	40.72
IE[d]	41.62	–0.06	–194.22	–29.39	0.19	–28.32
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(2) Cocoa						
DE	89.33	0.00	21.74	92.28	0.00	105.10
SE	23.53	99.99	158.11	1.50	100.17	22.69
IE	–12.86	0.01	–79.85	6.22	–0.17	–27.79
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(3) Copra						
DE	37.30	0.00	279.84	59.88	0.01	104.10
SE	21.91	100.56	1040.87	8.16	101.18	68.18
IE	40.79	–0.56	–1220.71	31.96	–1.19	–72.40
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(4) Coconut oil						
DE	99.54	14.18	136.26	99.96	30.23	100.57
SE	0.00	129.77	21.59	0.00	78.09	4.51
IE	0.46	–43.95	–57.85	0.04	–8.32	–5.08
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(5) Rubber						
DE	98.26	3.92	441.96	98.75	8.43	269.15
SE	0.01	137.53	268.04	0.01	155.19	86.16
IE	1.73	–41.45	–610.00	1.24	–63.62	–255.31
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.10a: continued – (10–year subperiods, PNG)

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1961–70)			10–years (1971–80)		
(6) Logs						
DE[b]	92.66	0.44	15.02	100.10	30.55	88.11
SE[c]	0.20	111.01	152.01	0.00	59.00	6.99
IE[d]	7.14	–11.45	–67.03	–0.10	10.45	4.90
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(7) Forestry						
DE	95.78	2.23	104.55	99.98	27.28	89.79
SE	0.06	126.89	286.89	0.00	74.28	13.38
IE	4.16	–29.12	–291.12	0.02	–1.56	-3.17
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(8) Marine						
DE	97.74	0.37	57.92	100.56	0.82	40.90
SE	0.04	106.38	140.16	0.02	95.39	40.31
IE	2.22	–6.75	–98.08	–0.58	3.79	18.79
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(9) Tea						
DE	102.23	0.06	15.89	100.56	0.04	12.32
SE	0.04	97.24	59.10	0.07	99.50	76.39
IE	–2.27	2.70	25.01	–0.63	0.46	11.29
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(10) Palm oil						
DE	–	–	–	101.39	0.68	36.41
SE	–	–	–	0.01	89.93	40.76
IE	–	–	–	–1.40	9.39	22.83
Total	–	–	–	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.10a: continued – (10–year subperiods, PNG)

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1961–70)			10–years (1971–80)		
(11) Copper						
DE[b]	–	–	–	100.55	0.63	41.88
SE[c]	–	–	–	0.02	95.99	54.01
IE[d]	–	–	–	–0.57	3.38	4.11
Total	–	–	–	*100.00*	*100.00*	*100.00*
(12) Gold						
DE[b]	–	–	–	100.65	1.94	58.84
SE[c]	–	–	–	0.01	85.99	22.34
IE[d]	–	–	–	–0.66	12.07	18.82
Total	–	–	–	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.10b: Percentage contribution of demand, supply and demand–supply interaction effects to price, volume and revenue variability for 10– and 30–year periods, PNG

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1981–90)			30–years (1961–90)		
(1) Coffee						
DE[b]	46.72	0.00	148.28	108.63	0.00	69.23
SE[c]	29.14	100.04	366.45	61.96	99.94	227.45
IE[d]	24.14	–0.04	–414.73	–70.59	0.06	–196.68
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(2) Cocoa						
DE	65.16	0.00	132.09	110.41	0.00	70.60
SE	12.18	100.06	244.56	7.16	99.92	61.28
IE	22.66	–0.06	–276.65	–17.57	0.08	–31.88
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(3) Copra						
DE	65.16	0.01	127.69	63.94	0.01	126.94
SE	10.39	100.70	112.47	9.32	100.86	100.56
IE	24.45	–0.71	–140.16	26.74	–0.87	–127.50
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(4) Coconut oil						
DE	99.80	96.44	118.09	100.28	7.97	72.47
SE	0.00	134.35	2.85	0.00	77.06	12.15
IE	0.20	–130.79	–20.94	–0.28	14.97	15.38
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(5) Rubber						
DE	126.02	1.26	41.83	98.72	4.23	191.82
SE	0.02	98.40	56.37	0.01	128.56	100.85
IE	–26.04	0.34	1.80	1.27	–32.79	–192.67
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.10b: continued – (10– and 30–year subperiods, PNG)

Coms[a]	% contribution to variance of: Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1981–90)			30–years (1961–90)		
(6) Logs						
DE[b]	101.14	7.74	51.78	102.30	3.62	31.51
SE[c]	0.01	62.35	16.99	0.02	68.48	24.51
IE[d]	−1.15	29.91	31.23	−2.32	27.90	43.98
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(7) Forestry						
DE	100.97	11.13	55.91	102.63	2.90	24.06
SE	0.00	56.72	15.45	0.03	74.54	33.60
IE	−0.97	32.15	28.64	−2.66	22.56	42.34
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(8) Marine						
DE	95.32	0.14	102.05	97.57	0.48	81.84
SE	0.11	105.13	662.60	0.03	109.03	156.75
IE	4.57	−5.27	−664.65	2.40	−9.51	−138.59
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(9) Tea						
DE	100.21	2.30	77.07	100.63	0.10	28.73
SE	0.00	87.85	6.80	0.02	98.63	67.15
IE	−0.21	9.85	16.13	−0.65	1.27	4.12
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(10) Palm oil						
DE	99.89	1.34	65.58	101.52	0.54	27.83
SE	0.00	100.11	41.27	0.02	91.32	39.93
IE	0.11	−1.45	−6.85	−1.54	8.14	32.24
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.10b: continued – (10– and 30–year subperiods, PNG)

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1981–90)			30–years (1961–90)		
(11) Copper						
DE[b]	100.31	13.05	77.85	101.49	1.22	38.04
SE[c]	0.00	48.17	2.42	0.01	81.64	21.54
IE[d]	–0.31	38.78	19.73	–1.50	17.14	40.42
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(12) Gold						
DE[b]	104.32	0.14	9.92	101.55	1.12	36.57
SE[c]	0.08	94.38	57.60	0.01	82.48	22.87
IE[d]	–4.40	5.48	32.48	–1.56	16.40	40.56
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

To summarise, the sources of commodity revenue variability differed across commodities and subperiods. In other words, not only were the sources different, but also the sources kept on changing from one commodity to another over the subperiods in PNG.

(d) SI

Sources of variability in the main market variables for the SI export commodities during the 10– and 30–year subperiods are presented in Tables 9.11a and 9.11b. Over the whole 30–year period (1961–90), demand effects were the major contributor of variability in price for all commodities except in forestry price where supply effects dominated, while supply was the main source of variability in the quantity variables.

Table 9.11a: Percentage contribution of demand, supply and demand–supply interaction effects to price, volume and revenue variability for 10–year subperiods, SI

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1961–70)			10–years (1971–80)		
(1) Copra						
DE[b]	70.16	0.02	127.16	93.11	0.06	91.63
SE[c]	3.85	102.05	481.48	1.32	101.23	66.96
IE[d]	25.99	–2.07	–508.64	5.57	–1.28	–58.59
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(2) Forestry						
DE	3.39	0.00	17.81	111.56	0.00	92.06
SE	94.12	100.06	181.81	22.48	99.95	2.80
IE	2.49	–0.00	–99.62	–34.04	0.05	5.14
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(3) Cocoa						
DE	100.19	3.86	26.08	100.23	2.49	38.96
SE	0.00	81.09	505.74	0.00	86.28	39.66
IE	–0.19	15.05	–431.82	–0.23	11.23	21.23
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(4) Marine						
DE	99.13	0.51	48.55	102.10	0.53	27.26
SE	0.03	102.93	81.33	0.03	90.65	39.49
IE	0.84	–3.44	–29.88	–2.13	8.82	33.25
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(5) Gold						
DE	96.11	0.05	64.74	100.21	10.75	88.16
SE	0.02	101.89	621.30	0.00	68.06	127.01
IE	3.69	–1.94	–586.04	–0.21	21.10	–115.17
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.11a: continued – (10–year subperiods, SI)

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1961–70)			10–years (1971–80)		
(6) Fish						
DE[b]	–	–	–	102.06	0.51	26.46
SE[c]	–	–	–	0.03	90.75	40.24
IE[d]	–	–	–	–2.09	8.74	33.30
Total	–	–	–	*100.00*	*100.00*	*100.00*
(7) Palm oil and Kernel						
DE	–	–	–	101.78	0.73	31.42
SE	–	–	–	0.01	86.38	31.43
IE	–	–	–	–1.79	12.89	37.15
Total	–	–	–	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.11b: Percentage contribution of demand, supply and demand–supply interaction effects to price, volume and revenue variability for 10– and 30–year subperiods, SI

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1981–90)			30–years (1961–90)		
(1) Copra						
DE[b]	88.68	0.04	102.51	96.54	0.08	87.56
SE[c]	2.24	101.19	85.90	1.05	100.61	44.89
IE[d]	9.08	−1.23	−88.41	2.41	−0.69	−32.45
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(2) Forestry						
DE	7.44	0.00	3.16	28.84	0.00	11.92
SE	70.91	100.02	2.75	138.64	99.97	7.12
IE	21.65	−0.02	94.09	−67.48	0.03	80.96
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(3) Cocoa						
DE	109.81	0.00	8.09	107.14	0.01	10.19
SE	0.55	99.07	75.62	0.31	98.79	62.56
IE	−10.36	0.93	16.29	−7.45	1.20	27.25
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(4) Marine						
DE	99.70	3.73	99.97	101.64	1.00	35.84
SE	0.00	105.11	23.84	0.01	86.03	26.28
IE	0.30	−8.84	−23.81	−1.65	12.97	37.88
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(5) Gold						
DE	99.64	1.23	77.24	100.75	2.17	56.18
SE	0.01	102.86	87.31	0.00	82.33	42.63
IE	0.35	−4.09	−64.55	−0.75	15.50	1.19
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.11b continued – (10– and 30–year subperiods, SI)

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1981–90)			30–years (1961–90)		
(6) Fish						
DE[b]	99.75	3.20	94.43	101.49	1.22	39.53
SE[c]	0.01	103.46	25.78	0.01	83.49	23.05
IE[d]	0.24	–6.66	–20.21	–1.50	15.29	37.42
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(7) Palm oil and Kernel						
DE	99.62	4.24	113.55	101.36	1.08	37.35
SE	0.01	111.62	25.18	0.01	84.38	24.83
IE	0.37	–15.86	–38.73	–1.37	14.54	37.82
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Demand effects dominated in revenue variability for copra, gold and fish; supply effects in only cocoa; and demand–supply interaction effects in forestry, marine and palm oil. In the 10–year subperiods, demand was the most important source of variability in prices, except for forestry price variability where supply was the most important source, while supply was the dominant source of variability in all the commodity quantities.

During the 1960s, supply dominated in forestry, cocoa, marine and gold revenues variability, while demand–supply interactions dominated in only copra revenue variability. In the 1960s, demand variability *per se* was not a dominant contributor to revenue variability of any commodity in SI.

During the 1970s, price variability was dominated by demand effects while variability in quantities was dominated by supply effects in all commodities analysed. Demand effects dominated in copra and forestry revenue variability, supply dominated in cocoa, marine, gold and fish revenue variability and demand–supply interaction effects dominated only in palm oil and kernel revenue variability. These results are fairly consistent with those found by Fleming and Piggott (1989) for copra prices, quantities and revenues and palm oil prices and quantities during the 1970s.

The sources of price and quantity variability for all the commodities during the 1980s were quite similar to those of the 1970s, but only in the forestry price variability were the supply effects dominant. Copra, marine, fish, and palm oil and kernel revenue variability was dominated by demand effects while cocoa and gold revenue variability was dominated by supply effects and forestry revenue variability by demand–supply interaction effects.

As in the other selected SPINs, SI experienced shifting sources of variability in the major market variables, particularly in the revenues. Hence, sources of revenue variability changed across the commodities and subperiods in SI.

(e) Vanuatu

Sources of variability for the major market variables for Vanuatu's principal export commodities over the 10– and 30–year subperiods are presented in Tables 9.12a and 9.12b. Over the 30 years, supply was the major contributor to quantity variability of all commodities and the coffee prices, while contributions from demand effects dominated in price variability of all other commodities. For commodity revenues, over the whole 30–year period, it is shown (Table 9.12b) that demand effects dominated in fish and beef revenue variability, supply dominated in cocoa and timber revenue variability and demand–supply interactions dominated in copra and coffee revenue variability.

In the 1960s, demand effects were predominant in price variability of all commodities except for coffee prices, while supply predominated in quantity variability of all commodities plus variability in the coffee prices. Supply effects contributed most to copra revenue variability, demand to cocoa and beef revenue variability, and demand–supply interactions to variability in coffee and fish revenues.

Table 9.12a: Percentage contribution of demand, supply and demand–supply interaction effects to price, volume and revenue variability for 10–year subperiods, Vanuatu

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1961–70)			10–years (1971–80)		
(1) Copra						
DE[b]	73.24	0.01	77.38	97.98	0.02	62.03
SE[c]	7.10	100.83	235.43	3.81	99.84	76.07
IE[d]	19.66	–0.84	–212.81	–1.79	0.14	–38.10
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(2) Cocoa						
DE	100.37	3.04	42.01	100.33	14.02	59.86
SE	0.01	89.23	41.20	0.00	66.45	20.83
IE	–0.38	7.73	16.79	–0.33	19.53	19.31
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(3) Coffee						
DE	4.86	0.00	3.16	41.79	0.00	142.51
SE	74.39	100.01	20.77	68.90	99.99	594.50
IE	20.75	–0.01	76.07	–10.69	0.01	–637.01
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(4) Fish						
DE	103.73	0.09	15.91	98.93	0.24	87.47
SE	0.04	94.39	38.91	0.02	104.14	86.96
IE	–3.77	5.52	45.18	1.05	–4.38	–74.43
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(5) Beef						
DE	101.35	7.16	52.13	99.25	11.99	107.73
SE	0.01	60.80	26.26	0.01	117.75	58.05
IE	–1.36	32.04	21.61	0.74	–29.74	–65.78
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.12a: continued – (10–year subperiods, Vanuatu)

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1961–70)			10–years (1971–80)		
(6) Timber						
DE[b]	–	–	–	102.21	0.01	25.04
SE[c]	–	–	–	0.02	98.74	38.83
IE[d]	–	–	–	–2.23	1.25	36.13
Total	–	–	–	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 9.12b: Percentage contribution of demand, supply and demand–supply interaction effects to price, volume and revenue variability for 10– and 30–year subperiods, Vanuatu

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1981–90)			30–years (1961–90)		
(1) Copra						
DE[b]	74.47	0.01	185.15	83.85	0.03	125.63
SE[c]	4.77	101.31	291.47	2.76	101.45	115.67
IE[d]	20.76	–1.32	–376.62	13.39	–1.48	–141.30
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(2) Cocoa						
DE	96.99	0.32	9.32	100.41	2.94	36.36
SE	0.20	103.39	115.74	0.02	91.54	52.58
IE	2.81	–3.71	–25.06	–0.43	5.52	11.06
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(3) Coffee						
DE	21.73	0.00	34.71	9.51	0.00	4.55
SE	65.31	100.01	440.92	63.91	100.02	20.23
IE	12.96	–0.01	–375.63	26.58	–0.02	75.22
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(4) Fish						
DE	98.47	0.42	267.47	99.40	1.53	135.89
SE	0.01	110.61	164.00	0.00	114.20	23.58
IE	1.52	–11.03	–331.47	0.60	–15.73	–59.47
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
(5) Beef						
DE	100.21	4.74	45.45	101.00	9.83	53.60
SE	0.02	91.62	47.46	0.01	57.53	17.50
IE	–0.23	3.64	7.09	–1.01	32.64	28.90
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

Table 12b continued – (10– and 30–year subperiods, Vanuatu)

	% contribution to variance of:					
Coms[a]	Price	Volume	Revenue	Price	Volume	Revenue
Subperiod	10–years (1981–90)			30–years (1961–90)		
(6) Timber						
DE[b]	98.32	0.01	122.65	100.50	0.01	38.26
SE[c]	0.02	101.21	154.94	0.02	99.63	48.96
IE[d]	1.66	−1.22	−177.59	−0.52	0.36	12.78
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Notes: [a] Coms = commodities, [b] DE = demand effect [c] SE = supply effect [d] IE = demand–supply interaction effect.

During the 1970s, the pattern of contributions to price and quantity variability was similar to that of the 1960s. However, the contribution to revenue variability changed slightly. Supply effects dominated copra and timber revenue variability, demand dominated revenue variability in cocoa, fish and beef, while demand–supply interaction effects dominated the variability in coffee revenues. While the 1970s results confirm those obtained by Fleming and Piggott (1989) for the variability in prices and quantities, and cocoa revenue variability, the results obtained here for copra revenue variability are contrary to those found by Fleming and Piggott.

The pattern for the sources of variability for the 1960s and 1970s was duplicated in the 1980s for the price and quantity variability. That is, supply effects dominated in quantity variability of all commodities analysed, plus the variability in coffee prices, while demand effects dominated in the price variability of all the other commodities. But the pattern for revenue variability changed quite substantially during the 1980s. Supply and demand–supply interaction effects were the dominant sources of revenue variability in all commodities in Vanuatu in the 1980s. As shown in Table 9.12b, the major sources of revenue variability in copra, fish and timber revenues was the demand–supply interaction effects while sources for cocoa, coffee and beef revenue variability were the supply effects.

Again, as in other selected SPINs (especially SI), Vanuatu experienced shifting sources of variability in the major market variables, particularly in the revenues. In fact, sources of revenue variability differed across commodities and subperiods. In general, however, supply effects contributed quite substantially to revenue variability in Vanuatu, particularly in the 1980s.

9.5 Summary and Some Conclusions

This analysis has produced some evidence indicating that the sources of commodity variability at sectoral and individual commodity levels, and in terms of demand and supply effects, are not singular. It has been shown that variability in different individual sectors and commodities and their paired combinations contributed to differing degrees to aggregate CERV, depending in part on the individual sector's or commodity's relative share of total export revenues.

The relative variance contributions to aggregate CERV varied across sectors, commodities and time–periods, and across nations. While direct contributions to aggregate CERV from variability in individual sectors and commodities were more often important than indirect contributions to total CERV, indirect contributions from variability in sectoral and commodity interactions were quite substantial.

Specifically, for the past three decades, most CERV in Fiji was concentrated in the agricultural sector variability. In PNG, CERV was most concentrated in agricultural sector variability in the 1960s while the mining sector variability took over in the 1970s and 1980s. In SI, forestry, agriculture and marine sectors were each leading in variability contribution to gross CERV in the 1960s, 1970s and 1980s, respectively. In the 1960s the marine sector, and in the 1970s and 1980s the agricultural sector were the dominant contributors of variability to aggregate CERV in Vanuatu.

In terms of individual commodities, most CERV in Fiji was concentrated in sugar variability throughout the whole period. In PNG, in descending order of importance, most CERV was concentrated in coffee, cocoa and copra variability in the 1960s. In the 1970s, the pattern of variability contribution to CERV changed to copper, gold and coffee exports, while in the 1980s gold, copper and coffee exports were the greatest variability contributors to aggregate CERV. In SI, it was variability in forestry and copra exports which mostly contributed to total CERV in the 1960s, while marine and fish exports did so in the 1970s and 1980s. Fish and copra exports variability contributed most to total CERV in Vanuatu in the 1960s as variability in copra and fish exports dominated in the 1970s and 1980s.

The sources of variability in prices, quantities and revenues from export commodities of the selected SPINs during the 30–year period were fairly consistent. Demand effects contributed mostly to variability in prices while supply effects did so for quantities. In revenues, the relative importance of the sources of variability varied from one commodity to another, from country to country and from one subperiod to another. However, it can be concluded that supply and demand–supply interaction effects were more important sources of revenue variability than demand effects in Fiji, SI and Vanuatu. On the other hand, demand and demand–supply effects were more important sources of revenue variability than were supply effects in PNG. These patterns of the sources of revenue variability were observable even during the shorter 10–year subperiods.

Finally, these results further confirm earlier results obtained in Chapters 7 and 8. In Chapter 7, it was found that CERV is caused by both the external (demand) and domestic (supply) factors. In Chapter 8, it was observed that export sector performance is determined (caused) by both external and domestic factors. And now, in Chapter 9, the empirical evidence points to demand, supply, and demand–supply interaction factors as the major sources of variability in commodity exports in the selected SPINs.

Chapter 10
CONCLUSIONS AND POLICY IMPLICATIONS

The conclusions and policy implications of this research are set out in this chapter. First, a summary of results and conclusions in relation to the stated research objectives and hypotheses is presented. A discussion of the strategic policy implications follows. The policy implications are extrapolated to alternative policy setting for the selected SPINs. Finally, an assessment of the study is made, including the limitations and the scope for further research.

10.1 Introduction

The first purpose of this chapter is to summarise the major findings of this study and to present the conclusions reached. The findings are discussed in the light of the objectives and hypotheses as set out in Chapter 1.

The second purpose of the chapter is to discuss the policy implications of the study. This is done by showing how the study findings relate to specific policy issues such as the commodity–specific price stabilisation schemes. Strategic policy implications are then suggested and these are extrapolated into some possible policy setting in the SPINs, especially for the Melanesian countries.

The third purpose is to assess the strong and weak points of this study. Scope for further research is suggested and some concluding remarks are made.

10.2 Summary of Results and Conclusions

The results are summarised with respect to research objectives and hypotheses. They are discussed under five headings corresponding to five objectives. The sixth objective, which deals with policy implications, is covered in section 10.3. The five headings are concerned with (a) commodity price stabilisation schemes, (b) causality between commodity export revenue growth and economic growth, (c) causes of CERV, (d) determinants of export sector performance, and (e) sources of CERV.

10.2.1 Historical overview of price stabilisation schemes in the SPINs

This objective was discussed in Chapter 2, using a descriptive approach. Because of the breadth of the subject, the description was confined to only one of the selected SPINs, PNG, which was perceived to have the longest experience of commodity stabilisation schemes. The discussion of commodity–specific price stabilisation schemes covered the four major commodities (copra, coffee, cocoa and palm oil) in PNG.

From this review, it was deduced that substantial amounts of resources have been devoted to price stabilisation in the SPINs. This process has been going on for a long time, at least for the past four decades, which implies that variability of prices and revenues has been an old problem in the SPINs. Although the schemes were supposed to be self–financing, they often ended up relying on government grants or loans on government guarantee to maintain their operations, and thus turned into subsidy schemes.

It seems that the basis of most schemes was faith in their effectiveness, rather than empirical evidence and careful analysis. Usually there was an implicit or explicit assumption that variability in export returns was attributable wholly or mainly to external causes. Hence, the schemes were seen as guarding against instability from only one side (external) rather than from two sides (external and domestic).

10.2.2 Causality between export expansion and instability and economic growth and instability

It was hypothesised that commodity export revenue growth and instability in the selected SPINs have no significant causal relationships with economic growth and instability. The causality between export expansion and instability, and economic growth and instability was analysed in Chapter 6. The results are summarised in terms of cointegration, Granger causality, FEDA and IRA, and the hypothesis testing.

(a) Cointegration test results

Of the three cointegration tests, the ADF and PP tests supported some minor cointegration in Fiji, the ADF, PP and POC supported moderate cointegration in PNG, while all three tests supported substantial cointegration in SI. Hence, moderate to substantial cointegration was observed for PNG and SI, respectively. However, the lack of statistical significance of the disequilibrium errors from the developed ECMs made the existence of cointegration between exports growth and economic growth doubtful for PNG and SI.

Over the long run, cointegration between exports and economic growth was accepted in PNG and SI but rejected in Fiji. Hence, it was generally concluded that export growth and economic growth in PNG and SI had some long–run equilibrium relationships. Thus they appeared to have been moving together over the long run, towards equilibrium. It appears from these results that there have been appreciable differences in economic structure and policy in Fiji, compared with PNG and SI, that have disrupted any long-run association between export growth and economic growth in the former country.

(b) Granger causality test results

Granger causality between export growth and economic growth (running from economic growth to export growth) was found only for the VAR model in levels in Fiji. Similar results were obtained for SI, where causality running from economic growth to export growth was also found for only the VAR model in levels. In both cases, the results seemed to imply that past economic growth had significantly contributed to export growth and that instability in economic growth had significantly induced instability in export growth.

For PNG, Granger causality between export growth and economic growth (in both levels and first differences) was found to be bidirectional. However, the causality running from export growth to economic growth was found to be significant at higher levels than the one running from economic growth to export growth. Causality from export growth to economic growth was obtained for all three estimating models (VAR models in levels and in first differences and ECMs) while that running from economic growth to exports was detected in only two models (VAR in levels and in first differences). PNG results imply that past export growth has caused economic growth and that past instability in export growth has caused instability in economic growth. Similarly, past economic growth has caused export growth and past instability in economic growth has caused instability in export growth.

Even though some causality, in the Granger sense, was found in Fiji and SI, the situation in these countries was less clear than in PNG. This lack of clarity is attributed to the fact that, of the three types of models estimated (VAR models in levels and in first differences and ECMs), only in one (the VAR models in levels) was Granger causality detected in Fiji and SI. The causation in Fiji and SI was also found running only from economic growth to export growth. This apparently unexpected result could have arisen because of the small sample sizes used. As a consequence of the unsatisfactory Fiji and SI results, it was judged that more emphasis should be placed on the results from FEDA and IRA decomposition analyses which are less reliant on long data series.

(c) FEDA and IRA test results

The causality results for the three SPINs were confirmed by the results from FEDA and IRA. For more details of these results, see Chapter 6.

From FEDA, the export contribution to GDP forecast error variance decomposition (hereafter referred to as decomposition for the sake of brevity) in Fiji was about 38 per cent for the VAR models in levels as compared with 35 per cent for the VAR models in first differences. These results were confirmed by the graphical analysis based on IRA.

The FEDA results for PNG indicated that the export contribution to GDP decomposition was 36, 57 and 54 per cent for the VAR models in levels and in first differences and ECMs, respectively. Export contribution to GDP decomposition in SI was found to be 66, 58 and 61 per cent for the VAR models in levels and in first differences, and ECMs, respectively.

In both PNG and SI, the graphical analyses from IRA results seemed to confirm the FEDA and causality results. Further, the IRA–ECM results also confirmed earlier doubts about the existence of cointegration relationships between exports and GDP in PNG and SI.

From FEDA and IRA results, it was concluded that, in the short run, dynamic relationships existed between export growth and economic growth (in both levels and first differences) in the selected SPINs. However, as suggested by IRA results, the impact of exports on economic growth faded away after a few years.

(d) Results of hypothesis testing about the causality between export growth and economic growth

From the results and conclusions summarised in (a), (b), and (c) above, the hypothesis that commodity export revenue growth and instability in the selected SPINs have no significant causal relationships with economic growth and instability was rejected. It was found that commodity export revenue growth and instability caused economic growth and instability in the selected SPINs.

10.2.3 Causes of CERV

It was hypothesised that CERV in the SPINs is mainly caused by external and not domestic factors. Establishment of the causes of CERV in terms of external and domestic market factors was tackled in Chapter 7. Again, the investigations were carried out and reported in terms of the long–run and short–run analyses.

(a) Cointegration test results

The POC test supported cointegration in both external and domestic factors while PP and POC tests supported cointegration in external factors in Fiji. For the domestic factors separately, cointegration was moderately supported by all the three tests. However, among the cointegration results reported in Table 7.2, those for Fiji were rather mixed, but tended to suggest that a reasonably strong cointegration existed between export growth and external factors, and export growth and domestic factors in that country.

Cointegration relationships were less evident in PNG. Only one test, the POC, suggested the existence of cointegration between the export growth and the external factors, and export growth and domestic factors in PNG.

In the case of SI, all three tests supported cointegration between export growth and both the external and domestic factors in a single model. Using separate models, the three tests supported cointegration between export growth and domestic factors while two tests (the ADF and PP tests) supported cointegration between export growth and the external factors in SI.

(b) Developed ECMs test results

From the ECMs applied to Fiji, significant disequilibrium error terms were found for both the external and domestic factors. However, on close examination of the results, it appeared that in Fiji external factors have been more important than domestic factors.

In PNG, the ECM results suggested that both the domestic and external disequilibrium error terms were highly significant when these factors were specified and estimated by a single market model. This result implies that both markets (external and domestic) have been important in exerting, through short–run dynamic adjustments, long–run influence on CERV in PNG.

Using the single market model for both the external and domestic factors, it was found that both markets were quite important for the SI case as well, although from the significance levels, the domestic factors seemed to have played a stronger role in influencing CERV. This was confirmed by results from the models of the two markets specified separately.

(c) Granger causality test results

For Fiji, Granger causality was found running from both the external and domestic markets factors to CERV in single market model specifications for all three estimating models (the VAR models in levels and in first differences and ECMs). In all three estimated models with the markets specified separately, only the external market factors were found to be highly significant in causing CERV in Fiji. Domestic market variables were also found significant as causal agents of CERV, albeit at a lower significance level and in only one model (the VAR models in levels). These results for Fiji were broadly in accord with the results from the disequilibrium errors based on the developed ECMs.

For PNG, both the external and domestic market variables in the single model specification, in all the three estimating models (VAR models in levels and in first differences and ECMs), were found to be strong causal agents of CERV. When analysed separately, both the external and domestic markets were found to cause CERV, again confirming what was found from the developed ECMs.

On the basis of single model specification for both markets, results for SI showed causality running from variables of both markets to CERV in all the three estimating models (VAR models in levels and in first differences and ECMs). When the external and domestic market variables were estimated in two separate models, it was again found that causality from the variables of the individual markets caused CERV. As in PNG, the SI evidence supported both external and domestic markets as important causal agents of CERV. The SI causality results were also fairly consistent with the estimated disequilibrium errors of the developed ECMs.

(d) FEDA and IRA test results

FEDA results for Fiji indicated that both the external and domestic market variables were important contributors to CERV. IRA results for the same country also indicated that the domestic factors, especially GDP, could be used to explain the causes of CERV. When the domestic factors were combined with the external factors, the latter had stronger influence than the former on CERV, further confirming results from causality and developed ECM testing.

For PNG, the FEDA results indicated that both external and domestic market factors contributed to CERV, with external variables dominating in most of the estimated models. The IRA results supported the notion that both external and domestic market factors were important in explaining the causes of CERV in PNG. The FEDA and IRA results for PNG generally confirmed the results obtained from the causality and the developed ECMs analyses, indicating that both markets were important causes of CERV.

For the SI case, it was found from the FEDA results that both the external and domestic market factors were important contributors to CERV, with domestic market factors often dominating. IRA results also supported the importance of both markets in influencing CERV in SI. However, evidence from the results of two out of the three IRA models implied that the domestic market factors have been more important than the external market factors in explaining the causes of CERV in SI. The FEDA and IRA results for SI were fairly consistent with those obtained by causality and the developed ECM tests.

(e) Results of hypothesis testing about the causes of CERV

On the basis of the results described above, the hypothesis that CERV in the SPINs is mainly caused by external and not domestic factors was rejected. It was found that both external and domestic factors were important causes of CERV.

10.2.4 Determinants of export sector performance

It was hypothesised that neither external factors (expressed as world demand) nor domestic supply factors determine export sector performance in the SPINs. Examination of the determinants of export sector performance was undertaken in Chapter 8. Time series econometric methods were mainly employed to tackle this objective. Results were again assessed and reported in terms of long–run and short–run relationships.

(a) Cointegration relationships

Using the three cointegration tests, most models were found not cointegrated for all three countries tested. These results led to a general rejection of the existence of long–run relationships between exports and the hypothesised determinants of export sector performance (external factors represented by world demand and domestic factors represented by competitiveness and diversification).

(b) Granger causality relationships

In Fiji, Granger causality was detected running from the world demand plus diversification to export sector performance in only the VAR models in levels. Causality running from competitiveness plus diversification, and diversification separately, to export sector performance, was also obtained. On the basis of the results from the VAR models in levels, it was found that both external (world demand) and domestic factors (competitiveness and diversification), especially diversification, were important determinants of export sector performance in Fiji. Thus, in addition to world demand, domestic factors were important determinants of export sector performance. This also confirmed the importance of domestic factors as causes of CERV (Chapter 7).

In PNG, more cases of Granger causality were obtained in both the VAR models in levels and in first differences. Relatively strong evidence of causality was found running from various specifications of world demand, competitiveness and diversification to export sector performance. Though diversification seemed to be more important than competitiveness, both the domestic factors were found to significantly determine export sector performance in PNG. Results suggest that domestic factors have been more important than external factors as determinants of export sector performance. The export sector performance results for PNG also confirmed those which were obtained in Chapter 7.

For the SI case, in many of the model specifications estimated, world demand, competitiveness and diversification were all found to be statistically significant determinants of export sector performance. The factors were found statistically significant in both the VAR models in levels and the VAR models in first differences. As in PNG, SI causality results point to domestic factors as important determinants of export sector performance, in addition to external factors. The SI results confirmed what was found in Chapter 7.

(c) FEDA and IRA test results

Causality results for Fiji were confirmed by FEDA and IRA. For the VAR models in levels, 24, 19 and 26 per cent of export sector performance were attributed to world demand, competitiveness and diversification, respectively. In the VAR models in first differences, world demand, competitiveness and diversification contributed 30, 3 and 13 per cent to export sector performance in Fiji. The graphical analysis of the IRA results generally supported the FEDA results which, in turn, were also consistent with the causality results for Fiji.

For PNG, the FEDA results for the VAR models in levels indicated that, on average, 16, 9 and 28 per cent of export sector performance were contributed by world demand, competitiveness and diversification, respectively. Results for the same factors in the same order for the VAR models in first differences changed to 26, 10 and 17 per cent. Generally, results from IRA graphs supported the FEDA results which were also consistent with the causality results in PNG.

The SI FEDA results for the VAR models in levels indicated, on average, that 40, 8 and 35 per cent of export sector performance were contributed by world demand, competitiveness and diversification, respectively. For the VAR models in first differences, these same factors contributed 22, 29 and 11 per cent to export sector performance. With a few contradictions, results from IRA graphs generally supported the FEDA results. The FEDA results were also consistent with those obtained from the causality tests in SI.

(d) Results of hypothesis testing about determinants of export sector performance

The hypothesis that neither external demand factors nor domestic supply factors determine export sector performance in the SPINs was rejected since it was found that, in addition to external demand factors, domestic supply factors were important determinants of CERV in the selected SPINs.

10.2.5 Sources of CERV

It was hypothesised that CERV in the SPINs largely came from demand sources and not from supply and demand–supply interaction. The objective of determining the sources of CERV was tested in Chapter 9. A variance decomposition method was used to study this objective, the results of which were reported in three parts. In the first part, the contributions of individual sectors to CERV were reported; in the second part, the individual commodity contributions to CERV were reported; and in the third part, contributions of demand and supply factors and their interactions with CERV were reported.

(a) Variance contributions to CERV by sectors

(i) Fiji

In Fiji, agriculture was found to be the dominant sector in contributing variability to total CERV throughout the subperiods. Direct contribution of variability in the agricultural sector to total CERV predominated (85 per cent) in the 1960s, decreasing progressively to 48 per cent into the 1980s when new sectors (mining and marine) emerged. Variability in pairwise sectoral interactions were quite substantial, particularly in the 1980 decade. During the whole 30–year period, variability in interactive contributions were slightly over 30 per cent of total CERV in Fiji.

(ii) PNG

In PNG, the agricultural sector was the dominant (90 per cent) direct contributor of variability to total CERV in the 1960s. By contrast, in the 1970s and 1980s, the dominant contributor of variability to total CERV was mining, contributing 40 and 81 per cent of total CERV, respectively. Variability in pairwise interactive contributions to total CERV were also important in all the subperiods, contributing slightly under 29 per cent of total CERV during the whole 30–year period.

(iii) SI

Variability in forestry sector in SI was the most important (51 per cent) direct contributor to total CERV in the 1960s. Variability in agriculture (29 per cent), became the dominant direct contributor to total CERV in the 1970s, closely followed by variability in marine sector (28 per cent). In the 1980s, variability in marine sector (38 per cent) had achieved a clear lead as the predominant contributor to total CERV. Variability in indirect contributions to total CERV were quite substantial in SI, contributing slightly over 45 per cent of total CERV during the whole 30–year period.

(iv) Vanuatu

In the 1960s, marine sector variability was the dominant contributor (41 per cent) to total CERV in Vanuatu, followed by variability in the agricultural sector (34 per cent). In the 1970s and 1980s, agricultural sector variability dominated, with 72 and 82 per cent of total CERV, respectively. Variability in indirect contributions to total CERV were not as great in

Vanuatu as in the other Melanesian countries, being slightly over 20 per cent of total CERV during the whole 30–year period.

(b) Variance contributions to CERV by commodities

(i) Fiji

Throughout all the subperiods in Fiji, sugar was by far the largest single contributor of variability to total CERV, contributing 88, 77 and 44 per cent of CERV in the 1960s, 1970s and 1980s, respectively. Commodity covariabilities were quite substantial, contributing about 38 per cent of total CERV in the 30–year period.

(ii) PNG

Coffee was the predominant direct variance contributor to total CERV in 1960s in PNG, followed by variability in cocoa and copra. With copper and gold as new emerging commodities, contributors of variability to total CERV in the 1970s were ranked in the order of copper, gold and coffee. Variability in gold took the lead in the 1980s, followed by variability in copper and coffee, in that order. Contributions of variability to total CERV from commodity interactions appear to have been very important in PNG, contributing about 55, 40 and 40 per cent of total CERV in the 1960s, 1970s and 1980s, respectively.

(iii) SI

Forestry variability contributed most to total CERV in SI in the 1960s, followed by variability in copra. In the 1970s and 1980s, marine and fish were the predominant contributors of variability to total CERV, followed by forestry and copra variability.

While the total direct variance contribution to total CERV was greatest in the 1960s (over 90 per cent), it decreased quite substantially in the 1970s and 1980s, to slightly below 40 and 50 per cent of total CERV, respectively. This decrease in direct variance contributions to total CERV in the later decades reflects the importance of commodity covariabilities in SI.

(iv) Vanuatu

Fish exports, followed by copra, predominated in the 1960s in contributing variability to total CERV in Vanuatu. In the whole of the 1970s and 1980s, copra became the dominant variance contributor to total CERV, followed by fish. Hence, most variability was concentrated in copra, fish and copra–fish covariabilities in Vanuatu during most of the periods studied.

(c) Demand and supply sources of variability for major market variables by commodities

(i) Fiji

In Fiji, supply effect was found to be the main source of variability in both prices and quantities for sugar and molasses throughout the subperiods. For cocoa, gold, forestry and marine, demand fluctuations were the main sources of price variability while supply fluctuations were the main sources of quantity variability throughout the subperiods. In all cases, fluctuations in demand–supply interactions made important contributions to both price and quantity variability.

For commodity revenue, sources of variability varied across commodities and subperiods. Variability in demand–supply interactions (implying that both demand and supply were important sources of revenue variability) contributed substantially to sugar and molasses revenue variability. Of the direct effects, supply was a dominant source of variability in the 1960s while demand became more important in the 1970s and 1980s. For cocoa revenue variability, demand–supply interaction was more important than any of the direct sources of variability while supply was more important than demand. For gold and forestry, demand dominated during the whole 30–year period while demand–supply interactions did so in marine exports variability. In general, the dominating sources of variability for different commodities varied from demand to supply and demand–supply interactions.

(ii) PNG

In PNG, the sources of variability were different across commodities and subperiods. However, demand effects were the main sources of variability in the prices while supply contributed most to variability in quantities of all the sampled commodities.

For coffee, marine, tea and palm oil, supply effects contributed most to revenue variability, followed by either demand or demand–supply interaction effects. Demand contributed most to cocoa and coconut oil revenue variability while demand–supply interactions did so for copra, rubber, forestry, copper and gold export revenues. During the shorter ten–year subperiods, supply was the dominant source of variability in contributing to revenue fluctuations in the 1960s, demand in the 1970s, and demand–supply interaction in the 1980s.

(iii) SI

The sources of variability also differed across commodities and subperiods in SI. For the 30–year period, demand was the major contributor to price variability for all the sampled commodities except for forestry prices where supply variability dominated. Supply variability also dominated in all quantities of the sampled commodities.

In terms of revenue variability, demand effects dominated in copra, gold and fish; demand–supply interactions in forestry, marine and palm oil; and supply in cocoa only. When sources of variability were examined for the shorter ten–year subperiods, supply variability substantially dominated in many of the sampled commodities.

(iv) Vanuatu

During the whole 30–year period, demand effect in Vanuatu was the major contributor to price variability in all the sampled commodities except for coffee for which supply variability dominated. Supply effects also dominated in quantity variability for all the sampled commodities.

For revenue variability, demand sources contributed most in fish and beef; supply in cocoa and timber; and demand–supply interactions in copra and coffee during the 30–year period. On the basis of shorter time periods (10 years), the three sources of revenue variability (demand, supply and demand–supply interactions) contributed fairly equally for all the sampled commodities during the 1960s and 1970s. However, in the 1980s, supply and demand–supply interaction effects became the two major sources of revenue variability for all the sampled commodities in Vanuatu.

Overall, the results obtained in Chapter 9, summarised in the preceding subsections, further reinforced the evidence educed from the results in Chapters 7 and 8 that both supply and demand factors are important causes of CERV.

(d) Results of hypothesis testing about the sources of CERV

The hypothesis that CERV in the SPINs largely comes from demand sources and not from supply and demand–supply interactions was rejected since it was generally found that the sources of CERV in the SPINs were not singular. As summarised in (a), (b) and (c) above, not only did the contributions of variability to total CERV come from individual sectors and commodities and their respective covariabilities but, even more importantly, evidence was obtained indicating that demand, supply and demand–supply interaction effects were all important sources of CERV in Melanesia. The relative importance of these different sources of CERV, however, varied across commodities, time periods and countries.

10.3 Policy Implications

Emerging policy issues in the SPINs are discussed in Chapter 2 (section 2.6). However, emerging policy implications from this research are discussed in this section with a description of how the study addresses the specific policy problem outlined in Chapter 1. Some promising policy options are offered for expanding export growth and economic growth, and mitigating CERV in the SPINs, particularly in the Melanesian countries.

The main findings of this study are that:

(a) export growth and instability caused economic growth and instability and vice versa;

(b) both external demand factors and domestic supply factors are important in determining export sector performance; and

(c) both external and domestic factors caused, and were important sources of, CERV.

It follows that appropriate strategic policies will revolve around the prudent management of both external demand factors and domestic supply factors in order to enhance economic growth and export sector performance, and to mitigate CERV in the SPINs. In discussing the strategic policy implications, two approaches are considered, vis–a–vis policies to: (a) enhance export growth and economic growth, and (b) reduce export instability and economic instability.

10.3.1 Policies to enhance export growth and economic growth

(a) Sector priorities

The evidence that expanding primary commodities do stimulate economic growth implies that, contrary to a view sometimes expressed about the SPINs, the development of primary export production can be an engine of economic growth.

While the results give no indication of how export growth stimulates overall growth, two effects are likely. First, where primary export industries contribute substantially to GDP, growth in the former will obviously have a direct effect on the later. But, in addition, indirect impacts are likely, whereby export production becomes a leading sector in innovation and diffusion of modern technology across other sectors, industries and the economy in general, so stimulating overall factor productivity.

Some ways of stimulating primary export production in order for the SPINs to reap the benefits of such growth are outlined in the next three subsections.

(i) Price incentives

Primary export production can be stimulated by turning the terms of trade more in the producers' favour. Most obviously, governments in the selected SPINs need to look at reducing or eliminating export taxes. Marketing arrangements should be examined carefully and, for example, inefficient statutory marketing boards should be overhauled or abolished. Similarly, barriers to exports, such as licensing arrangements, should be reviewed.

Measures to keep down production costs will also lead to improving terms of trade for export producers and hence greater international competitiveness. Chief among the costs of producing most primary commodities are labour costs, so policies that keep wages at reasonable levels will be important. For instance, policies to stimulate local food production will keep food costs low, thus limiting pressure from workers for wage rises to meet increasing living costs.

Finally, macroeconomic policies, further discussed below, can have substantial impacts on the export sectors. Most directly, measures or other actions that affect exchange rates will affect the profitability, production incentives and international competitiveness of export industries.

(ii) Non–price incentives

In addition to policies aimed directly at prices, measures to improve non–price factors are also likely to be needed to stimulate export production. Well–developed basic infrastructure (access roads, water, electricity, telephone and marketing and other institutions) – serving all the export commodity–producing areas – needs to put into place. To improve factor productivity in export production, relevant research development to find improved technologies should be supported, and backed by appropriate extension. Institutional factors such as land tenure systems may need to be reviewed to see whether these match the present–day needs.

(iii) Human–related incentives

Human capital needs to be developed continuously in order to fill demands for skilled labour accompanying the expanding export sectors. This can be done by further well–targeted investments in general and technical education, combined with measures to improve nutrition and health. Farmer education and training is especially important in that it enables an educated population to make proper use of technical capital (fertilisers, herbicides, pesticides, machinery and equipment).

In agriculture, there is also a need for measures to ensure the availability of affordable technical inputs at the right times and the right places. These technical inputs need to be appropriate and applied in optimal amounts and frequencies. Affordability may be improved by providing credit to producers in good time and by buying inputs in bulk (for example through producer organisations such as production and marketing cooperatives, and the private sector if allowed). Finding the optimal applications is a matter for research and extension services working co–operatively with farmers.

(b) National (economy–wide) priorities

Since it was also found that expanding economic growth supports the expansion of commodity exports, policies that stimulate economic growth will also stimulate exports. Some such policies are outlined below.

(i) Management capacity building

Most developing countries, including the selected SPINs, will face a growing need for people with good management skills in both the public and private sectors. This need might be met by programs to train and retrain professionals, including policy makers and planners, as well as technocrats. The management of export–oriented businesses and organisations demands special skills that may be difficult to build up in the small and relatively isolated SPINs. Judicious use may therefore need to be made of suitable personnel recruited from overseas, at least until nationals with the required backgrounds are available to take on these duties.

Training staff is likely to be only part of the answer; retaining them may prove difficult unless suitable steps are taken to provide good working conditions, reasonable career prospects and appropriate rates of remuneration.

(ii) Policy adjustments

Economic growth in the SPINs may be stimulated by policy measures that create a stable economic environment conducive to both domestic and foreign investment, especially in the export sector related industries. One way of encouraging such investment is to remove any impediments on trade and the flow of funds. This would allow private investors to conduct their businesses freely. Another way is to adopt policies that encourage the accumulation of domestic savings. In addition, measures to promote financial intermediation through the development of effective financial markets will give would–be investors access to credit at internationally competitive rates. Policy makers should therefore look at measures that might be taken to promote the development of an effective and efficient finance sector, such as removal of controls on interest rates.

(iii) Monetary and fiscal factors

Through getting the prices right, sound macroeconomic management, based on prudent monetary and fiscal policies, could help to minimise or eliminate rigidities and distortions within the economies and the commodity export markets. Appropriate budgetary and monetary measures may not stabilise prices but may reduce variability around the trend (Ariff 1994). Basically, this is brought about by the links between agriculture and the rest of the economy. These links influence demand for money which, in turn, influences the general price levels (Fritz–Krockow 1989). Therefore, it could be attractive if governments avoid budget deficits and aim at balanced, or even at surplus, budgets. Broad–based taxes, rather than heavily taxing the export sectors, should be a goal.

(iv) Exchange rate management

Exchange rates can significantly affect a country's competitiveness in external markets. As mentioned earlier (in Chapter 7), about 80 per cent of exchange rate volatility is transmittable to domestic prices in the Asia–Pacific region (Garnaut 1991) and this could be an obstacle to successful export performance (Caballero and Carbo 1989, Nogues 1990). This volatility could lead to distortions in prices, ultimately negatively affecting the incentives to producers to maintain and expand production of export commodities. Moreover, further distortion of exchange rates could also reduce the export competitiveness of the SPINs.

Good exchange rate management could therefore help stabilise the economies in general and the export sectors in particular. Such good management could result in improved competitiveness in the export sectors of the SPINs. Therefore, it should be the aim of the SPIN governments to work towards a stable real effective exchange rate (an exchange rate adjusted for differences in inflation between domestic and export markets). Currency floating could be an important step towards the attainment of this goal.

(v) Political stability

To achieve most of the suggested sector and national priorities above, the political stability of the SPINs will be important. Political stability is likely to be a major factor encouraging both local and foreign investment. Experience has shown that those countries which have achieved accelerated economic growth and stability had, at the same time, achieved stable and conducive political climates and good democratic governance (Summers and Thomas 1993, Williams 1995).

(c) Sector and national priorities

Resources are limited so it is not possible to do everything at once. However, the evidence of a synergistic (complementary) relationship between primary commodity export growth and growth of GDP offers the prospect of self–sustaining economic growth in the SPINs. If export promotion policy is right, economic growth will be stimulated and if macroeconomic policy settings are right, so that economic growth increases, the export sectors will be stimulated. In other words, the findings indicated that exports could be the leading sector in the growth and development of these economies.

10.3.2 Policies for reducing variability in export growth and economic growth

While it was found that export instability caused economic instability and economic instability caused export instability, this instability was found to be caused by both external and domestic factors.

Whether such instability has a negative impact on growth and development was not investigated as this was not an objective of this study. To have included it would have made the study too large for the available resources. If instability does have negative impacts on these economies, as some authors (SPC 1980, Guest 1985, Gumoi 1989, Ilala 1992) seem to agree, it is obviously desirable that it be reduced.

The varying results of the causes and sources of CERV suggest that the formulation of effective commodity stabilisation policies in the SPINs is a complex and difficult task. The causes and sources of CERV differ across countries, sectors, commodities and over time. While commodity stabilisation arrangements may help, they are unlikely to be sufficient to curb CERV–related problems effectively. Commodity–specific price stabilisation schemes, for example, deal with individual commodities by addressing the causes and/or the sources of CERV one at a time. Yet, the different causes and sources of CERV often occur simultaneously. Thus, commodity arrangements alone are not likely to curb the CERV–related problems. Consequently, if the problems of CERV are to be reduced to manageable levels, multiple policy measures, skilfully implemented, may be required.

(a) International commodity arrangements

Given the evidence from this research on the importance of external demand factors in explaining the determinants of export sector performance and the causes and sources of CERV, policy makers of the SPINs worried about export variability evidently need to consider various means to safeguard against the undesirable influences of unfavourable changes in the external factors. For example, participation in international commodity arrangements – the commodity agreements, the IMF compensatory financing facility and the European Union Stabex – may help (most of these schemes have been described in Chapter 2).

Participation in international price stabilisation arrangements may sometimes help mitigate price and revenue variability. PNG's participation in international coffee and cocoa agreements and Fiji's participation and special trading involvement in the international sugar agreement and the Lome convention's sugar protocol are examples of such policies[40]. However, before deciding to participate in these international commodity arrangements it is necessary to conduct an assessment of the benefits as well as the costs accruing from them.

(b) National stabilisation schemes

With good management, national stabilisation schemes (e.g., buffer stocks and buffer funds) could, possibly, reduce undesirable impacts of instability in the export sectors and economies in general. Given that some of the schemes, especially buffer stocks, may involve substantial management problems, SPIN governments may need to consider the potential costs of such schemes (including possible future subsidies) as well as the potential benefits.

According to Fleming and Piggott (1989), national stabilisation schemes are designed to deal directly with price, volume and revenue variability. Volume stabilisation schemes are normally operated either at the point of export or within the marketing system. Export quotas for a particular commodity could, for example, then be issued at the export point while long–term trade arrangements (e.g., supply contracts) could be negotiated within the marketing system.

Price stabilisation schemes are aimed at reducing variability in commodity export prices. Usually, the operation of the price stabilisation scheme is carried out through various sorts of either the buffer–stocks or buffer–funds schemes (whose details are given in Chapter 2). Since most SPINs are price takers for their major export commodities, they mainly operate the buffer–fund type of schemes.

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40 The SPINs can only participate in the international commodity arrangements when they are actively operational. When they are dormant, as with the currently suspended coffee agreement, participation is obviously impossible.

Revenue stabilisation schemes are aimed at stabilising incomes at both national and farm levels. SPINs have also been trying to stabilise their revenues through participation in the EU Stabex and IMF compensatory financing schemes (Fleming and Piggott 1989).

(c) Macroeconomic management policies

In conjunction with the suggestions above, it appears that instituting some structural reforms and sound management of other domestic supply factors (macroeconomic variables) could help in reducing CERV. Evidence obtained in this study suggests that there is need to stabilise domestic factors such as the GDP and exchange rates. In addition, monetary and fiscal policies might also need reform and more careful management. Most of these have already been discussed above (see 10.3.1 (b)).

In addition, as pointed out by others (see, for example, Fleming 1992a), a system of moderate taxation during high commodity prices and subsidisation during low commodity prices could be useful in reducing instability in commodity revenues in the SPINs. In other words, a monetary policy of sterilising funds in times of high commodity prices and drawing on reserves during low prices could be a feasible way to reduce any undesirable macro–impacts of variable export revenues. To accompany this, incentives should be introduced to encourage the beneficiaries to work towards greater domestic savings and investment during times of good prices.

(d) Forward/futures trading

Forward contracts are mainly a private enterprise approach which have been used as alternative options for reducing variability in commodity exports in the absence of formal government intervention. Forward contracts provide mechanisms for reducing variability in prices. As pointed out by Campbell and Fisher (1991), in forward trading, arrangements for commodity delivery, at specified times in future, of specified quantities at known prices are agreed upon in advance. In other words, both parties (sellers and buyers) agree on prices in advance and guarantee that the agreed prices for set quantities of given commodities are adhered to. However, the applicability of forward contracts is subject to a number of limitations (e.g., lack of quality control, not always being able to meet the requirement of an assured supply of an assured quality, lack of well developed financial markets and others) some of which are well discussed by Falvey (1986) and Morgan et al. (1994).

Futures markets are a special type of forward trading which offer some opportunities to reduce variability associated with the production and trading of commodities. Futures markets are highly organised and standardised, and have a high requirement of trading liquidity (cash requirements). Users of futures markets are therefore given the benefits associated with forward pricing without the problem of requiring the actual physical transfer of the commodities. Through their hedging mechanisms, these markets are best recognised as having the special ability of reducing risks associated with variability in both commodity prices and quantities (Morgan et al. 1994).

The success of participation in a futures market depends much on having cutting edge information on price discovery. According to Morgan et al., well organised futures markets could facilitate decision making by market participants on production, sales, purchases and storage of commodities. Various detailed aspects of the futures markets are discussed by Gray and Rutledge (1971), Telser (1981), Kamara (1982), Gemmell (1985), Gilbert (1985), Tomek and Robinson (1990), Campbell and Fisher (1991), and Morgan et al. (1994).

It seems likely that forward and futures trading is best done by the private sector as high risks are involved if it is mismanaged. For the SPINs, there is some uncertainty about the capacity of the personnel of the marketing authorities to handle and manage forward and futures trading, especially, given the disadvantage of operation in small and isolated economies in obtaining up–to–the–minute market information and in acting on it promptly.

(e) Diversification

Diversification is another alternative which merits consideration. Over the medium– to long–term, many commodity–dependent countries seek to diversify away from specialising in just a few traditional export commodities. According to Maizels (1994), diversification could be attained by shifting into non–traditional commodities, processing, manufacturing, service industries and/or some combinations of these.

Diversification could also be exploited from both the micro– and macro–standpoints. At the micro–level, producers could pursue diversification strategies which could broaden and strengthen their sources of income (Fleming and Piggott 1989, Taylor 1994). At macro–level, countries can diversify away from the dependence on agriculture.

As Taylor (1994) puts it, diversification could be operated either horizontally or vertically. In principle, horizontal diversification involves diversifying to expand product mix at the farm level while vertical diversification involves off–farm strategies of generating income. Processing, manufacturing and diversification of the market are some examples of strategic vertical diversification. Diversification of the market here implies diversifying into new market outlets, away from the traditional major trading destinations.

Macro–level diversification could involve structural transformation of national economies away from agriculture to manufacturing and service industries. Macro–level diversification is especially suitable at a stage when countries have adequately developed their agricultural industries and their infrastructures to permit new industries to thrive.

In pursuit of export diversification, Malaysia's success could be emulated given that its diversification program has resulted in substantial value adding. This has been especially successful in reducing emphasis on the tin and rubber industries whose relative value to total value of primary exports decreased from 63 per cent in 1970 to 15 per cent in 1990 (Yaacob 1992).

Arguably, diversification may not be a panacea for CERV–related problems. Especially in the selected SPINs, it is shown from the results on commodity decompositions (see, for example, Chapter 9, Piggott et al. 1986 and Fleming 1989) that positive covariabilities of sectors and commodities contribute greatly to CERV. Together, positive covariabilities interactively adjust towards increasing aggregate CERV, implying that horizontal diversification may not be of much use in mitigating aggregate CERV. Therefore, holistic diversification practice in selected SPINs could be a waste of effort and resources; rather, selective diversification may have a role in the Melanesian countries. A better option may be diversification into, for example, quality and product efficiency and increased and efficient processing, such that, according to Sapsford and Balasubramanyan (1994), the following products are produced:

> instant tea and tea bags instead of raw tea, rubber tyres instead of rubber, chocolate preparations and drinking cocoa instead of raw cocoa, clothing instead of cotton or just textiles, vegetable oils instead of oil seeds and others.

However, whatever type of diversification is adopted, comparative advantage has to be taken into consideration. Given certain resource endowments, nations have to take the opportunity to produce first what they can produce at internationally competitive cost levels.

10.4 Assessment and Limitations

The strengths (achievements) and weaknesses (failures to achieve the expected results) are summarised in this section under the assessment and limitation subsections, respectively.

10.4.1 Assessment of the study

(a) The research problem – an overview

For over three decades, CERV has been perceived to impact deleteriously on the small open economies of the SPINs. Government authorities in the SPINs appeared to have come to a general consensus that CERV affected negatively both the macro– and micro–performance of their economies. Consequently, the policy makers of the SPINs regarded CERV as undesirable because of its perceived effects in disturbing their export trade and the economies in general. Given the perceived problem, the authorities in the SPINs were then prompted to establish commodity–specific price stabilisation schemes intended to neutralise the deleterious effects of CERV. In establishing these schemes, it was assumed that CERV was basically an externally–induced problem, in that changes in demand and tastes in the importing countries triggered price fluctuations.

The above assumption has raised various central issues in terms of research. For example, empirical evidence was lacking to support the claims that CERV results mainly from external causes and/or sources. Apart from also incurring high costs of establishment and operations, the stabilisation schemes have recently been criticised as inappropriate approaches to deal effectively with the problems of CERV. Moreover, evidence has been required to ascertain whether the growth of export trade has boosted the growth of the economies of the SPINs. If it could be found that export growth caused economic growth in the SPINs, this could suggest that CERV also caused economic instability. In this way, the importance of the export sector in the SPINs would be clarified.

Given the importance of exports, it was also decided to examine the determinants of export sector performance. The aim was to find out whether it was mainly external factors that were responsible for export sector performance.

In general, the objective of this study was to conduct an empirical economic analysis of CERV for a selected number of SPINs. The motivation for this type of analysis arose in order to supply evidence relevant to the debate about the desirability of the commodity–specific price stabilisation schemes in the SPINs. The broad objective was broken down into specific ones which are listed in chapter 1. The work presented in the analytical chapters (6, 7, 8 and 9), which form the cornerstones of this thesis, was directed to specific objectives.

(b) The analytical approaches

The objectives of this study were accomplished by the applications of the time series econometric methods and the variance decomposition method. The time series methods were used to analyse data for Chapters 6, 7 and 8 while the variance decomposition method was employed for the data analysis in Chapter 9.

Time series econometric methods consisted of: three (ADF, PP and PC) unit roots tests for pre–testing for stationarity conditions of the data series, three (ADF, PP and POC) cointegration methods for testing of long–term relationships, and three other time series methods (Granger causality, FEDA and IRA) for testing of the short–term dynamic relationships. Further, ECMs were developed for those relationships which were found cointegrated. Because of mixed results obtained in the cointegration relationships, Granger causality, FEDA and IRA were estimated in three models: the VAR models in levels, VAR models in first differences and the ECMs. Finally, a variance decomposition method was applied in the analysis in Chapter 9.

(c) The data and study area

This study utilised data from four selected SPINs, altogether called the Melanesian countries, namely Fiji, Papua New Guinea, Solomon Islands and Vanuatu. Because of data constraints for Vanuatu, its available data were analysed in Chapter 9 only. Details on the actual variables chosen, sample sizes, data sources and treatments are described in Chapter 5.

(d) The findings

While details of the actual findings are described in the analytical chapters (6, 7, 8 and 9) and again summarised in section 10.2, a major finding is that export expansion and instability caused economic growth and instability in the selected SPINs. The study confirmed the importance of external demand factors and established that domestic supply factors were also important in explaining the causes and sources of CERV and export sector performance.

These findings were established after using various analytical methods on various data types from the selected SPINs. The results obtained from these methods and data were reasonably consistent and pointed to conclusions relevant to policy making aimed at promoting stable export growth and overall economic development in the selected SPINs.

(e) The general contributions

- This study has led to an assembly of fairly up–to–date reviews on CERV and exports/GDP related literature.
- To carry out this study, a long data series on export/GDP related work for the Melanesian countries has been gathered and summarised.
- To analyse the gathered data, relatively new time series econometric methods (unit roots and cointegration, and Granger causality, FEDA and IRA – based on both VAR and ECM estimations) have been used on new data from the SPINs. Unlike previous studies in which the optimal lags were determined mostly by guess work or rule of thumb, this analysis included the use of two lag length tests (AIC and SC) to determine empirically the optimal lags for the SPINs data set analysed in this study.
- In this study it was demonstrated that it is possible to supplement causality work with FEDA and IRA procedures to capture the short–run dynamic relationships which could not be detected by Granger causality tests. This type of demonstration has not been common in the past.
- Results confirmed that the external demand factors are important in explaining the changes that occur within the export/economic growth subsystem.
- It has also been shown that domestic supply factors have been important in determining the changes occurring within the export/economic growth sectors in the selected SPINs.
- Policy implications have been derived for the export sector which might assist policy–makers in the SPINs.
- Finally, it is evident from the results obtained in this study that commodity–specific price stabilisation schemes alone are unlikely to be sufficient to curb effectively the CERV–related problems in the selected SPINs.

10.4.2 Limitations and scope for further research

(a) Limitations of the research

Time series econometric methods work best when applied on long data series. Given that the longest data series used in this study had 33 annual observations[41], the results produced in this study should be treated cautiously. Despite the fact that there are some previous studies which have used time series econometrics on data with as few as 16 annual observations, the small sample size was a limitation of this study. Efforts were made to overcome the data problem by using different types of data as well as various analytical methods. By this means it was possible to check the consistency of the results.

Methods for the econometric analysis of time series data have been evolving rapidly in recent years. It is possible that some of the newer methods, such as the Johansen maximum likelihood ratios method (Johansen 1988, Johansen and Juselius 1990) would have given better results. However, the lack of suitable software to implement these more recent methods at the time the analysis was done precluded their use.

A number of more specific limitations of the methods of analysis used have been mentioned at various points in the text. For example, it would have been desirable to have accounted for the impact of the effects of the various price stabilisation schemes, but no means of doing so could be devised. Similarly, the possibility that the inclusion of exports in GDP may have compromised the estimates of the relationship between GDP growth and export growth has to be recognised. Some of these issues could with value be investigated in future work, while others must await the development of more advanced forms of analysis.

(b) Scope for further research

This study has revealed a number of unanswered issues and scope for further research. For instance, further studies may be warranted to determine whether export growth and economic growth are actually cointegrated in Fiji and SI and whether there exists Granger causality between these variables in those countries. Such work is needed before it can definitely be said that Fiji and SI conform to the theory of export–driven economic growth.

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41 To date, the author believes that 33 annual observations are the longest data series ever collected for a study of export performance in the selected SPINs.

Further studies are needed to measure the impacts of instability on producers' welfare and the SPIN economies – at both micro– and macro–levels. Similarly, there is a need to examine the effectiveness of existing commodity–specific stabilisation schemes and potential options for reducing variability in the export sectors and the general economies of the SPINS. Before any of the alternative stabilisation policy options (which are also referred to as alternative supply management schemes by Maizels (1994)) discussed in this study are adopted, there is need to undertake appraisals to assess their potential benefits and costs.

To carry out the suggested studies, it may be necessary to assemble longer data series. Use of more powerful analytical techniques such as the Johansen maximum likelihood time series econometric method and other alternative methods such as partial and computable general equilibrium analyses are suggested.

10.4.3 Concluding remarks

This study was focused mainly on an economic analysis of commodity export revenue variability and related problems in the selected SPINs. As is evident from the above summary of the results and conclusions, the overall objectives of this study to conduct an empirical economic analysis of CERV for selected SPINs have been attained.

If the insights gained from this study can be communicated to SPIN policy makers, they may be able to make better–informed decisions about policies affecting export production and general economic growth.