AN ECONOMIC ANALYSIS OF COMMODITY EXPORT REVENUE VARIABILITY IN THE SOUTH PACIFIC ISLAND NATIONS

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ABSTRACT

The contention held by the policy makers of the South Pacific island nations that commodity export revenue variability is caused by external factors is hereby analysed empirically. Though the contention lacks empirical evidence, it has resulted in the design and implementation of major policies in terms of commodity price stabilization schemes. Using a consistent data set available on external factors (weighted GDP of major trading partners, and world commodity prices) and domestic factors (country domestic GDP, exchange rates, and commodity export values), sources of export revenue variability are analysed using error correction models and decomposition procedures (forecast error decomposition and impulse response analysis). The main empirical evidence show that there are different sources which contribute to export revenue variability, though, the magnitudes of the contributions are variable.

1. INTRODUCTION

South Pacific island nations (SPINs) rely heavily on external markets for primary commodities to promote economic growth (Fleming and Piggott 1985). In fact, in less developed countries (LDCs), the SPINs included, exports from primary commodities account for up to 80 percent of total export earnings (Adams and Behrman 1982). The importance of total export markets in the SPINs cannot be over-emphasized.

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However, during the 1960s the export percent share of gross domestic product (GDP) for Fiji, Papua New Guinea (PNG) and Solomons Islands (SI) was, on average, about 33, 17 and 23 percent, respectively. This changed to 26, 34 and 33 percent in the 1970s and 26, 36 and 45 percent in the 1980s for Fiji, PNG and SI, respectively. Overall, export share of GDP was on an increasing trend for PNG and SI while decreasing for Fiji over the same period for the past three decades.

Commodity export revenue variability (CERV) has caused a great deal of concern to the SPINs. The CERV problem is especially known to be acute in the LDCs. This is particularly more important to those LDCs which are characterized by small open economies, high commodity concentration (Fleming and Piggott 1989) and geographical (export market) concentration, remoteness from international markets, an inability to influence export prices and poorly developed marketing and associated institutional infrastructure. Most of these characteristics fit the descriptions of the SPINs.

The main objective of this study is to analyse empirically sources of export variability for selected SPINs as influenced by both external and domestic factors. This objective is accomplished by the use of the error correction mechanisms (ECM) and forecast error variance and impulse response analysis decomposition procedures.

This paper is organised as follows. While some background information is dicussed in section 2, a brief review of the analytical methods, the forecast error variance decomposition analysis (FEDA) and impulse response analysis (IRA) including the model specification tests (the unit roots and cointegration tests), is presented in section 3. The data and main empirical results and discussion are presented in section 4. In section 5, a summary is given and some conclusions are drawn.

2. BACKGROUND

The motivation for this study is to investigate the effects of domestic and external markets on CERV in the SPINs. The major domestic factors which were considered to have most influence on CERV in the SPINs include domestic GDP_d, domestic exchange rates (EXR_d), and domestic exports (EXP_d). Those which were considered from the external markets are the weighted world GDP_w of the main trading partners, and world commodity prices (CPI_a).

Thus, the analysis is performed from two perspectives, ie.,from external and domestic fronts. External market conditions, particularly the external demand fluctuations, are regarded to slow down the growth of export revenues from primary commodities (Pinckney 1988). Many researchers (Athukorala 1987, Schulter 1984, Tshibaka 1986) have also observed that a lot could be done on the domestic front to reduce instability and enhance growth in export earnings of primary commodities. In his study Schulter (1984) found that domestic pricing, exchange rate and storage policies were important determinants of competitiveness and stability in agricultural export earnings. Love (1984) also supported the contention that export performance is affected more by domestic than exogenous factors.

The empirical analysis utilises the innovations of ECM modelling which is based on the joint evaluation of the long-run and short-run behaviour. The ECM analysis is supplemented by FEDA procedures. An alternative procedure which can be used to evaluate CERV is the variance decomposition model (VDM) as proposed by Piggott (1978) and used by Fleming and Piggott (1985) and (1989), and Myers and Runge (1985). The reason for choosing FEDA rather than VDM procedure is that we are more concerned with the sources rather than causes of CERV. VDM is more suited in providing a better description of the causes of CERV in terms of decomposing CERV into supply, demand and interaction components (Piggott 1978, Myers and Runge 1985). FEDA is better suited in decomposing CERV into various sources and their proportional contributions. Thus, on the basis of the present objective, FEDA looks an appropriate analytical procedure for this study.

FEDA is supplemented by IRA, and both are used to estimate the relative contribution (FEDA) and analyse the consequences of the various types of unexpected exogenous shocks (IRA) to an export market system (Myers et al. 1990). Other previous studies with interesting results that have utilised the methods of FEDA and IRA to analyse various macroeconomic variables as they interrelate with and affect each other include, among others, Myers et al. (1990), Orden (1986), Tegene (1990), and In and Sugema (1992).

3. METHODOLOGICAL FRAMEWORK

The main objective of this study is to investigate the transmission effects of domestic and external factors on CERV in the SPINs. The domestic sector describes the relation between export revenues, domestic GDP_d and exchange rates while the external sector describes the foreign transmission effects (major trading partners' GDP_w and world commodity prices) on CERV in the SPINs. Therefore, the basic idea is to explain CERV by (a) the domestic sector, (b) the external sector or, (c) both sectors.

The empirical analysis makes use of the ECM which are based on the joint analysis of the long-run and short-run behaviour. The cointegration approach is used to analyse each sector separately while the ECM uses the derived disequilibrium states as the explanatory variables of CERV. This procedure gives us an advantage to investigate complicated interactions of the domestic and external markets in the determination of a single variable (CERV).

The empirical model of the domestic and external sectors for the SPINs is presented in this section. The specification of the empirical model is based on model specification tests (the unit roots and cointegration tests), which have recently been popularized by Engle and Granger (1987). Thus the empirical model is investigated within the framework of the long-run relationship or cointegration, short-run dynamics, and error correction representation.

Given the ECM models, we then supplement the FEDA and IRA methods to empirically analyse the CERV in the SPINs.

Brief reviews on the methods used in this study are presented as follows: model specification tests; the ECM; and FEDA and IRA.

3.1 Model Specification Tests

First, standard procedures for the model specification tests were conducted. We use Y_t to denote a generic univariate time series. In the empirical analysis Y_t represents, in turn, GDP_w, CPI_a, GDP_d, EXR_d and EXP_d series of the selected SPINs.

Before any economic variables such as GDP_w, CPI_a, GDP_d EXR_d and EXP_d are tested for their relationships, testing innovations (Dickey and Fuller 1979, 1981, Said and Dickey 1984, Phillips 1987, Perron 1988, Park and Choi 1988) are reviewed. These tests are employed in this study in finding out the statistical properties of these variables so that data are transformed appropriately. This is to ensure that the standard statistical tests performed on the data are not considered spurious (Granger and Newbold 1974).

For the test of the unit roots, we have employed three distinct methods, namely, the augmented Dickey-Fuller (ADF) test, Phillips and Perron (PP) (1988) test, and Park and Choi (PC) (1988) test. Since the basic statistical procedures for the ADF and PP have now become relatively familiar, we only provide a brief explanation of them. But, some relatively more detailed statistical procedures are reviewed and discussed for PC and Park-Ouliaris-Choi (POC) (1988) tests for unit root and cointegration, respectively.

The most commonly used unit roots test is the ADF test. It is based on the autoregressive process of variable differences:

$$\Delta Y_t = \upsilon_0 + \alpha Y_{t-1} + \alpha_1 \text{trend} + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + u_t \qquad (1)$$

The motivation for the augmentation of the lagged differences is to ensure that the errors are uncorrelated and, therefore, 'to whiten' u_t in (1). The null hypothesis of the unit roots is given by Ho: $\alpha = 0$ and $\alpha_1 = 0$ while the alternative hypothesis is Ha: $\alpha < 0$. If the computed statistics are negative and 'large' in absolute values, compared with the critical values, the null hypothesis of the unit roots is rejected in favour of the alternative. Critical values for the ADF and PP tests were obtained by simulations and published by Fuller (1976).

In theory, the value of the test statistic depends on m, the order of the autoregressive process. Note that the ADF test is an extension of the Dickey-Fuller (DF) (1979) test which is based on regression equation (1) for which m = 0. Normally the DF test suffers from autocorrelation problems. An extension (or augmentation) of m to a positive number in the ADF test is done to accommodate a richer dynamic structure that may govern the innovation sequence.

The second unit roots test used which also tackles the autocorrelation problems in the DF-tests, is the PP test. This test transforms the DF regression, and is essentially a non-parametric procedure. Ideally, the PP test tries to remove the nuisance parameters which are associated with serial correlations in the DF regressions:

$$1/T^* \sum_{t=1}^{T} u_t^2 + 2/T \sum_{s=1}^{l} w(s,l) \sum_{t=s+1}^{T} u_t u_{t-s} \qquad (2)$$

where: u_t = estimated residual from the ADF equations where m=0, l = truncation lag number, *and* $w(s, l) = (1-s)/(l+1)$ = window.

As discussed by Perron (1988), it is essential to consider the selection of proper truncation lags. The statistics are transformed to remove the effects of autocorrelation on the asymptotic distribution of the test statistics. We used the transformed test statistics which are listed in Perron (1988, Table 1, pp. 308-9). The α of the transformed regression is then tested following the usual ADF procedure.

The third unit roots test applied is the PC test. The PC test is fundamentally different from the previous two methods (the ADF and PP tests) in the sense that the autoregressive root is not determined directly. This approach has some intuitive merits and notable simplicity. Instead of examining the autoregressive root the PC test deploys a *spurious* feature of a regression that involves integrated processes where polynomials are added. The test procedure utilises two OLS regressions:

$$Y_t = \sum_{k=0}^{p} \gamma_k t^k + u_t \tag{3}$$

$$Y_t = \sum_{k=0}^{q} \gamma_k t^k + u_t \tag{4}$$

While regression (3) is without (or has fewer) time polynomials terms, regression (4) has superfluous time polynomials, i.e. $t^{p+1},\ldots, t^q$ $(q>p)$.

The test statistic for the above regressions is defined by:

$$J_2(p, q) = (RSSp - RSSq)/RSSq \tag{5}$$

where RSSp and RSSq are residual sums of squares from regressions (3) and (4), respectively.

The statistic essentially tests the null hypothesis, Ho: $= \gamma_{p+1} = \ldots = \gamma_q = 0$ against the alternative hypothesis that at least one of the redundant gamma terms is not zero. Under the null hypothesis that Y_t is a non-stationary time series, $J_2(p, q)$ has a stable distribution and the critical values are tabulated following Park and Choi (1988). The null hypothesis of a unit root in Y_t is accepted if $J_2(p, q)$ is greater than the relevant critical value, and rejected if smaller.

Cointegration, as originated by Granger (1981), implies the existence of a long-run equilibrium relationship between two or more variables. Thus, two variables are said to be cointegrated if their data series have a linear combination which is stationary, even though the individual series are non-stationary or unit roots (Hallam, Machado and Rapsomanikis 1992). In using cointegration theory as recently developed by Granger (1986), Engle and Granger (1987), Johansen (1988) and Stock and Watson (1988), it is now possible to test for long-run equilibrium relationships among variables such EXP_d, GDP_w and CPI_a, and EXP_d, GDP_d and EXR_d. If these variables are each I(1), for example, it is typically true that any linear combination of these variables in a trivariate representation may also be I(1). However, if the linear combination is I(0), then the variables are said to be cointegrated.

To test for the long-run relationships or cointegr[illegible]ng the variables, two tests of cointegration (ADF and PP) based on residuals, and a third test by variable addition (POC), are introduced and deployed. First, the ADF and PP tests are tests for no cointegration. They examine the least squares residuals from the regression:

$$Y_t = \beta_0 + \beta_1 trend + \beta X_t + u_t \tag{6}$$

With $\beta_1 = 0$, the equation becomes a no-trend case.

In order to test for cointegration among variable (e.g. EXP_{dt}, GDP_{wt} and CPI_{at}) series, which is expected to be I(1), by the unit roots tests, first, we run the regression EXP_{dt} on GDP_{wt} and CPI_{at} and obtain the computed u_t. If the residuals have unit roots, the regression model is not cointegrated and there is thus no cointegration among the variables (EXP_{dt}, GDP_{wt} and CPI_{at}). As Phillips and Ouliaris (1987) have shown, the ADF and PP unit roots tests can be used to test for no cointegration among variables.

The ADF test for no cointegration follows the procedure below:

(a) Compute the residuals u_t from the regression of EXP_{dt} on GDP_{wt} and CPI_{at}.

(b) Run the regression for equation (7):

$$\Delta u_t = \gamma u_{t-1} + \sum_{i=1}^{p} \delta_i \Delta u_{t-i} + e_t \qquad (7)$$

(c) Check the coefficient of u_{t-1}. If $\gamma = 0$, u_t will be an I(1) series.

The hypothesis of cointegration corresponds to γ being significantly negative (a positive value would imply that the computed u_t is non-stationary). If the value is less than the critical value, which is negative, then it supports cointegration among the variables. Under similar principles, the PP test is also performed on the series of the OLS residuals, u_t. Failure to reject the null hypothesis that u_t is = I(1) is taken to imply that the variables are not cointegrated. The PP test depends on the choice of the lag truncation number chosen for the window to estimate the long-run variance of the error process. The critical values for the ADF and PP tests of cointegration are tabulated by Engle and Yoo (1989). Finally, the POC test for cointegration is briefly presented. Here a superfluous time polynomial is added to the model. The test is carried out to find whether the coefficients of the added polynomial are zero or not. If the test shows the coefficients of the added polynomial are zero, stationary errors are implied (In, Mehta and Doran 1992), showing that cointegration exists.

Two equations are postulated for the POC test:

$$Y_t = \alpha_1 + \beta_1 X_t + \gamma_1 trend + u_{1t} \qquad (8)$$

$$Y_t = \alpha_2 + \sum_{k=1}^{5} \rho_k t^k + \beta_2 X_t + u_{2t}. \qquad (9)$$

The POC test statistic for models (8) and (9) is defined as:

$$J_2(1,5) = (RSS_1 - RSS_2)/RSS_2 \qquad (10)$$

where RSS_1 = residual sum of squares from regression (8) and RSS_2 = residual sum of squares from equation (9). The critical value for this test is 0.295 and any observed value less than 0.295 supports the existence of cointegration, meaning that stationary errors are implied.

Thus, based on POC cointegration test, the $J_2(0, 3)$ test for no trend model, we postulated cointegrating regressions for our variables as:

$$\log(EXP_d) = \alpha_1 + \beta_1 \log(GDP_w) + \beta_2 \log(CPI_a) + e_{1t} \quad (11)$$

$$\log(EXP_d) = \alpha_2 + \beta_3 \log(GDP_d) + \beta_4 \log(EXR_d) + e_{2t} \quad (12)$$

The POC test statistic for models (11) and (12) is the same as (10) above. The critical value for this test is 0.330 at the 5 percent significance level and any observed value less than 0.330 supports the existence of cointegration.

Following Granger (1988: 203), if the above regression supports the cointegration, the model should be estimated in the ECM model. But if the variables are not cointegrated, the only valid relationship that exists between them is in terms of their first differences. A vector autoregressive (VAR) model is the most suitable representation for such variables (Granger 1988, Engle and Granger 1987).

3.2 The Error Correction Mechanisms

An ECM model suggests two possible ways of explaining CERV in the SPINs, namely external and domestic sectors. The determination of CERV can be influenced either by external sector variables, or domestic sector variables or both. For the domestic sector we expect the long run CERV to be related and influenced by GDP_d and EXR_d. In small open economies like the SPINs, we expect external factors to exert substantial influence on CERV, hence the consideration of external sector in the model. Only the most important variables for the two sectors expected to determine the long- and short-run relationships of CERV were considered as there was need to keep the system manageable.

First, we developed an ECM model for the domestic sector of the selected SPINs. We let $Y_{1,t}$ be $(EXP_t - EXP_{t-1}, GDP_t - GDP_{t-1}, EXR_t - EXR_{t-1})$, and considered the residual $X_{1,t-1} = EXP_{t-1} - \gamma_1 GDP_{t-1} - \gamma_2 EXR_{t-1}$, where the estimate is based on the following cointegrating equation:

$$EXP_t = \gamma_1 GDP_t + \gamma_2 EXR_{t-1} + \mu_t \qquad (13)$$

where $\{\mu_t\}$ is integrated of order at most zero
Then we estimate the following system of equations:

$$Y_{1,t} = -\lambda_1 X_{1,t} + \beta_1 + \sum_{i=1}^{n} B_{1,i}\, Y_{1,t-i} + v_{1,t} \qquad (14)$$

where λ_1 and β_1 are 3 * 1 vectors, each $B_{1,i}$ is a 3 * 3 matrix, and $v_{1,t}$ is a 3 * 1 vector of error terms. It is important to define, $X_{1,t-1}$, the disequilibrium error for the system. The first row of (14) describes the dynamic adjustment of export revenue variability (or CERV), and its second and third rows model those of GDP_d and EXR_d, respectively.

The above regressions contain stationary variables and can be analysed in the usual way. We are particularly interested in the first row elements of the vector λ_1, since we intend to investigate the dynamic adjustment of export revenue variability in the SPINs.

For the SPINs external sector, similarly, we developed the ECM model. Let $Y_{2,t}$ be $(EXP_t - EXP_{t-1}, GDP_{wt} - GDP_{wt-1}, CPI_{at} - CPI_{at-1})$ and consider the residual $X_{2,t-1} = EXP_{t-1} - \delta_1 GDP_{wt-1} - \delta_2 CPI_{at-1}$, where the estimate is based on the following cointegrating equation:

$$EXP_t = \delta_1 GDP_{wt} + \delta_2 CPI_{at} + v_t \qquad (15)$$

where $\{v_t\}$ is integrated of order at most zero

Note that the cointegrating test for equation (15) is conducted before the estimation of ECM model. We, then, estimated the following system of ECM equations:

$$Y_{2,t} = -\lambda_2 X_{2,t-1} + \beta_2 + \sum_{i=1}^{k} B_{2,i} Y_{2,t-i} + v_{2,t} \qquad (16)$$

where λ_2 and β_2 are 3 * 1 vectors, each $B_{2,i}$ is a 3 * 3 matrix, and $v_{2,t}$ is a 3 * 1 vector of error terms. Again, we focus on the first row of (16) which describes the dynamic adjustment of export revenue variability. Equation (16)'s second and third rows model those variables of the SPINs' GDP_w and (CPI_a), respectively.

Finally, the ECM model for the dynamic determination of export revenue variability in the SPINs can be expanded by incorporating the two types of macroeconomic explanations (the domestic and external sectors) simultaneously. Let Z_t be (EXP_t - EXP_{t-1}, GDP_{dt} - GDP_{dt-1}, EXR_{dt} - EXR_{dt-1}, GDP_{wt} - GDP_{wt-1}, CPI_{at} - CPI_{at-1}), the ECM model can be estimated by the following system of equations:

$$Z_t = -\lambda_3 X_{1,t-1} - \lambda_4 X_{2,t-1} + \beta + \sum_{j=1}^{m} C_j Z_{t-j} + v_t \qquad (17)$$

where $X_{1,t-1}$ and $X_{2,t-1}$ are defined as previously and λ_3 and λ_4 are 5 * 1 vectors, respectively; and β is a 5 * 1 vector, each C_j is a 5 * 5 matrix, and v_t is a 5 * 1 vector of error terms.

Again, the strength of the ECM is to allow the effects of the external and domestic influences on CERV in the SPINs. The estimation of the λ_3 and λ_4 coefficients on the equilibrium error terms are reported in Table 5.

3.3 The FEDA and IRA Testing Procedure

3.3.1 FEDA

According to Ford (1986), Orden (1986), Tegene (1990), Doan (1990) and In and Sugema (1992), decomposition of forecast variance permits one to account for portions of the forecast variance to particular variables in a system. Sources and their proportionate contributions of variability/instability of a particular variable in a system are traced, apportioned and attributed to other variables in the system. Essentially, decomposition is based on the variance of the shocks to each variable (estimated from the error terms of the autoregressive equations) and the impacts of these shocks on each forecast (estimated by the coefficients of the moving average [MA] representation) (Orden 1986).

According to Ford (1986), a MA transformation is based on an autoregressive model such as the one below (18):

$$Z_t = H\eta_t + \sum_{j=1}^{m} D_j \varepsilon_{t-j} \qquad (18)$$

where Z is an M-variate stochastic process, $H\eta_t$ is the deterministic part of Z_t, and ε_t is an N-variate white noise process - if t is not equal to j and ε_t and ε_j are uncorrelated

from (18), the MA representation for the decomposition becomes:

$$Z_t = \sum_{j=0}^{\infty} H'_j S V_{t-j} \qquad (19)$$

where the H_j are the MA parameters.
The K-step ahead forecast error variance is:

$$\text{var}\,(Z_{t+k} - E_t[z_{t+k}])$$

$$= \sum_{k=j=0}^{k-1} (H_k S)(H_k S)' \qquad (20)$$

Letting $h_k s_{ij}$ be the ijth element of $H_k S$, then $(h_k s_{ij})^2$, $j = 1,..., m$ is the ith diagonal of $H_k S(h_k S)'$.

The k-step ahead forecast variance of the ith variable is the given by:

$$\sum_{k=0}^{k-1} \sum_{j} (h_k s_{ij})^2 \qquad (21)$$

and the percentage of that variance from equation (19) accounting for variable i by variable J is:

$$100 * \sum_{k=0}^{k-1} (h_k s_{iJ})^2 / \sum_{k=0}^{k-1} \sum_{j=1}^{m} (h_k s_{ij})^2 \qquad (22)$$

It is worth noting that the decomposed variance highly depends on the ordering of the variables prior to the decomposition.

3.3.2 IRA

Also as described by Ford (1986), Tegene (1990), Doan (1990), Orden (1986) and In and Sugema (1992), IRA is a shock evaluation procedure where the dynamic characteristics of a system are assessed. The evaluation reveals the effect on a system of an initial exogenous shock impacting on one variable in that system.

Like FEDA, IRA is actually a MA representation of a system, whose coefficients provide impulse response functions that map out the responses of all the variables in a model to a one-standard deviation initial increase in one of the variables.

Hence, the effects of an unexpected shock to the system are traced through the deviations of the shocked time paths from the expected time paths given by the model. For example, IRA could be used to predict the response of EXP_d, GDP_w and CPI_a if there is an unexpected initial shock or an upward trend (fluctuation such as an unexpected boom) in export revenues.

Based on the same MA transformation of the autoregressive model in equation (18), Ford (1986) represents the MA of IRA as:

$$Z_t = \sum_{j=0}^{\infty} H_j \eta_{t-j} \tag{23}$$

One disadvantage that arises with both FEDA and IRA is the occurrence of contemporaneous correlation of forecast errors. That is, the covariance matrix of the error terms $\Sigma = E\eta_t\eta_t^1$ is not diagonal. Therefore, one important step is to orthogonalise the innovations (errors) (Ford 1986). The RATS statistical package (Doan 1990) applied for the analysis of this study automatically, by default, orthogonalises the innovations using the choleski decomposition method.

4 EMPIRICAL RESULTS AND DISCUSSION

4.1 Data

Consistent current time series data on aggregate EXP_d values, GDP_w, CPI_a, GDP_d and EXR_d were collected for three selected SPINs from various issues of the International Financial Statistics (IFS) Yearbooks of the International Monetary Fund (IMF). These were supplemented by various government and private reports (Fiji Government 1982 and 1991, AIDAB 1991, Bank of PNG 1972-91, British SI Protectorate 1971, SI Government 1979 and 1981-83). It ought to be noted that GDP_w is a simple weighted average of major trading partners of the respective selected SPINs. The three selected SPINs are Fiji, PNG and SI, each representing an economy which is, by the standards of SPINs, medium in size and fairly diverse, large and diverse, and small and fairly concentrated, respectively. The major trading partners for Fiji were identified as UK, Australia, New Zealand, Canada, USA and Japan.

Those for PNG included Japan, Federal Republic of Germany, Australia, UK, USA, Spain and the Netherland., while the ones for SI were Australia, Japan, UK, Federal Republic of Germany and the Netherlands.

The data, which were in respective local currencies, had to be corrected to a common denominator, the US dollar. To remove the effect of inflationary trends and stabilise the data, all values were deflated into constant prices, using 1985 as the base year. Logarithms were also taken to smooth the series before any analyses were performed.

A limitation of the data is that the sample sizes for each selected SPIN were not large enough. For instance, Fiji, PNG and SI had 32, 30 and 30 annual observations, respectively, ranging from 1958 to 1989 for Fiji, 1961 to 1990 for PNG and 1960 to 1989 for SI. Longer data series were not available for these SPINs at the time of undertaking this study. These small sample sizes limit the degrees of freedom in the analyses, resulting in OLS statistical small sample bias which might affect the parameter estimates, thereby weakening the integrity of the results. Nevertheless, these results should still shed some light on the relationship among EXP_d, GDP_w, CPI_a GDP_d and EXR_d in the SPIN economies over the past three decades.

4.2 Unit Root Test Results

For the test of the unit roots, we employed three methods (ADF, PP and PC). The SHAZAM statistical application package (White et al. 1990) was used to carry out these tests. Using specified univariate models for the GDP_w, CPI_a, GDP_d, EXR_d and EXP_d, all the three tests were applied for comparison and supplementary purposes.

All the three tests indicate (Tables not reported, too long) that nearly all of the observed values are bigger than the critical values. Therefore, at 10 and five per cent significance levels for ADF and PP, and PC tests, respectively, all fail to reject the null hypothesis that $\alpha = 0$ and $\alpha_1 = 0$, thereby declaring the GDP_w, CPI_a, GDP_d and EXP_d

variables as non-stationary, with an integration order of I(1) or I(2), respectively. Thus, for the four series to be stationary, they will have to differenced at least once.

To confirm the order of integration, all the series in their first difference form were also tested for unit root using the same three tests. The results of the unit root tests (Tables not reported as well) in the first difference confirmed most variables to be I(1) by either all the three or at least two of the tests.

Further, it is now becoming increasingly known that most economic variables are I(1). In fact, some earlier unit root tests (among others, Kugler (1991) for USA, Japan, Switzerland, West. Germany, UK and France. Serletis (1992) for Canada and Giles et al. (1992) for New Zealand) have found unit root results for export and GDP data series.

4.3 Testing for Cointegration

After the unit roots tests, we conducted tests for cointegration in order to find whether a trivariate representation series has long-run equilibrium relationships; that is, whether the three series have a linear combination series which is stationary I(0). In Stock and Watson's (1988) terms, finding whether some series is driven by common trends is equivalent to identifying their long-run equilibrium relationships.

Applying the SHAZAM package, the three tests (ADF, PP and POC) were conducted for cointegration testing. In cointegrating regression tests, the emphasis is to test whether the errors (u_t) are I(0). Equations (7) and (8) for ADF and PP unit roots tests and equations (9) and (10) for PC C test of the u_t, were applied to test for the cointegration null hypothesis that Ho: $\gamma_t = 0$ vs the alternative hypothesis, Ha: γ_t is not equal to zero. If the errors are stationary then cointegration relation exists among the series in question.

While both ADF and PP tests support cointegration for model 2 (external) for Fiji, PNG and SI, ADF alone supports model 3 (external) for PNG and 3 (domestic) for SI. PP alone supports over 50 percent of all the models (2 and 3 - external for Fiji and PNG and domestic for SI, and 2 - external for SI). Of the three tests, POC test seemed the most stringent in accepting the cointegration hypothesis (Table 1).

(Attached Table 1 about here)

The significance levels for accepting cointegration in these tests are 10 and five percent for ADF and PP, and POC, respectively. In cointegration tests, observed values smaller than critical values support the cointegration hypothesis. At this stage, therefore, we have empirical evidence to conclude, with mixed results, that cointegration exists among the series under investigation

To support these mixed results, we also conducted residuals analysis. Residuals generated from the respective cointegration regressions were plotted against time. All the plots showed no particular pattern and unusual large residuals (Griffiths at al. 1993: 639-706). Thus, with these plots we were convinced and motivated to proceed and estimate the long-run and decomposition relationships among the series using the ECM models.

It is interesting to note that some previous studies found no cointegrating relations between domestic exports and GDP in other countries, e.g., in UK, USA, Switzerland and Japan (Kugler 1991; Canada (Serletis 1992), and in New Zealand - with mixed results due to disaggregated exports (Giles et al. 1992).

4.4 ECM Estimation and Analysis

Given some evidence of cointegration by ADF and PP tests, and sparing one by POC test, we estimated disequilibrium errors (Z_{t-1}) by ordinary least squares (OLS) method, following the ECM equations in (14), (16) and (17) and as suggested by Engle and Granger (1987). This was done for each selected SPINs.

As shown in Table 2, Fiji l.. a significant disequilibrium error coefficients λ_1 and λ_2 for the domestic and external markets. Both the two coefficients had the right expected negative signs. This implies that when the external and domestic markets are treated separately, the two markets portray long-run influence on CERV in Fiji. This is a key preliminary finding in the sense that policies regarding CERV in Fiji may well be based on long-term considerations of both markets when these are analysed individually. However, it was our objective to analyse this situation using a single system of equations as in (17) where both the domestic and external markets simultaneously adjust interactively to exert influence on CERV. This was thought to be closer to what might actually be happening in the real situation. The results indicate (Table 2) that only the coefficient λ_3 pertaining to domestic markets was significant with the right sign. This means that domestic markets have a longer-term impact on CERV than the external factors in Fiji. On the basis of these results, policies regarding CERV in Fiji should be treated differently, emphasizing longer-term plans more on the domestic than external markets.

(Attached Table 2 about here)

The case for PNG is quite different from Fiji when the two markets were analysed separately. In fact, only the domestic market coefficient, λ_1, had the right sign. Further, both the disequilibrium errors were insignificant. This means that, on the long-term basis, PNG CERV is not influenced much by both the two markets. When these markets were analysed in a single ECM model, the results for PNG changed quite drastically. This time, apart from having the right negative sign, the coefficient λ_3 for domestic markets was significant. Hence, domestic markets are more important than external markets in exerting long-term impact on CERV in PNG. This is only on the basis of the results accruing from the single ECM model (17).

The SI case is also different. Unlike PNG, but like Fiji, the results show that when the markets are treated individually, both coefficients λ_1 and λ_2 for the domestic and external factors, respectively, are significant with the right signs. This gives both markets equal importance in terms of their long-term relationships with CERV in the SI case. So long-term policies should consider both markets when dealing with curbing CERV. However, when the two markets are analysed in a single ECM model, both the coefficients, λ_3 and λ_4, for the domestic and external markets, respectively, become insignificant though having the right signs. This implies that when using the single model with both markets together, there is little influence on the long-run relationships between CERV and the two markets in SI.

In brief, when the two markets are analysed separately, the evidence from the results of the ECM models shows that both markets (domestic and external) are equally important in exerting long-run influence on CERV in Fiji and SI. None of the markets is important in the PNG case. However, when the markets are evaluated together in a single ECM model, only domestic factors are important in exerting long-term impact on CERV in Fiji and PNG. This is not the case in SI as neither of the two markets is important on the long-run basis. Overall, these preliminary ECM model results give some evidence supporting long-run relationships between CERV and the domestic markets in the selected SPINs, particularly as evidenced from Fiji and PNG cases. So in trying to curb the problem of CERV over a long period, domestic market policies could be given more weight in the SPINs.

With these mixed ECM model results, the outcome is inconclusive and we were put in a dilemma in terms of model selection for further analysis. This dilemma therefore led us to estimate the decomposition procedures using both the ECM and vector autoregressive (VAR) techniques.

4.5 Forecast Error Decomposition Analysis

The main objective of this study was to trace out sources and associated contributions of variability of EXP_d as attributed to both the external (GDP_w and CPI_a) and domestic (GDP_d and EXR_d) factors. We used FEDA as one way to accomplish this objective.

Thus, a single model, involving the five variables, based on both the ECM and VAR models, was used to look into the problem of export variability from two angles. To account for contemporaneous correlations among the innovations in the system, the model was orthogonalised in the order of GDP_w, CPI_a, GDP_d, EXR_d and EXP_d. This is similar to imposing a recursive structure in the system. This type of orthogonalisation permits most exogenous factors (external) to come first in the ordering so as to allow the greatest opportunity for the factors to impact on the domestic exports (Tegene 1990).

Decomposition of forecast error variances for both the ECM and VAR models for Fiji, PNG and SI showed, in general, that a disturbance (or shock) originating from a given variable inflicts the greatest own variability. Though the contributions to export variability originating from different sources differ from one model (and country) to another during the different time periods, the findings from this study indicate that these contributions are not as great as expected (Tables 3, 4 and 5).

(Attached Tables 3, 4 and 5 about here)

For instance, the ECM model indicates that GDP_w, CPI_a, GDP_f, EXR_f and EXP_f attribute an average of about 14, 4, 1, 2 and 45 percent, respectively, of EXP_f variability over a 15-year period (Table 3). Based on the VAR model, the same respective variables attribute an average of 2, 7, 3, 1 and 55 percent of EXP_f variability over the same period. Apparently, in Fiji, external factors were more important than domestic factors in explaining the sources' [illegible]s of Fiji's export variability. Otherwise, own variability is always the most important. These results seem consistent on the basis of both the ECM and VAR models.

In PNG, the results look different and more convincing. Both models indicate that the contributions of the different variables to export variability are much h[illegible]er (Table 4). Unlike in Fiji, the PNG evidence indicates that domestic factors are more important than the external factors. Again, own contribution of export variability is greatest in the PNG [illegible] as well. For example, based on ECM, GDP_w, CPI_a, GDP_{pg}, EXR_{pg} and EXP_{pg} each contribute to EXP_{pg} variability an average of 14, 13, 22, 23 and 43 percent, respectively, over a 15-year period. Similarly, the VAR model shows that the same variables contribute 20, 9, 21, 21 and 43 percent of EXP_{pg} variability in the same order over the same period.

The results for the SI case are most unexpected (Table 5). While the importance of both the external and domestic factors is almost the same, their overall contributions to export variability is marginal. For instance, based on the ECM, GDP_w, CPI_a, GDP_{si}, EXR_{si} and EXP_{si} contribute an average of about 1, 1, 1, 2 and 27 percent, respectively, of export variability over the 15 years. According to the VAR model, this contribution is about 4, 4, 3, 4 and 44 percent respectively over the same period. As in the other selected SPINs, own contribution to export variability is also greatest in SI.

Apart from finding the sources and contributions of export variability accruing from other variables, one could find the contributions of export as a source of variability to these other variables. Evidence points to different sources which contribute to export variability, albeit, with different magnitudes, depending on the source of the disturbance (or shock).

To arrest these disturbances, it is imperative to know the sources and their contributions of the instability within a system. These will guide policy makers to focus on the elimination of the most important factors of export variability which may be within their limited means.

4.6 Impulse Response Analysis

Together with FEDA, IRA focuses on another version of shock evaluation in assessing the dynamic relationships of a system. Using similar MA representation and orthogonalisation like FEDA, IRA reveals the effect of an exogenous shock on certain variables in a system. Responses of given variables are traced, over a given time, due to effects of some initial one-standard deviation positive shocks of other variables in a system (Ford 1986, Tegene 1990, Orden 1986, and In and Sugema 1992).

Figures 1 to 6, show that EXP_d responses to shocks from the other variables in the system are different for different variables. Figures 1 and 2 represent Fiji graphs based on both the ECM and VAR, respectively. During the first 5-8 years, initial shocks to EXP_f invoke greatest responses from all the other 5 variables within the system. These responses start dying out from year 8 to 10, tending towards zero by the 15th year. Apart from responses pertaining to initial own shocks, EXP_f responses are quite noticeable. Initially, EXP_f respond positively to initial shocks from almost all the variables (except from EXR_f which gives the exports an initial big negative response) before the responses tend towards zero. Though not exactly in the same magnitudes, the graphs for both the ECM and VAR models portray consistently similar pictures in terms of direction of the responses. This is also quite consistent with the decomposition results for Fiji.

(Attached Figures 1-6 about here)

As in Fiji, the graphs for PNG (Figures 3 and 4 based on ECM and VAR respectively) depict similar short-run dynamic relationships among variables, particularly during the first 5-8 years. Again, both the ECM and VAR models portray consistently similar pictures pointing the conspicuous EXP_{pg} responses due to initial exogenous shocks from other variables being positive during the initial periods. After a period of about 2 years, the export responses start decreasing towards the negative side before they increase again, eventually starting to settle down after 5-8 years (particularly for the ECM model). By the 10th year, most of these responses have tended towards zero. This time, initial export responses due to the EXR_{pg} shock are positive for ECM (unlike in Fiji) but negative for the VAR model. PNG's IRA results are also consistent with the corresponding FEDA results.

As evidenced in Figures 5 and 6 (for the respective ECM and VAR models), the SI case portrays similar trends to other selected SPINs. Apart from initial shocks in EXR_{si} which signal initial big negative responses to exports (almost similar to Fiji), EXP_{si} responses triggered from disturbances of the other variables are substantial and positive during the first 2 years; this trend persists sometimes up to 3 or 4 years, especially for GDP_w and CPI_a. By year 8, most of these responses (apart from those accruing from EXR_{si} and EXP_{si} which persist up to year 10, sometimes longer) would have settled down to almost zero. Both the ECM and VAR models point towards same direction in variable responses. Though the IRA results seem consistent with the corresponding FEDA results, IRA seems to give a much clearer picture of the short-run dynamic relationships of exports and the other variables in the SI system.

5. SUMMARY AND SOME CONCLUSIONS

The overall objective of this study was to test empirically the dynamic relationships existing between export variability and other factors; based on cointegration analysis, we used FEDA and IRA decomposition procedures modelled on the ECM basis to test for the long-term equilibrium relationships and their sources and contributions to export variability. VAR models were also used for the same analysis to countercheck the consistency, and perhaps the validity of the results.

We also used model specification tests (ADF, PP, PC and POC) to pretest and check on the statistical properties of the variables. These tests which have become a requirement for statistical time series analysis, are essentially supposed to reveal the unit roots and cointegration conditionality of the variables.

Based on ECM modelling, the evidence of the preliminary evaluation gives support to a contention of long-term influence of the domestic markets on CERV in the selected SPINs, particularly in Fiji and PNG. This implies that when trying to curb CERV over the long-tem, more consideration should be given to policies pertaining to domestic markets in the SPINs.

From these preliminary findings, this study also sets the stage for identifying the sources and associated contributions of export variability/CERV in the selected SPINs. For example, evidence from FEDA and IRA suggests that individual variables from external markets contribute more to CERV in Fiji. This is almost contrary to the ECM results for Fiji. In PNG domestic factors are more important while in SI factors from both markets are almost of equal importance in their contribution to CERV. This is consistent with the ECM results for PNG and SI. Thus, this type of analysis could give guidance to relevant policy makers in making decisions as to what sources of export variability are more important.

The approaches to arresting the export variability will be different for the different SPINs as the evidence from this study suggests that sources differ in their contribution to export variability among countries.

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Table 1. Cointegration test results for the selected SPINs

	ADF		PP		POC	
	Test stat.	10% Crit value	Test stat.	10% Crit value	Test stat.	5% Crit value
FIJI						
EXTERNAL[a]						
Model 2	-4.54	-3.45	-4.50	-3.45	0.22	0.330
Model 3	-1.91	-3.83	-4.66	-3.83	0.93	0.295
DOMESTIC[b]						
Model 2	-3.34	-3.45	-3.40	-3.45	0.03	0.330
Model 3	-3.32	-3.83	-3.32	-3.83	0.74	0.295
PNG						
EXTERNAL[a]						
Model 2	-3.84	-3.45	-3.98	-3.45	0.76	0.330
Model 3	-4.18	-3.83	-4.18	-3.83	0.63	0.295
DOMESTIC[b]						
Model 2	-2.27	-3.45	-3.01	-3.45	0.08	0.330
Model 3	-2.29	-3.83	-3.03	-3.83	0.18	0.295
SI						
EXTERNAL[a]						
Model 2	-3.62	-3.45	-3.72	-3.45	1.40	0.330
Model 3	-3.70	-3.83	-3.70	-3.83	1.50	0.295
DOMESTIC[b]						
Model 2	-3.09	-3.45	-4.35	-3.45	0.34	0.330
Model 3	-4.51	-3.83	-4.51	-3.83	0.31	0.295

Notes:

Model 2 = Drift, No trend
Model 3 = Constant, Trend

a = External factors (major trading partners weighted GDP_w and CPI_a).
b = Domestic factors (exporting SPIN GDP and exchange rates).

Both ADF and PP support cointegration in Model 2 (external) of Fiji, PNG and SI.
ADF alone supports Model 3 (external) of PNG and 3 (domestic) of SI.
PP alone supports over 50% of all the models
POC supports Model 2 (both external & domestic) of Fiji, and Models 2 and 3 (domestic) of PNG.

Table 2. Results of the disequilibrium errors (Z_{t-1}) of the estimated ECM models for the selected SPINs

	Z_{t-1}					
	FIJI		PNG		SI	
Model						
a - λ_1	-0.850	(-4.076)*	0.008	(-0.030)	-0.980	(-2.709)*
b - λ_2	-0.488	(-2.850)*	-0.101	(-0.605)	-0.728	(-3.041)*
c - $\lambda 3$	-0.266	(-2.577)**	-0.401	(-2.700)**	-0.096	(-0.465)
c - $\lambda 4$	0.138	(1.775)	0.097	(1.254)	0.164	(-1.085)

Notes:

Model a (λ_1) = domestic factors
Model b (λ_2) = External factors
Model c = both (λ_3) domestic and (λ_4) external factors in a single model

* Most equilibrium errors have the expected, negative sign and significant, particularly for models a and b for Fiji and SI.

** Though model c has the correct signs and significant for λ_3 of Fiji and PNG, this is not the case for SI.

Table 3. Decomposition (in %) of forecast error variance of selected SPINs - FIJI

	Pd	GDP_w	CPI_a	GDP_f	EXR_f	EXP_f
			ECM			
Shock To:						
GDP_w						
	1	100.00	0.00	0.00	0.00	0.00
	5	61.56	1.58	12.14	10.10	14.62
	10	57.80	1.78	15.12	11.07	14.23
	15	57.64	1.78	15.33	11.06	14.19
CPI_a						
	1	19.73	80.27	0.00	0.00	0.00
	5	29.04	52.34	1.25	13.53	3.84
	10	29.00	51.23	1.65	14.24	3.88
	15	29.00	51.23	1.66	14.23	3.88
GDP_f						
	1	19.27	3.98	76.75	0.00	0.00
	5	11.43	4.08	72.06	11.75	0.68
	10	11.21	4.66	69.58	13.84	0.71
	15	11.15	4.66	69.65	13.77	0.77
EXR_f						
	1	12.13	9.55	45.83	32.49	0.00
	5	9.65	8.71	35.14	45.02	1.48
	10	9.95	9.02	35.36	44.12	1.55
	15	9.89	8.98	35.65	43.87	1.61
EXP_f						
	1	2.19	1.45	25.83	0.11	70.42
	5	4.60	6.91	14.77	34.28	39.45
	10	6.51	7.70	13.42	36.35	36.02
	15	6.53	7.70	13.46	36.31	36.00

Notes:

Pd = Period in years

GDP_w, CPI_a, GDP_f, EXR_f and EXP_f are attributable to about 14, 4, 1, 2 and 45%, respectively, of EXP_f variability over a 15 year period.

Table 3. (continued) - FIJI

Shock To:	Pd	GDP_w	CPI_a	GDP_f	EXR_f	EXP_f
		VAR				
GDP_w	1	100.00	0.00	0.00	0.00	0.00
	5	86.79	1.49	5.40	4.08	2.24
	10	83.33	1.76	7.70	4.81	2.40
	15	82.88	1.78	8.04	4.88	2.42
CPI_a	1	25.86	74.14	0.00	0.00	0.00
	5	41.92	48.87	0.46	1.58	7.17
	10	41.81	48.72	0.61	1.66	7.20
	15	41.79	48.70	0.64	1.67	7.20
GDP_f	1	26.47	3.82	69.71	0.00	0.00
	5	22.87	3.29	70.53	0.37	2.94
	10	21.90	3.26	70.96	0.68	3.20
	15	21.81	3.27	70.96	0.74	3.22
EXR_f	1	22.14	7.89	40.40	29.57	0.00
	5	15.48	8.06	47.28	28.43	0.75
	10	14.97	7.95	48.18	27.89	1.01
	15	14.91	7.93	48.30	27.82	1.04
EXP_f	1	2.84	1.08	22.69	0.17	73.22
	5	23.67	10.59	16.32	1.03	48.39
	10	23.77	10.58	16.31	1.02	48.32
	15	23.77	10.58	16.31	1.02	48.32

Notes:

Pd = Period in years

GDP_w, CPI_a, GDP_f, EXR_f and EXP_f are attributable to about 2, 7, 3, 1 and 55%, respectively, of EXP_f variability over a 15 year period.

Table 4. Decomposition (in %) of forecast error variance of selected SPINs - PNG

	Variables					
	Pd	GDPw	CPIa	GDPpg	EXRpg	EXPpg
			ECM			
Shock To:						
GDP_w	1	100.00	0.00	0.00	0.00	0.00
	5	59.18	0.81	1.48	24.92	13.61
	10	59.14	0.82	1.49	24.92	13.63
	15	59.14	0.82	1.49	24.92	14.19
CPI_a	1	18.90	81.10	0.00	0.00	0.00
	5	32.27	21.47	12.14	21.31	12.81
	10	32.17	21.42	12.21	21.35	12.85
	15	32.17	21.42	12.21	21.35	12.85
GDP_{pg}	1	30.99	7.42	61.59	0.00	0.00
	5	36.19	3.99	25.60	11.85	22.37
	10	36.08	3.97	25.61	12.07	22.27
	15	36.08	3.97	25.61	12.07	22.27
EXR_{pg}	1	51.32	0.95	6.41	41.32	0.00
	5	46.01	0.48	2.55	28.33	22.63
	10	45.98	0.48	2.61	28.34	22.59
	15	45.98	0.48	2.61	28.34	22.59
EXP_{pg}	1	32.02	15.98	6.32	1.11	44.57
	5	29.70	5.76	8.45	13.17	42.92
	10	29.59	5.75	8.51	13.34	42.81
	15	29.59	5.75	8.51	13.34	42.81

Notes:

Pd = Period in years

GDP_w, CPI_a, GDP_{pg}, EXR_{pg} and EXP_{pg} are attributable to about 14, 13, 22, 23 and 43%, respectively, of EXP_{pg} variability over a 15 year period.

Table 4. (continued) - PNG

	Variables					
	Pd	GDP_w	CPI_{pg}	GDP_{pg}	EXR_{pg}	EXP_{pg}
			VAR			
Shock To:						
GDP_w						
	1	100.00	0.00	0.00	0.00	0.00
	5	54.99	0.81	0.52	23.37	20.31
	10	54.74	0.81	0.53	23.43	20.49
	15	54.74	0.81	0.53	23.43	20.49
CPI_a						
	1	9.59	90.41	0.00	0.00	0.00
	5	23.69	38.60	12.55	16.44	8.72
	10	23.56	38.57	12.57	16.39	8.91
	15	23.56	38.57	12.57	16.39	8.91
GDP_{pg}						
	1	30.09	6.46	63.45	0.00	0.00
	5	33.10	8.19	33.00	4.64	21.07
	10	32.83	8.17	32.76	5.11	21.13
	15	32.83	8.17	32.76	5.11	21.13
EXR_{pg}						
	1	43.72	3.12	7.66	45.50	0.00
	5	44.67	1.90	4.12	28.90	20.41
	10	44.48	1.91	4.11	28.99	20.51
	15	44.48	1.91	4.11	28.99	20.51
EXP_{pg}						
	1	17.60	36.33	4.19	0.12	41.76
	5	19.63	23.31	9.84	4.26	42.96
	10	19.56	23.33	9.84	4.34	42.93
	15	19.56	23.33	9.84	4.34	42.93

Notes:

Pd = Period in years

GDPw, CPIa, GDP_{pg}, EXR_{pg} and EXP_{pg} are attributable to about 20, 9, 21, 21 and 43%, respectively, of EXP_{pg} variability over a 15 year period.

Table 5. Decomposition (in %) of forecast error variance of selected SPINs - SI

		Variables				
	Pd	GDI_w	CPI_a	GDP_{si}	EXR_{si}	EXP_{si}
			ECM			
Shock To:						
GDP_w						
	1	100.00	0.00	0.00	0.00	0.00
	5	93.59	1.34	2.58	1.71	0.78
	10	92.73	1.45	2.64	2.38	0.80
	15	92.70	1.45	2.64	2.41	0.80
CPI_a						
	1	2.86	97.14	0.00	0.00	0.00
	5	52.38	41.20	4.50	1.43	0.49
	10	52.01	40.96	4.53	1.99	0.51
	15	51.99	40.95	4.53	2.02	0.51
GDP_{si}						
	1	0.00	29.17	70.83	0.00	0.00
	5	43.86	21.59	28.53	5.37	0.65
	10	43.83	21.57	28.51	5.44	0.65
	15	43.83	21.57	28.51	5.44	0.65
EXR_{si}						
	1	16.44	30.11	5.97	47.48	0.00
	5	25.31	18.47	3.57	50.37	2.28
	10	25.08	18.40	3.60	50.63	2.29
	15	25.08	18.40	3.60	50.63	2.29
EXP_{si}						
	1	0.05	12.47	40.23	0.08	47.17
	5	38.56	17.97	20.86	1.99	20.62
	10	38.43	17.93	20.81	2.29	20.54
	15	38.42	17.93	20.81	2.31	20.53

Notes:

Pd = Period in years

GDP_w, CPI_a, GDP_{si}, EXR_{si} and EXP_{si} are attributable to about 1, 1, 1, 2 and 27%, respectively, of EXP_{si} variability over a 15 year period.

Table 5. (continued) - SI

	Pd	GDP_w	CPI_a	GDP_{si}	EXR_{si}	EXP_{si}
			VAR			
Shock To:						
GDP_w	1	100.00	0.00	0.00	0.00	0.00
	5	88.06	3.32	0.91	3.83	3.88
	10	87.86	3.31	0.91	4.01	3.91
	15	87.86	3.31	0.91	4.01	3.91
CPI_a	1	5.04	94.96	0.00	0.00	0.00
	5	35.60	53.94	3.57	2.96	3.93
	10	35.63	53.75	3.56	3.11	3.95
	15	35.63	53.75	3.56	3.11	3.95
GDP_{si}	1	0.19	24.12	75.69	0.00	0.00
	5	38.75	22.89	28.99	6.29	3.08
	10	38.78	22.88	28.97	6.29	3.08
	15	38.78	22.88	28.97	6.29	3.08
EXR_{si}	1	11.42	17.22	11.21	60.15	0.00
	5	30.12	10.40	5.45	50.17	3.86
	10	30.06	10.37	5.44	50.25	3.88
	15	30.06	10.37	5.44	50.25	3.88
EXP_{si}	1	0.02	13.87	30.93	2.83	52.35
	5	11.33	18.57	24.56	4.28	41.26
	10	11.36	18.56	24.54	4.31	41.23
	15	11.36	18.56	24.54	4.31	41.23

Notes:

Pd = Period in years

GDP_w, CPI_a, GDP_{si}, EXR_{si} and EXP_{si} are attributable to about 4, 4, 3, 4 and 44%, respectively, of EXP_{si} variability over a 15 year period.

Fig. 1 EXPf impul. responses - ECM
Shock to all 5 variables - Fiji

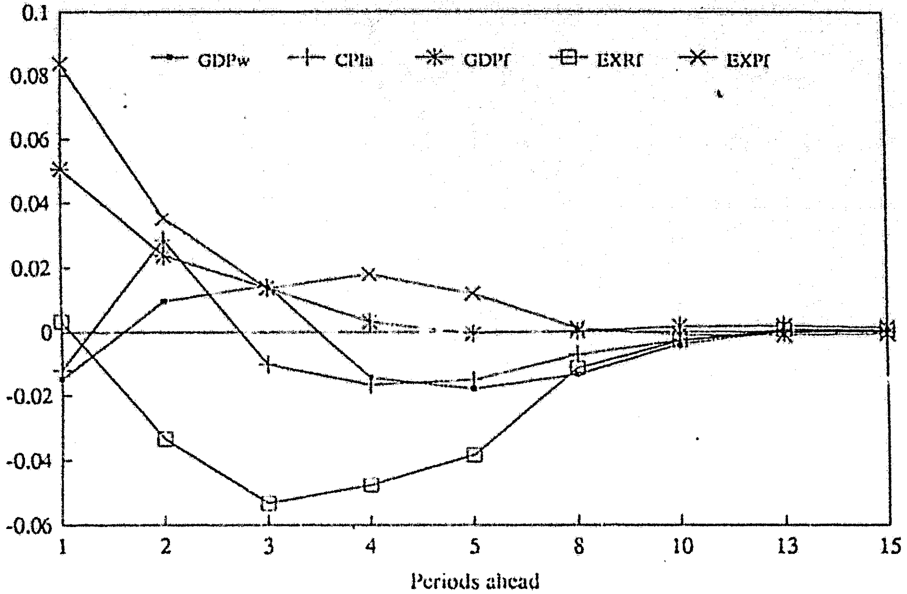

Fig. 2 EXPf impul. responses - VAR
Shock to all 5 variables - Fiji

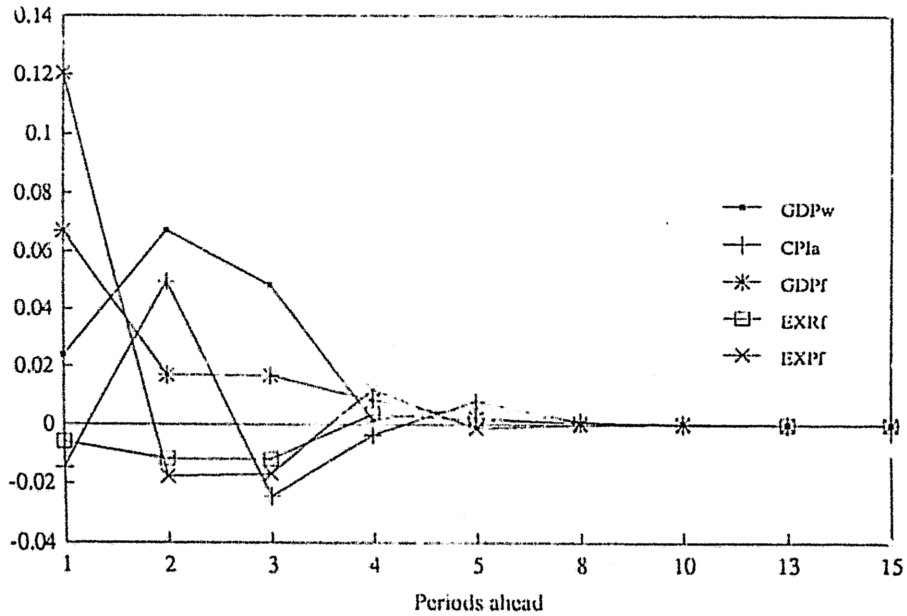

Fig. 3 EXPpg impul. responses - ECM
Shock to all 5 variables - PNG

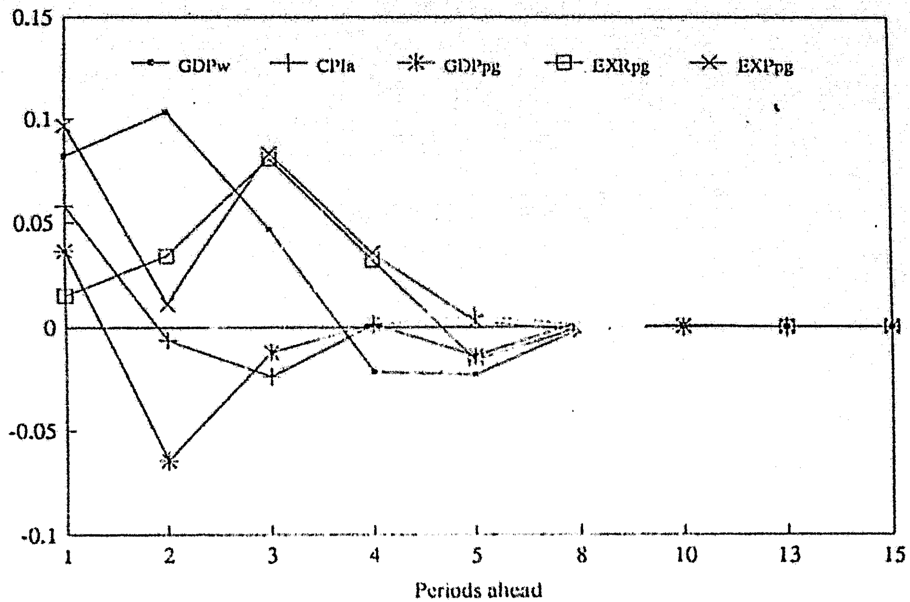

Fig. 4 EXPpg impul. responses - VAR
Shock to all 5 variables - PNG

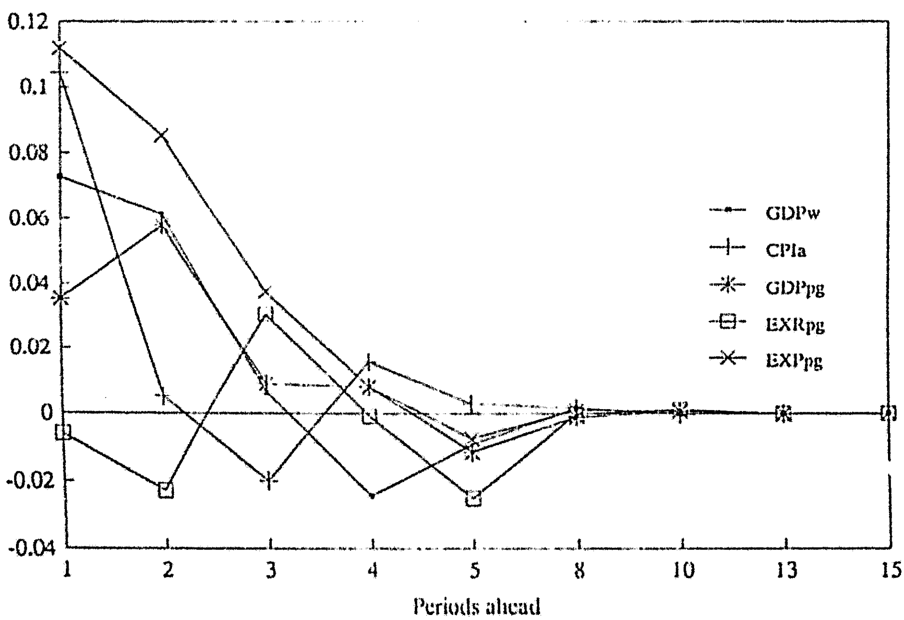

Fig. 5 EXPsi impul. responses - ECM
Shock to all 5 variables - SI

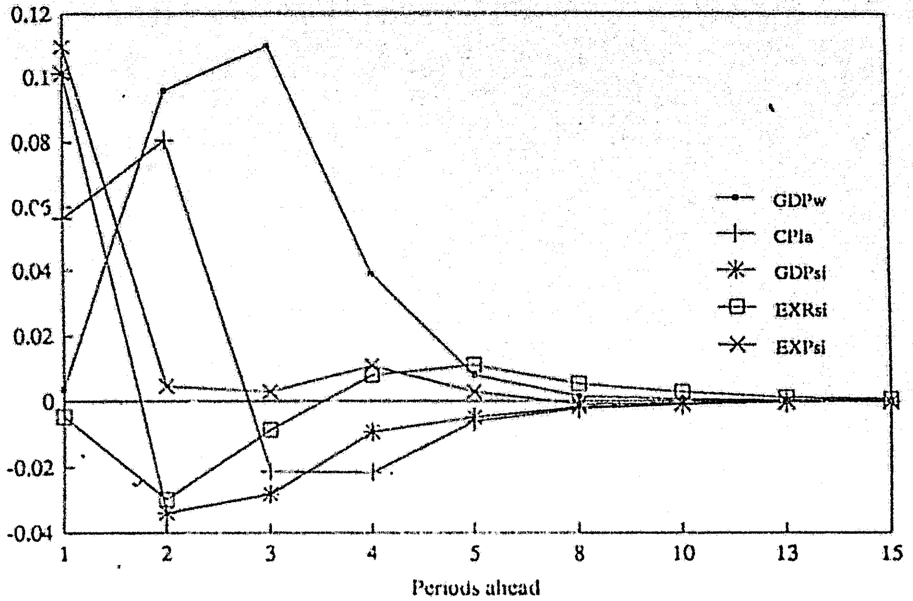

Fig. 6 EXPsi impul. responses - VAR
Shock to all 5 variables - SI