Chapter 7

EXTERNAL AND DOMESTIC CAUSES OF CERV IN THE SELECTED SPINS

The conventional view held by the policy–makers of the selected SPINs that CERV is caused almost solely by external factors is analysed empirically in this chapter[23]. Both external and domestic factors are included in the analysis. Even though there is a lack of empirical evidence, the belief that external factors predominate has, nevertheless, resulted in the formulation and operation of major policies in terms of commodity–specific price stabilisation schemes. Using available data sets on specific variables for external factors (world GDP of major trading partners and world commodity prices) and domestic factors (GDP and exchange rates for the selected SPINs), the analysis has been conducted using cointegration, error correction mechanisms, Granger causality, forecast error variance decomposition and impulse response analysis. Various types of causality results and other relationships, many consistent and a few mixed, were found for the selected SPINs. These results varied across countries, factors and factor combinations, and time periods. In addition to external market factors, domestic factors were found to have quite a significant influence in explaining the causes of CERV in the selected SPINs. Domestic factors were found to be more important in Solomon Islands and Fiji than in PNG.

7.1 Introduction

Evidence of marked export expansion in relation to specific external and domestic factors for the selected SPINs can be observed in Figures 7.1, 7.2 and 7.3. The figures show that the expansion of exports and domestic factors was particularly conspicuous around 1975, the political independence period of the selected SPINs. Despite the expected annual fluctuations, there has been growth over time in both real GDP and exports. Except for the exchange rates, the growth of the domestic factors seems to have been more significant from the 1960s to early 1970s than in the late 1970s to 1980s. The nominal domestic exchange rates for the selected SPINs were largely fixed until the mid 1970s when the fixed exchange rate regimes seem to have been relaxed.

The observed slow–down in this growth, particularly after the mid 1970s, could be attributed to interruptions due to transitional changes and expectations for political independence and unfavourable world market conditions. In a nutshell, over the past three decades, the real growth of GDP and export growth seem to have generally moved together.

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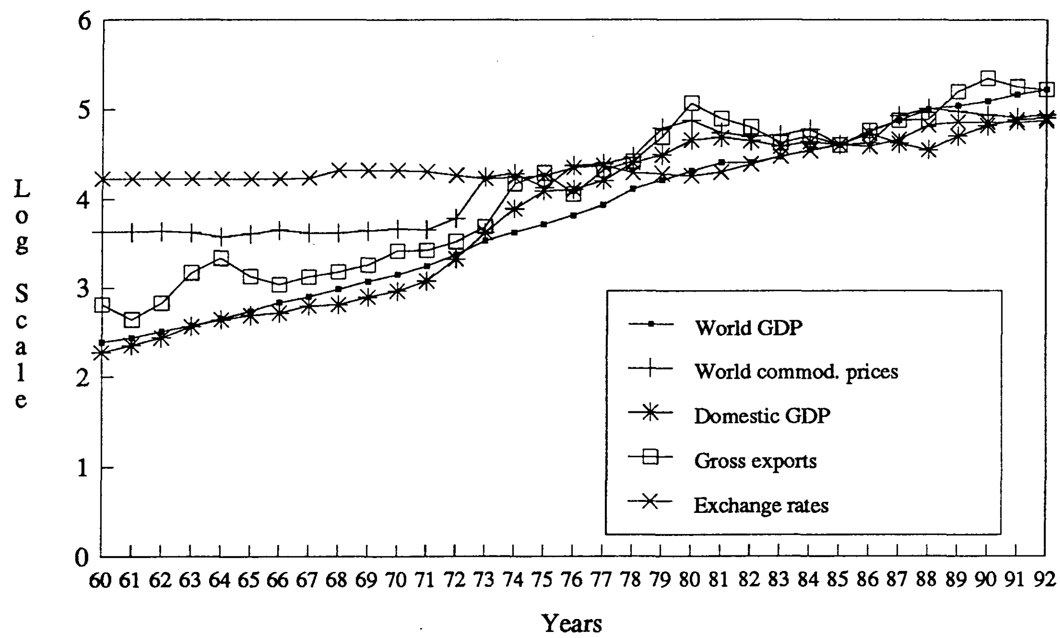
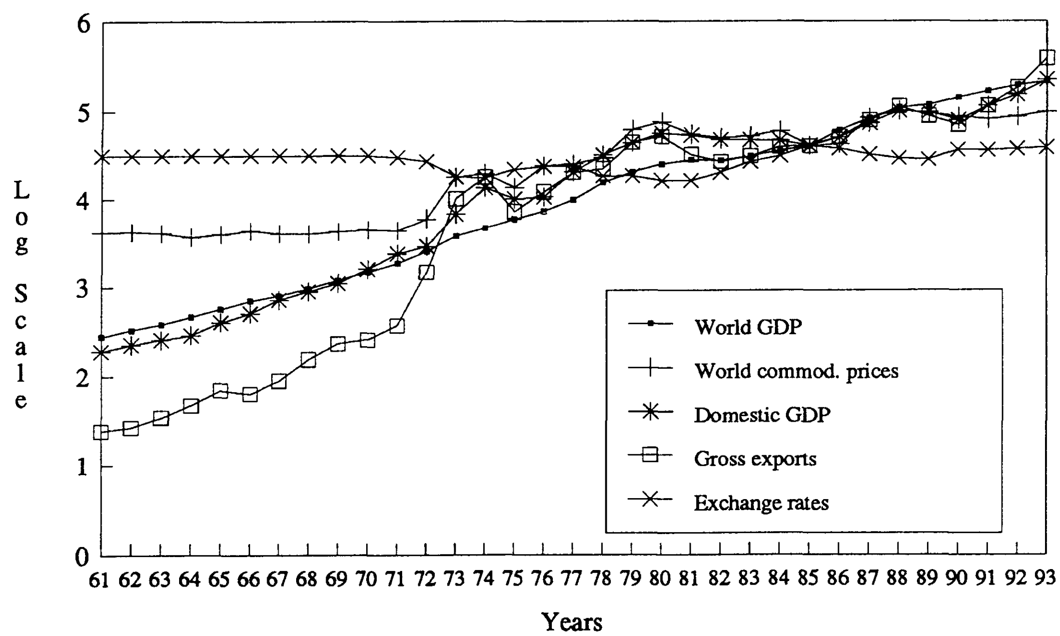
23 The author's contributions to Onchoke, Fleming and In (1993), In, Onchoke and Fleming (1994) and In and Onchoke (1995) form the bases of parts for this chapter.

Figure 7.1: External and domestic factor trends, 1985 constant prices, Fiji, 1960–1992



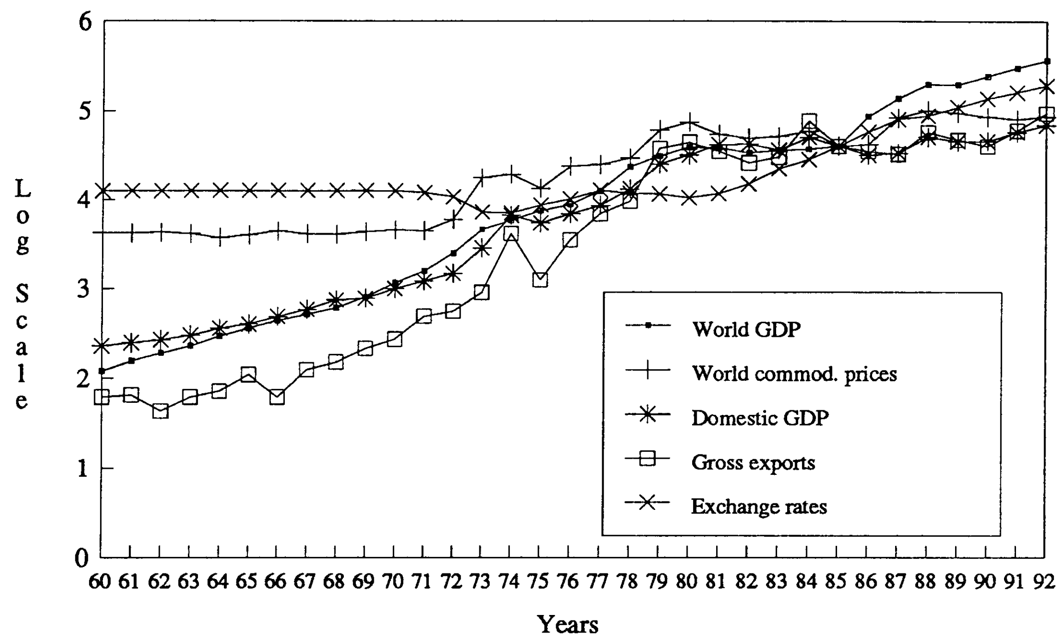
Source: Chapter 5.

Figure 7.2: External and domestic factor trends, 1985 constant prices, PNG, 1961–1993



Source: Chapter 5.

Figure 7.3: External and domestic factor trends, 1985 constant prices, SI, 1960–1992



Source: Chapter 5.

The relationship between the real growth of exports and external factors has also been plotted and compared alongside the relationship of exports and domestic factors in Figures 7.1, 7.2 and 7.3. The external factors considered in this analysis are the real weighted world gross domestic product of the major trading partners of the selected SPINs and the world real agricultural commodity prices. As depicted in Figures 7.1, 7.2 an 7.3, the real export growth has moved along with the real WGDP and WCPI growth. This growth occurred despite the expected and unexpected fluctuations in exports, some of which were sporadically large.

It is suggested here that there are important potential linkages between the external market factors and exports. Because of these linkages, a positive random shock in WGDP is expected to increase the demand for the export commodities. Similarly, if WCPI is given a positive random shock, there should be a rise in the supplies of export commodities. The external factors make up the important demand side for the export markets.

The aim of this chapter is to investigate the long–run as well as short–run relationships between CERV and the domestic and external market factors in the selected SPINs. This is achieved by analysing causal relationships between CERV and external and domestic market factors in the selected SPINs. This objective is accomplished by the use of a time series econometric package. The package includes cointegration analysis, ECMs[24], and Granger causality, forecast error variance decomposition and impulse response analysis techniques, based on both VAR and ECM models.

This chapter is structured as follows. After the introduction, some background is reviewed in section 7.2. Selection and justification of variables are discussed in section 7.3. Results and discussion are presented in section 7.4. In section 7.5, a summary is given and some conclusions drawn.

7.2 Background Review

7.2.1 An overview

It is hypothesised that external market conditions, and not domestic market factors, influence CERV in the selected SPINs. Because the domestic and external factors are quite variable and diverse, it was decided to narrow down the factors into two variables from each market for ease of investigation. The domestic factors considered to have most influence on CERV in the selected SPINs are GDP and exchange rates. Those factors from external markets that were considered to influence CERV most are world GDP and world commodity prices. Details on the selection and justification of the specific variables are given in the next section.

Although some work has been done in the past on the problem of CERV for some commodities in some countries including the SPINs (Piggott 1978, Fleming and Piggott 1985 1989), Myers and Runge 1985, Myers et al. 1990), the CERV problem, in terms of the causes and sources, effects and remedies, has not been fully addressed. Information generated from the results of this empirical study could form useful bases for the re–formulation of more appropriate policies regarding the stabilisation schemes.

24 In this chapter, ECMs are used to describe the dynamic short–run adjustments of CERV towards the long–run equilibrium.

7.2.2 CERV in the selected SPINs

Because of the heavy reliance of the SPINs producers of primary commodities on external markets, the SPIN governments have almost always assumed, with little empirical evidence, that the variability in commodity export revenues and economic growth of their nations are mainly dependent on and affected only by external market factors. They have seen that the prices paid for their commodities in external markets have fluctuated negatively over time, inducing corresponding fluctuations in their export revenues, with perceived deleterious impacts on the overall performance of the economies. These perceptions have prompted governments of many SPINs, among them, Fiji, PNG and SI, to formulate and implement commodity–specific price stabilisation schemes (Fleming 1992a). Even though a few of these schemes started to operate as early as the 1940s, many started operating in the 1970s.

Given that most of these stabilisation policies were formulated with little empirical evidence as to the major causes of CERV, this chapter seeks to investigate the causes of CERV from both the external and domestic perspectives before ways of stabilising CERV are suggested. Without proper knowledge of the causes of CERV, operating stabilisation schemes could turn out to be ineffective or even produce consequences contrary to the planned goals. For example, the operation of an ineffective stabilisation scheme might tie up substantial amounts of limited capital and human resources (Fleming and Piggott 1989) which could otherwise be used in more productive projects.

In their efforts to stabilise the export revenue fluctuations through commodity–specific price stabilisation schemes, the SPIN governments have assumed and addressed a single external variable only, the WCPI, out of the many variables which could potentially cause CERV. As a consequence, the effectiveness of these commodity–specific price stabilisation schemes has recently become a question of substantial debate. In spite of these debates, most of the SPIN governments still favour the continuation of the schemes. In part, it is this untested view of the causes of CERV by the governments of the selected SPINs that motivated this study.

7.3 Variable Selection and Justification

There are a number of potentially feasible variable alternatives which can be used in the analysis of CERV. They include both externally–based factors (the WGDP and WCPI) and domestic market factors (GDP and EXR). The selection of specific variables was based primarily on the perceived importance of each in its influence on CERV.

7.3.1 Domestic factors

Two variables, namely domestic GDP and EXR, were considered among the most influential domestic factors affecting CERV in the selected SPINs. They were therefore chosen to represent the domestic effects in the analysis. In order to show how they could induce CERV, a detailed description of the individual domestic variables follows.

Arguments for including domestic factors as analytical variables of CERV can be supported by previous research (see, for example, Love 1984, Hsiao 1987, Athukorala, 1991). Several other studies (Schulter 1984, Tshibaka 1986, Athukorala and Huynh 1987) have observed that many domestic measures could be taken to reduce instability and enhance growth in export earnings of primary commodities. Specifically, Schulter found that domestic pricing, exchange rates and storage policies, among others, were important determinants of competitiveness and stability in agricultural export earnings.

(a) GDP

GDP is an important aggregate economic variable which measures the total income of a nation. By virtue of the national accounting identity, it is equal to the sum of personal consumption expenditures, gross private domestic investment, government purchases of goods and services, and net exports. An unexpected positive shock in GDP is therefore expected to expand net exports and other elements in the identity. Similarly, unexpected positive shocks to the identity variables, either individually or in combinations, will increase GDP. However, given the concern in this analysis with the potential linkages between exports and domestic GDP, the remaining identity variables were not considered further.

It is argued that the expansion of domestic factors, as reflected in increased GDP, will not divert commodities away from the export markets. Rather, it will expand the exports through increased supplies of export commodities. This could be achieved through greater use of imported inputs (such as agricultural machinery, fertilisers, pesticides and herbicides).

In other words, higher GDP implies higher demand for goods and services, consumption and investment. More investment means higher output (e.g., of export products). Further, given that net exports are known to be important components of GDP, variability in a given nation's GDP is a direct potential cause of CERV. This could be due especially to export supply variability. Supply variability could also be influenced by the environment (climate – rainfall, pests and diseases – infrastructure, and marketing institutions), some of which factors are not within human control.

(b) Exchange rates

Exchange rates are included as domestic factors likely to affect CERV because they reflect economic relations between a given country and its trading partners. EXR are defined here as the prices of domestic currencies relative to other (normally foreign) currencies or baskets of currencies (Intal 1992). International trade is transacted mainly in recognised foreign currencies of the giant seven industrialised countries. Every country (including the selected SPINs) dealing in international trade therefore needs to build up some specified foreign reserves in one or more of these currencies.

Most LDCs such as the selected SPINs earn much of their foreign exchange reserves from primary commodity exports. All the imports of these countries are also paid for in foreign exchange. Most of these imports are composed of food and consumption goods. But also imported are inputs such as machinery, equipment and associated tools, fertilisers, plant and animal feeds, herbicides and pesticides – used mostly for the production, harvesting and marketing of the primary commodities for export.

The strength of a given country's exchange rate will influence the amount of goods and services that country will import. If the exchange rate is overvalued (higher than the actual level that would be determined by the market forces), this will make imports relatively cheap, leading to an increase in imports. Some of these goods may be used to expand supplies through increased commodity production. On the other hand, an overvalued exchange rate reduces the price of exports in domestic currency, discouraging export production.

As the above discussion shows, exchange rates regulate trade flows through effects on prices. They capture the impacts of many domestic factors that affect a country's competitiveness in external markets. For example, about 80 per cent of variability in exchange rates is passed into domestic prices in the Asia–Pacific region (Garnaut 1991). This volatility could be harmful and may distort prices, thus affecting both the domestic producers and exporters (Schuh 1974, Phillips and Bewley 1991). The outcome of this volatility can be increased risk in investment, resulting in production or supply variability, and eventually in CERV.

The exchange rates for the selected SPINs were largely fixed until the mid 1970s when the fixed exchange rate regimes were relaxed (see the trends in Figures 7.1, 7.2 and 7.3) although not left to float completely freely. Managed exchange rate regimes were adopted whereby the governments could occasionally intervene. For instance, before independence the Australian dollar and the British pound sterling were the currencies in use in PNG and SI, and Fiji, respectively. After independence, however, each SPIN adopted its own currency but these were pegged against a major currency or basket of currencies used in international transactions. PNG's local currency was pegged against the Australian dollar while those of Fiji and SI were pegged against the British pound sterling, the US dollar, the Australian dollar or a basket of currencies of the respective major trading partners during different time periods. Although fixing or pegging of currencies against one currency in a system of generalised floating exchange rates implies accepting constant variation against other currencies (Garnaut 1991), the SPINs, particularly PNG, maintained 'hard currency' policies where governments ensured that external values of their currencies were not compromised. These policies resulted in somewhat overvalued currencies which not only made imports cheaper but also made exports more expensive and so reduced international competitiveness.

7.3.2 External factors

From the external perspective, two variables, namely world gross domestic product and world commodity prices, were chosen as the major potential causes of CERV. External market conditions, particularly external demand fluctuations, are known to influence the rate of growth and variability of export revenues from primary commodities (Pinckney 1988).

It is therefore postulated that important potential linkages exist between the external factors and exports. Since these external factors affect the demand for SPIN exports, a positive random shock in either WGDP or WCPI is expected to increase the demand for export commodities.

(a) World gross domestic product

It is expected that effects of changes in consumer incomes and tastes, technological advancement, availability of close substitutes and complements, will all be captured in a single variable, the WGDP. The WGDP is computed as a simple weighted average of GDP from major trading partners of the selected SPINs. The major trading partners are those countries which have been, consistently over a reasonably long period, the main destinations of the commodity exports of the selected SPINs. Demand fluctuations for primary export commodities usually arise from external trade cycles, i.e., from variability of incomes in the importing countries. Improved economic conditions in the major trading partners would improve WGDP, leading to expansion of the foreign markets to which the selected SPINs export. The reverse is also true. Hence, WGDP is expected to be an important variable in explaining the causes of CERV.

(b) World commodity prices

Prices are major signals to export producers. Consequently, it is argued that fluctuations in WCPI affect CERV. The WCPI used is not specific to the major trading partners, but reflects worldwide demand and supply effects on the primary export commodity trade in the international trade arena. Changes in international commodity prices determine commodity earnings of the exporting countries in particular periods. Mundlak and Larson (1992), for instance, found that most variability in world agricultural prices is transmittable and contributes a major component of the variability of domestic prices.

7.4 Results and Discussion

This section deals with the following: data and data sources, unit roots test results, cointegration test results, development, estimation and analysis of ECMs, Granger causality test results, FEDA test results and IRA test results.

7.4.1 Data and data sources

Data and data sources, explained in more detail in Chapter 5, are only briefly summarised here. Consistent current time series data on external factors (aggregate WGDP and WCPI) and domestic factors (aggregate EXP values, GDP and EXR) were collected for the three selected SPINs. The data sources were from various issues of the IFS Yearbook of the IMF. These were supplemented by various government and private reports (Fiji Government 1982 1991, AIDAB 1991a b, Bank of PNG 1972–91, British SI Protectorate 1971, SI Government 1979 and 1981–83).

7.4.2 Unit roots test results

For the test of the unit roots, three testing methods (ADF, PP and PC) were employed, as described in Chapter 6. These tests, specifically the PC test, have been shown to perform better than other standard tests (In et al. 1992). The SHAZAM statistical application package (White et al. 1990) was used to carry out these tests (see sample instruction program in Appendix 7.1). Using three specified univariate models[25] for the WGDP, WCPI, GDP, EXR and EXP, all three tests were applied for comparison and supplementary purposes. The unit roots test results are in Table 7.1.

(a) Unit roots results in levels

As shown in Table 7.1, test statistics for the three tests are bigger than the critical values for each respective model of the VARs in levels. Thus, at 10 and 5 per cent significance levels for ADF and PP, and PC tests, the three tests failed to reject the null hypothesis that $\alpha = 0$ and $\alpha_1 = 0$. This implies that the WGDP, WCPI, GDP, EXR and EXP data series are non–stationary, with an integration order of perhaps I(1) or I(2). For the five series to be stationary [I(0)], they will have to be differenced at least once.

(b) Unit roots results in first differences

In order to confirm the order of integration, all the five data series in their first difference forms of the VAR models were tested for unit roots using the same three tests. The results of the unit root tests in the first difference forms are presented alongside the results of unit roots of the VAR models in levels in the Table 7.1.

Test statistics smaller than the critical values at the 10 and 5 per cent significance levels for ADF and PP, and PC, support the stationarity hypothesis. The null hypothesis was rejected and the alternative hypothesis accepted, that α and $\alpha_1 \neq 0$. Although most results came out as expected, a few did not. The stationarity condition was not found by the ADF and PP tests for model 1 of WGDP in Fiji, and by ADF alone for models 1 of WCPI and EXP, respectively, in Fiji (see specifications (1), (2) and (5) in Table 7.1). This feature was also portrayed in PNG where model 1 of WGDP was declared non–stationary in its difference forms by both the ADF and PP tests while model 1 of WCPI was found non–stationary by ADF test alone (see specifications (6) and (7) in Table 7.1). In SI, models 1 of

[25] In turn, each univariate model is composed of three models, namely, model 1 which has neither constant nor trend, model 2 which has constant but not trend, and model 3 which has both constant and trend present.

WCPI and EXP, and model 3 of EXR were found non–stationary in their first difference forms by ADF and PC tests, respectively, (see specifications (12), (15) and (14) in Table 7.1).

Table 7.1: Unit roots test results of external and domestic factors, in both levels and first differences

	Test Statistics					
	ADF		PP		PC	
	VARL[a]	VARD[b]	VARL[a]	VARD[b]	VARL[a]	VARD[b]
			FIJI			
(1) WGDP						
Model 1	2.35	–0.38	9.44	–0.98	–	–
Model 2	–0.67	–2.71*	–0.19	–3.71*	452.86	0.32**
Model 3	–1.90	–3.15*	–1.77	–3.63*	125.07	0.21**
(2) WCPI						
Model 1	2.07	–1.56	1.56	–4.65*	–	–
Model 2	–0.46	–2.76*	–0.64	–4.97*	16.03	0.06**
Model 3	–1.73	–3.61*	–2.31	–4.89*	1.55	0.12**
(3) GDP						
Model 1	1.50	–2.34*	3.27	–2.26*	–	–
Model 2	–1.30	–3.15*	–1.33	–3.16*	33.79	0.23**
Model 3	–1.22	–3.28*	–0.72	–3.29*	31.49	0.27**
(4) EXR						
Model 1	1.45	–0.96	2.04	–3.26*	–	–
Model 2	0.06	–2.62*	–0.69	–3.63*	14.38	0.24**
Model 3	–1.61	–3.39*	–1.20	–3.85*	100.81	0.28**
(5) EXP						
Model 1	2.12	–1.61	2.00	–4.34*	–	–
Model 2	–0.80	–2.75*	–0.81	–5.05*	16.85	0.04**
Model 3	–2.19	–3.34*	–2.38	–5.01*	3.94	0.11**

Notes: [a] VARL = VAR in levels, [b] = VAR in first differences, Model 1 = No constant, no trend; Model 2 = Constant, no trend; Model 3 = Constant, trend.
ADF and PP critical values at 10% significance levels for models 1, 2 and 3 are –1.62, –2.57 and –3.13, respectively, while those of the PC test at 5% level for models 2 and 3 are 0.330 and 0.295, respectively.
* Significant at 10% level, ** Significant at 5% level.

Table 7.1: continued (unit roots test results)

	Test Statistics					
	ADF		PP		PC	
	VARL[a]	VARD[b]	VARL[a]	VARD[b]	VARL[a]	VARD[b]
PNG						
(6) WGDP						
Model 1	2.00	−1.31	7.95	−1.24	–	–
Model 2	−0.83	−3.19*	−0.63	−3.24*	234.18	0.11**
Model 3	−2.17	−3.19*	−1.49	−3.23*	66.84	0.29**
(7) WCPI						
Model 1	2.15	−1.58	1.63	−4.64*	–	–
Model 2	−0.62	−2.86*	−0.69	−4.98*	15.23	0.07**
Model 3	−1.54	−3.17*	−2.27	−4.90*	1.45	0.14**
(8) GDP						
Model 1	4.24	−1.67*	3.63	−2.72*	–	–
Model 2	−1.19	−2.59*	−1.13	−4.07*	40.97	0.32**
Model 3	−1.13	−3.71*	−1.30	−4.10*	30.01	0.26**
(9) EXR						
Model 1	0.22	−3.80*	0.18	−3.85*	–	–
Model 2	−1.28	−3.75*	−1.57	−3.80*	0.99	0.09**
Model 3	−1.31	−3.78*	−1.56	−3.84*	66.80	0.16**
(10) EXP						
Model 1	2.21	−1.64*	2.29	−3.15*	–	–
Model 2	−1.25	−2.69*	−0.98	−3.95*	19.39	0.15**
Model 3	−1.22	−3.79*	−1.60	−3.92*	19.62	0.24**

Notes: [a] VARL = VAR in levels, [b] = VAR in first differences, Model 1 = No constant, no trend; Model 2 = Constant, no trend; Model 3 = Constant, trend.
ADF and PP critical values at 10% significance levels for models 1, 2 and 3 are −1.62, −2.57 and −3.13, respectively, while those of the PC test at 5% level for models 2 and 3 are 0.330 and 0.295, respectively.
* Significant at 10% level, ** Significant at 5% level.

Table 7.1: continued (unit roots test results)

	Test Statistics					
	ADF		PP		PC	
	VARL[a]	VARD[b]	VARL[a]	VARD[b]	VARL[a]	VARD[b]
SOLOMON ISLANDS						
(11) WGDP						
Model 1	2.22	−1.95*	5.34	−1.90*	–	–
Model 2	−0.52	−3.50*	−0.48	−3.55*	78.01	0.05**
Model 3	−2.66	−3.45*	−1.87	−3.50*	34.63	0.28**
(12) WCPI						
Model 1	2.07	−1.56	1.56	−4.65*	–	–
Model 2	−0.46	−2.76*	−0.64	−4.97*	16.03	0.06**
Model 3	−1.73	−3.61*	−2.31	−4.89*	1.55	0.12**
(13) GDP						
Model 1	3.65	−1.75*	3.29	−3.25*	–	–
Model 2	−0.93	−2.64*	−0.92	−4.58*	54.35	0.31**
Model 3	−0.88	−3.70*	−1.04	−4.60*	34.55	0.24**
(14) EXR						
Model 1	1.30	−2.01*	2.42	−2.02*	–	–
Model 2	0.36	−2.88*	1.97	−2.74*	20.51	0.08**
Model 3	−0.95	−3.19*	−0.22	−3.18*	41.79	1.01
(15) EXP						
Model 1	1.89	0.97	2.25	−6.06*	–	–
Model 2	−0.67	−2.62*	−0.60	−7.29*	33.22	0.12**
Model 3	−2.02	−3.79*	−1.89	−7.19*	25.72	0.14**

Notes: [a] VARL = VAR in levels, [b] = VAR in first differences, Model 1 = No constant, no trend; Model 2 = Constant, no trend; Model 3 = Constant, trend.
ADF and PP critical values at 10% significance levels for models 1, 2 and 3 are −1.62, −2.57 and −3.13, respectively, while those of the PC test at 5% level for models 2 and 3 are 0.330 and 0.295, respectively.
* Significant at 10% level, ** Significant at 5% level.

Overall, the three tests indicated that all five data series are non–stationary in levels but stationary in their first differences. On the basis of this, it can thus be concluded that all models in the data series which were confirmed as stationary in their first difference are I(1) while those not confirmed might be I(2). But from Table 7.1, all the models in all the data series can generally be regarded as non–stationary and integrated of order one, I(1), as confirmed by the unit roots tests of the VAR models in differences.

7.4.3 Cointegration test results

After testing for the unit roots, the next step was to investigate whether the five data series have any long–run equilibrium relationships; i.e., whether there is any linear combination of the various series which is stationary or I(0). In Stock and Watson's (1988) terms, finding whether some series are driven by common trends is equivalent to identifying their long–run equilibrium relationships or finding whether the series are cointegrated.

Using the SHAZAM package (see instruction program in Appendix 7.1), the three residual–based tests (ADF, PP and POC) described in Chapter 6 were employed for cointegration testing. In cointegrating regression tests, the emphasis is to test whether the errors (residuals) are stationary, I(0). If they are found to be, then a cointegration relation exists among the series in question.

Seven different cointegration regressions were specified for each country. Using exports as the dependent variable, the seven cointegration regressions involved external and domestic variables as explanatory variables in one specification, and external and domestic variables separately in other specifications. The remaining specifications used separate individual variables from both the external and domestic markets as independent variables. However, it should be emphasised here that the main interest in these specifications is in those involving both external and domestic variables.

The null hypothesis for cointegration is Ho: $\gamma_t = 0$ vs the alternative hypothesis, Ha: $\gamma_t \neq 0$. Cointegrating OLS regressions based on equations (6.7) and (6.8) in Chapter 6 were conducted for ADF and PP unit roots tests of the residuals, u_t, while regressions on equations (6.9) and (6.10) were used to test for POC unit roots of the same u_t. The cointegration test results for the various specifications are presented in Table 7.2.

(a) Cointegration results for Fiji

In Fiji, only the POC test supported cointegration in model 3 with both the external and domestic variables in a single model (regression (1) in Table 7.2). Cointegration is supported for the external factors in model 2 by both the PP and POC tests and in model 3 by the PP test alone (regression (2) in Table 7.2).

Table 7.2: Cointegration test results of external and domestic factors

	Test Statistics		
	ADF	PP	POC
		FIJI	
(1) EXP = f(WGDP, WCPI, GDP, EXR)			
Model 2	−3.62	−3.89	0.27**
Model 3	−3.68	−3.88	0.43
(2) EXP = f(WGDP, WCPI)			
Model 2	−1.76	−3.96*	0.20**
Model 3	−1.84	−3.92*	0.34
(3) EXP = f(GDP, EXR)			
Model 2	−3.47*	−3.62*	0.21**
Model 3	−3.45	−3.97*	0.36
(4) EXP = f(WGDP)			
Model 2	−2.79	−2.93	0.28**
Model 3	−1.92	−3.82	1.45
(5) EXP = f(WCPI)			
Model 2	−2.11	−4.27*	0.80
Model 3	−1.74	−4.05*	0.29**
(6) EXP = f(GDP)			
Model 2	−2.79	−2.93	0.58
Model 3	−3.68*	−3.55*	0.47
(7) EXP = f(EXR)			
Model 2	−1.64	−1.75	1.33
Model 3	−3.03	−3.18	0.35

Notes: Model 2 = Drift, no trend; and Model 3 = Constant, trend.
Critical values for ADF and PP at 10% significance levels for model 2 are: −4.13, −3.45, and −3.04 for 5, 3, and 2 variables, respectively, while those for model 3 are: −4.43, −3.84, and −3.50. Those for POC are 0.330 and 0.295 for models 2 and 3, at 5% significance level. Test statistics greater than critical values support no cointegration hypothesis.
* Significant at 10% level, ** Significant at 5% level.

Table 7.2: continued (cointegration test results)

	Test Statistics		
	ADF	PP	POC
		PNG	
(8) EXP = f(WGDP, WCPI, GDP, EXR)			
Model 2	−1.91	−2.97	0.14**
Model 3	−1.98	−2.94	0.49
(9) EXP = f(WGDP, WCPI)			
Model 2	−1.66	−1.80	1.96
Model 3	−1.94	−2.07	3.89
(10) EXP = f(GDP, EXR)			
Model 2	−2.13	−3.04	0.05**
Model 3	−2.00	−3.13	0.15**
(11) EXP = f(WGDP)			
Model 2	−1.46	−1.80	1.62
Model 3	−2.07	−2.19	2.79
(12) EXP = f(WCPI)			
Model 2	−2.24	−2.29	2.91
Model 3	−1.72	−1.83	4.74
(13) EXP = f(GDP)			
Model 2	−1.90	−2.90	0.16**
Model 3	−2.61	−3.11	0.15**
(14) EXP = f(EXR)			
Model 2	−0.44	−0.55	41.13
Model 3	−2.64	−2.82	0.62

Notes: Model 2 = Drift, no trend; and Model 3 = Constant, trend.
Critical values for ADF and PP at 10% significance levels for model 2 are: −4.13, −3.45, and −3.04 for 5, 3, and 2 variables, respectively, while those for model 3 are: −4.43, −3.84, and −3.50. Those for POC are 0.330 and 0.295 for models 2 and 3, at 5% significance level. Test statistics greater than critical values support no cointegration hypothesis.
* Significant at 10% level, ** Significant at 5% level.

Table 7.2: continued (cointegration test results)

	Test Statistics		
	ADF	PP	POC
		SOLOMON ISLANDS	
(15) EXP = f(WGDP, WCPI, GDP, EXR)			
Model 2	−4.21*	−5.14*	0.11**
Model 3	−4.77*	−5.32*	0.30
(16) EXP = f(WGDP, WCPI)			
Model 2	−3.56*	−3.62*	0.93
Model 3	−3.21	−3.15	1.71
(17) EXP = f(GDP, EXR)			
Model 2	−4.28*	−5.24*	0.16**
Model 3	−4.08*	−5.11*	0.27**
(18) EXP = f(WGDP)			
Model 2	−1.88	−2.64	1.32
Model 3	−2.90	−2.83	3.07
(19) EXP = f(WCPI)			
Model 2	−3.41*	−3.42*	1.60
Model 3	−2.31	−3.14	1.58
(20) EXP = f(GDP)			
Model 2	−4.30*	−5.24	0.11**
Model 3	−4.27*	−5.18*	0.14**
(21) EXP = f(EXR)			
Model 2	−1.41	−1.43	34.48
Model 3	−2.76	−3.42	1.97

Notes: Model 2 = Drift, no trend; and Model 3 = Constant, trend.
Critical values for ADF and PP at 10% significance levels for model 2 are: −4.13, −3.45, and −3.04 for 5, 3, and 2 variables, respectively, while those for model 3 are: −4.43, −3.84, and −3.50. Those for POC are 0.330 and 0.295 for models 2 and 3, at 5% significance level. Test statistics greater than critical values support no cointegration hypothesis.
* Significant at 10% level, ** Significant at 5% level.

For the domestic factors, cointegration is supported by all three tests in model 2 while cointegration in model 3 is supported by the PP test alone (regression (3) in Table 7.2). Except for the regression for the exchange rate where no test supported any cointegration, some form of cointegration was supported by at least one test in all the remaining regressions. Although it appears that some cointegration existed between exports and external variables, and exports and domestic variables separately, it is clear that these results are quite mixed. Hence, it is difficult to conclude whether or not cointegration exists between exports and other variables of interest in Fiji.

(b) Cointegration results for PNG

In PNG, only a few cointegration relationships are supported by one test only, the POC. The POC test supports model 2 of both the external and domestic variables in a single model specification, and models 2 and 3 of the domestic variables together and GDP alone (see regressions (8), (10) and (13) in Table 7.2). Given that out of the three tests, only one test was able to detect a few cointegration relationships, little can be said about cointegration relationships in PNG.

(c) Cointegration results for SI

In SI, more cointegration relationships were found than for Fiji and PNG. For example, all three tests, and ADF and PP tests supported cointegration in models 2 and 3, respectively, of both the external and domestic variables in a single model (regression (15) in Table 7.2). Together, the external factors were supported by ADF and PP in model 2 only (regression (16) in Table 7.2), while the domestic factors were supported by all three tests in both models 2 and 3 (regression (17) in Table 7.2). Apart from the individual WGDP and EXR regressions, cointegration was supported by at least two tests in the various models of the WCPI and GDP regressions (regressions (18) – (21) in Table 7.2). Cointegration relationships were detected for most of the regressions of interest, (15), (16) and (17). The evidence in support of cointegration is stronger in SI and Fiji than in PNG.

(d) Residuals analyses

To obtain additional support for the above mixed results, residuals analyses for most relationships were conducted. Residuals generated from the respective cointegration regressions were plotted against the time variable. None of the plots showed any particular pattern, and no unusually large residuals were portrayed on the plots. Thus, with these plots, more convincing evidence for cointegration was achieved.

This additional evidence supported a decision to proceed with estimation of short–run dynamic relationships in terms of Granger causality, FEDA and IRA among the series, based on ECMs (Engle and Granger 1987). However, in addition to reasons given in Chapter 6, the mixed results found here for cointegration and the short data series used (33 observations), the estimation of the short–run dynamic relationships was also based on the VAR models in both levels and first differences.

7.4.4 Development, estimation and analysis of ECMs

There are two parts in this subsection, namely the development of ECMs and the estimation and analysis of the developed models.

(a) The development of the ECMs

Following the findings of some support for cointegration, ECM models were developed to explain the causes of CERV in the selected SPINs. The explanations were focused from two perspectives discussed earlier, namely the external and domestic sectors.

There are several alternative ways of constructing ECMs. Those used here follow the most popular and most frequently used method in the time series applied research, the Engle–Granger (1987) two–step approach (discussed in detail in Chapter 4). The same Engle–Granger approach was used for estimation.

Various specifications of ECMs were constructed, but, for the sake of brevity, only three types are described. These are the ECMs for: external market factors, domestic market factors and factors from the two markets combined.

(i) ECMs for the external market factors

An ECM model was developed for the external market factors of the selected SPINs. In the construction of the ECMs for the external factors, let

$$Y_{1,t} = (EXP_t - EXP_{t-1},\ WGDP_t - WGDP_{t-1},\ WCPI_t - WCPI_{t-1})', \quad (7.1)$$

and consider the residual

$$X_{1,t-1} = EXP_{t-1} - \delta_1 WGDP_{t-1} - \delta_2 WCPI_{t-1}. \quad (7.2)$$

The cointegration regression is based on OLS estimation procedure with an equation of the following nature:

$$EXP_{t-1} = \delta_1 WGDP_{t-1} + \delta_2 WCPI_{t-1} + \upsilon_{t-1} \qquad (7.3)$$

where (υ_{t-1}) is I(0).

Then, the following system of the ECM equations is estimated:

$$Y_{1,t} = -\lambda_1 X_{1,t-1} + \beta_1 + \sum_{i=1}^{k} B_{1,i} Y_{1,t-i} + \upsilon_{1,t} \qquad (7.4)$$

where λ_1 and β_1 are 3 x 1 vectors, each $B_{1,i}$ is a 3 x 3 matrix, and $\upsilon_{1,t}$ is a 3 x 1 vector of white noise error terms.

It is important to define, $X_{1,t-1}$, the disequilibrium error of the external system. The first row of equation (7.4) describes the short–run dynamic adjustment of CERV, while the second and third rows model those of the WGDP and WCPI, respectively.

(ii) ECMs for the domestic market factors

Similarly, an ECM model for the domestic market factors of the selected SPINs was constructed. As in the development of the ECM model for the external factors, let

$$Y_{2,t} = (EXP_t - EXP_{t-1},\ GDP_t - GDP_{t-1},\ EXR_t - EXR_{t-1})', \qquad (7.5)$$

and consider the residual

$$X_{2,t-1} = EXP_{t-1} - \gamma_1 GDP_{t-1} - \gamma_2 EXR_{t-1}. \qquad (7.6)$$

The estimate is based on the following cointegration equation:

$$EXP_{t-1} = \gamma_1 GDP_{t-1} + \gamma_2 EXR_{t-1} + \mu_{t-1} \qquad (7.7)$$

where (μ_{t-1}) is I(0).

Then, the following system of ECM equations is estimated:

$$Y_{2,t} = -\lambda_2 X_{2,t-1} + \beta_2 + \sum_{i=1}^{n} B_{2,i} Y_{2,t-i} + \upsilon_{2,t} \qquad (7.8)$$

where λ_2 and β_2 are 3 x 1 vectors, each $B_{2,i}$ is a 3 x 3 matrix, and $\upsilon_{2,t}$ is a 3 x 1 vector of white noise error terms.

Again, it is important to define, $X_{2,t-1}$, the disequilibrium error of the system. The first row of equation (7.8) describes the short–run dynamic adjustment of CERV, while the second and third rows model those of the GDP and EXR, respectively.

The above regressions contain stationary variables and can be analysed in the usual way. Since the main intention was to investigate the dynamic adjustments of CERV in the selected SPINs, the major interest lies in the first row elements of the vector λ_1.

(iii) ECMs for the external and domestic market factors together

Finally, an overall ECM model is expanded and developed. This is done by combining the variables of the external and domestic markets simultaneously for the determination of the dynamics of CERV in the selected SPINs. Let

$$Z_t = (EXP_t - EXP_{t-1},\ WGDP_t - WGDP_{t-1},\ WCPI_t - WCPI_{t-1},$$
$$GDP_t - GDP_{t-1},\ EXR_t - EXR_{t-1})', \qquad (7.9)$$

and then the ECM model is estimated based on the following system of equations:

$$Z_t = -\lambda_3 X_{1,t-1} - \lambda_4 X_{2,t-1} + \beta + \sum_{j=1}^{m} C_j Z_{t-j} + \theta_t \qquad (7.10)$$

where $X_{1,t-1}$ and $X_{2,t-1}$ are defined as previously, while λ_3 and λ_4 are 5 x 1 vectors, representing the coefficients for the external and domestic sectors, respectively, β is a 5 x 1 vector, each C_j is a 5 x 5 matrix, and θ_t is a 5 x 1 vector of white noise error terms.

Again, the focus is on the estimation of the coefficients of the first rows of λ_3 and λ_4 on the equilibrium error terms.

(b) Estimation and analysis of the developed ECMs

Using the OLS version of the Engle–Granger (1987) two–step estimation method, the disequilibrium errors (X_{it}) were estimated and their coefficients are represented by λ_is in Table 7.3. The estimated disequilibrium errors for each selected SPIN follow the ECM equations in (7.10), (7.8) and (7.4) above, and are given in Table 7.3, together with ECM equations for combinations of variables additional to those specifically formulated above. As noted, the main interest here lies in the first elements of the vectors λ_is, which model the causes of CERV.

(i) Disequilibrium error results for Fiji

The results show that Fiji had significant disequilibrium errors for coefficients (λ_3), (λ_2), (λ_5) and (λ_6), at 10 per cent significant level and (λ_1) at 5 per cent level.

Using a single equation as in (7.5) where both the domestic and external market factors adjust interactively to influence CERV[26], only the coefficient pertaining to the external markets (λ_3) was significant with the expected negative sign. This implies that the external markets have a more prominent long–run impact (which adjust dynamically in the short run) on CERV in Fiji than do the domestic factors.

The importance of external factors in Fiji became even more evident as they were found to significantly influence CERV in all the models. Though not as significant in as many of the models as the external factors, the domestic market factors (λ_2) were also found to be significant with the expected negative sign when they were specified separately (see models (1) to ((5) in Table 7.3). On the other hand, this could imply that when the external and domestic markets are estimated in separate models, the two markets portray some short–run dynamic adjustments towards the long–run influence on CERV. The overall implication of this for Fiji could be that both markets are important determinants of CERV in the long–run, though the evidence is that the external markets could have greater influence.

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[26] Using a single equation for the external and domestic markets together is thought to be conceptually more appealing than the other models. A single equation combining both sectors permits the two markets to simultaneously adjust interactively in exerting short–run dynamic influence on CERV toward the long–run equilibrium. Hence, this could be more indicative of what might actually be happening in the real world situation.

Table 7.3: Results of the coefficients of the disequilibrium errors of the estimated ECMs

Export Models[a]	Optimal lags AIC[b]	SC[c]	The selected SPINs FIJI		PNG		SI	
(1) WGDP, WCPI, GDP, EXR								
λ_3	1	1	–0.75	(–1.79)*	–1.10	(–3.45)***	0.22	(2.13)**
λ_4	1	1	0.54	(1.32)	1.12	(3.33)***	–1.54	(–3.65)***
λ_3	2	2	–	–	0.13	(0.50)	–	–
λ_4	2	2	–	–	–0.10	(–0.55)	–	–
λ_3	4	4	–0.76	(–0.73)	–	–	–0.11	(–0.48)
λ_4	4	4	0.74	(0.72)	–	–	0.03	(0.16)
(2) WGDP, WCPI								
λ_1	1	1	–0.19	(–2.45)**	–0.03	(–1.11)	–0.06	(–0.98)
λ_1	2	2	–	–	–0.01	(–0.44)	–	–
(3) GDP, EXR								
λ_2	1	1	–0.20	(–1.95)*	–0.04	(–1.32)	–0.60	(–1.75)*
λ_2	2	2	–	–	–0.17	(–1.49)	0.82	(1.34)
λ_2	4	4	–	–	–	–	–0.01	(–0.11)
(4) WGDP								
λ_5	1	1	–0.11	(–1.80)*	–0.04	(–1.26)	–0.04	(–0.72)
λ_5	2	2	–0.01	(–0.72)	–0.02	(–1.18)	–	–
(5) WCPI								
λ_6	1	1	–0.11	(–1.89)*	–0.02	(–0.91)	–0.04	(–0.88)
λ_6	2	2	–	–	–0.01	(–0.22)	–	–
(6) GDP								
λ_7	1	1	–0.11	(–1.49)	–0.04	(–1.30)	–0.69	(–1.96)*
λ_7	2	2	–	–	–0.11	(–1.14)	–	–
(7) EXR								
λ_8	1	1	–0.05	(–1.21)	–0.04	(–1.17)	0.01	(0.30)
λ_8	2	2	–	–	–0.04	(–1.21)	0.01	(0.16)
λ_8	4	4	–	–	–	–	0.003	(0.04)

Notes: [a] implies models with exports as the dependent variables, [b] AIC is Akaike information criterion, and [c] SC is Schwarz criterion.
Coefficients (λ_i), i = 1, 3, 5 and 6 belong to external market factors, while i = 2, 4, 7 and 8 belong to domestic market factors. t-statistics are in the parentheses.
*, **, and *** Significant at 10, 5, and 1% level, respectively.

(ii) Disequilibrium error results for PNG

The case for PNG is rather different from that of Fiji when the two markets were analysed in a single ECM model. Both coefficients were highly significant, at 1 per cent level. The coefficient pertaining to external markets (λ_3) had the right expected negative sign but that of the domestic markets (λ_4) had an unexpected positive sign. Hence, it can be inferred that both markets have been equally important in exerting long–run influence on CERV in PNG through the short–run dynamic adjustments (model (1) in Table 7.3).

When the two markets were analysed separately, first with their factors together and then individually, all the cases yielded the right expected negative signs but all were statistically insignificant (models (2) to (7) in Table 7.3). With a separate market model, the long–run influence (through short–run dynamic adjustments) of both markets with respect to CERV in PNG was not supported statistically. However, since the former case (a single model for the two markets) was thought to be more realistic, the inferences from this case could then be regarded as plausible.

(iii) Disequilibrium error results for SI

Unlike both Fiji and PNG, the Solomon Islands results (Table 7.3) show that, when using the two markets in a single ECM model, both the external and domestic markets influenced CERV in the long run. However, the domestic market coefficient (λ_4) had the expected negative sign and was significant at the 1 per cent level. In contrast, the coefficient of the external markets (λ_3) which was also found to be statistically significant at the 5 per cent level, had an unexpected positive sign (model (1) in Table 7.3). This evidence suggests that, although both markets were important in determining CERV in SI, the domestic markets could have been dominant.

To confirm this suggestion, further analysis was carried out with the two markets estimated separately, and only coefficient (λ_4) for the domestic market factors was found statistically significant with the expected negative sign. Similarly, of the individual variables, only domestic GDP (λ_7) was found statistically significant with the expected negative sign (see models (2) to (7) in Table 7.3). Thus, through the usual short–run dynamic adjustments, these results suggest that, in the long term, CERV in SI is affected more by domestic than external market factors.

(iv) Summary of the overall ECM results

In summary, empirical evidence from the analysis of the developed ECMs for the selected SPINs seems to suggest that different countries experience different influences on CERV. For instance, for Fiji, it was found that, even though domestic markets did influence CERV, external market factors impacted on CERV more strongly. In PNG, the two markets were found to be about equally important. The SI case showed that while the two markets were important, the domestic factors prevailed.

Given that these results were mixed and sometimes inconsistent, they may be regarded as inconclusive but indicative. To try to obtain more conclusive evidence, Granger causality, FEDA and IRA were undertaken on the basis of both the VAR techniques in levels and first differences, and the ECMs, and these are presented in the subsequent sections.

7.4.5 Granger causality test results

Three main model formulations were used in investigating causal linkages between CERV and the domestic and external market factors: (1) both external and domestic markets together in a single model, (2) external factors only, and (3) domestic market factors only. However, the investigations were taken further in the sense that causation was also investigated between CERV and the individual variables from both the domestic and external factors.

Using the RATS applications package (see instruction program in Appendix 7.2), all the causality testing was accomplished by employing the Granger OLS regression approach as described in Chapter 6. For the same reasons as given in Chapter 6, Granger causality testing was based on three types of modelling, namely, VAR models in levels, VAR models in first differences and ECMs. The results are reported in Table 7.4.

Before causality testing was conducted, all the series were tested for up to a maximum of four lags by using AIC and SC methods. The reasons for this are the same as those given in Chapter 6. Results are also presented in Table 7.4.

Table 7.4: Granger causality test results from external and domestic factors to CERV

No causality from	For models in VARL[a], VARD[b] and ECMs[c] Model Type	Optimal lags AIC[d]	SC[e]	F–Test statistics	Remark
			FIJI		
(1) WGDP, WCPI, GDP, EXR to EXP					
	VARL	2	2	5.24***	Causality
	VARD	4	4	6.72***	Causality
	ECMs	4	4	5.49**	Causality
(2) WGDP, WCPI to EXP					
	VARL	–	1	7.55***	Causality
	VARL	2	–	10.47***	Causality
	VARD	1	1	7.01***	Causality
	ECMs	1	1	7.55***	Causality
(3) GDP, EXR to EXP					
	VARL	–	1	4.43**	Causality
	VARL	2	–	3.82**	Causality
	VARD	1	1	0.33	No causality
	ECMs	1	1	1.51	No causality
(4) WGDP to EXP					
	VARL	3	3	5.96***	Causality
	VARD	2	2	5.88***	Causality
	ECMs	1	1	7.55***	Causality
(5) WCPI to EXP					
	VARL	1	1	10.69***	Causality
	VARD	1	1	13.22***	Causality
	ECMs	1	1	9.01***	Causality
(6) GDP to EXP					
	VARL	–	1	6.25**	Causality
	VARL	2	–	3.83**	Causality
	VARD	1	1	0.62	No causality
	ECMs	1	1	1.44	No causality

Notes: [a] VARL is VAR in levels, [b] VARD is VAR in differences, [c] ECMs are error correction models, [d] AIC is Akaike information criterion, and [e] SC is Schwarz criterion.
Test statistics are based on critical values of F–distributions whose degrees of freedom used are listed in Appendix 8.10.
* , ** , and *** Causality significant at 10%, 5% and 1% levels, respectively.

Table 7.4: continued (causality test results)

No causality from	For models in VARL[a], VARD[b] and ECMs[c]				
	Model Type	Optimal lags AIC[d]	SC[e]	F–Test statistics	Remark
		FIJI			
(7) EXR to EXP					
	VARL	1	1	0.95	No causality
	VARD	1	1	0.16	No causality
	ECMs	1	1	0.82	No causality
		PNG			
(8) WGDP, WCPI, GDP, EXR to EXP					
	VARL	2	2	5.32***	Causality
	VARD	2	2	4.50***	Causality
	ECMs	2	2	3.82***	Causality
(9) WGDP, WCPI to EXP					
	VARL	3	3	3.93***	Causality
	VARD	2	2	3.98**	Causality
	ECMs	2	2	3.11**	Causality
(10) GDP, EXR to EXP					
	VARL	3	3	2.93**	Causality
	VARD	2	2	4.35***	Causality
	ECMs	2	2	4.10***	Causality
(11) WGDP to EXP					
	VARL	3	3	1.89	No causality
	VARD	2	2	2.62*	Causality
	ECMs	2	2	2.24	No causality
(12) WCPI to EXP					
	VARL	3	3	5.17***	Causality
	VARD	2	2	4.41**	Causality
	ECMs	2	2	2.85*	Causality

Notes: [a] VARL is VAR in levels, [b] VARD is VAR in differences, [c] ECMs are error correction models, [d] AIC is Akaike information criterion, and [e] SC is Schwarz criterion.
Test statistics are based on critical values of F–distributions whose degrees of freedom used are listed in Appendix 8.10.
* , ** , and *** Causality significant at 10%, 5% and 1% levels, respectively.

Table 7.4: continued (causality test results)

No causality from	Model Type	Optimal lags AIC[d]	Optimal lags SC[e]	F–Test statistics	Remark
PNG					
(13) GDP to EXP					
	VARL	–	3	2.35*	Causality
	VARL	4	–	2.44*	Causality
	VARD	2	2	3.83**	Causality
	ECMs	2	2	3.02**	Causality
(14) EXR to EXP					
	VARL	–	1	2.12	No causality
	VARL	3	–	0.38	No causality
	VARD	2	2	0.17	No causality
	ECMs	2	2	0.60	No causality
SOLOMON ISLANDS					
(15) WGDP, WCPI, GDP, EXR to EXP					
	VARL	4	4	3.74**	Causality
	VARD	1	1	3.29**	Causality
	ECMs	1	1	4.62***	Causality
(16) WGDP, WCPI to EXP					
	VARL	3	3	4.14***	Causality
	VARD	1	1	6.81***	Causality
	ECMs	1	1	4.86***	Causality
(17) GDP, EXR to EXP					
	VARL	3	3	3.82**	Causality
	VARD	–	1	1.14	No causality
	VARD	2	–	2.26*	Causality
	ECMs	2	2	2.23*	Causality
(18) WGDP to EXP					
	VARL	1	1	8.81***	Causality
	VARD	1	1	6.05**	Causality
	ECMs	1	1	3.23*	Causality

For models in VARL[a], VARD[b] and ECMs[c]

Notes: [a] VARL is VAR in levels, [b] VARD is VAR in differences, [c] ECMs are error correction models, [d] AIC is Akaike information criterion, and [e] SC is Schwarz criterion.
Test statistics are based on critical values of F–distributions whose degrees of freedom used are listed in Appendix 8.10.
*, **, and *** Causality significant at 10%, 5% and 1% levels, respectively.

Table 7.4: continued (causality test results)

No causality from	For models in VARL[a], VARD[b] and ECMs[c] Model Type	Optimal lags AIC[d]	SC[e]	F–Test statistics	Remark
			SOLOMON ISLANDS		
(19) WCPI to EXP					
	VARL	2	2	6.17***	Causality
	VARD	1	1	12.22***	Causality
	ECMs	1	1	6.45***	Causality
(20) GDP to EXP					
	VARL	1	1	9.31***	Causality
	VARD	1	1	1.01	No causality
	ECMs	1	1	2.48	No causality
(21) EXR to EXP					
	VARL	3	3	3.70**	Causality
	VARD	–	2	4.82**	Causality
	VARD	4	–	4.48**	Causality
	ECMs	–	2	3.09**	Causality
	ECMs	4	–	3.40**	Causality

Notes: [a] VARL is VAR in levels, [b] VARD is VAR in differences, [c] ECMs are error correction models, [d] AIC is Akaike information criterion, and [e] SC is Schwarz criterion.
Test statistics are based on critical values of F–distributions whose degrees of freedom used are listed in Appendix 8.10.
* , ** , and *** Causality significant at 10%, 5% and 1% levels, respectively.

(a) Causality test results for Fiji

From almost every model specification (except for specification (7) in Table 7.4) for Fiji, there was at least one model type in which causality was found running to CERV. Highly significant (at 1 and 5 per cent levels) Granger causality was found for both external and domestic factors in a single model (specification (1) in Table 7.4) for all the model types – the VAR models in levels and first differences and ECMs, respectively.

When the external and domestic market factors were analysed separately, all the model types were found to be highly significant at 1 per cent level for the external market factors as causal agents of CERV. However, this was not the case for the domestic market factors because they were found to cause CERV in only one model type, the VAR in levels at 5 per cent significance level (specifications (2) and (3) in Table 7.4). Causality tests for the single variables from both the external and domestic sides seemed to confirm these findings. When tested individually, the external market variables were found to be strong causal agents of CERV while the domestic market variables seemed to be weak causal agents. Both the external variables were found to cause CERV at the 1 per cent significance level. The domestic factors, and especially the GDP was significant at the 5 per cent level (specifications (4) to (7) in Table 7.4).

One way to interpret these results is that both the external and domestic market factors have, in the past, caused CERV in Fiji. However, the empirical evidence tends to point more strongly toward external market factors as the dominant causal agents of CERV. The Fiji results seem to confirm what was found by the ECMs in the previous subsection.

(b) Causality test results for PNG

For PNG, except for the model specification (14) in Table 7.4, there was at least one model type in which causality was found running from the explanatory variables to CERV. For the external and domestic market variables in a single model specification (8), Granger causality was found to be highly significant, at 1 per cent level, for all model types – the VAR models in levels and first differences and ECMs, respectively (Table 7.4).

On analysing the external and domestic market factors separately, all the model types were found to be significant at 1 per cent or 5 per cent levels for both the external and domestic market factors as causal agents of CERV. The external market factors were found significant at 1 per cent in the VAR model in levels and at 5 per cent in both the VAR model in first differences and ECMs. Domestic market factors were found to cause CERV at 5 per cent significance level in the VAR model in levels and at 1 per cent level in both the VAR model in first differences and ECMs (specifications (9) and (10) in Table 7.4). Further causality tests were conducted for the single variables from both the external and domestic sides. From the external side, there was stronger evidence in support of causality running from WCPI to CERV than causality from WGDP. Similarly, between the domestic market variables (specifications (11) to (14) in Table 7.4) there was more evidence in support of GDP than for exchange rate as individual causal agents of CERV.

Empirical evidence from the causality results for PNG suggests that both external and domestic market factors have caused CERV in the past. Unlike Fiji, the evidence tends to support both external and domestic market factors as equally important in causing CERV in PNG, confirming what was previously found by the ECMs.

(c) Causality test results for SI

In almost every model specification for SI, there was at least one model type in which causality was found running from the specified variables to CERV. Specifically, for the external and domestic market variables in single model specification (15), Granger causality was found to be significant at the 5 per cent level in the VAR models in levels and first differences and 1 per cent level in the ECMs (Table 7.4).

When the external and domestic market factors were analysed separately, most model types were found to be significant. For instance, the external market variables were significant causes of CERV at the 1 per cent level in all the three model types while the domestic factors were significant at 5 per cent level in the VAR models in levels and 10 per cent level in both the VAR models in first differences and ECMs (specifications (16) and (17) in Table 7.4).

Further causality tests on an individual variable basis revealed some support for the previous findings. For example, causality running from WGDP to CERV was present at 1 per cent significance level in the VAR models in levels, 5 per cent in the VAR models in first differences and 10 per cent in the ECMs. Causality from WCPI was found present at 1 per cent significance level in all the model types. Similarly, for the domestic side, causality from GDP to CERV was found to be present at 1 per cent significance level in only the VAR models in levels. Finally, causality from the exchange rates to CERV was found present at 5 per cent significance levels in all the model types (specifications (20) to (21) in Table 7.4).

The causality results for SI indicate that both external and domestic market factors have been important causal agents of CERV in the past. As for PNG, the SI evidence tends to support both external and domestic market factors as equally important in causing CERV. These results conform with what was previously found by the ECMs for SI.

(d) Summary of the causality test results

In summary, reasonably strong empirical evidence has been found that, in the past, CERV has been caused, in the Granger sense, by both the external and domestic market factors in the three selected SPINs. This was verified by conducting the Granger causality tests in various model specifications as indicated in Table 7.4. In most of these specifications, Granger causality running from the variables to CERV was found in at least one model type.

7.4.6 FEDA test results

In a bid to verify the causality test results the forecast error variance decomposition technique has also been applied. The causes of CERV were examined from both the external and domestic market variables in a single model. The causes of CERV were quantified in percentages in terms of magnitudes and persistence over time. That is, the underlying question here is: given an unexpected CERV in a system, what percentages of this variability can be attributed to the individual variables from the external and domestic sides? This technique is used to provide more information about the short–run dynamic relationships between CERV and the various variables.

Only one single model involving the five variables was used in the tests for FEDA. To account for the contemporaneous correlations among the errors in the system, the model was orthogonalised in the order of WGDP, WCPI, GDP, EXR and EXP. This is similar to imposing a recursive structure in the system. This type of orthogonalisation permits the most exogenous factors (external) to come first in the ordering so as to allow the greatest opportunity for the factors to impact on CERV in the model (Tegene 1990). This is an assumption which attempts to emulate what might be happening in the real world situation. FEDA is discussed in Chapter 4 in general and in Chapter 6 in specific terms.

FEDA tests were estimated using the RATS program (see instruction program in Appendix 7.2). The variance decomposition results from FEDA tests of the three selected SPINs are presented in Table 7.5.

(a) FEDA test results for Fiji

The FEDA results in Table 7.5 show the contributions to export variance decomposition of the five variables (WGDP, WCPI, GDP, EXR and EXP) over time.

(i) VAR models in levels

In the VAR model in levels in Fiji, WGDP contributed about 8 per cent to variance decomposition of CERV in the first year, increasing to about 24 per cent in year 20. WCPI contributed about 1 per cent in the first year but the contribution jumped to about 12 per cent in year 3 and then decreased to about 9 per cent in year 20. GDP accounted for the greatest cross–contributions (from different variables to exports) to export variance decomposition, registering about 34, 42 and 51 per cent in years 1, 10 and 20, respectively.

Table 7.5: Variance decomposition of the difference of exports (CERV) for selected SPINs

Period	Export decompositions in %				
	WGDP	WCPI	GDP	EXR	EXP
			FIJI		
			VARL		
1	6.7	1.1	34.4	1.1	56.7
3	18.3	12.1	28.5	1.9	39.2
5	22.9	10.5	31.6	2.2	32.8
8	23.6	10.6	38.6	1.8	25.4
10	23.7	10.2	42.0	1.7	22.4
15	23.7	9.3	47.7	1.3	18.0
20	23.5	8.6	51.3	1.2	15.4
Average	20	9	39	2	30
			VARD		
1	0.1	0.1	37.0	1.1	61.7
3	21.5	11.4	24.8	1.1	41.2
5	21.4	11.4	25.2	1.1	40.9
8	21.5	11.3	25.2	1.1	40.9
10	21.5	11.3	25.2	1.1	40.9
15	21.5	11.3	25.2	1.1	40.9
20	21.5	11.3	25.2	1.1	40.9
Average	18	10	27	1	44
			ECMs		
1	0.6	1.6	28.2	3.2	66.4
3	21.8	10.5	19.2	3.0	45.5
5	22.4	10.4	19.3	3.0	44.9
8	22.5	10.4	19.3	3.0	44.8
10	22.5	10.4	19.3	3.0	44.8
15	22.5	10.4	19.3	3.0	44.8
20	22.5	10.4	19.3	3.0	44.8
Average	19	9	21	3	48

Notes: (a) Based on the VAR models in levels (VARL), about 39, 30, 20, 9 and 2 per cent of CERV are accounted for by GDP, EXP, WGDP, WCPI and EXR, respectively, over 20 years.
(b) For the VAR models in first differences (VARD), about 44, 27, 18, 10 and 1 per cent of CERV are attributable to EXP, GDP, WGDP, WCPI and EXR, respectively, over the 20 years.
(c) In terms of ECMs, these are about 48, 21, 19, 9 and 3 per cent of CERV which are accounted for by EXP, GDP, WGDP, WCPI and EXR over the same period of time.

Table 7.5: continued (variance decompositions)

	Export decompositions in %				
Period	WGDP	WCPI	GDP	EXR	EXP
			PNG		
			VARL		
1	14.5	27.6	19.1	0.5	38.3
3	7.9	14.2	21.4	0.5	56.0
5	7.4	17.5	20.7	3.8	50.6
8	11.4	20.3	18.1	11.0	39.2
10	13.1	20.5	16.7	15.0	34.7
15	14.3	19.9	14.5	21.6	29.7
20	14.2	19.2	13.4	25.7	27.5
Average	12	20	18	11	39
			VARD		
1	7.4	37.7	15.3	0.3	39.3
3	14.9	25.0	12.8	1.0	46.3
5	17.0	24.3	12.5	1.4	44.8
8	17.0	24.3	12.5	1.4	44.8
10	17.0	24.3	12.5	1.4	44.8
15	17.0	24.3	12.5	1.4	44.8
20	17.0	24.3	12.5	1.4	44.8
Average	15	26	13	1	44
			ECMs		
1	20.7	2.4	23.8	0.7	52.4
3	22.5	12.1	28.7	2.8	33.9
5	23.2	11.9	28.3	4.2	32.4
8	22.5	12.9	27.3	6.1	31.2
10	22.8	13.9	26.7	6.2	30.4
15	22.4	14.1	27.2	6.4	29.9
20	22.4	14.1	27.2	6.4	29.9
Average	22	12	27	5	34

Notes: (a) Based on the VAR models in levels (VARL), about 39, 20, 18, 12 and 11 per cent of CERV are accounted for by EXP, WCPI, GDP, WGDP and EXR, respectively, over 20 years.
(b) For the VAR models in first differences (VARD), about 44, 26, 15, 13 and 1 per cent of CERV are attributable to EXP, WCPI, WGDP, GDP and EXR, respectively, over the 20 years.
(c) In terms of ECMs, these are about 34, 27, 22, 12 and 5 per cent of CERV which are accounted for by EXP, GDP, WGDP, WCPI and EXR over the same period of time.

Table 7.5: continued (variance decompositions)

Period	Export decompositions in %				
	WGDP	WCPI	GDP	EXR	EXP
			SOLOMON ISLANDS		
			VARL		
1	7.2	17.2	42.1	0.1	33.4
3	24.6	15.4	34.5	0.8	24.7
5	39.1	14.7	23.1	1.6	21.5
8	38.7	26.7	15.3	1.3	18.0
10	36.8	31.9	13.8	1.2	16.3
15	35.6	35.6	13.2	1.0	14.6
20	36.2	35.8	13.1	1.2	13.7
Average	31	25	22	1	20
			VARD		
1	0.1	13.0	33.5	2.3	51.1
3	11.3	15.6	27.1	3.2	42.8
5	11.7	15.5	27.0	3.3	42.5
8	11.7	15.5	27.0	3.3	42.5
10	11.7	15.5	27.0	3.3	42.5
15	11.7	15.5	27.0	3.3	42.5
20	11.7	15.5	27.0	3.3	42.5
Average	10	15	28	3	44
			ECMs		
1	0.0	11.5	31.5	5.2	51.8
3	7.7	18.1	28.0	5.2	41.0
5	8.5	17.9	27.3	5.9	40.4
8	8.5	17.9	27.3	5.9	40.4
10	8.5	17.9	27.3	5.9	40.4
15	8.5	17.9	27.3	5.9	40.4
20	8.5	17.9	27.3	5.9	40.4
Average	7	17	28	6	42

Notes: (a) Based on the VAR models in levels (VARL), about 31, 25, 22, 20 and 1 per cent of CERV are accounted for by WGDP, WCPI, GDP, EXP and EXR, respectively, over 20 years.
(b) For the VAR models in first differences (VARD), about 44, 28, 15, 10 and 3 per cent of CERV are attributable to EXP, GDP, WCPI, WGDP and EXR, respectively, over the 20 years.
(c) In terms of ECMs, these are about 42, 28, 17, 7 and 6 per cent of CERV which are accounted for by EXP, GDP, WCPI, WGDP and EXR over the same period of time.

Contributions from exchange rates were small, about 1, 2, and 1 per cent for years 1, 10 and 20. Own–contributions (from exports to exports) were initially about 57 per cent in year 1, decreasing to about 15 per cent in year 20.

Overall, domestic market factors contributed more than external factors to export variance decomposition in the VAR models in levels in Fiji. Individually, the GDP, EXP, WGDP, WCPI, and EXR variables followed each other in that order in their contributions to export variance decomposition. On average, these were about 39, 30, 20, 9 and 2 per cent of CERV, respectively, over the 20–year period.

(ii) VAR models in first differences

In the VAR model in first differences in Fiji, WGDP contributed less than 1 per cent to variance decomposition of CERV in the first year, rising to about 21 per cent in year 3 and stabilising at about the same amount in year 8. WCPI behaved almost like WGDP, contributing less than 1 per cent in the first year and rising to about 11 per cent in year 3. This stabilised at about 11 per cent in year 8. GDP, again, accounted for the greatest cross–contributions to export variance decomposition, registering about 37 per cent in year 1 and stabilising at about 25 per cent in year 3. Contributions from exchange rates were minimal, averaging about 1 per cent throughout the 20 years. Own–contributions by exports were substantial, starting with about 62 per cent in year 1 and decreasing to a stabilising level at about 41 per cent in year 8.

Overall, the domestic and external market factors contributed almost equally to export variance decomposition in the VAR models in first differences. Individually, the EXP, GDP, WGDP, WCPI and EXR variables followed each other in that order in their contributions to export variance decomposition which was, on the average, about 44, 27, 18, 10 and 1 per cent of CERV, respectively, over the 20–year period.

(iii) ECMs

In the ECMs in Fiji, WGDP contributed less than 1 per cent to variance decomposition of CERV in the first year, rising to about 22 per cent in year 3 and stabilising at about the same amount in year 10. WCPI contributed about 2 per cent in the first year, rising to about 11 per cent in year 3 and stabilising at about 10 per cent in year 8. For cross–contributions, GDP accounted for most of the contributions to export variance decomposition, registering about 28 per cent in year 1, stabilising at about 19 per cent in year 8. Contributions from exchange rates were about same – 3 per cent throughout the 20 years. Own–contributions were large, starting at about 66 per cent in year 1 and decreasing to a stabilised level of about 45 per cent in year 10.

Overall, the external market factors contributed more than domestic factors to export variance decomposition in ECMs. Individually, the EXP, GDP, WGDP, WCPI and EXR variables followed each other in that order in their contributions to export variance decomposition. On the average, these were about 48, 21, 19, 9 and 3 per cent of CERV, respectively, over the 20–year period.

In brief, the overall results for FEDA in Fiji could be interpreted to imply that both external and domestic market factors are important contributors to CERV. On the basis of individual variables, GDP seems to have been more important than the other three variables from the external and domestic sides in explaining the causes of CERV. The FEDA results appear fairly consistent with the previous results obtained for causality and ECMs analysis for Fiji.

(b) FEDA test results for PNG

(i) VAR models in levels

For PNG, the VAR model in levels in Table 7.5 indicates that WGDP contributed about 15 per cent to variance decomposition of CERV in the first year, decreasing to about 13 per cent in year 10 and then increasing to about 14 per cent in year 20. WCPI gave the greatest cross–contributions of about 28 per cent in the first year but the contributions decreased to about 21 per cent in year 10, further decreasing to about 19 per cent in year 20. Contributions from GDP were substantial too, accounting for about 19, 17 and 13 per cent in years 1, 10 and 20, respectively. Contributions from exchange rates were variable but increasing steadily, at about 1, 15, and 26 per cent for years 1, 10 and 20, respectively. Own–contributions were large, starting with about 38 per cent in year 1 and decreasing to about 28 per cent in year 20.

Overall, external market factors contributed a little more than domestic factors to export variance decomposition in the VAR models in levels in PNG. Individually, the EXP, WCPI, GDP, WGDP and EXR variables followed each other, in that order, in their contributions to export variance decomposition. On the average, these were about 39, 20, 18, 12 and 11 per cent of CERV, respectively, over the 20–year period.

(ii) VAR models in first differences

For PNG's VAR model in first differences, WGDP contributed about 7 per cent to variance decomposition of CERV in the first year, which more than doubled to about 15 per cent in year 3 and stabilised at about 17 per cent in year 8. WCPI displayed the greatest cross–contributions, starting with about 37 per cent in the first year and decreasing to about 25 per cent in year 3. This stabilised at about 24 per cent in year 8. GDP accounted for about 15 per cent in year 1 which decreased to about 13 per cent in year 3 and stabilised at about the same amount (13 per cent) in year 8. Contributions from exchange rates were minimal, starting with less than one–half per cent in year one and stabilising at about 1 per cent in year 8. Own–contributions were substantial, starting with about 39 per cent in year 1 and increasing to a stabilised level of about 45 per cent in year 8.

Overall, external factors contributed almost three times as much as the domestic factors did in explaining the causes of CERV in PNG in the VAR models in first differences. Individually, the EXP, WCPI, WGDP, GDP and EXR variables followed each other, in that order, in their contributions to CERV. On the average, these were about 44, 26, 15, 13 and 1 per cent of CERV, respectively, over the 20–year period.

(iii) ECMs

In the ECMs in PNG, WGDP contributed about 21 per cent to variance decomposition of CERV in the first year, increasing to about 23 per cent in year 3 and stabilising to about 22 per cent in year 20. WCPI contributed about 2 per cent in the first year, rising to about 12 per cent in year 3 and stabilising at about 14 per cent in year 20. For cross–contributions, GDP accounted for most of the contributions to export variance decomposition, at about 24 per cent in year 1. This increased to about 29 per cent in year 3 and stabilised at about 27 per cent in year 20. Contributions from exchange rates were also variable, starting with about 1 per cent in year 1 and increasing to about 3 per cent in year 3. This increased further to a stabilised level of about 6 per cent in year 20. Own–contributions were substantial, starting with about 52 per cent in year 1 and decreasing progressively to a stabilised level of about 30 per cent in year 20.

Overall, the external market factors contributed a little more than domestic factors to export variance decomposition in ECMs. Individually, the EXP, GDP, WGDP, WCPI and EXR followed each other, in that order, in their contributions to CERV. On the average, these were about 34, 27, 22, 12 and 5 per cent of CERV, respectively, over the 20–year period.

In summary, overall evidence of FEDA results for PNG indicates that, even though both external and domestic market factors are important contributors to CERV, the external factors were more important in most of the model types in most years. Individually, WCPI seemed to dominate in both the VAR models whereas GDP dominated in the ECMs. Despite differences among model types, variables and time periods, the FEDA results for PNG appear to confirm the results obtained for causality and ECMs analysis that both markets are important causes of CERV.

(c) FEDA test results for SI

(i) VAR models in levels

For SI, the VAR model in levels indicates that WGDP contributed about 7 per cent to variance decomposition of CERV in the first year, more than trebling to about 25 per cent in year 3 and then increasing to about 36 per cent in year 20. WCPI contributed about 17 per cent in the first year but decreased to about 15 per cent in year 3 and increased to about 36 per cent in year 20. Contributions from GDP started quite high at about 42 per cent in year 1 and decreased continuously to about 13 per cent in year 20. Exchange rate contributions were minimal, being less than one–half per cent in year 1 and increasing to a maximum of only about 2 per cent in year 5, eventually stabilising at about 1 per cent in year 20. Own–contributions were substantial too, starting with about 33 per cent in year 1 and decreasing progressively to about 14 per cent in year 20.

Overall, the external market factors contributed more than twice as much as domestic factors to export variance decomposition in the VAR models in levels in SI. Individually, the WGDP, WCPI, GDP, EXP and EXR variables followed each other, in that order, in their contributions to export variance decomposition. On average, these were about 31, 25, 22, 20 and 1 per cent of CERV, respectively, over the 20–year period.

(ii) VAR models in first differences

In the VAR model in first differences for SI, WGDP contributed less than one–half per cent to variance decomposition of CERV in the first year, but the contributions increased substantially to about 11 per cent in year 3 and stabilised at about 12 per cent in year 8. WCPI contributed about 13 per cent in year 1 and increased to stabilise at about 16 per cent in year 8. Contributions from GDP accounted for about 34 per cent in year 1 and decreased and stabilised at about 27 per cent in year 8. Exchange rates contributed about 2 per cent in year 1 and this increased then stabilised at about 3 per cent in year 8. Own–contributions were large, starting with about 51 per cent in year 1 and progressively decreasing to a stabilised amount of about 43 per cent in year 8.

Overall, the domestic factors contributed more than external factors to variance decomposition of CERV in SI in the VAR models in first differences. Individually, the EXP, GDP, WCPI, WGDP, and EXR variables followed each other, in that order, in their contributions to export variance decomposition. On the average, these were about 44, 28, 15, 10 and 3 per cent of CERV, respectively, over the 20–year period.

(iii) ECMs

In the ECMs for SI, WGDP contributed zero per cent to variance decomposition of CERV in the first year, increasing to about 8 per cent in year 3 and stabilising at about 9 per cent in year 8. WCPI contributed about 12 per cent in the first year, increasing to about 18 per cent in year 3 and stabilising at about 18 per cent in year 8. GDP accounted for most of the cross–contributions to export variance decomposition, registering about 32 per cent in year 1. This decreased to about 28 per cent in year 3 and stabilised at about 27 per cent in year 8. Contributions from exchange rates were almost uniform, starting at about 5 per cent in year 1 and increasing to a stabilised level of about 6 per cent in year 8. Own–contributions were substantial, starting at about 52 per cent in year 1 and decreasing progressively to a stabilised level of about 40 per cent in year 8.

Overall, the domestic market factors again contributed more than the external factors to export variance decomposition in ECMs. Individually, the EXP, GDP, WCPI, WGDP and EXR followed each other, in that order, in their contributions to export variance decomposition. On the average, these were about 42, 28, 17, 7 and 6 per cent of CERV, respectively, over the 20–year period.

In summary, the FEDA results for SI suggest that both external and domestic market factors are important contributors to CERV. Even though these contributions differ across time periods and model types, the results suggest that domestic market variables are more important than external factors in the SI case. On the basis of individual variables, WGDP appeared to predominate in VAR model in levels while GDP dominated in both the VAR model in first differences and in the ECMs. Again, evidence from the FEDA results for SI, appear to confirm the results for causality and ECMs analysis that, while both markets are important causes of CERV, domestic factors stand out in SI.

(d) General conclusion

The above findings indicate that, in addition to the external market factors, domestic factors are also important as causes of CERV in the selected SPINs. However, the contributions of the explanatory variables to decomposition of variance of CERV differed over time across countries and model types. In particular, GDP yielded the largest contribution in explaining the causes of CERV, especially in SI and Fiji. This seems to be at odds with the conventional view that external factors were the only causes of CERV.

7.4.7 IRA test results

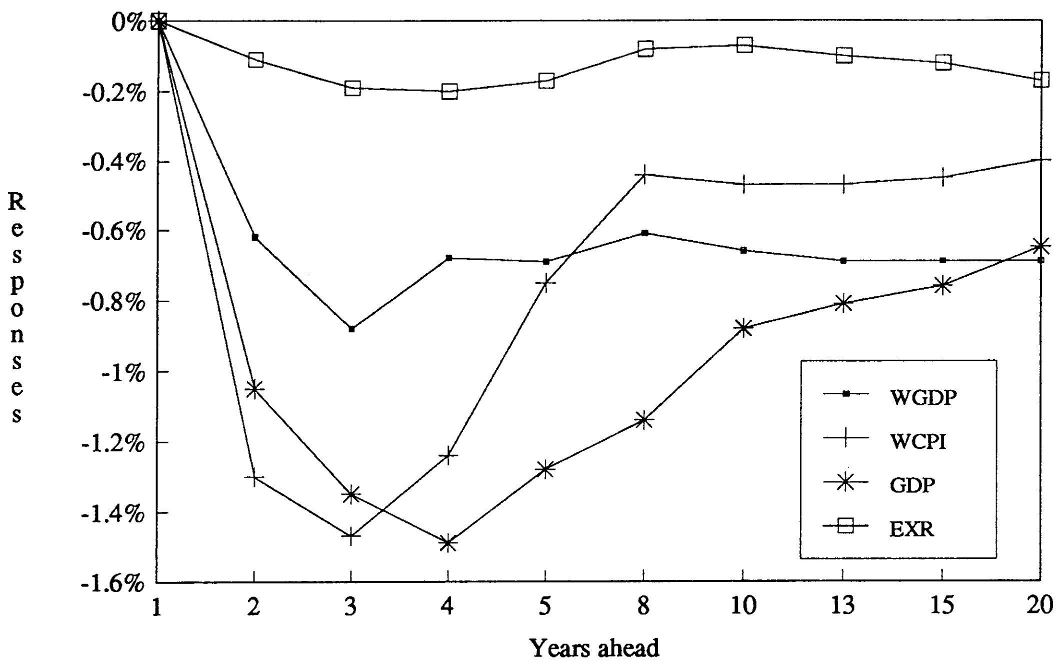
As explained in Chapters 4 and 6, impulse response analysis is a useful analytical technique which is related to FEDA. IRA is, however, more suited for shock evaluation where the dynamic characteristics of a system are assessed. The evaluation reveals the effect on a system of an unexpected initial exogenous shock impacting on one variable in that system. As in FEDA, the IRA shocks can be quantified in terms of magnitudes and persistence over time. These are normally manifested in terms of transitory or permanent short–term dynamic relationships toward long–term equilibrium.

Given that both FEDA and IRA are based on the MA representations of the VAR models, IRA is normally employed in conjunction with FEDA. Hence, the IRA technique was also conducted by applying the RATS software (see sample instruction program in Appendix 7.2). The IRA results, all based on VAR models in levels and first differences and ECMs for each selected SPIN, are presented in Figures 7.4a, b and c – 7.6a, b and c. The impulse responses in these figures are different for different variables during the same and different times over a given period.

(a) IRA test results for Fiji

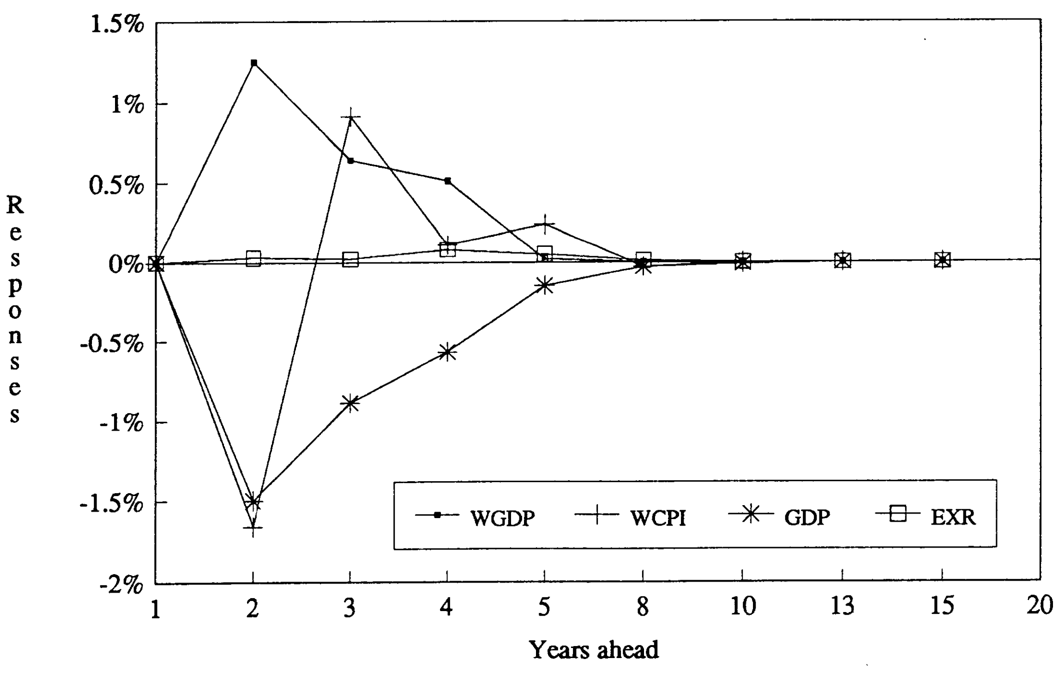
CERV impulse responses for Fiji, based on different model types, are presented in Figures 7.4a – c.

Figure 7.4a: CERV impulse responses in VAR models in levels, Fiji



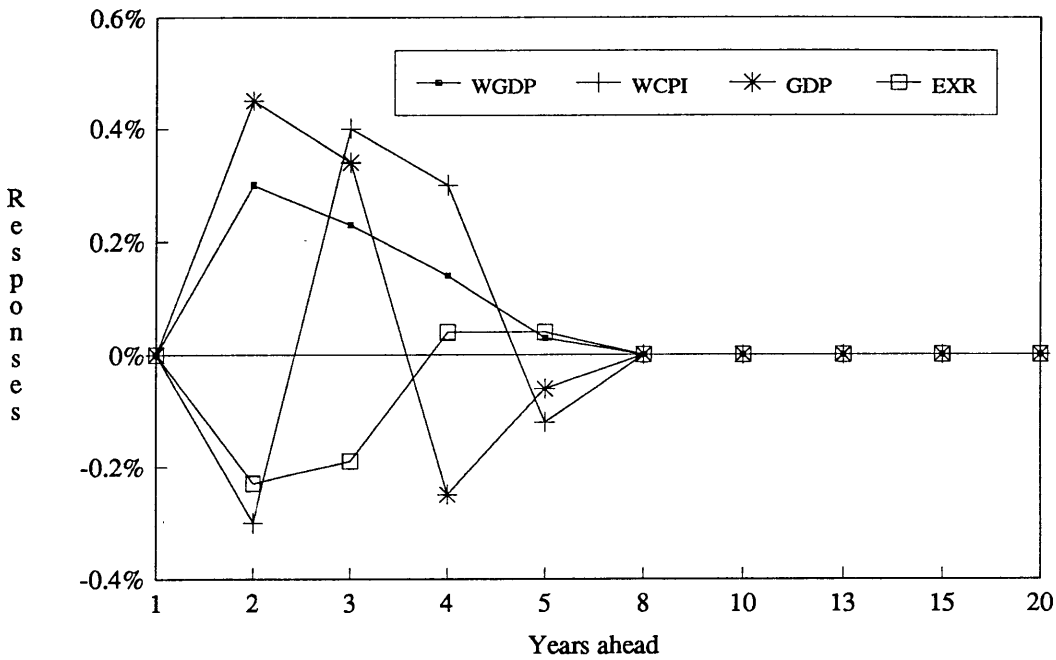
Source: Appendix 7.3.

Figure 7.4b: CERV impulse responses in VAR models in first differences, Fiji



Source: Appendix 7.3.

Figure 7.4c: CERV impulse responses in ECMs, Fiji



Source: Appendix 7.3.

(i) VAR models in levels

In the VAR model in levels (Figure 7.4a), initial shocks into the system (i.e., economy) invoked greatest CERV responses from other variables within the system, especially during the first 5 to 8 years. Though they never converged to zero (which is another indication of non–stationary variables), these responses started stabilising from year 8 onwards, persisting through to year 20. During the first five years, CERV responses from WCPI were the largest in magnitude but did not persist as long as did the responses from GDP and WGDP. CERV responses from EXR were the smallest in both magnitude and persistence (Figure 7.4a). From both the magnitudes and persistence, the responses from GDP, WCPI, WGDP and EXR can be rated in that order. Although this rating can be subjective, it is reasonably consistent with the decomposition results for Fiji, with the exception of WGDP and WCPI.

(ii) VAR models in first differences

The VAR model in first differences (Figure 7.4b) shows that initial shocks into the system invoked CERV responses from other variables within the system during the first 5 to 8 years. These responses fell to zero from year 8 to 10, remaining at zero thereafter. During the first 4 years, CERV responses from GDP were largest in both magnitude and persistence, followed by those from WGDP, WCPI and EXR, respectively. Impulse response results from all the variables conform well with the results obtained from FEDA.

(iii) ECMs

The responses based on ECMs (Figure 7.4c) differ only slightly from those based on VAR model in first differences. Most responses were in accord with the results from FEDA. CERV responses from GDP, again, were the largest, followed by responses from WGDP, WCPI and EXR, respectively. Most of these responses occurred within the first 5 to 8 years, after which all the responses faded to zero.

In summary, impulse responses for Fiji tend to confirm that both external and domestic market factors can cause CERV. With some variation, the results of the three model types suggest that external and domestic market factors are important in explaining the causes of CERV in Fiji. However, as can be seen in the graphs, GDP appears to have been the most important individual variable. But when combined with extended factors (domestic and external factors together) in the analysis, external variables appear to have stronger influence on CERV.

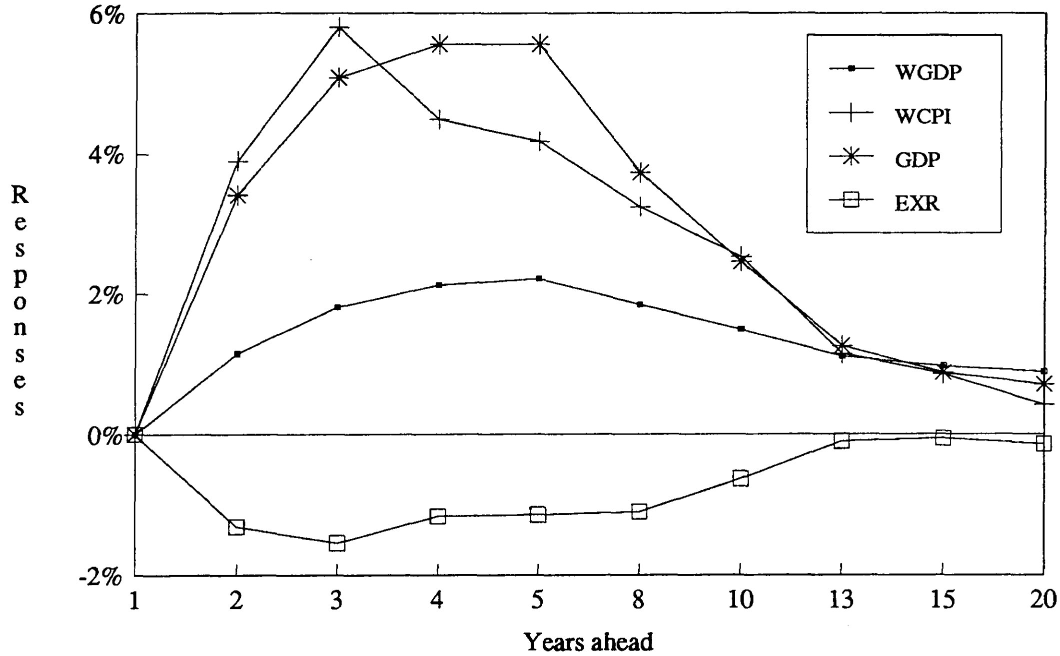
(b) IRA test results for PNG

CERV impulse responses for PNG, based on different model types, are presented in Figures 7.5a – c.

(i) VAR models in levels

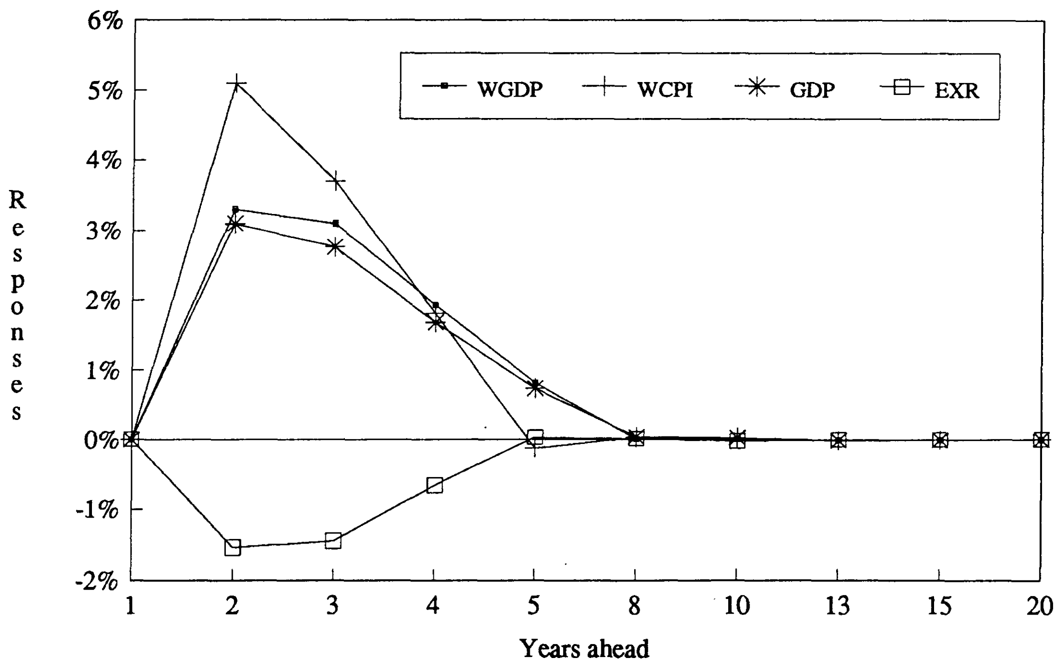
In the VAR model in levels (Figure 7.5a), initial shocks to the system invoked greatest CERV responses from other variables within the system, especially during the first 8 to 13 years. These responses never converged to zero but tended towards zero from year 13 and persisted to year 20. During the first 5 to 8 years, CERV responses from GDP were largest, followed closely by those from WCPI, then by WGDP and EXR.

Figure 7.5a: CERV impulse responses in VAR models in levels, PNG



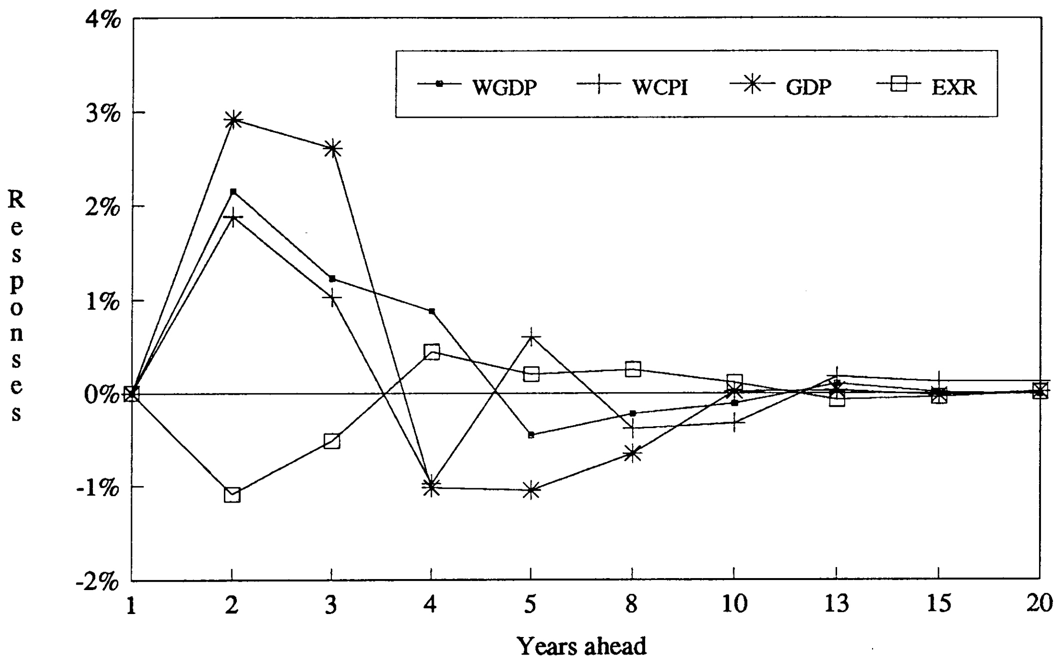
Source: Appendix 7.3.

Figure 7.5b: CERV impulse responses in VAR models in first differences, PNG



Source: Appendix 7.3.

Figure 7.5c: CERV impulse responses in ECMs, PNG



Source: Appendix 7.3.

Apart from GDP and WCPI, which swapped places, this ranking is consistent with the FEDA results. However, responses from GDP and WCPI are quite close to one another as they were in the FEDA results.

(ii) VAR models in first differences

The VAR model in first differences (Figure 7.5b) for PNG shows that initial shocks to the system invoked CERV responses from other variables within the system during the first 5 years. These responses fell to zero from years 5 to 8, remaining at zero thereafter. During the first 4 years, CERV responses from WCPI were largest, followed closely by responses from WGDP and GDP, and EXR, respectively. These results are quite consistent with those obtained by FEDA, again showing that CERV can be explained by both the external and domestic market factors.

(iii) ECMs

The responses based on ECMs (Figure 7.5c) were more persistent (going beyond year 10) than those based on VAR model in first differences. Responses from GDP were the largest and quite persistent. These were followed by the responses from WGDP, WCPI and EXR in terms of both magnitude and persistence. Results in Figure 7.5c are also quite consistent with the results from FEDA, confirming that both external and domestic market factors can be used to explain the causes of CERV in PNG.

In PNG too, the impulse responses seem to support the notion that both the external and domestic market factors can cause CERV. On balance, the results of the three model types suggest that both external and domestic market factors are equally important in explaining the causes of CERV in PNG.

(c) IRA test results for SI

CERV impulse responses for SI, based on different model types, are presented in Figures 7.6a – c.

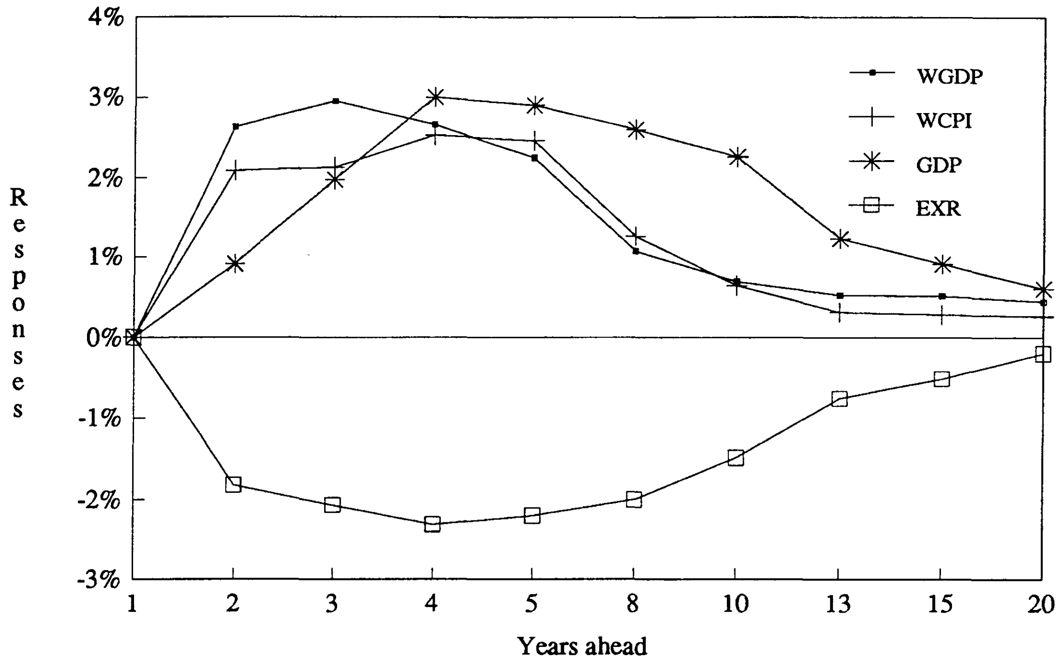
(i) VAR models in levels

In the VAR model in levels (Figure 7.6a), initial shocks to the system invoked greatest CERV responses from other variables within the system, especially during the first 10 to 13 years. These responses did not converge to zero but tended toward zero from year 15 and persisted to year 20. During the first 5 years, CERV responses from WGDP were largest, followed closely by those from WCPI and GDP, and EXR. These results seem quite consistent with the FEDA results.

(ii) VAR models in first differences

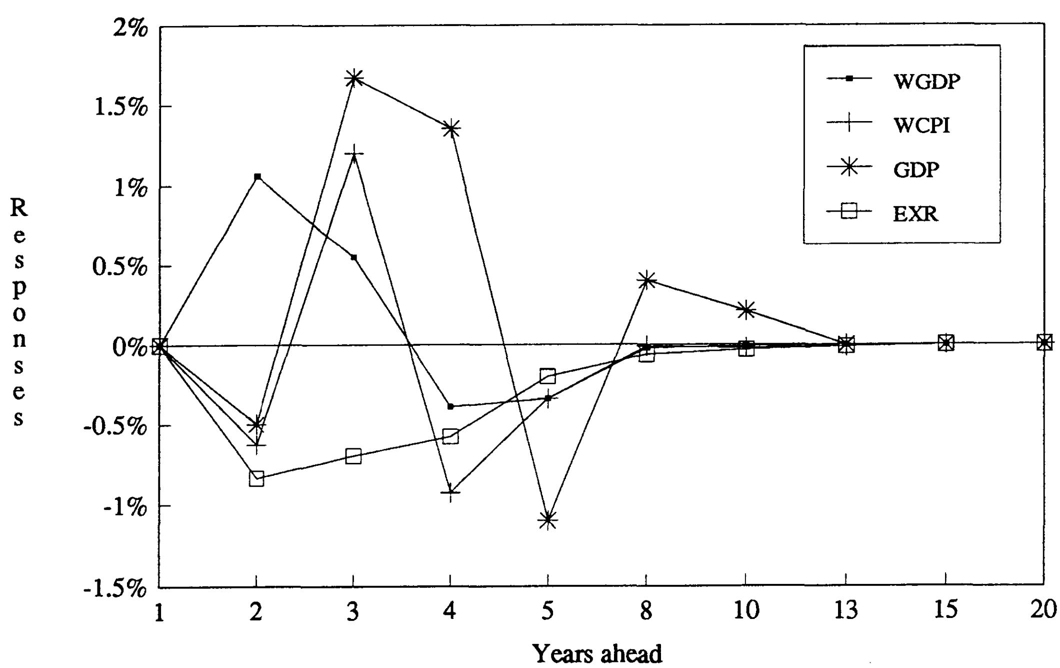
The VAR model in first differences (Figure 7.6b) for SI shows that initial shocks into the system invoked CERV responses from other variables within the system during the first 5 to 10 years. These responses started to fall toward zero from year 10 and were zero from year 13 onwards. During the first 10 years, CERV responses from GDP prevailed in both magnitude and persistence, followed by responses from WCPI, WGDP and EXR, respectively. This is consistent with the results from FEDA, confirming that CERV can be explained by both the external and domestic market factors.

Figure 7.6a: CERV impulse responses in VAR models in levels, SI



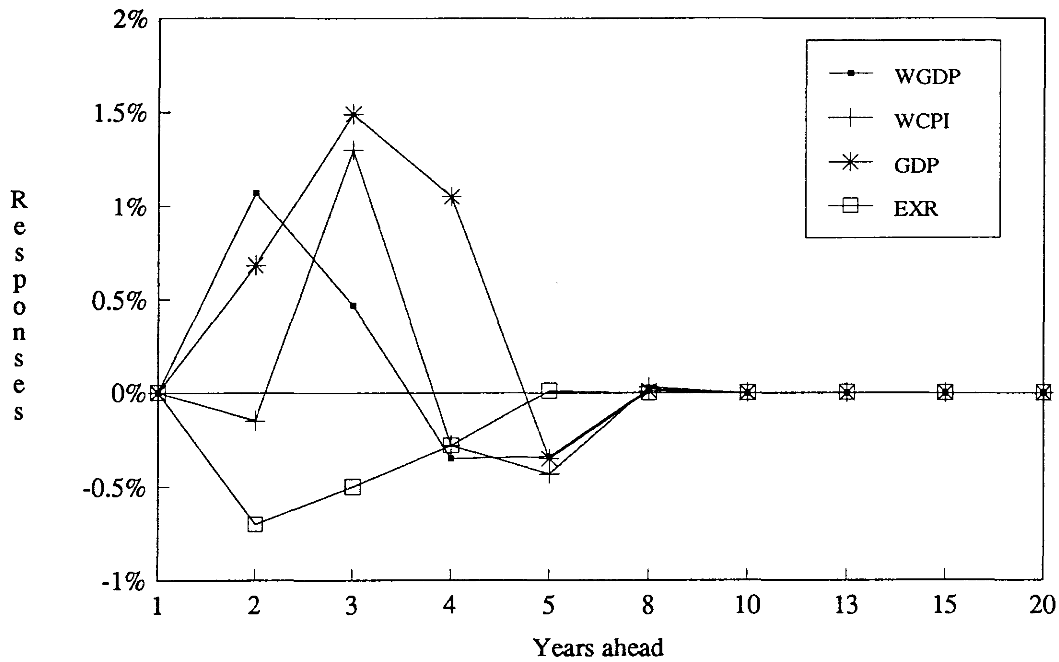
Source: Appendix 7.3.

Figure 7.6b: CERV impulse responses in VAR models in first differences, SI



Source: Appendix 7.3.

Figure 7.6c: CERV impulse responses in ECMs, SI



Source: Appendix 7.3.

(iii) ECMs

The responses based on ECMs (Figure 7.6c) pointed to almost the same conclusions as those based on VAR models in first differences. All the responses collapsed to zero after year 8. Responses from GDP dominated, followed by those from WCPI, WGDP and EXR in that order. Like the results from the VAR models in first differences, the ECM–based results are quite consistent with the results from FEDA. These results confirm the importance of both external and domestic market factors in explaining the causes of CERV in SI. In terms of individual variables, CERV responses from GDP predominated, suggesting that domestic markets are crucial in explaining the causes of CERV in SI.

In SI too, the impulse responses support the notion that both the external and domestic market factors explain the causes of CERV. The results of two of the three model types suggest that domestic market factors are more important than external factors in explaining the causes of CERV in SI.

(d) General conclusion

While results based on IRA confirm that both external and domestic market variables are important in explaining the causes of CERV in the selected SPINs, these results differ across countries, time periods and model types. Especially in Fiji and SI, the importance of GDP is confirmed as an important variable affecting CERV.

7.5 Summary and Some Conclusions

The following conclusions summarise the results of the main empirical findings.

(a) The unit roots tests indicated that the five univariate data series (WGDP, WCPI, GDP, EXR, and EXP) were found non–stationary in levels and stationary in their first differences. The data series were confirmed stationary in their first differences, implying that they were integrated of order one, or I(1).

(b) With mixed results, cointegration was found to exist among the data series in all the three selected SPINs. However, cointegration evidence was stronger for SI and Fiji than for PNG.

(c) Empirical evidence from the developed ECMs suggested that different countries experienced different influences on CERV. Although both the external and domestic market factors were found to be important, differences among countries were observed. For example, it was found that external factors impacted on CERV more strongly in Fiji, while in SI, domestic factors were more dominant. In PNG, both external and domestic market factors seemed to have been equally important in their influence on CERV.

(d) Fairly strong evidence was found that CERV has been caused, in the Granger sense, by both the external and domestic market factors in the selected SPINs. Specifically, the evidence pointed to external factors as more dominant causal agents in Fiji, but for PNG and SI both the external and domestic market factors appeared to be equally important in causing CERV.

(e) The FEDA results differed across countries, variables, model types and time periods. However, in the majority of cases, these results were in conformity with results for causality and the ECMs. In particular, it was found that both external and domestic market factors were important contributors to CERV in the selected SPINs. But because GDP, as an individual variable, stood out as a predominant contributor to CERV in both SI and Fiji, domestic factors can be placed in the forefront in SI and Fiji in particular. In PNG, both the external and domestic market factors were found important, though the FEDA results tended to give more support to external factors.

(f) Results from IRA generally confirmed that both external and domestic market variables were important in explaining the causes of CERV in the selected SPINs. In Fiji, the external market factors were found to have prevailed although GDP was found to be the single most prominent variable in explaining the causes of CERV. In PNG, both the external and domestic market variables were found to be equally important, while the domestic market variables were more prevalent in SI, with GDP the most important single variable.

In general, contrary to the conventional belief in the selected SPINs that CERV is generated entirely by external causes (hence the establishment of commodity–specific price stabilisation schemes), the results from this analysis support the view that CERV can, to a large extent, be generated by domestic market causes. In addition, results from this analysis also confirm the dominant role played by external market factors as important causal agents of CERV in the selected SPINs. The observed differences between the three countries analysed may reflect real differences between the economic structures and policy regimes. The results suggest that the economic circumstances of Fiji have made that economy more sensitive to external influences than are the other two SPINs.

Chapter 8
THE EXPORT SECTOR PERFORMANCE

In this chapter, factors that influence the success of export sector performance in the selected SPINs are assessed using both exploratory and time series econometric analyses. These factors are viewed from two perspectives – the external (world demand) and the domestic supply sides. It is assumed that the net effects of all the domestic supply–side factors are captured by competitiveness and diversification factors. The main results indicate that, while the selected SPINs had not kept pace in competitiveness, they nevertheless have tried to diversify their export commodity composition over the years. Further, it is found that, over and above world demand, the domestic supply factors, more particularly the diversification factors, were crucial in the determination of the success of export sector performance in the selected SPINs.

8.1 Introduction

In Chapter 6 it was established that export growth substantially influenced economic growth of the selected SPINs. These SPINs have depended very heavily on the earnings from primary export commodities. The export revenues have been, however, subject to unpredictable periodic variability. In Chapter 7, the export revenue variability was found to be induced not only from external causes but also from domestic factors. The effects of such domestic (supply–side) factors were not taken into serious consideration in the past when designing and implementing export policies in the selected SPINs. Rather, external (demand-side) influences have been regarded as the main determinants of export policies in these countries, as evidenced by the establishment and operation of commodity–specific price stabilisation schemes (detailed in Chapter 2) to guard against externally–induced CERV.

Without the development and growth of the primary commodity export sectors, overall economic growth of the selected SPINs may lag. The economies of many of the SPINs are dependent on narrowly based natural resources. Consequently, their comparative advantage may be confined to producing a few primary export commodities.

It has long been believed that success in the performance of primary export commodity subsectors is mainly determined by external factors (mainly world demand). For instance, it is usually held that it is the external factors which (albeit without empirical evidence) induce unpredictable CERV and so should be brought under control. As has already been shown, the commonest way of dealing with the problem of CERV in the SPINs has been via commodity–specific price stabilisation schemes. One implication of the preceding remarks is that domestic (supply–side) factors may not have been given the importance they deserve as determinants of the success of export sector performance.

Only a few researchers have examined the role of domestic factors as determinants of export sector performance. For instance, Love (1984) examined this problem for 27 LDCs, exclusive of SPINs, while Athukorala (1991) assessed the same problem for seven Asian agricultural–exporting countries. Results from these assessments supported the view that relative export performance of individual countries is determined significantly by supply–side factors, contradicting the previously widely held view that only external demand factors determined export sector performance.

It is thus necessary to test contributions of the two types of factors to export sector performance in SPINs. The purpose of this chapter is to undertake an assessment of whether both external and domestic factors caused export sector performance in the selected SPINs over the past three decades, 1961–1990. It is hypothesised that neither the domestic nor the external factors have determined export sector performance in the selected SPINs over the past 30 years.

To undertake the above task, an econometric method, theoretically introduced by Kravis (1970) and empirically popularised by Love (1984) and Athukorala (1991), is applied. While Love used the standard OLS in his analysis, Athukorala combined OLS with some more recent time series methods in his study. As a main point of departure from these previous studies, more elaborate and more recent time series econometrics are used here in an integrated approach. Various methods (as described in Chapter 6) of testing for unit roots, cointegration, Granger causality, FEDA and IRA are all applied in this analysis.

In section 8.2, a general exploratory assessment of the export sectors is discussed. A brief description of the specific method used is presented in section 8.3. Results are given and discussed in section 8.4, while some conclusions are drawn in section 8.5.

8.2 Exploratory Assessment of the Export Sector

In this section, the following aspects of export sector performance are explored and discussed: factors affecting export sectors, policy setting of the export sectors, composition and commodity shares of total exports and commodity market shares in the world markets.

8.2.1 Factors affecting export sectors

There are many factors that affect export sector performance in any country. These factors can be grouped into three broad categories, namely: external, domestic, and natural factors.

(a) External factors

External factors – mainly world prices and total output or incomes (GDP) of the trading partners, rise of substitutes (synthetics) in the export destination countries and related factors – are all together referred to, in this study, as world demand. These factors have been widely accepted as the main determinants of the performance of the export sectors.

Arguments supporting the prominence of external factors have been advanced in the post World War 2 period, especially since the 1960s (Nurkse 1961, Prebisch 1964, SPC 1980, Garnaut and Baxter 1984, World Bank 1988, Hazell, Jaramillo and Williamson 1990, Jolly et al. 1990, Svedberg 1991, Streeten 1993, Liu, Chung and Meyers 1993). As discussed in Chapter 2 and also by In et al. (1994) most of those who favoured the establishment and operation of the commodity–specific price stabilisation schemes are among the proponents of the prominence of external factors.

(b) Domestic factors

Domestic factors with substantial impacts on export sector performance include policy interventions (discussed in subsection 8.2.2), size of domestic markets, producer prices, commodity composition and their market shares (also discussed in subsection 8.2.3); direct financial incentives, e.g., through infrastructural and institutional development, and agricultural research and extension services and various other spontaneous non–policy supply–side factors (Love 1984, Athukorala 1991). Even though many policy makers appear to underplay the influence exerted by domestic factors on export sector performance, it has now become clear that individual countries with appropriate domestic policies have superior performance in their export sectors (Athukorala 1991). This can be witnessed in the export performance of the South East Asian countries as compared with those of sub–Saharan Africa and Latin America. Given almost similar world market conditions, the export sectors of the South East Asian countries have grown much more rapidly.

With increased recognition of the influence of domestic factors, the importance of the supply–side factors to export sector performance is being given higher priority on the research agenda as is evident from the pioneering research by Kravis (1970) and applications by Love (1984) and Athukorala (1991).

According to Kravis, under given external market conditions, individual countries can achieve higher export sector performance by improving the market shares of their traditional exports. In addition, export sector performance can be improved by diversifying the country's commodity mix into new product lines. Kravis called the improvement of the export market shares the competitiveness factor and diversifying the commodity mix the diversification factor. Together, competitiveness and diversification represent the domestic supply–side factors. These two factors can be said to capture the net effects of all the domestic supply–side factors on export performance, including both domestic policy influences and various spontaneous non–policy factors.

One way of establishing the relative importance of domestic supply factors, in comparison with those of external demand, in export sector performance is to investigate the relationship of export growth to changes in world demand and domestic supply factors. If it is found that supply conditions rather than external demand are the major determinants of export sector success, then it could be inferred that successful individual exporting countries have been able to take measures to increase their market shares and/or diversify the commodity composition of their exports. But if, on the contrary, external world demand is the major determinant, competitiveness or diversification factors can have little effect on export sector performance (Athukorala 1991).

(c) Natural factors

Climatic conditions such as excessive rain, droughts, and cyclones and incidences of pests and diseases, and sometimes wars (e.g., *coup d'etats* and rebellions) can all greatly and negatively affect export sector performance. Other environmental factors such as smallness, geographical isolation, and costly and infrequent access to major markets may also adversely affect the performance of export sectors in the SPINs.

For example, as recently as 1987, there occurred a coup in Fiji, while periodic cyclones, such as the devastating cyclone *Namu* in Solomon Islands in 1986, and the long–term rebel war in PNG over the Bougainville copper mines are some of the damaging events that have taken place. Geographical isolation means long distance from overseas markets and is compounded by the wide dispersion of islands within national boundaries. Unfavourable topographic conditions such as rugged islands with mountainous hinterlands or flat atolls make working conditions difficult and retard the growth rates of infrastructural and institutional development. In one way or the other, some or all of these natural factors adversely affect the performance of the export sectors in the SPINs (Tsusaka 1984, Browne and Scott 1989, Fleming 1992b, Delforce 1992).

8.2.2 Export sector policy setting

In broad terms, trade policies can be classified into two major categories. The first category is export–oriented and the other is import substitution. These two policies impact differently on export sector performance.

Policies aimed at the production of commodities for external markets are export–oriented. These policies are outward–looking and tend to enhance export sector performance. Policies directed towards the production of goods and services for domestic markets, mainly for the purposes of trying to replace previously imported goods (hence the term import substitution), are inward–looking and tend to discourage export sector performance.

The type of policy orientation to be followed depends on an individual country's trade objectives. To this end, as a result of trade pessimism ideas, particularly in the post World War 2 period, many LDCs adopted inward–looking policies with emphasis on import substitution. However, due to apparent failures of import–substitution policies, an increasing number of LDCs have adopted more outward–looking export promotion policies, especially from the mid–1960s (Milner 1988).

At one time or another, the SPINs have tried both categories of policies, sometimes simultaneously but usually consecutively. For example, until the mid–1980s, Fijian trade policies were based on import substitution, with manufacturing industries protected by various import tariffs and licensing restrictions. This system resulted in a bias against export industries. In some cases, low or even negative value added resulted. Over 1975–87, taxes on export transactions provided 23–30 per cent of the total government revenues (Delforce 1992).

In the late 1980s, particularly after the 1987 coup, in a pronounced change in policy direction, Fiji adopted an export–oriented growth strategy and started to deregulate the economy. Initially, this deregulation included restraining government spending, and instituting tax reforms and a wage policy that recognised the importance of international competitiveness. In particular, high tariffs (of as much as 50 per cent to be reduced gradually within five years) replaced import quotas. Certain existing tariffs were reduced. In 1988, new tax concessions were put into effect to promote manufactured exports. Export–oriented industries were exempt from import duties on all equipment and materials and were permitted not to pay tax on profits for up to 13 years (Browne and Scott 1989, Delforce 1992, AIDAB 1992a).

To some extent, Fiji Sugar Corporation and the Copra Price Stabilisation Scheme controlled the prices received by the primary commodity producers. Before 1986, the Fijian exchange rate policy focused on maintenance of a stable real effective rate. This was accomplished through small but frequent adjustments of the nominal exchange rate against a basket of currencies to which the Fijian dollar was pegged. Hence, during the first half of the 1980s, the Fiji dollar experienced steady nominal appreciation. But this hampered the competitiveness of Fiji's tradeable goods and services. Consequently, from 1986, the Fiji dollar experienced large depreciations. This has opened long–term opportunities for an export–led growth strategy (Browne and Scott 1989, Delforce 1992, AIDAB 1992a).

The history of trade policy making in PNG has been mixed, though there is some evidence to suggest that from the beginning PNG had mainly adopted an export–oriented policy. Despite commodity export taxes, the PNG government established commodity–specific marketing boards and stabilisation schemes as part of an effort to develop its export sectors. While most of these boards and schemes were intended to promote export sectors, some of them have in fact inhibited the expansion of those sectors. Because the costs of operating and maintaining them have been high, the required deductions from farmers' proceeds have been so great as to constitute disincentives. The net effect on export sector performance in PNG is debatable.

The export sector performance in PNG has also been affected by the exchange rate policy. For a long period, PNG maintained a 'hard currency' strategy (Goodman, Lepani and Morawetz 1987, pp. 53–54, Delforce 1992, AIDAB 1992b). This resulted in an overvalued exchange rate which exerted an adverse influence on the export sector (Lam 1984, p. 204). As a result of the 'US dollar–kina' exchange depreciation between 1982 and 1986, the volume of PNG's agricultural exports rose by as much as 27 per cent (Jarrett and Anderson 1989, p. 24). In more recent times, the exchange rate devaluations have been useful in improving PNG's export competitiveness (AIDAB 1991b).

Like PNG, SI mainly practised export–oriented production (Browne and Scott 1989). For instance, the marketing of copra and other export commodities has been controlled by the Commodity Export Marketing Board whose work operates on almost similar lines to boards in Fiji and PNG. Taxes on foreign marketing transactions increased in the 1980s; in 1980, 43 per cent of the central government revenue was provided by these taxes compared with 56 per cent in 1987. A greater proportion of these taxes is now from import duties, providing up to 80 per cent in 1987 compared with 55 per cent in 1980. Import duties for non–oil products were raised by 20 per cent in 1981. These were increased further in 1982 and in 1986. Following the devastating cyclone *Namu*, the fishing industry was given a reduction in export taxes and reduced import duties on fuel and other imports (Delforce 1992).

SI exchange rate policy has been determined on the basis of a trade–weighted basket of currencies of the country's major trading partners. Generally, since 1984, the SI dollar has depreciated very considerably, falling by as much as 50 per cent (AIDAB 1991b). This has greatly improved the international competitiveness of SI's exports.

In brief, the policy setting by government interventions in the selected SPINs has seen agricultural producer prices affected both directly and indirectly. Direct government intervention to affect export performance has included price controls, imposition of export taxes and quotas, and the establishment of marketing boards and schemes with both monopolistic and monopsonistic powers. Measures have been taken that are likely to have affected exports indirectly as when, for example, import–tariff measures are introduced to protect domestic industries and propagate import–substitution policies, and through overvalued exchange rate mechanisms. Essentially, overvalued exchange rates make exports relatively more expensive than imports, thus discouraging the domestic production of tradeables and weakening the export trade position (Delforce 1992).

8.2.3 Composition and commodity shares of total exports

The development experiences of export sectors of the selected SPINs are briefly surveyed, permitting an assessment of the extent to which differences in export performance are reflections of the different policy regimes adopted. Major export commodities are surveyed for each selected SPIN both for the whole period from 1961–1990 and five–year sub–periods. For each SPIN, individual commodities accounting for at least 1 per cent of total exports in the 1961–65 sub–period were defined as principal or traditional export commodities. Table 8.1 portrays the composition and major commodity market shares of total exports for the selected SPINs.

Table 8.1: Composition and major commodity shares (in %) of total exports for selected SPINs, 1961-1990

Period	Sugar	Molasses	Coconut oil	Gold	Forestry products	Marine products
	Major export commodity shares (%)					
			FIJI			
1961–65	58.0	0.7	10.1	7.3	0.5	–
1966–70	53.0	1.0	7.9	6.7	0.8	–
1971–75	54.5	0.9	6.0	6.3	0.5	–
1976–80	54.7	2.4	4.4	4.0	0.8	3.3
1981–85	44.4	2.3	3.7	6.5	0.9	5.0
1986–90	40.9	2.3	0.9	13.0	2.5	6.2
			PNG			
	Coffee	Cocoa	Coconut oil	Copra	Rubber	Palm oil
1961–65	13.6	14.2	12.7	27.2	6.3	–
1966–70	22.0	18.6	8.9	18.7	3.4	–
1971–75	12.0	8.1	3.5	6.0	1.1	1.0
1976–80	21.3	10.6	2.4	4.2	0.6	1.8
1981–85	13.4	6.5	2.9	3.8	0.4	5.1
1986–90	12.5	4.2	1.2	1.2	0.3	2.8
	Tea	Copper	Gold	Forestry products	Marine products	
1961–65	0.0	–	3.1	3.1	2.0	
1966–70	0.5	–	1.2	3.9	1.9	
1971–75	1.1	48.1	0.6	4.1	3.0	
1976–80	1.4	24.8	17.1	3.6	4.0	
1981–85	1.5	20.6	29.0	7.1	2.0	
1986–90	0.6	27.8	34.6	7.4	0.8	

Note: Percentages shares are in 5–year sub–period averages.
Sources: Computed from Appendix 8.1 and 8.2 for Fiji and PNG, respectively.

Table 8.1: continued (composition and major commodity shares)

	Major export commodity shares (%)					
Period	Copra	Cocoa	Palm oil & kernel	Minerals	Forestry products	Marine products
			SOLOMON ISLANDS			
1961–65	87.75	0.3	–	0.2	5.9	1.7
1966–70	64.5	0.7	–	0.3	27.4	1.1
1971–75	36.1	0.5	–	0.4	31.1	23.6
1976–80	24.1	1.4	11.2	0.4	26.5	31.6
1981–85	17.9	2.8	13.2	0.8	29.1	32.8
1986–90	7.8	5.6	8.4	1.2	28.4	43.1

Note: Percentages shares are in 5–year sub–period averages.
Sources: Computed from Appendix 8.3 for Solomon Islands.

(a) Fiji

One striking feature for Fiji is the country's high dependence on sugar as its major export commodity throughout the past three decades (Table 8.1). The share of sugar in Fiji's total exports ranged from about 58 per cent in 1961–65 to 41 per cent in 1986–90. Coconut oil appears to be the second most important export commodity for Fiji. The share of coconut oil in total exports ranged from about 10 per cent in 1961–65 to less than 1 per cent in 1986–90. Gold increased from about 7 per cent in 1961–65 to 13 per cent in 1986–90.

Export commodities whose shares started to appear important particularly towards the latter half of the 1980s were the marine and forestry products. These products became relatively more important as exports of the agricultural commodities fell.

In general, over the three decades, Fiji's export commodities were concentrated on three major products – sugar, coconut oil and gold. These commodities represented a total export market share of a little over 75 per cent in 1961–65, decreasing to about 54 per cent in 1986–90. The decreasing aggregate share of the three major traditional export commodities indicates that apart from the increasing shares of some old commodities such as forestry and marine products, Fiji must have diversified into newer product lines in order to meet the challenges of changing world market conditions. Due to data difficulties, the new product lines were, however, not covered in the sample analysed in Table 8.1.

(b) PNG

PNG's major commodity market shares of total exports are presented in Table 8.1. During the 1960s, PNG's exports were concentrated mainly on agricultural commodities (copra, cocoa, coconut oil, coffee and rubber). In 1961–65, these products had an aggregate export market share of about 74 per cent. This went down to 70 per cent in the 1966–70 sub-period. By 1985–90, the export market share of the most important agricultural commodities had decreased to a little less than 20 per cent. However, while copra, coconut oil and cocoa lost their export shares to both old product lines (forestry and marine products and gold) and new product lines (palm oil and copper), coffee remained one of the few agricultural commodities that maintained their shares throughout the review period.

From the 1970s onwards, the export market share was dominated by copper, gold, coffee, cocoa and forestry products, respectively. However, the three most important export commodities for PNG during the 1970s and 1980s were copper, gold and coffee. A few interesting points for PNG can be deduced from Table 8.1:

- For various reasons, PNG could not sustain the high export market shares enjoyed by agricultural commodities in the 1960s. Their importance continued to diminish right up to the latter half of the 1980s.
- The above scenario could be attributed to unstable external markets which could not sustain the attractive real prices of the 1960s for agricultural commodities.
- Another explanation could be that domestic policies supporting agricultural production were shifted to alternative products such as forestry and minerals whose risks and production costs may not have been as high as those of agricultural production.
- Switching export dependence to minerals and forestry products implied that the traditional export performance whose support came mostly from agriculture was being sidelined. In the long run, agricultural producers whose livelihood depended on the agricultural export products could be marginalised.

(c) SI

Table 8.1 shows SI's composition and major commodity shares of total exports. Like the other selected SPINs, SI depended on a highly concentrated export base of a few primary commodities. The most important among them were copra, forestry and marine products. These three commodities had an aggregate export market share of about 95 per cent in 1961–65 and this decreased to about 79 per cent by 1986–90. Actually, this aggregation masks some very important information because, initially in the 1960s, copra was the single most important export commodity for SI. In 1961–65, copra's export market share stood at about 88 per cent, decreasing to about 64 per cent in 1966–70. By 1986–90, copra's export market share had diminished to less than a mere 8 per cent.

Copra's place was taken mostly by forestry and marine products whose export shares increased from a mere 6 per cent and 2 per cent, respectively, in 1961–65 to about 28 per cent and 43 per cent in 1986–90. SI also increased the export market share of cocoa from just less than 1 per cent in 1961–65 to about 6 per cent in 1986–90. From the 1970s, SI started reaping the benefits of a new product line, palm oil and kernel, whose export market share ranged from about 11 per cent in 1976–80 to about 8 per cent in 1986–90. As in Fiji and PNG, the importance of agricultural export commodities in SI dwindled through time, with the emergence and establishment of more natural commodity lines, the forestry and marine products.

8.2.4 Commodity market shares in the world markets

One way an individual country can improve its competitiveness internationally is to increase sustainable market shares of its principal export commodities in world markets. In general, a superior export sector performance is associated with market share gains in principal exports. In contrast, if a country records substantial market share losses in its traditional export commodities, then that country's international competitiveness diminishes (Athukorala 1991). World market shares of principal export commodities for the selected SPINs have been computed and are given in Table 8.2.

Table 8.2: World market shares (in %) of major export commodities for selected SPINs, 1961-1990

Period	Sugar	Molasses	Coconut oil	Forestry products	Marine products	
			FIJI			
1961–65	1.4	0.02	4.4	0.0	–	
1966–70	1.5	0.03	3.0	0.0	–	
1971–75	1.1	0.02	2.1	0.0	–	
1976–80	1.3	0.1	1.2	0.0	0.1	
1981–85	1.1	0.1	1.2	0.0	0.1	
1986–90	1.3	0.1	0.5	0.01	0.1	
			PNG			
	Coffee	Cocoa	Coconut oil	Copra	Rubber	Palm oil
1961–65	0.3	1.3	5.2	5.4	0.2	–
1966–70	0.7	2.3	4.7	7.6	0.2	–
1971–75	1.0	2.5	3.9	9.7	0.2	0.7
1976–80	1.4	2.8	2.5	14.5	0.4	1.1
1981–85	1.2	2.4	3.3	26.2	0.1	2.0
1986–90	1.4	1.9	2.5	19.7	0.1	1.5
	Tea	Copper	Logs	Forestry products	Marine products	
1961–65	0.0	–	0.01	0.02	0.1	
1966–70	0.1	–	0.02	0.03	0.1	
1971–75	0.5	3.8	0.1	0.1	0.2	
1976–80	0.6	2.1	0.1	0.1	0.3	
1981–85	0.6	1.8	0.1	0.1	0.1	
1986–90	0.3	2.1	0.1	0.1	0.03	

Notes: Percentage shares are in 5–year sub–period averages.
Sources: Computed from Appendices 8.4 and 8.5 for Fiji and PNG, respectively.

Table 8.2: continued (world market shares)

Period	Major export commodity shares (%)					
	Copra	Cocoa	Palm oil & kernel	Fish	Forestry products	Marine products
			SOLOMON ISLANDS			
1961–65	1.7	0.0	–	–	0.01	0.01
1966–70	2.0	0.01	–	–	0.02	0.0
1971–75	2.5	0.01	–	0.1	0.02	0.1
1976–80	4.9	0.02	2.8	0.1	0.03	0.1
1981–85	6.5	0.1	3.2	0.1	0.04	0.1
1986–90	7.1	0.2	2.0	0.1	0.03	0.1

Notes: Percentage shares are in 5–year sub–period averages.
Sources: Computed from Appendix 8.3 for Solomon Islands.

(a) Fiji

As shown in Table 8.2, the world market shares of the principal primary export commodities for Fiji have not been very competitive for the past three decades. Save for sugar, molasses and probably the marine products, Fiji lost the world market share for coconut oil which was a little over 4 per cent in 1961–65 to less than 1 per cent in 1986–90. The world market share for the forestry products was barely above zero throughout the study period. However, sugar maintained its market share at about 1 per cent throughout the period. Apart from coconut oil which lost its world market share continuously through time, sugar appeared to be the only principal commodity which Fiji was able to continue exporting competitively.

(b) PNG

The trends in the shares of the major primary export commodities of PNG reflecting international competitiveness, are shown in Table 8.2. While copra, coconut oil and cocoa appeared to be the most competitive traditional export commodities, coffee, copra and palm oil can be said to have improved quite substantially and maintained their world market shares. Copra and cocoa were actually PNG's most competitive export commodities, improving and maintaining their world market shares from about 5 per cent and 1 per cent, respectively, in 1961–65 to about 20 per cent and 2 per cent in 1986–90.

Although PNG's world market share for coconut oil was high, coconut oil lost its competitiveness throughout the study period except in 1981–85 when it re–emerged but then fell again in 1986–90. Copper, logs, forestry and marine products were also quite competitive in that they seemed to gain world market shares throughout the whole period. From the above, it appears that PNG's primary commodity exports could have been more competitive than those in Fiji.

(c) SI

Similarly, the case for SI is presented in Table 8.2. The world market shares for almost all the SI export commodities grew continuously until after 1986 when the commodities lost their shares. Most probably, this could be attributed to the devastating cyclone *Namu* which hit SI in 1986.

Otherwise, as in PNG, copra was the most competitive export commodity because it had the highest share in world market among its export products throughout the study period. Its share ranged from about 2 per cent in 1961–65 to about 7 per cent in 1986–90. Copra was followed by palm oil and kernel. Other export commodities which followed palm oil and kernel on almost equal magnitudes were marine and fishery products, cocoa and forestry products. In general, SI appeared to have been more competitive than Fiji, and almost as competitive as PNG.

8.3 Methodological Considerations

Based on the above exploratory assessment of the export sectors in the selected SPINs, it appears that, given certain external demand conditions, relative export sector performance depends on domestic supply–side influences. Further, the domestic supply conditions influence the success of export sectors through the ability of a given country to gain and maintain its competitiveness in traditional export commodities and to diversify its commodity composition into new product lines. Notice should be taken that the competitiveness and diversification factors supposedly capture the net effects[27] of the domestic supply–side influences of the export sector performance.

To confirm the above, an econometric assessment of the export sector performance was undertaken. In order to make an econometric assessment of the determinants of export sector performance for individual countries feasible, indices are constructed for the external world demand, competitiveness and diversification factors. These indices are then used to test for the relative importance of the external world demand and domestic supply conditions on the export sector performance. As is now becoming standard procedure, the indices are first pretested for stationarity and cointegration conditions. The unit roots and cointegration tests have to be undertaken before proceeding to perform other time series tests such as the optimal lag length determination, causality, FEDA, and IRA.[28]

The traditional approach to the analysis of the factors determining export trade performance involves the decomposition of these factors into structural effects and residuals using constant market share analysis (CMSA).[29] Traditional CMSA has been used by Richardson (1971a b), and Nugent and Yotoupolus (1976). Later, this method was improved by Jepman (1986) and the improved version has been applied by, for example, Ahmadi–Esfahani and Betts (1991). Despite its great attraction to researchers due to its modest data requirements, CMSA has major limitations (Nugent and Yotoupolus 1976, pp. 315–16). One limitation is that results are sensitive to the choice of the base year for the analysis of the sample. Secondly, only the demand influences are computed directly; other influences are all estimated as the residuals (Athukorala 1991).

Given the limitations of CMSA, the following alternative approach is adopted in this study. The approach shows how a country's export sector performance is determined by external world market conditions and domestic supply factors. The external factors are collectively represented by WD. Those of the net domestic supply factors are represented by (a) the country's ability to compete in the world market, or the CM factor, and (b) the extent

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27 Net effects of the supply–side factors are expected to include all the measurable and unmeasurable domestic factors, both spontaneous and policy–induced (Love 1984).

28 It seems that this could be the first time such a comprehensive time series econometrics has been conducted for a model of the kind developed and applied by Kravis (1970), Love (1984) and Athukorala (1991).

29 CMSA compares the change in exports of a country with that of a standard group of competitors. The change is decomposed into two components: (a) the hypothetical change in exports if competitiveness remained unchanged and thus the market share remained constant over time (the structural effect), and (b) the residual which is the difference between the actual and expected changes. These residuals are assumed to be associated with changes in competitiveness (Ahmadi–Esfahani and Betts 1991).

to which the country succeeds in diversifying its commodity composition, or the DV factor (Kravis 1970, Love 1984, Athukorala 1991).

WD, CM and DV factors are constructed as indices, and these are then used as explanatory variables in the time series regressions where export indices are specified as dependent variables. Changes in export indices are used as proxy measures of export sector performance.

8.3.1 World demand

World market conditions for given commodities are determined by the interactions of aggregate demand and supply factors. Under normal circumstances, individual countries such as the selected SPINs have little influence over changes in the world markets. The value of world market trade (influenced by WD) for a given commodity is taken as an indicator of external market conditions impacting upon the success of that particular commodity (Love 1984).

For a given country's set of traditional export commodities, an index of the world trade (to represent export market potential) can be constructed. For a set of principal export commodities, WD is measured in terms of a weighted–average index of the constant price of the world exports for the relevant commodities (Love 1984, Athukorala 1991):

$$WD_t = \sum_{i=1}^{n} W_{it} V_{it} \qquad (8.1)$$

where: WD_t = an index of world demand at time t, W_{it} = share of commodity i in the country's total export commodities at time t, V_{it} = an index of constant world price of export commodity i for a given country, with V_i = 100 for t = 1, n = the number of commodities.

8.3.2 Competitiveness

The competitiveness index of the principal primary export commodities is constructed as a ratio of actual or observed exports to hypothetical or assumed normal exports.[30] Thus a given country's overall competitiveness for year t, CM_t is defined as:

30 Hypothetical or normal exports are estimated with the assumption that a country has maintained the initial world market shares of its export commodities throughout a given period. Initial world market share could be for a period of either 1 year or an average of 2 to 5 years (Love 1984, Athukorala 1991). In this thesis, normal exports were taken as an average of the first 5 years (1961–65).

$$CM_t = 100 \left[\sum_{i=1}^{n} EXP_{it} / \sum C_{it} WX_{it}\right] \quad (8.2)$$

where: CM_t = an index of competitiveness at time t, EXP_{it} = export earnings for commodity i at time t, C_i = hypothetical or normal (1961–65, 5–year initial period average) world market share for commodity i, WX_{it} = world export earnings for commodity i at time t, n = the number of commodities.

8.3.3 Diversification

One way of judging the success of export sector performance is by determining if a country reduces its dependence on a narrow range of export commodities, that is, by observing the index of commodity concentration. This is referred to as diversification (DV) and is measured by the Gini–Hirschman coefficient[31] (Love 1984, Athukorala 1991). The DV as measured by the Hirschman coefficient is defined as:

$$DV_t = 100 \sqrt{\sum_{i=1}^{n} \left(EXP_{it} / \sum_{i=1}^{n} EXP_{it}\right)^2} \quad (8.3)$$

where: DV_t = an index of diversification at time t, DV = 100 for t = 1, n = the number of commodities.

The Gini–Hirschman coefficient (DV from here on) is a direct and indirect measure of concentration and diversification, respectively. Its highest possible value of 100 occurs when the total export is made up of only one commodity. If the number of commodities exported increases and/or there is a more even distribution of exports among these commodities, the value of DV diminishes (Athukorala 1991).

The above indices could then be specified in a time series regression model where an index of total exports (which is also set equal to 100 for t = 1) is treated as follows:

$$EXP_t = f(WD_t, CM_t, DV_t) \quad (8.4)$$

While the signs of coefficients of WD and CM are expected to be positive, those of DV are hypothesised to be negative, DV being an inverse measure of diversification. By

31 This type of Gini–Hirschman coefficient is extensively discussed by MacBean and Nguyen (1980).

using (8.4), Love (1984) specified his model in a linear functional form while Athukorala (1991) used a log–linear model. Given the aim in this thesis is to investigate the importance of the world demand and domestic supply factors in determining export sector performance, the magnitudes of the coefficients could be important in interpreting the results. Hence, for comparison purposes, the variable estimates must be free of units of measurements, something that is a characteristic of log models (Doran and Guise 1984, pp. 135–8). Log models are thus adopted in this research:

$$\ln EXP_t = \alpha_0 + \alpha_1 \ln WD_t + \alpha_2 \ln CM_t + \alpha_3 \ln DV_t + u_t \qquad (8.5)$$

The two supply–side variables (CM_t and DV_t) used in the above estimation model are expected to capture most of the domestic influences on export sector performance. The domestic influences not only cover those that are policy–induced but also include various other spontaneous (non–policy) factors. Among these are some of the adverse factors such as 'resource pull' effects of agricultural sector to manufacturing and limiting the opportunities of extending cultivation to unused land (Athukorala 1991).

Previous comparative studies on the trade and economic performance in LDCs[32] provide some convincing evidence that both market share gains in export commodities and diversification correlate more with the nature of domestic policy orientation than with the influence of the non–policy factors. In the light of this, it is expected that CM and DV capture the net effects of domestic policy on export sector performance (Athukorala 1991).

Instead of CM and DV, it could have been more appropriate to use variables directly representing domestic policy influences. However, the latter approach faces formidable conceptual and data problems. First, many determinants of export sector performance are not measurable directly (Bhagwati and Srinivasan 1975, Riedel, Hall and Grawe 1984). Secondly, in addition to financial incentives, various other supply–side government initiatives such as infrastructure, agricultural research and extension services are also important in determining the success of export sector performance. These are usually not well captured in analyses, resulting in the world demand tending to pick up the influences of these missing variables, giving an exaggerated estimate of demand effects in the final results. Given these problems, using CM and DV to represent supply side factors appears more appealing and appropriate in attempting to assess the importance of world demand and domestic supply factors on exports sector performance (Athukorala 1991).

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32 Some examples of previous comparative studies are: Kravis (1970), Balassa (1978), Krueger (1978, Chap. 12), Chenery and Keesing (1981) and Papageorgiou, Michaely and Choksi (1991, Chaps. 11 and 12).

8.3.4 Specifications of time series estimation methods

As the time series techniques applied in this chapter have already been described in Chapter 6, only an overview of their description is given here.

The three computed time series indices (WD, CM and DV) as well as EXP are pretested for non–stationarity conditions. Using the three unit roots techniques (ADF, PP and PC), testing for the order of integration is conducted. These tests reveal the presence of unit roots in the time series indices. The order of integration is confirmed only after testing for the presence of the unit roots in the difference forms of the indices. Only when the indices in difference forms are found stationary can the number of times to differentiate the indices for stationarity be known.

Cointegration testing also uses the two residual–based unit roots tests (ADF and PP) and a third non–parametric test (POC). Causality testing follows the Granger type of specifications while FEDA and IRA are specified from the MA representations of the reduced VAR models. All other details of the methodology are as described in Chapter 6.

8.4 Results and Discussion

Empirical findings are presented and discussed in this section. Data and data sources for this chapter are described in Chapter 5. The results are discussed under the headings of: unit roots, cointegration, Granger causality, FEDA and IRA test results.

8.4.1 Unit roots test results

Using the SHAZAM applications (see the sample instructions program in Appendix 7.1), the data series of the four indices (total EXP, WD, CM and DV – listed in Appendices 8.7–8.9) were tested for unit roots, first in log levels and then in the first difference log forms. The log level data were first tested for the presence of one or more unit roots (also referred to as testing for the order of integration – one I(1) or higher). If a series is found to be integrated of order greater than zero, then the series is said to be non–stationary. To make it stationary or integrated of order zero – I(0), this series needs to be differenced. This is checked and confirmed by testing for unit roots of difference data. The unit roots results for Fiji, PNG and SI are presented in Table 8.3 in both levels and first difference forms.

Table 8.3: Unit roots test results of the variables for export performance for selected SPINs, in levels and first differences

	Test Statistics					
	ADF		PP		PC	
	Levels	1st Diffs[a]	Levels	1st Diffs[a]	Levels	1st Diffs[a]
			FIJI			
Exports						
Model 1	2.71	−3.72*	2.53	−3.70*	–	–
Model 2	−0.68	−4.43*	−0.72	−4.43*	13.68	0.02**
Model 3	−2.13	−4.33*	−2.32	−4.32*	2.75	0.30**
World demand						
Model 1	0.96	−2.70*	0.90	−4.47*	–	–
Model 2	−1.13	−2.87*	−1.19	−4.57*	4.16	0.02**
Model 3	−1.87	−2.80	−2.04	−4.48*	2.12	0.14**
Competitiveness						
Model 1	0.29	−4.33*	0.24	−4.31*	–	–
Model 2	−3.17*	−4.25*	−3.30*	−4.22*	0.01**	0.20**
Model 3	−3.08	−4.12*	−3.21	−4.09*	9.12	0.35
Diversification						
Model 1	−0.53	−2.11*	−0.54	−5.43*	–	–
Model 2	−1.39	−2.62*	−1.50	−5.42*	1.61	0.09**
Model 3	−2.63	−3.27*	−3.33*	−5.48*	47.60	0.17**

Notes: [a] 1st Diffs = first difference models; Model 1 = No constant, no trend; Model 2 = Constant, no trend; and Model 3 = Constant, trend.
ADF and PP critical values at 10% significance levels for models 1, 2 and 3 are −1.62, −2.57 and −3.13, respectively, while those of the PC test at 5% level for models 2 and 3 are 0.330 and 0.295, respectively.
* Significant at 10% level, ** Significant at 5% level.
All the three tests lead to rejection of the stationarity hypothesis for all the variables in most models in levels, but accept the hypothesis in first difference models, implying that the variables in these series are at least I(1).

Table 8.3: continued (unit roots test results)

	Test Statistics					
	ADF		PP		PC	
	Levels	1st Diffs[a]	Levels	1st Diffs[a]	Levels	1st Diffs[a]
			PNG			
Exports						
Model 1	2.07	−1.75*	2.08	−3.14*	–	–
Model 2	−1.58	−2.76*	−1.37	−3.65*	22.61	0.17**
Model 3	−0.58	−2.71*	−1.08	−3.79*	7.58	0.36
World demand						
Model 1	0.96	−2.99*	1.02	−5.46*	–	–
Model 2	−1.68	−3.24*	−1.67	−5.58*	4.38	0.03**
Model 3	−1.96	−3.29*	−1.98	−5.55*	3.25	0.16**
Competitiveness						
Model 1	0.36	−3.54*	0.46	−6.65*	–	–
Model 2	−2.43	−3.47*	−2.44	−6.61*	5.74	0.25**
Model 3	−1.44	−4.17*	−1.00	−7.45*	4.23	0.28**
Diversification						
Model 1	−0.11	−3.32*	−0.11	−4.75*	–	–
Model 2	−1.81	−3.26*	−1.94	−4.66*	0.45	0.03**
Model 3	−1.99	−3.19*	−2.13	−4.57*	18.18	0.22**

Notes: [a] 1st Diffs = first difference models; Model 1 = No constant, no trend; Model 2 = Constant, no trend; and Model 3 = Constant, trend.

ADF and PP critical values at 10% significance levels for models 1, 2 and 3 are −1.62, −2.57 and −3.13, respectively, while those of the PC test at 5% level for models 2 and 3 are 0.330 and 0.295, respectively.

* Significant at 10% level, ** Significant at 5% level.

All the three tests lead to rejection of the stationarity hypothesis for all the variables in most models in levels, but accept the hypothesis in first difference models, implying that the variables in these series are at least I(1).

Table 8.3: continued (unit roots test results)

	Test Statistics					
	ADF		PP		PC	
	Levels	1st Diffs[a]	Levels	1st Diffs[a]	Levels	1st Diffs[a]
			SOLOMON ISLANDS			
Exports						
Model 1	1.77	−1.96*	2.12	−5.89*	–	–
Model 2	−0.92	−2.83*	−0.91	−7.12*	42.08	0.12**
Model 3	−1.77	−3.25*	−1.62	−7.19*	9.46	0.14**
World demand						
Model 1	1.30	−2.06*	1.50	−6.04*	–	–
Model 2	−1.28	−2.98*	−1.23	−6.48*	9.69	0.03**
Model 3	−2.30	−2.74	−2.26	−6.43*	1.89	0.08**
Competitiveness						
Model 1	1.36	−1.93*	0.97	−8.87*	–	–
Model 2	−1.53	−2.91*	−1.48	−9.46*	15.36	0.08**
Model 3	−0.48	−3.86*	−2.17	−9.91*	2.33	0.09**
Diversification						
Model 1	−0.90	−3.12*	−0.77	−7.68*	–	–
Model 2	−1.85	−3.24*	−2.01	−7.71*	2.25	0.09**
Model 3	−1.78	−3.50*	−2.39	−7.69*	64.39	0.11**

Notes: [a] 1st Diffs = first difference models; Model 1 = No constant, no trend; Model 2 = Constant, no trend; and Model 3 = Constant, trend.
ADF and PP critical values at 10% significance levels for models 1, 2 and 3 are −1.62, −2.57 and −3.13, respectively, while those of the PC test at 5% level for models 2 and 3 are 0.330 and 0.295, respectively.
* Significant at 10% level, ** Significant at 5% level.
All the three tests lead to rejection of the stationarity hypothesis for all the variables in most models in levels, but accept the hypothesis in first difference models, implying that the variables in these series are at least I(1).

For Fiji, test statistics for all data series in the models 1, 2 and 3 are significantly greater than their respective critical values at 10 per cent level for ADF and PP tests and 5 per cent for the PC test, hence the three tests fail to reject the hypothesis of non–stationarity for the exports, world demand, competitiveness and diversification.

Without further unit roots testing it is difficult to tell whether the series are I(1) or I(2) or higher. To check for the actual integration order, the data series are again tested for unit roots, but this time the tests are conducted in the first difference forms of the data series.

As indicated in Table 8.3, almost all the test statistics in the first difference forms for the Fiji data series are significantly smaller than their respective critical values. This confirms that the data series for Fiji indices are non stationary, with I(1) process. Thus, to conduct further statistical estimations of these indices, they should be differenced once to make them stationary.

Similar results to those of Fiji were obtained for PNG and SI (see Table 8.3 for details). Based on these results, therefore, all the indices were transformed to first differences prior to further statistical estimations.

8.4.2 Cointegration test results

Given that the indices are non–stationary and are I(1), the possibilities of long–run equilibrium relationships were investigated. As mentioned, the data series for all the indices were transformed into logarithmic forms so that the estimated coefficients could be interpreted directly as constant elasticities.

When conducting the cointegration regression analyses, various combinations of the explanatory indices were formulated and tried. The aim here was to find out which combinations could capture the cointegration relationship best. Multivariate and bivariate regression models were used in the tests of cointegration to explain export sector performance:

$$\ln EXP_t = f(\ln WD_t, \ln CM_t, \ln DV_t) + Z_{1t} \qquad (8.6)$$

$$\ln EXP_t = f(\ln WD_t, \ln CM_t) + Z_{2t} \qquad (8.7)$$

$$\vdots \qquad \vdots \qquad \vdots$$

$$\ln EXP_t = f(\ln DV_t) + Z_{7t} \quad (8.12)$$

For each residual (Z_{it}, i = 1, ..., 7) of the above equations (8.6) – (8.12), three residual–based cointegration tests (ADF, PP and POC) were applied[33] (see sample instruction program in Appendix 7.1)

The results given in Table 8.4 reveal that cointegration was detected for Fiji in model 2 in only two equations (1) and (3), by both ADF and PP tests at 10 per cent significance levels. These equations had world demand, competitiveness and diversification in one model, and world demand and diversification in the other model as explanatory variables.

As indicated in Table 8.4, no test detected any cointegration in any model for PNG. For SI, cointegration was found in models 2 and 3 of equations (2) and (6) and model 2 of equation (5). Variables in equation (5) were found to be cointegrated at the 10 per cent significance level by the PP test only while variables in equations (2) and (6) were found cointegrated by both ADF and PP tests at 10 per cent level of significance.

Since non–cointegrating relationships were found to dominate (based on the results in Table 8.4), estimations in VAR models could be the most appropriate approach. Moreover, due to the small sample sizes, statistical estimations were conducted in VAR models in log levels in addition to the first differences. In addition to reasons given in Chapter 6, the unit root tests are based on asymptotic results, and thus their power in small samples is highly reduced. Therefore, the purpose for conducting estimations in VAR models in levels was to try to preserve the degrees of freedom which are reduced when estimations are carried out in difference forms. Using data in levels will also keep the data intact without losing useful information (Doan 1990, p. 8–3, Ramachandran and Kamaiah 1992). Fuller's (1976) Theorem (8.5.1), shows that, even if it is appropriate, differencing produces little gain in asymptotic efficiency in an autoregression. Particularly in VARs, differencing loses information. For instance, while almost no gain is obtained, simple VARs on differences cannot capture co–integrating relationships (Doan 1990).

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33 These tests are commonly known as 'residual–based tests for cointegration' which is done by estimating the static cointegrating regressions, followed by the ADF, PP and POC tests conducted on the estimated residuals (Z_t) from the static cointegration regressions.

Table 8.4: Cointegration test results of the variables for export performance for the selected SPINs

	Test Statistics		
	ADF	PP	POC
		FIJI	
(1) EXP = f(WD, CM, DV)[a]			
Model 2	–3.99*	–4.00*	1.27
Model 3	–3.32	–3.45	0.84
(2) EXP = f(WD, CM)			
Model 2	–2.47	–2.63	3.49
Model 3	–3.30	–3.44	0.82
(3) EXP = f(WD, DV)			
Model 2	–4.38*	–4.35*	1.31
Model 3	–3.32	–3.46	0.84
(4) EXP = f(CM, DV)			
Model 2	–1.93	–1.98	9.94
Model 3	–2.42	–2.58	2.23
(5) EXP = f(WD)			
Model 2	–2.27	–2.42	3.71
Model 3	–3.34	–3.47	0.81
(6) EXP = f(CM)			
Model 2	–0.25	–0.38	15.92
Model 3	–2.12	–2.27	2.51
(7) EXP = f(DV)			
Model 2	–2.67	–2.69	12.52
Model 3	–2.40	–2.56	2.21

Notes: [a] EXP = Exports, WD = World demand, CM = Competitiveness, DV = Diversification, Model 2 = Constant, no trend; and Model 3 = Constant, trend.
Critical values for ADF and PP at 10% significance level are: Model 2 = –3.81, –3.45, –3.04; Model 3 = –4.15, –3.84, and –3.50 for 4, 3, and 2 variables, respectively. Those for POC at 5% level are 0.330 and 0.295 for models 2 and 3.
Test statistics greater than critical values support no cointegration hypothesis.
* Significant at 10% level.

Table 8.4: continued (cointegration test results)

	Test Statistics		
	ADF	PP	POC
		PNG	
(1) EXP = f(WD, CM, DV)[a]			
Model 2	−3.26	−3.27	14.07
Model 3	−3.49	−3.58	3.81
(2) EXP = f(WD, CM)			
Model 2	−3.03	−3.02	13.00
Model 3	−3.30	−3.39	3.94
(3) EXP = f(WD, DV)			
Model 2	−3.25	−3.26	8.29
Model 3	−3.08	−3.18	1.61
(4) EXP = f(CM, DV)			
Model 2	−1.73	−1.66	16.26
Model 3	−2.97	−3.05	2.67
(5) EXP = f(WD)			
Model 2	−2.82	−2.81	6.18
Model 3	−3.19	−3.29	1.11
(6) EXP = f(CM)			
Model 2	−1.68	−1.67	8.69
Model 3	−1.96	−2.17	2.57
(7) EXP = f(DV)			
Model 2	−1.34	−1.43	51.63
Model 3	−1.19	−1.23	4.32

Notes: [a] EXP = Exports, WD = World demand, CM = Competitiveness, DV = Diversification, Model 2 = Constant, no trend; and Model 3 = Constant, trend.
Critical values for ADF and PP at 10% significance level are: Model 2 = −3.81, −3.45, −3.04; Model 3 = −4.15, −3.84, and −3.50 for 4, 3, and 2 variables, respectively. Those for POC at 5% level are 0.330 and 0.295 for models 2 and 3.
Test statistics greater than critical values support no cointegration hypothesis.

Table 8.4: continued (cointegration test results)

	Test Statistics		
	ADF	PP	POC
		SOLOMON ISLANDS	
(1) EXP = f(WD, CM, DV)[a]			
Model 2	−2.03	−3.26	2.70
Model 3	−3.68	−3.67	2.06
(2) EXP = f(WD, CM)			
Model 2	−2.43	−3.93*	2.30
Model 3	−4.12*	−4.12*	0.89
(3) EXP = f(WD, DV)			
Model 2	−2.71	−2.78	3.88
Model 3	−2.85	−2.88	1.69
(4) EXP = f(CM, DV)			
Model 2	−1.95	−2.94	2.83
Model 3	−3.40	−3.41	1.52
(5) EXP = f(WD)			
Model 2	−3.06	−3.10*	3.74
Model 3	−3.02	−3.06	1.37
(6) EXP = f(CM)			
Model 2	−2.72	−4.14*	2.73
Model 3	−3.89*	−3.90*	1.22
(7) EXP = f(DV)			
Model 2	−1.04	−1.63	24.39
Model 3	−1.27	−2.21	2.87

Notes: [a] EXP = Exports, WD = World demand, CM = Competitiveness, DV = Diversification, Model 2 = Constant, no trend; and Model 3 = Constant, trend.
Critical values for ADF and PP at 10% significance level are: Model 2 = −3.81, −3.45, −3.04; Model 3 = −4.15, −3.84, and −3.50 for 4, 3, and 2 variables, respectively. Those for POC at 5% level are 0.330 and 0.295 for models 2 and 3.
Test statistics greater than critical values support no cointegration hypothesis.
* Significant at 10% level.

8.4.3 Granger causality test results

Since the results of Granger causality are sensitive to the proper selection of lags, all the time series indices were first tested for optimal lag lengths. Two tests – AIC and SC (described in Chapter 6) were employed (see RATS sample instructions program in Appendix 7.2). The optimal lag length results are presented alongside the observed test statistics of Granger causality for both the VAR models in levels and first differences in Table 8.5.

(a) Fiji

Results for Fiji indicate that only one year was found to be the optimal lag length for all the seven specifications in both VAR models in levels and first differences (Table 8.5). Granger causality was detected in the VAR models in levels only. The direction of causation was running from WD plus DV (specification (3)) to export sector performance at the 5 per cent significance level. Granger causality was also obtained running from CM plus DV and DV alone to export sector performance at 5 per cent and 10 per cent significance levels, respectively (see specifications (4) and (7) in Table 8.5).

No causality was detected for any specifications in VAR models in first differences. The results of the VAR models in levels suggest that the WD factors have causal relationships with the export sector performance only if they are specified with the DV. Similarly, when both CM and DV are specified together, they were found to be causally related with export sector performance. But, when the two domestic factors were specified individually, only DV had a causal relationship with export sector performance.

The Fiji results show that domestic factors were important in determining the export sector performance and were more important than the external world demand in this regard. These results seem to confirm the indications noted in subsections 8.2.3 and 8.2.4 that Fiji had lost competitiveness in its principal export commodities (sugar and coconut oil). Over time, however, Fiji started gaining export market shares from new[34] product lines (marine and forestry products) so that diversification increased. These causality results confirm that domestic diversification has been important in export sector performance. The Fiji results thus indicate the importance of domestic factors as causes of export sector performance – the domestic factors were also found to cause CERV in the selected SPINs (Chapter 7, In et al. 1994).

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[34] The word 'new' is used in the sense that these commodities have not been the traditional export commodities in large quantities.

Table 8.5: Causality test results from demand and supply factors to export performance for selected SPINs, in levels and first differences

NO causality from	VAR in Levels: Optimal lags AIC[b]	SC[c]	Test statistics	VAR in 1st Diffs[a]: Optimal lags AIC[b]	SC[c]	Test statistics
			FIJI			
(1) WD, CM and DV[d]						
	1	1	2.25	1	1	1.58
(2) WD and CM						
	1	1	0.89	1	1	0.08
(3) WD and DV						
	1	1	3.49**	1	1	0.98
(4) CM and DV						
	1	1	2.57*	1	1	2.13
(5) WD						
	1	1	0.10	1	1	0.07
(6) CM						
	1	1	1.84	1	1	0.02
(7) DV						
	1	1	5.26**	1	1	1.42

Notes: [a] 1st Diffs = first difference models, [b] AIC = Akaike information criterion, and [c] SC = Schwarz criterion, [d] WD, CM and DV = world demand, competitiveness and diversification, respectively.
Test statistics are based on critical values of F–distributions whose degrees of freedom used are listed in Appendix 8.10.
* Causality from the variables to export performance significant at 10% level, ** Causality significant at 5% level.

Table 8.5: continued (causality test results)

NO causality from	VAR in Levels Optimal lags AIC[b]	SC[c]	Test statistics	VAR in 1st Diffs[a] Optimal lags AIC[b]	SC[c]	Test statistics
			PNG			
(1) WD, CM and DV[d]						
	3	3	5.79***	3	3	4.06**
(2) WD and CM						
	–	2	1.74	2	2	1.15
	3	–	1.17	–	–	–
(3) WD and DV						
	4	4	5.23***	3	3	4.90***
(4) CM and DV						
	3	3	4.41***	3	3	3.58**
(5) WD						
	3	3	1.56	2	2	2.23
(6) CM						
	–	2	3.36*	2	2	1.60
	4	–	1.38	–	–	–
(7) DV						
	4	4	4.66**	–	3	4.97**
	–	–	–	4	–	4.74**

Notes: [a] 1st Diffs = first difference models, [b] AIC = Akaike information criterion, and [c] SC = Schwarz criterion, [d] WD, CM and DV = world demand, competitiveness and diversification, respectively.
Test statistics are based on critical values of F–distributions whose degrees of freedom used are listed in Appendix 8.10.
* Causality from the variables to export performance significant at 10% level, ** Causality significant at 5% level, *** Causality significant at 1% level.

Table 8.5: continued (causality test results)

NO causality from	VAR in Levels			VAR in 1st Diffs[a]		
	Optimal lags AIC[b]	SC[c]	Test statistics	Optimal lags AIC[b]	SC[c]	Test statistics
			SOLOMON ISLANDS			
(1) WD, CM and DV[d]						
	–	–	–	–	1	4.25**
	3	3	5.90***	3	–	3.63**
(2) WD and CM						
	–	–	–	–	1	4.25**
	3	3	3.50**	2	–	3.80**
(3) WD and DV						
	–	–	–	1	1	6.64***
	3	3	5.38***	–	–	–
(4) CM and DV						
	–	1	2.24	1	1	0.50
	2	–	2.04	–	–	–
(5) WD						
	–	–	–	1	1	3.51*
	2	2	2.32	–	–	–
(6) CM						
	–	–	–	1	1	1.05
	2	2	2.45	–	–	–
(7) DV						
	–	1	4.22*	1	1	0.93
	3	–	2.95*	–	–	–

Notes: [a] 1st Diffs = first difference models, [b] AIC = Akaike information criterion, and [c] SC = Schwarz criterion, [d] WD, CM and DV = world demand, competitiveness and diversification, respectively.
Test statistics are based on critical values of F–distributions whose degrees of freedom used are listed in Appendix 8.10.
* Causality from the variables to export performance significant at 10% level, ** Causality significant at 5% level, *** Causality significant at 1% level.

(b) PNG

Optimal lag lengths and Granger causality results for PNG are also reported in Table 8.5. Lags as many as 4 years were found to be optimal for PNG.

Cases of Granger causality were detected in various specifications of the VAR models in both levels and first differences. For example, using the specification (1) involving all the three factors (WD, CM, and DV), causality running from these factors to export sector performance was obtained in the VAR models in both levels and first differences at 1 per cent and 5 per cent significance levels, respectively. Evidence of causality for WD and DV specification (3) was strong. In both cases (levels and first differences), this evidence was statistically significant at the 1 per cent level. CM and DV specification (4) was statistically significant at 1 per cent for the VAR models in levels and at 5 per cent for the VAR models in first differences. Of the two domestic supply factors, diversification appeared to be more important. When the explanatory factors were specified individually, the domestic supply side factors seemed more important causal agents of export sector performance than did world demand.

The causality results for PNG also appear to confirm the evidence discussed in subsections 8.2.3 and 8.2.4. As the traditional agricultural export commodities were declining, it was seen that PNG had apparently maintained substantial competitiveness while at the same time diversifying its exports into both old and new product lines (marine and forestry products, gold, copper and palm oil). Not only do the PNG causality results tend to confirm these trends but they also appear to be in agreement with the results of Chapter 7 and In et al. (1994).

(c) SI

The lag length and Granger causality test results for SI are not very different from those for PNG and Fiji. As shown in Table 8.5, lag lengths as long as three years were found to be optimal for the SI models. Granger causality results show that at 1 per cent and 5 per cent significance levels, in VAR models in levels and first differences, respectively, WD, CM, and DV specification (1) helped to predict the export sector performance in SI. This was true with the specifications (2) and (3) involving WD plus CM and DV separately. Individual specifications indicate that WD (specification (5)) was significant at 10 per cent level in the VAR models in first differences and DV (specification (7)) was significant at the same level in the VAR models in levels. Hence, SI results show that all three factors had a stronger causal relationship with the export sector performance when specified together. The domestic factors were quite important when each of them was specified separately with WD.

Again, the Granger causality results for SI tend to confirm the evidence discussed in subsections 8.2.3 and 8.2.4. While SI was found to be as competitive as PNG, it has also been diversifying the composition of its export commodities into marine and forestry products, cocoa, and palm oil and kernel. In addition, the SI causality results seem to be in line with those obtained in Chapter 7 and by In et al. (1994).

8.4.4 FEDA test results

As described in Chapter 6, variance decomposition not only augments (or supplements) the causality test results but also permits quantification[35] of the responses of one variable, for example exports, from contributions of each cause of disturbance to its own or other cross variables, e.g., EXP, WD, CM and DV, within a given system. FEDA has been performed for the VAR models in both levels and first differences (RATS sample instruction program in Appendix 7.2). Decomposition results for Fiji, PNG and SI are presented in Table 8.6.

(a) Fiji

Fiji results indicate that own shocks (from exports) had the greatest impacts (Table 8.6). This was followed by diversification whose effects kept increasing with time. World demand, with a decreasing influence, and competitiveness whose impacts increased up to year eight and then started decreasing, followed in that order for the VAR models in levels. Generally, on average, about 24, 19, 26 and 31 per cent of export sector performance are attributed to (or accounted for by) WD, CM, DV and EXP, respectively. When exports are left out, diversification appears to have had the greatest impact in influencing export sector performance in Fiji. This is quite consistent with the causality results presented earlier (subsection 8.4.3).

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[35] Quantification of causality results refers to the fact that, if causality has been detected, for example, running from one direction to another, there are possibilities of making inferences with regard to the directions for which the impacts are greater in magnitudes and more persistent. Magnitudes and persistence of the impacts can be measured by FEDA and IRA, respectively (Baffes and Shah 1994).

Table 8.6: Variance decompositions (in %) of the export sector performance for selected SPINs

Period	Export sector decompositions			
	World demand	Competitiveness	Diversification	Exports
		FIJI		
		Levels		
1	42.5	7.8	0.7	49.0
3	29.5	18.7	12.2	39.6
5	23.1	22.0	21.5	33.3
8	19.6	22.4	30.5	27.5
10	18.8	22.2	34.1	24.9
15	18.0	21.8	38.8	21.3
20	17.6	21.8	41.0	19.6
Average	24	19	26	31
		1st Differences		
1	35.5	2.0	0.1	62.4
3	29.5	3.0	14.8	52.7
5	29.3	3.4	14.8	52.5
8	29.3	3.4	14.8	52.5
10	29.3	3.4	14.8	52.5
15	29.3	3.4	14.8	52.5
20	29.3	3.4	14.8	52.5
Average	30	3	13	54
		PNG		
		Levels		
1	44.0	9.7	0.9	45.4
3	22.7	4.1	20.2	53.0
5	13.9	5.5	30.2	50.4
8	9.5	8.5	34.7	47.2
10	8.4	9.9	35.6	46.1
15	7.2	11.7	36.2	44.9
20	6.8	12.3	36.3	44.5
Average	16	9	28	47

Notes: On average, about 24, 19, 26 and 31; and 30, 3, 13 and 54% of export performance, over 20 years, for the VAR models in levels and first differences, are attributable to world demand, competitiveness, diversification and exports, respectively, in Fiji.
The variance decomposition for PNG in VAR models in levels is, on average, about 16, 9, 28 and 47% for the same variables and period.

Table 8.6: continued (variance decompositions)

	Export sector decompositions			
Period	World demand	Competitiveness	Diversification	Exports
		PNG		
		1st Differences		
1	37.7	10.5	0.1	51.7
3	24.7	9.7	18.8	46.8
5	24.1	9.6	19.5	46.8
8	24.1	9.6	19.5	46.8
10	24.1	9.6	19.5	46.8
15	24.1	9.6	19.5	46.8
20	24.1	9.6	19.5	46.8
Average	26	10	17	47
		SOLOMON ISLANDS		
		Levels		
1	50.5	5.7	17.5	26.3
3	56.7	3.7	24.4	15.2
5	52.5	5.1	31.7	10.7
8	38.9	8.3	41.5	11.3
10	32.0	9.9	44.5	13.6
15	25.8	11.4	44.2	18.6
20	26.6	11.4	41.4	20.6
Average	40	8	35	17
		1st Differences		
1	29.8	17.3	17.0	35.9
3	18.4	32.2	10.1	39.3
5	20.8	30.7	10.0	38.5
8	20.7	30.8	9.9	38.6
10	20.7	30.8	9.9	38.6
15	20.7	30.8	9.9	38.6
20	20.7	30.8	9.9	38.6
Average	22	29	11	38

Notes: On average, about 26, 10, 17 and 47% of export performance, over 20 years, for the VAR models in first differences are attributable to world demand, competitiveness, diversification, and exports, respectively, in PNG.
Similarly, about 40, 8, 35 and 17; and 22, 29, 11 and 38% of export performance, over 20 years, for the VAR models in levels and first differences are attributable to world demand, competitiveness, diversification and exports, respectively, in SI.

In the VAR models in first differences, the results pointed in a similar direction, although they were different in magnitudes. This time, impacts from EXP, WD, DV and CM followed in that order in exerting their influences on export sector performance. Most of these effects seemed to have stabilised at year 8. In general, an average of about 30, 3, 13 and 54 per cent of Fiji's export sector performance were accounted for by world demand, competitiveness, diversification and exports, respectively. These results were obtained even though causality was not detected in the first difference VAR models for Fiji, revealing that most of the explanatory factors influenced export sector performance.

(b) PNG

Decomposition results for PNG (Table 8.6) are also quite consistent with the causality findings in subsection 8.4.3. For the VAR models in levels, export contributions were the greatest, increasing from year one to two and decreasing consistently thereafter. World demand followed but its impact decreased from year one towards year 20. This is quite different from competitiveness and diversification whose impacts increased over time. Nevertheless, impacts from diversification were found to be greater than those from the competitiveness factor. Generally, averages of about 16, 9, 28 and 47 per cent of PNG's export sector performance were accounted for by WD, CM, DV and EXP, respectively.

For the PNG VAR models in first differences, the results, though different from those of the model in levels, tend to depict the same message. They generally seemed to stabilise at year 8. About 26, 10, 17 and 47 per cent of PNG's export sector performance were attributed to WD, CM, DV and EXP, respectively. Again, these results are quite consistent with the findings of the PNG causality tests.

(c) SI

Decomposition results for SI (Table 8.6) were also quite consistent with their corresponding causality results. Results from the VAR models in levels show that world demand had the strongest impact on the export sector performance, initially increasing to year three and then starting to decrease towards year 15. The second most important factor was diversification whose contributions increased continuously to year 10 and then started decreasing to year 20. Similar effects were shown by exports and competitiveness. Generally, about 40, 8, 35 and 17 per cent of the export sector performance for SI were accounted for by WD, CM, DV and EXP, respectively.

In terms of the VAR models in first differences, the various contributions were different and they were found to stabilise at year 10. The results indicated that, while world demand was important, domestic factors were even more important in determining export sector performance. In general, about 22, 29, 11 and 38 per cent of export sector performance for SI were determined by WD, CM, DV and EXP, respectively. Again, these results are generally consistent with those obtained from the causality tests for SI (subsection 8.4.3).

8.4.5 IRA test results

IRA is a technique to evaluate the impacts of shocks on variables, by tracing out responses deviating from the expected time path for a chosen variable due to random shocks of that variable and other variables in a system. According to Baffes and Shah (1994), IRA gives dynamic responses of each variable to innovations of the same variable plus other variables.[36]

IRA (and FEDA) are computed from the MA representation of a VAR. If the variables in the VAR are non–stationary, and the VAR is estimated in levels, the resulting impulse responses may tend not to settle even after many periods. When this is the case, it is taken as an extra evidence of non–stationarity.

Impulse responses in VAR models in levels and first differences are graphed in Figures 8.4a and b, 8.5a and b, and 8.6a and b for Fiji, PNG, and SI, respectively. The data sources for these figures are listed in Appendix 8.13.

(a) Fiji

The impulse responses for Fiji are quite persistent for the VAR models in levels (Figure 8.4a) and fairly transitory in the VAR models in first differences (Figure 8.4b). The responses for the VAR models in first differences were all large initially, but began to collapse after year 3 to 5 and converged to zero at year 8.

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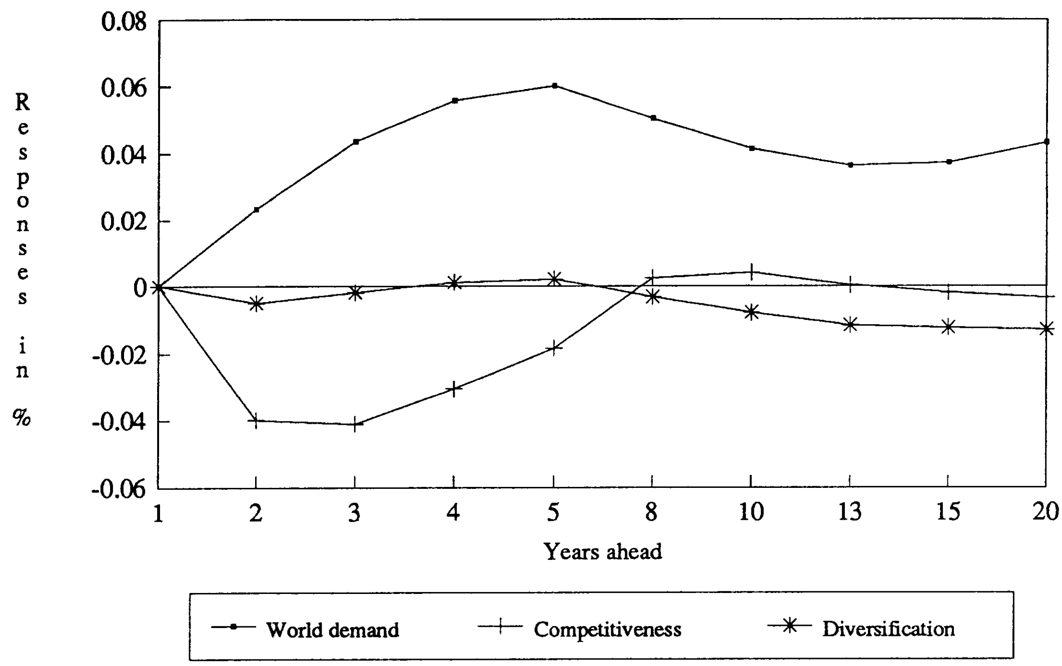
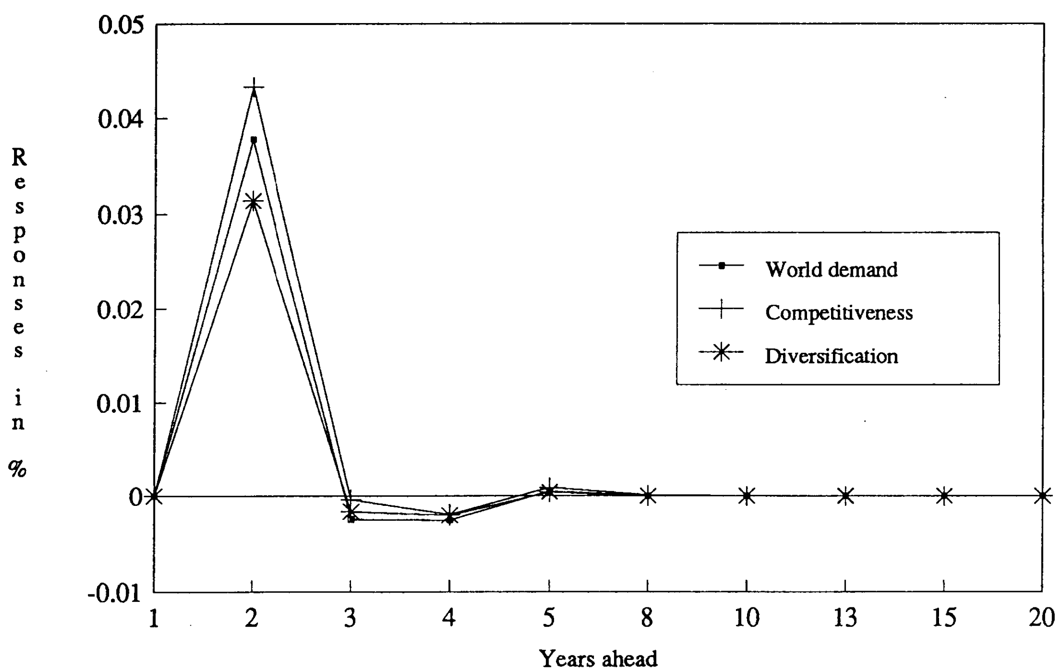
36 Essentially, impulse responses could describe whether a shock of one variable portrays a persistent or transitory effects on itself as well as other variables (Baffes and Shah 1994).

Figure 8.1a: Responses of export sector performance in VAR models in levels, Fiji



Note: Responses in % to 1 standard deviation shock to other variables.
Source: Appendix 8.13.

Figure 8.1b: Responses of export performance in VAR models in 1st differences, Fiji



Note: Responses in % to 1 standard deviation shock to other variables.
Source: Appendix 8.13.

One standard deviation shock in WD, DV and CM produced quite big and persistent responses (which followed each other in that order) on the export sector performance for Fiji in the VAR models in levels (Figure 8.4a). Responses from competitiveness tended to diminish with time, especially after year five, while responses from the diversification increased. Again, the importance of all the factors is reflected in the impulse response models as they affect export sector performance. Although the persistence of the results for the first difference VAR models appears to have collapsed to near zero, neither were their magnitudes great. But, overall, the results confirm those found in the previous models of FEDA and causality that both external and domestic factors influence export sector performance.

(b) PNG

Impulse response analysis results for PNG are graphed in Figures 8.5a and 8.5b. The magnitudes and persistence of the responses of export sector performance due to unexpected shocks in WD, CM and DV follow each other in that order for the VAR models in levels. These responses seem to have persisted to year 20 and perhaps beyond (see Figure 8.5a).

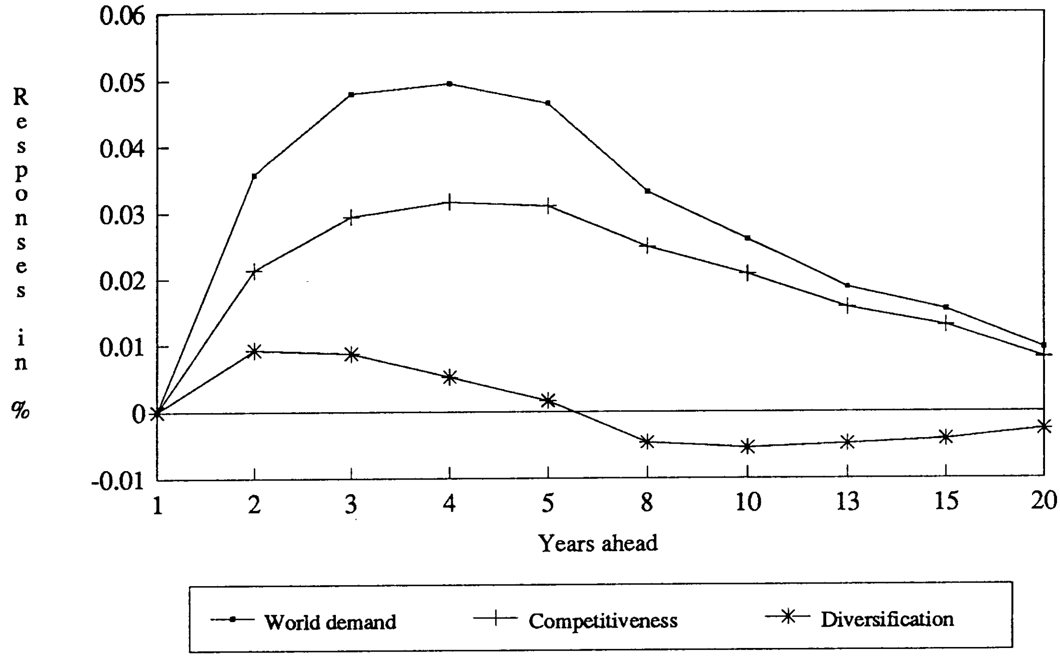
Unlike the estimated impulse responses for the VAR models in levels, results based on the VAR models in first differences imply responses that collapse to near zero from year 8 to 10. The magnitudes found indicate that world demand responses are strongest, followed by responses from diversification and competitiveness, in that order. Generally, however, these results are in accord with those obtained previously from the FEDA and causality models.

(c) SI

Results of the impulse response analysis for SI are portrayed in Figures 8.6a and 8.6b. Response patterns indicate more persistence and are greater in magnitudes for the VAR models in levels (Figure 8.6a) and are less persistent, more transitory and smaller in magnitudes for the VAR models in first differences (Figure 8.6b).

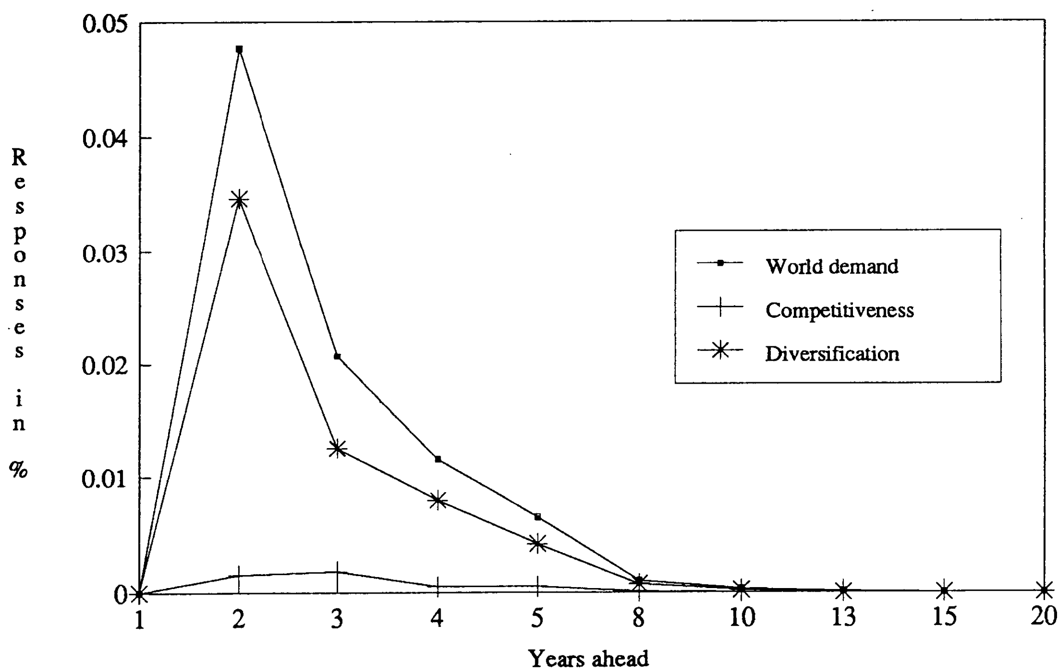
The most persistent and strongest responses in magnitudes are received from CM, followed by those from WD and DV – for the VAR models in levels. For the VAR models in first differences, responses received from WD were the strongest in magnitude, followed by those from DV and CM in that order. Again, most of these responses tended to collapse almost to near zero by year 8. The results for SI, generally, but not universally, were in line with those obtained from variance decompositions and causality tests.

Figure 8.2a: Responses of export sector performance in VAR models in levels, PNG



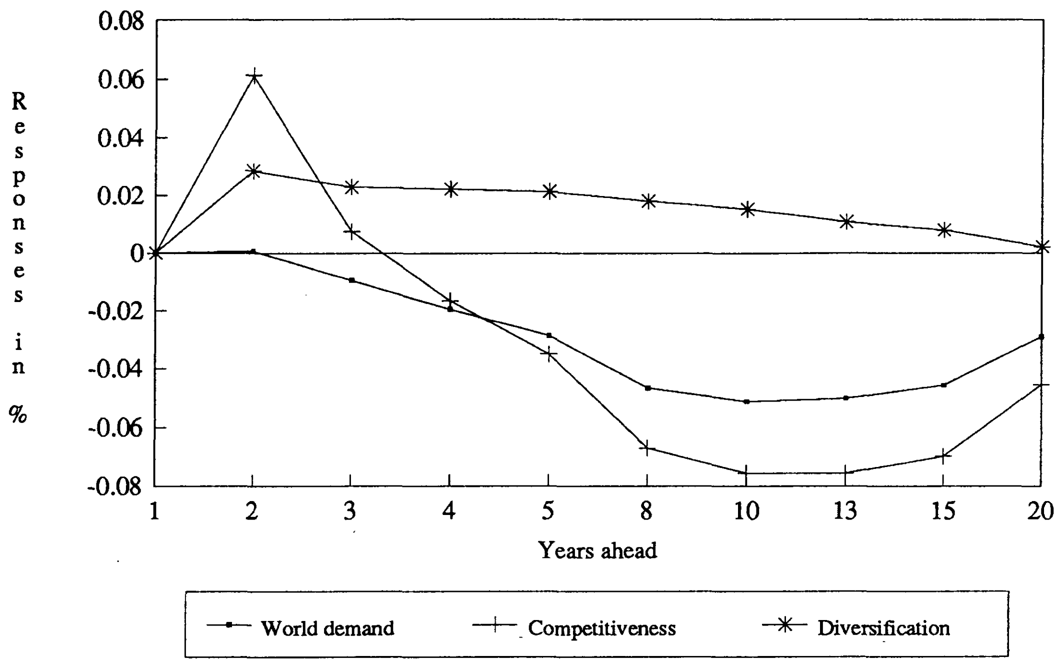
Note: Responses in % to 1 standard deviation shock to other variables.
Source: Appendix 8.13.

Figure 8.2b: Responses of export performance in VAR models in 1st differences, PNG



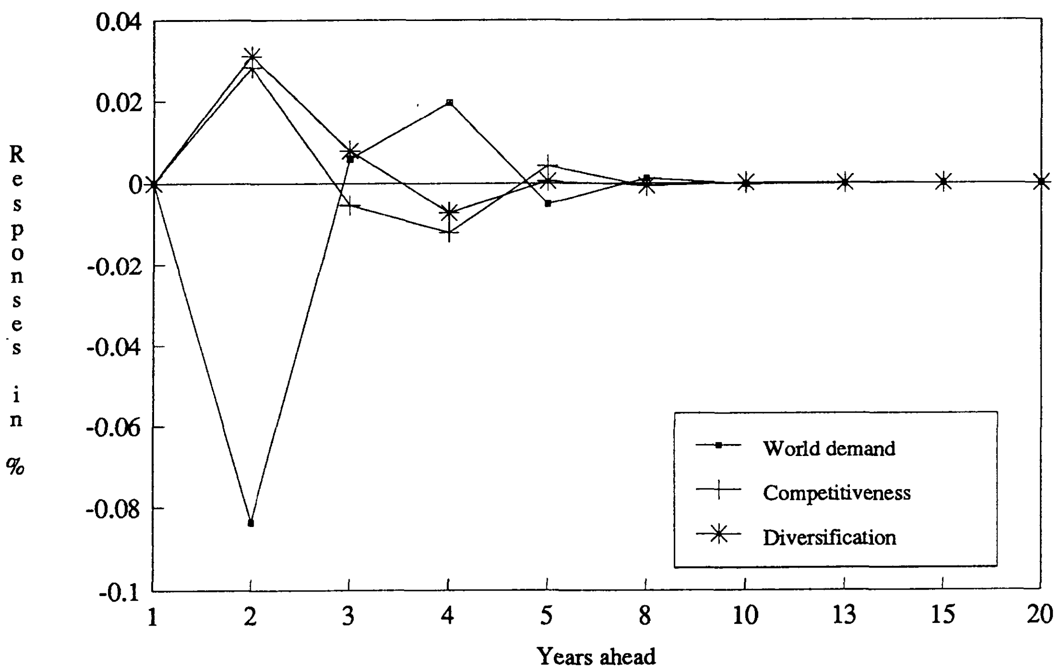
Note: Responses in % to 1 standard deviation shock to other variables.
Source: Appendix 8.13.

Figure 8.3a: Responses of export sector performance in VAR models in levels, SI



Note: Responses in % to 1 standard deviation shock to other variables.
Source: Appendix 8.13.

Figure 8.3b: Responses of export performance in VAR models in 1st differences, SI



Note: Responses in % to 1 standard deviation shock to other variables.
Source: Appendix 8.13.

8.5 Summary and Some Conclusions

This chapter has dealt with the factors affecting export sector performance from the external (world demand) and domestic (supply–side) perspectives. First presented was exploratory assessment (involving external and domestic factors) in export sector policy setting, composition and share of total exports and world market shares of the export sectors for the selected SPINs. Second, indices for the aggregate exports, world demand, competitiveness and diversification were constructed following Kravis (1970), Love (1984) and Athukorala (1991). These indices were then pretested for the presence of unit roots and cointegration. Thereafter, Granger causality, FEDA and IRA tests were applied to the indices. The main results found from the various investigations and tests are summarised below:

(a) Even though the selected SPINs had a high degree of concentration on a narrow range of primary commodities for their exports before the mid 1970s, this situation tended to change thereafter. This was found to be as a result of diversifying the commodity composition into some new product lines. As dependence on the primary agricultural products started to diminish, new (non–traditional) primary commodities such as marine and forestry products and minerals emerged.

(b) As the diversification became important, international competitiveness also became apparent. The selected SPINs were becoming less competitive as they started losing market shares of their principal exports in world markets. From this study, it would appear that the selected SPINs, particularly Fiji, did not gain much in international markets.

(c) Some selected SPINs, notably Fiji, had adopted inward–looking policies of import substitution immediately after political independence. As the policies proved less effective, they were changed to more outward–looking export–oriented policies. From time to time, other policies such as exchange rate measures, and commodity–specific marketing authorities and stabilisation schemes were also used.

(d) Tests for the presence of unit roots indicated that most of the indices were I(1). To make them stationary, they had to be differenced once.

(e) Cointegration results were mixed. Some cointegration was obtained in Fiji and SI but no single case of cointegration was found in PNG.

(f) One year lag was found optimal for all the model specifications in Fiji, while lags of four and three years were optimal for PNG and SI, respectively.

(g) Fairly strong evidence was found in all the selected SPINs that both external and domestic factors influence export sector performance. The direction of causality ran from the factors to export sector performance. In many cases, evidence was obtained for domestic supply factors, especially from diversification in all the selected SPINs.

(h) When the causality results were examined by looking at their magnitudes and persistence, both FEDA and IRA results supported the causality results.[37] This support was consistent in that, in addition to finding that external factors contributed substantially and with reasonable persistence to export sector performance, domestic factors (especially diversification) were also found to have a strong influence on the export sector performance.

(i) Overall, these results appear to support results of Chapter 7 in which domestic factors (in addition to external factors) were found to be important causes of CERV.

(j) These results may be used to suggest the directions that export sector policy settings should take in the selected SPINs. More might be achieved in the export sectors given appropriate policy orientations. Possible alternative strategies for policy design and implementation are explored and discussed in Chapter 10.

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[37] Given that the impulse responses do not settle for the VAR models in levels, the conclusions for both IRA and FEDA from the VAR models in differences should be taken as more reliable than conclusions from VAR models in levels in this study.