COINTEGRATION TESTS ON TRADE EQUATIONS:
IS DEVALUATION AN OPTION FOR FIJI

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COINTRODUCTION TESTS ON TRADE EQUATIONS: IS DEVALUATION AN OPTION FOR FIJI?

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Abstract

In this paper, the two crucial trade equations, viz exports and imports are estimated for Fiji using alternative time series approaches of LSE-Hendry’s General to Specific (GETS), Johansen Maximum Likelihood (JML) and Phillips-Hansen’s Ordinary Least Squares (FMOLS). The results with proper specification of relative price indicate that income and price elasticity of exports are around unity and -1.25, respectively and those for imports are 1.20 and 0.50. Therefore, exports could be considered as an engine of growth and devaluation can be useful in improving trade performance. However, we suggest that devaluation would be costly due to the lack of productivity in export sector. Consequently, alternative policies are needed to boost supply of exports.

KEYWORDS: Devaluation, Exports and Imports in Fiji and Time Series Methods in Trade Equations

* I am grateful to Professor B. B. Rao for his encouragement and comments. However errors are my responsibility.
1 INTRODUCTION

Trade plays a crucial role in growth process. In Fiji, the average share of trade (sum of exports and imports) on GDP over the last five years has been around 75%. Further, the high growth rates of the early 1990’s have been largely attributed to export promotion policies. While traditional exports such as sugar, garments, gold, fisheries/marine products and other agricultural commodities dominate exports, recently tourism has become the largest foreign exchange earner and contributes around 20% to GDP. However, most of these traditional exports have become highly incompetent in the world market due to decline in their productivity. While reforms and other government initiatives are being implemented, international shocks such as the expiry of the trade agreements (LOME and SPARTECA) pose serious threats to the sugar and garment industries. Although Fiji is an insignificant player in the world market, exports play an important role in generating foreign exchange reserves for financing imports and facilitating capital formation. Imports are largely for consumption purposes. However, raw materials and intermediate goods constitute a significant proportion of total imports. Increased levels of imports with sluggish exports performance has led to massive trade deficits which now stands at around 25% of GDP.

Improving current account situation requires prudent trade policies, which in turn require proper estimation of income and price elasticities in trade equations. The Marshall-Learner condition implies that a real devaluation leads to improvement in trade balance if the sum of the absolute value of relative price elasticities of exports and imports exceed unity. Further, if the income elasticity of exports is also high, exports could be treated as the engine of growth. However, in some influential empirical works including those of the IMF - see for example, Senhadji (1998) and Senhadji and Montenegro (1999), the relative price (in logs) is defined as $ln\left(\frac{P_t}{PF_t}\right)$ ignoring the effect of the exchange rate. We shall refer to this as the IMF specification. It is necessary to pay close attention to the specification of relative price because such mis-specifications, through the omitted variable effect, may give biased estimates of the income and price elasticities. Since the relevant relative price variable has three components viz. $P_t$, the price level in domestic country, $PF_t$, the price level in the trading partner countries and $E_t$, the nominal exchange rate, relative price should be specified as $ln\left(\frac{P_t}{E_t \times PF_t}\right)$.\(^1\) It is clear that a 1% decline in the rela-

\(^1\) where $E_t$ is defined as the price of a unit of foreign currency expressed in domestic currency. An increase in $E_t$ implies a depreciation of domestic currency and a proportionate decrease in relative price.
tive price could be due to a 1% decline in $P_t$ or a 1% increase in $E_t$ or $PF_t$. The impact of omitting $E_t$ on the estimated relative price and income elasticities are, a priori, not known. Maddala (1992) shows that the omitted variable bias could be computed by multiplying the coefficient of the excluded variable with the coefficient in a regression of the excluded variable on the included variable(s). Based on Maddala’s approach, Rao and Singh (2006) using Fiji data have shown that omitting $E_t$ leads to an over-estimation of the income elasticity by 40% to 60%.

However, in the IMF specification, the impact of a devaluation cannot be directly computed. Nonetheless, it seems to be widely used to quickly obtain empirical results since inclusion of $E_t$ tends to produce implausible results. Further, some studies have used the relative price in “split-form” by separating the two prices $P_t$ and $PF_t$. However, since the two prices are highly correlated, the estimated coefficients will be distorted. Fiji data from 1970-2002 shows that the correlation between Fiji’s export price and its trading partners’ export price is 0.948 which implies that the split-form specification is inappropriate. These mis-specification have implications for growth policy based on trade promotions. If the income elasticity for example is over estimated, policy makers with the assumption that trade liberalization will bring fortunes to their economies, will not be wary of improving productivity and export competitiveness. Consequently, the deterioration of relative prices may overshadow the anticipated gains from trade liberalization. Therefore, this paper applies various time series methods to estimate exports and imports equations with proper specification of relative prices. The objectives are to estimate the implied elasticities and evaluate if a devaluation would improve Fiji’s current account balance. The paper is organized as follows: Section 2 is a brief survey of empirical works on trade equations in Fiji. In sections 3 and 4, respectively, the specification and empirical results are discussed and the conclusion & policy implications are stated in Section 5.

2 A BRIEF SURVEY OF LITERATURE

There are numerous studies on exports and imports for both developed and developing countries. In most of these studies two important variables are emphasized, viz, activity and relative prices. In exports equations, trading partner GDP or some measure of foreign demand conditions play a major role and in imports functions, domestic income is the key explanatory variable. While trade patterns are dominated
by global demand conditions, relative price is also important. Oskooee and Brooks (2003) modeled the US exports and imports using the JML approach and found that the long-run income and price elasticities were 3.35 and 3.10 for imports and 2.07 and -0.99 for exports, respectively.\(^1\) In the two comprehensive IMF studies, Senhadji (1998) and Senhadji and Montenegro (1999) estimated imports and exports equations for 77 and 75 countries, respectively, using OLS and FMOLS methods. However, they used the IMF specification of relative prices and the activity variables in both are proxied by respective GDP less exports. For example, in exports equations, trading partners’ GDP less exports are used and for imports, domestic GDP less domestic exports are taken. The implied long-run mean estimates of income and price elasticities of both the equations with alternative approaches are summarized in Table-1 below.

### Table-1: IMF Cross-Country Survey
Imports and Exports Equations- Alternative Estimates

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>FMOLS</th>
<th>FMOLS*</th>
<th>OLS</th>
<th>FMOLS</th>
<th>FMOLS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\ln\left[\frac{P_t}{P_{Fe}}\right])</td>
<td>0.32</td>
<td>1.08</td>
<td>1.07</td>
<td>-0.27</td>
<td>-1.02</td>
<td>-1.07</td>
</tr>
<tr>
<td></td>
<td>(0.21)</td>
<td>(1.08)</td>
<td>(1.06)</td>
<td>(0.20)</td>
<td>(0.97)</td>
<td>(1.04)</td>
</tr>
<tr>
<td>(\ln Y_t)</td>
<td>0.56</td>
<td>1.45</td>
<td>1.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.39)</td>
<td>(0.93)</td>
<td>(0.93)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\ln Y_{Tt})</td>
<td></td>
<td></td>
<td></td>
<td>0.59</td>
<td>1.47</td>
<td>1.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.35)</td>
<td>(0.85)</td>
<td>(0.84)</td>
</tr>
</tbody>
</table>

Estimated mean values of the implied long-run elasticities for imports are in the first three columns followed by those for exports. Standard deviations are reported below the coefficients. Small sample bias corrected estimates are in FMOLS*.

Both these studies show that while there were large variations in price and income elasticities across countries, on average, the long-run price and income elasticities were 1.07 (1.06) and 1.45 (1.32), respectively.\(^2\) Senhadji (1998) argue that industrial countries have

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\(^1\) While their specification of the relative price variable is correct, they have used an ad hoc procedure for selecting the order of the VAR, based purely on the goodness of fit criteria. However, this procedure is somewhat restrictive and time consuming. Furthermore, their selected order of 3 is not much different from an order of 2 implied by the standard SBC and AIC tests. Therefore, one wonders whether it is worth computing the goodness of fit statistics by estimating the cointegrating equations and the ARDL to determine an optimal VAR order.

\(^2\) The standard deviations are reported in brackets. It is noted that while their
significantly higher income and lower relative price elasticities than developing countries. However, he did not report their respective estimates separately. Senhadji and Montenegro (1999) found that Asian countries have higher price and income elasticities than developed or other developing countries. This implies that for these economies, export promotion polices are highly effective and exports are the engine of growth. They also suggest that other developing counties have lower price and income elasticities than developed economies and the African countries, in particular have the lowest. Although these two studies are comprehensive, it may be noted that both samples constitute a mixture of developed and developing countries. However, it would be more interesting to review some cross country studies based on developing economies. In this respect, Reinhart (1995) in her sample sample of 12 developing countries found that the average price and income elasticities for imports were -0.66 and 1.31, respectively. For these countries, her results showed that the price and income elasticities for exports were -0.44 and 1.99, respectively. However, we are unable to obtain her paper for further review and our observations are based on Senhadji’s survey.

Similar studies in Fiji are only a handful and most of them seem to have limitations. Murphy (1992) estimated imports and exports equations for Fiji using annual data from 1974-1986. He dis-aggregated exports into three major categories, viz sugar, other goods and travel, but treated imports as a composite good. Essentially, he has used the Partial Adjustment Model (PAM) with expectations that real imports/exports (excluding tourism) would adjust to their equilibrium levels. The equilibrium values of both for exports and imports were computed using an optimization output equation in his macroeconomic model. His estimated imports equation is:

\[ \Delta \ln RM_t = 0.016 + 0.382 \ln RM^* + 0.618 \ln RM_{t-1} \]

\[ (1.06) \ (2.73)^* \ (--) \]  

\[ Period: \ 1974 - 1986 \]

\[ \bar{R}^2 = --, \ SER = 0.055, \ DW = 2.89 \]

where \( RM_t \) is real imports of goods and services and \( RM^*_t \) is its equilibrium value. \( (--\) \) indicates that the statistics were not reported in the original paper and \( * \ & ** \) indicates significance at 5% and 10% level respectively. The exports equations are modeled as both demand and supply functions. The first two (sugar and other goods) sample average elasticities are same, the standard deviations are slightly different.
are estimated as supply functions in PAM formulation with a pre-specified speed of adjustment of 40% each. However, travel is further dis-aggregated into tourism and other services. While Murphy assumes that other services depend on tourism activities, he takes the view that demand for tourism depends on relative prices. His estimated tourism export demand equation is as follows:

$$\Delta \ln X_T^T = -1.50 + 0.023T - 0.650 \ln \left[ \frac{P_t}{E_t \times P_{Ft}} \right]$$

$$+ 0.713 \ln X_{T-1}^T$$

(0.540) (3.06)* (1.79)**

$$\bar{R}^2 = 0.055, DW = 2.89$$

The period is 1974-1986.

Reddy (1997) estimated both demand for exports and imports using the OLS method. His estimated income elasticities were 0.761 and 2.385 for exports and imports, respectively, and the relative price elasticities specified in the IMF specification were -0.778 and -1.530. He concluded that although a devaluation would eventually lead to an improvement in current account balance, it would have negative implications in the short-run. However, a few limitations can be noted. Reddy failed to test for unit roots or cointegration but estimated the equations in the levels of I(1) variables which leads one to conclude that his estimates are spurious. Further, like others, he has also misspecified the relative price variable variable.

Rogers (2000) used the IMF specification and modeled import equation using annual from 1968-1998. She applied an unrestricted ECM procedure and found that the income and price elasticities were around 1.80 and 0.60, respectively. Guided by Rogers, Prasad (2000) applied a similar methodology and estimated an exports equation for the same sample period. She showed that the implied long-run income elasticity of exports was 2.45. However, there are some limitations in both the studies. The unit root test results (see Table-1 in both
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papers) need further attention. Specifically, Rogers finds that real GDP is stationary in levels, which is doubtful. Second, it is not clear how they estimated the cointegrating vectors as there were no lagged error correction terms in either of their dynamic equations. Prasad failed to explain why Fiji’s exports should be treated as a luxury good by the trading partner countries.

Similarly, Narayan and Narayan (2004 & 2005) estimated income and price elasticities for both exports and imports, respectively, for Fiji using the ARDL, Dynamic Least Squares and FMOLS methods. They used annual data from 1970-2002 for exports and 1972-1999 for imports, respectively. Their results show that the long-run income elasticity for exports is around 0.80, while that for imports ranges from 1.05 to 1.90. However, like other studies, there are problems in the specification of relative prices in both the studies.

Recently, Rao and Singh (2006) obtained close results with GETS and FMOLS by using the correct specification of relative price. Their implied long-run relative price elasticity is -0.86 in GETS and -1.02 in FMOLS. The income elasticity is not different from unity in all their estimates. As indicated earlier, they showed that mis-specification of relative price leads to an over-estimation of the income elasticity by 40-60%. However, they claim that similar estimate for relative price elasticity is difficult because, first, devaluations did not dominate the Fiji data and second, the bias is low because the coefficient of $E_t$ in the auxiliary regression is small. Based on Rao and Singh, we re-estimate both exports and imports equations for Fiji using JML, GETS and FMOLS methods for the sample period of 1970-2002 with proper specification of relative prices.

3 THE SPECIFICATION

Both exports and imports are treated as two separate composite goods and their specifications are conventional demand equations, where real quantities are related to relative prices and income variables. Although further dis-aggregation along the lines of Murphy is valuable, this is outside the scope of the present study. Total exports are expected to respond positively to an increase in foreign income and similarly, imports are expected to increase with domestic income. A raise in the relative prices would lead to a decline in the demand for exports and increase Fiji’s demand for imports. Therefore, our basic specifications for exports and imports equations are as follows:
\[ \ln X_t = \alpha_0 + \alpha_1 \ln \left( \frac{P_t}{E_t \times P_{Ft}} \right) + \alpha_2 \ln YT_t + \epsilon_t \] 

(3)

\[ \ln RM_t = \beta_0 + \beta_1 \ln \left( \frac{P_t}{E_t \times P_{Ft}} \right) + \beta_2 \ln Y_t + \phi_t \] 

(4)

Where: \( X_t \) and \( RM_t \) are real exports and imports, \( P_t \) is Fiji’s export price index and that for the trading partners is \( P_{Ft} \). \( E_t \) is the nominal exchange rate and \( YT_t \) and \( Y_t \) are Fiji’s and trading partners’ real income. \( \epsilon_t \) and \( \phi_t \) are the error terms with the usual classical properties and \( \alpha_1 \) and \( \beta_1 \) are expected to be negative and positive coefficients, respectively. A detailed description of the variables and data are given in Appendix A-2. All variables in both equations (3 and 4) are tested for unit roots and are found to be I(1) in levels and I(0) in first difference; see Appendix A-1 for details of unit root tests. Later it was necessary to include \( SS \) - a measure of supply shock which is I(1) in levels and stationary in its first difference. The empirical results for exports equation are discussed below followed by imports which are discussed in the subsequent section.

4 EMPIRICAL RESULTS

4.1 THE JML METHOD

This section reports the estimates of exports equation using the JML procedure. The variables, \( \ln X_t, \ln \left( \frac{P_t}{E_t \times P_{Ft}} \right) \) and \( \ln YT_t \) are subjected to the Johansen cointegration test together with an intercept and a trend term included as exogenous variables in a VAR(4) framework. Both the SBC and AIC suggest that VAR(1) is adequate and we selected with a restricted intercept and no trend option. Both the eigenvalue and the trace statistics reject the null of no cointegration, but indicate that there exists at least one cointegrating vector. The eigenvalue and the trace statistics are, respectively, 19.163(19.860) and 32.697(31.930) for the null that there is no cointegration and 8.349(15.870) and 13.534(20.180) for at least one long-run relationship. The 95% critical values are given in parenthesis and the selection

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4 The supply shock is proxied with average sugar productivity per hectare (in 000’s tonnes) in Fiji. This measure of \( SS \) is consistent with Prasad (2000). However, the SS variable is I(1) with a longer lag structure of six periods, compared to short lag structures of other variables in the ARDL.
of the CV is based on trace test. The cointegrating vector normalized on $lnX_t$ is given in column JML(a) of Table-2. Note that although, the two crucial elasticities are correctly signed, the relative price elasticity is not significant at conventional levels. However, the income elasticity is significant and plausible.

<table>
<thead>
<tr>
<th>Table-5: Implied Long-run Elasticities Our Alternative Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
</tr>
<tr>
<td>JML(a)</td>
</tr>
<tr>
<td>$ln\left[ \frac{P_t}{E_t \times P_{t-1}} \right]$</td>
</tr>
<tr>
<td>(0.67)</td>
</tr>
<tr>
<td>$lnY_{Ft}$</td>
</tr>
<tr>
<td>(2.29)*</td>
</tr>
<tr>
<td>Const.</td>
</tr>
<tr>
<td>(1.11)</td>
</tr>
<tr>
<td>Trend</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SS</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

The t-ratios are reported below the coefficients and significance at 5% and 10% are indicated by * and ** respectively. The CVs are normalised on $lnX_t$ and $lnRM_t$. Microfit 4.1 of Pesaran and Pesaran (1997) is used for estimation.

There are some caveats to the JML results. The exogeneity tests based on Enders (2004) show that relative price is mildly exogenous as the lagged ECM term is significant only at 11.8% in the selected VAR. Therefore, the JML estimate reported in Table-2 should be interpreted with caution. However, the identification tests were satisfactory. In estimating the dynamic adjustment equations, we used the one period lagged residuals and applied GETS in the second stage. Starting with lags upto 4 periods and by sequentially deleting insignificant variables we obtained the parsimonious equations reported in Table-3, see columns 5(a) and 5(b). The t-ratios are indicated below the coefficients, except for the $\chi^2$ summary statistics where p-values are in brackets. The $\chi^2_{f,2}$ is for the null of functional form mis-specification, $\chi^2_n$ for nomality in residuals, $\chi^2_{sc}$ for serial correlation and $\chi^2_{hs}$ is for heteroscedasticity. The unconstraint VECM is reported as (5a). Note that the estimates are reasonable with the error correction term having
the correct negative sign indicates that near 15% adjustments completed within a year. None of the summary $\chi^2$ statistics, except the $\chi^2_{(ff)}$ are significant at 5% level. To further improve our results, we incorporated a few parameter restrictions. Note that the coefficients of $ECM_{t-1}$ and $\Delta \ln X_{t-2}$ are similar in magnitudes and signs. Similar conclusions are drawn for $SS_{t-1}$ and $SS_{t-2}$. The Wald test accepted the null that these paired variables are equal and this gives the preferred VECM in (5b). The SER has marginally declined and the $\chi^2$ summary statistics have improved. The ECM term also gained significance. The TIMVAR stability tests indicates temporal stability of the preferred VECM equation.\footnote{An in-sample fit of actual vs. predicted values of growth of exports had an $R^2$ of 0.768 and the SER is 0.069. The fitted equation has an intercept of zero and the slope is unity. The actual vs. fitted graphs and stability test graphs are not produced here to conserve space. However, they are available from the author upon request.}

4.2 THE GETS APPROACH

This section discusses the results obtained with the GETS approach. Note in the JML, the VAR was only meaningful with a restricted intercept and no trend option. Therefore, the GETS equation is estimated with the NLLS to restrict the intercept term. Starting with lags up to 4 periods and by sequential deleting the insignificant variables, we obtained the implied long-run income and relative price elasticities detailed in column GETS(a) of Table-2. Note that both the crucial elasticities have expected signs and are better determined than JML. The implied long-run income and relative price elasticities are around unity and -1.25, respectively.

The full GETS equations are reported in columns 6(a) and 6(b) of Table-3. In (6a), the SER is around 0.09 and there are no residual problems as none of the $\chi^2$ summary statistics are significant at 5% level. However, we noted that the inclusion of $\Delta \ln X_{t-2}$ leads to the mild insignificance of the implied long-run elasticities. Therefore, it was excluded from the model. This gives 6(b) which is the preferred GETS equation. The plot of actual vs. predicted values from 6(b) indicates that oscillations in exports are adequately captured and the TIMVAR stability tests results indicate temporal stability.\footnote{The fit of the actual vs. predicted values of growth of exports gives $R^2$ of 0.535 and the SER was 0.097. This seems somewhat low. The graph of actual and fitted values and for temporal stability are not produced here to conserve space. However, they are available from the author upon request.}
Subjecting the exports function to Phillips-Hansen’s procedure gave better results. This is perhaps due to mild endogeneity that was noted with JML. The implied long-run elasticities obtained with FMOLS are reported in FMOLS(a), see Table-2. However, unlike in the GETS and JML, we are unable to restrict the intercept term in the VAR. It was also necessary to include a supply dummy ($SS$) in FMOLS estimates. All the estimated long-run elasticities, except that of $SS$,
are significant and have the expected signs. It is noteworthy that, like in GETS but unlike in JML, there are only marginal differences in the estimated relative price elasticities of $-1.018$ against $-1.248$. Moreover, there are no significant differences in the estimated income elasticities of $0.995$ against $1.066$ between GETS and FMOLS.

The dynamic version of FMOLS are obtained by applying the general to specific approach in the second stage. The unconstraint estimates are in 7(a) of Table-3. The results are reasonable and none of the $\chi^2$ summary statistics are significant at 5% level. However, to further improve the 7(a), we adopted some parameter restrictions noting that $\Delta \ln Y_{t-2}$ and COUP are similar in signs and magnitudes. The COUP dummy is computed as 1 since 1987 to 2000, and zero in other periods. Similar conclusions are drawn regarding $RES_{t-1}$ and $\Delta \ln X_{t-2}$. The Wald test approved both these restrictions and the preferred FMOLS dynamics of 7(b) is obtained where none of the $\chi^2$ summary statistics are significant at 5% level. The SER is around 0.06 and is comparable to 6(b) of GETS. An in-sample plot of actual vs. predicted values of the exports indicate that the model predicts changes in exports reasonably well. Since there are no minor differences between the two preferred dynamic exports equations of GETS 6(b) and FMOLS 7(b), it can be concluded that the implied long-run income and price elasticities of exports are around unity and as high as -1.25, respectively.

4.4 THE IMPORTS EQUATION

This section reports the estimates of imports equation using the afore-said three approaches. The variables $lnRM_t$, $ln\left[\frac{P_t}{E_t \times P_{F_t}}\right]$ and $lnY_t$ were subjected to the JML tests with an intercept and a trend term in a VAR(3) framework by allowing $(SS_{t-1})$ and a COUP dummy as exogenous variables. The AIC suggested VAR(2), but the SBC indicated that VAR(1) was adequate. Given our sample size, we selected VAR(1). The eigenvalue and the trace statistics rejected the null that there is no cointegration, but accepted the alternative of at least one long-run relationship. The eigenvalue and trace statistics are, respectively, 26.780 (25.420) and 48.339(42.340) for the null that there are no cointegration. Details are available from the author upon request.

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6 The graph of the fit is not reported to conserve space. It has $R^2$ of 0.807 and the SER of 0.064. The fitted equation does not have an intercept, but the slope is unity. The TIMVAR tests (not reported) indicates temporal stability of the preferred equation. Details are available from the author upon request.
Cointegration and Devaluation

no cointegrating vectors and 12.874(19.220) and 21.559(25.770) for at least one long-run relationship. The selected cointegrating vector normalized on $\ln RM_t$ is given in JML(b) of Table-2. Both the crucial elasticities are well determined with correct signs and are statistically significant at 5% level.

However, the weak exogeneity tests were not conclusive as ECM$_{t-1}$ was significant when the dependent variables were $\Delta \ln RM_t$ and $\Delta \ln Y_t$. Thus, it is hard to say that income can be treated as a weakly exogenous variable in imports equation. Therefore, the single equation methods may give biased estimates. Nonetheless the bias depends on the degree of endogeneity. In this respect, JML, FMOLS but GETS with instrumental variables are useful. While GETS with instruments are not applied, the other two are given below. Further, the above signals for a two equation VAR model which is not only a tedious procedure but is more applicable for forecasting. As it is usual in empirical works, the obtained CV is interpreted as the equilibrium imports equation.

In estimating the dynamic counterparts, the general to specific philosophy was applied and the parsimonious VECM equations are reported in columns 8(a) and 8(b) of Table-6. The estimates are noteworthy and the error correction term has the correct negative sign with a near 70% adjustments completed within a year. Further, none of the summary $\chi^2$ statistics are significant at the 5% level and the SER is around 0.06. To further improve the results, restrictions on $\Delta \ln \frac{P_E}{E \times PF}$ and $\Delta \ln Y_{t-4}$ were imposed since they were similar in signs and magnitudes. The null was easily accepted by the Wald test. The results are given in equation 8(b) which is the preferred VECM model. Note that the SER has dropped marginally and the individual variables gained significance. Further, none of the $\chi^2$ statistics are significant at 5% level.$^8$

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7 The 95% critical values are given in parenthesis. The null that $r = 1$ was also accepted for VAR(2). However, the implied income elasticity seemed somewhat low for Fiji.

8 The plot of actual vs. fitted values of growth of imports indicates that the in-sample predictions are good. A fit of the actual vs. predicted values has zero intercept and 1.00 as the slope. The $R^2 = 0.830$ and the SER is 0.049. The TIMVAR stability tests results indicate that the 8(b) is structurally stable. Details are available from the author.
### TABLE 6: Dynamic Imports Equations

<table>
<thead>
<tr>
<th>JML</th>
<th>GETS</th>
<th>FMOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>8a</td>
<td>8b</td>
</tr>
<tr>
<td>Trend</td>
<td>0.02</td>
<td>0.043</td>
</tr>
<tr>
<td>ln $M_{t-1}$</td>
<td>-0.624</td>
<td>-0.623</td>
</tr>
<tr>
<td>ln $X_{t-1}$</td>
<td>0.834</td>
<td>0.837</td>
</tr>
<tr>
<td>$\ln \left( \frac{P_{D_{t-1}}}{P_{E_{t-1}}^{1.5}} \right)$</td>
<td>0.254</td>
<td>0.436</td>
</tr>
<tr>
<td>$\Delta \ln \Delta M_{t-1}$</td>
<td>0.347</td>
<td>0.393</td>
</tr>
<tr>
<td>$\Delta \ln X_{t}$</td>
<td>0.787</td>
<td>0.785</td>
</tr>
<tr>
<td>$\Delta \ln X_{t-2}$</td>
<td>(2.47)*</td>
<td>(2.52)*</td>
</tr>
<tr>
<td>$\Delta \ln X_{t-4}$</td>
<td>0.439</td>
<td>0.415</td>
</tr>
<tr>
<td>$\Delta \ln \left( \frac{P_{D_{t}}}{P_{E_{t}^{1.5}}} \right)$</td>
<td>0.411</td>
<td>0.415</td>
</tr>
<tr>
<td>$\Delta \ln \left( \frac{P_{D_{t}}}{P_{E_{t}^{1.5}}} \right)$</td>
<td>(3.67)*</td>
<td>(4.26)*</td>
</tr>
<tr>
<td>$\Delta \ln K_{t-1}$</td>
<td>0.259</td>
<td>0.254</td>
</tr>
<tr>
<td>$S_{t-1}^{\gamma}$</td>
<td>-0.287</td>
<td>-0.288</td>
</tr>
<tr>
<td>$\alpha_{t-1}^{\gamma}$</td>
<td>(3.99)*</td>
<td>(4.16)*</td>
</tr>
<tr>
<td>$\beta_{t-1}$</td>
<td>-0.711</td>
<td>-0.716</td>
</tr>
<tr>
<td>$R^2_{t-1}$</td>
<td>-0.805</td>
<td>-0.792</td>
</tr>
<tr>
<td>$\hat{R}^2$</td>
<td>0.789</td>
<td>0.799</td>
</tr>
<tr>
<td>$S_{EE}$</td>
<td>0.005</td>
<td>0.053</td>
</tr>
<tr>
<td>$x^2 (SC)$</td>
<td>0.115</td>
<td>0.072</td>
</tr>
<tr>
<td>$x^2 (DF)$</td>
<td>(0.73)</td>
<td>(0.79)</td>
</tr>
<tr>
<td>$x^2 (MH)$</td>
<td>1.657</td>
<td>1.668</td>
</tr>
<tr>
<td>$x^2 (NH)$</td>
<td>(0.20)</td>
<td>(0.20)</td>
</tr>
<tr>
<td>$x^2 (PM)$</td>
<td>2.533</td>
<td>2.475</td>
</tr>
<tr>
<td>$x^2 (PM)$</td>
<td>(0.25)</td>
<td>(0.29)</td>
</tr>
</tbody>
</table>

### 4.5 THE GETS APPROACH

The GETS results for imports are estimated using the NLLS proce-
dure. Both the restricted and unrestricted intercept and trend or no trend options were tried. However, except for the unrestricted trend and no intercept, none of the others gave meaningful results. The implied long-run income and relative price elasticities are, respectively, 0.84 and 0.44, see GETS(b) in Table-2 and both are significant with expected signs. The full GETS equation is in (9a) of Table-6. Note that although the SER is low at around 0.06, the implied relative price elasticity is significant only above 10% level. However, the implied long income elasticity is strongly significant and none of the $\chi^2$ summary statistics are significant at 5% level. To further improve the results, it was necessary to exclude $\Delta \ln Y_t$ and $\Delta \ln Y_{t-4}$ from the equation. The final GETS results are given as (9b) where none of the $\chi^2$ summary statistics are significant at 5% level. The SER is around 0.05 and the implied long-run income and relative price elasticities are well-determined and significant. An in-sample plot of actual vs. predicted values of the growth of imports indicates that the model predicts changes in imports, within the sample, reasonably well and is stable.\footnote{The fit of the actual vs. predicted values gives $R^2$ of 0.772 and the SER = 0.042. The fitted equation has an intercept of zero and the slope is unity. The TIMVAR tests suggest that (9b) is temporally stable. The graphs is not reported, but available from the author.}

4.6 THE FMOLS ESTIMATES

The FMOLS based implied long-run elasticities are reported in last column of Table-2.\footnote{Since the trend term was significant in all other methods, it was included in the VAR.} It is noteworthy that, like in JML, the income elasticity is not significantly different from a value of 1.20 and the relative price elasticity is similar to the GETS estimates. Both the crucial elasticities obtained with FMOLS are significant at 5% level. Its dynamic counterpart 10(a) is reported in Table-6. Note that the results are good and none of the $\chi^2$ summary statistics are significant at 5% level. The SER is low at 0.05. It is further improved by adopting a few restrictions. Note that $\Delta \ln \left[ \frac{P_{t-1}}{E_{t-1} \times P_{Ft-1}} \right]$ and $\Delta \ln \left[ \frac{P_{t-4}}{E_{t-4} \times P_{Ft-4}} \right]$ are similar in signs and magnitudes. However, COUP and $\Delta \ln \left[ \frac{P_t}{E_t \times P_{Ft}} \right]$ have similar magnitudes but are opposite in signs. The Wald tests accepted these restrictions an 10(b), which is the preferred FMOLS dynamic equation was obtained. Note that none of the $\chi^2$ summary statistics are significant at 5% level and the SER dropped marginally.
All the included variables are highly significant and around 80% adjustments are completed in the next period. An in-sample plot of actual vs. predicted values of FMOLS estimates indicate that the model predicts changes in imports reasonably well.\textsuperscript{11} Comparing the results for imports, the VECM and FMOLS estimates are quite close. However, FMOLS seems to be better because of some allowance for endogeneity. The GETS results are also reasonable. Thus we conclude that the implied long-run income elasticity for imports is as high as 1.20 and the relative price elasticity is around 0.50.

\section*{5 CONCLUSION & POLICY IMPLICATIONS}

In this paper, previous works on trade equations were surveyed. It was found that the relative price variable was poorly specified in many empirical works, both in Fiji and elsewhere. This leads to biased estimates of crucial elasticities, see Rao and Singh (2006) for a discussion. Our results, based on various time series methods with proper specification of relative prices indicate that the long-run income elasticity for exports is around unity and the relative price elasticity is as high as -1.25. For imports, the implied long-run income and price elasticities are around 1.20 and 0.50, respectively. On this basis, a few policy recommendations can be made. First, high income elasticity implies that exports is an engine of growth. However, reliance on sheer good fortunes of the trading partners may not aid domestic growth. Second, since the Marshall-Learner conditions are fulfilled, it can be concluded that a real devaluation would help reduce trade deficits in the long run. However, this may actually make matter worse for the short-term because, maintaining international competitiveness is only useful if the domestic economy can produce competitive exports of goods and services. In Fiji, the export sector is highly unproductive and such a price adjustment will at most be futile and costly. It will unnecessarily raise the import bills for raw materials, other consumption and investment goods therefore, escalate will inflation in the economy. Thus a real devaluation is not possible in the short-run because the import penetration ratio in Fiji’s inflation is as high as 60%. This suggests that international competitiveness can only be attained by reducing the costs of exports through raising productivity. Fiji

\textsuperscript{11} The fit of the actual vs. predicted values gives an $\bar{R^2}$ of 0.873 and the SER = 0.042. The fitted equation has an intercept is zero and the slope is close to unity. Stability tests indicate that 10(b) is temporally stable. Details are available upon request.
does not have problems of demand as it is a very small player in the world market. The major problem, however, is the lack sufficient and competitive supply of exports. Further, the results show that political instability has negative impact on trade through embargos and exclusions. Therefore, having a stable macroeconomic environment is also important for trade based growth. For the policy makers, the message is clear. Devaluation is not an option unless export productivity can be improved. Recently, in the fear that growing imports might be unsustainable, the Reserve Bank of Fiji (RBF) has increased the rate of interest by 1 percentage point from 2.25% to 3.25% in their attempts to reduce imports. However, containing import demand through interest rates is not pragmatic as consumption expenditure hardly responds to changes in the rate of interest, see Rao and Singh(2004). It would be better to apply monetary approach to BOP management by controlling money supply as there are sufficient evidence that demand for money in Fiji is stable, for recent surveys on demand for money in Fiji, see Rao and Singh(2005) and Singh and Kumar(2006). Thus the RBF should control money supply and embark on policies to raise productivity of exports. Unless policy makers seriously consider these options, a devaluation is unavoidable in the near future, which as a cure is worse than the disease.
Data Appendix-1A

$X_t =$ Quantity of exports, determined by nominal (FOB) export deflated with domestic export unit value index. Source: Key Economic Statistics, (various years)


$R_{Mt} =$ Quantity of imports of goods and services determined by nominal imports deflated with $P_F$. Source: Key Economic Statistics, (various years).


Notes:
1. Trade weights represent respective shares of the trading partners in total trade of Fiji.
2. Data are available for replication on request.
Table-2A: ADF Unit Root Tests

<table>
<thead>
<tr>
<th></th>
<th>Lags</th>
<th>ADF</th>
<th>PP</th>
<th>Lags</th>
<th>ADF</th>
<th>PP</th>
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<tr>
<td>(\ln X_t)</td>
<td>[0,0]</td>
<td>2.74</td>
<td>2.42</td>
<td>[1,1]</td>
<td>6.57</td>
<td>5.91</td>
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<tr>
<td></td>
<td></td>
<td>(0.23)</td>
<td>(0.24)</td>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
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<tr>
<td>(\ln RM_t)</td>
<td>[2,2]</td>
<td>2.26</td>
<td>3.64</td>
<td>[1,1]</td>
<td>6.08</td>
<td>13.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.43)</td>
<td>(0.71)</td>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>(\ln \left[\frac{P_t}{E_t \times P_F_t}\right])</td>
<td>[1,1]</td>
<td>2.71</td>
<td>2.08</td>
<td>[1,1]</td>
<td>6.38</td>
<td>6.08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.06)</td>
<td>(0.08)</td>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>(\ln Y_t)</td>
<td>[1,2]</td>
<td>1.23</td>
<td>1.48</td>
<td>[1,1]</td>
<td>4.46</td>
<td>7.89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.15)</td>
<td>(0.53)</td>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>(\ln YT_t)</td>
<td>[1,1]</td>
<td>2.93</td>
<td>2.00</td>
<td>[1,1]</td>
<td>3.51</td>
<td>4.59</td>
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<tr>
<td></td>
<td></td>
<td>(0.33)</td>
<td>(0.58)</td>
<td></td>
<td>(0.01)</td>
<td>(0.00)</td>
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<tr>
<td>(SS_t)</td>
<td>[6,6]</td>
<td>1.45</td>
<td>1.23</td>
<td>[6,6]</td>
<td>3.48</td>
<td>14.99</td>
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<tr>
<td></td>
<td></td>
<td>(0.54)</td>
<td>(0.20)</td>
<td></td>
<td>(0.02)</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

Notes:
1. The ADF is the usual argumented Dicky-Fuller test and PP is the Phillips-Perron test.
2. The first three columns are for the levels of the variables and the subsequent three are for the first difference.
3. The p-values are reported in parenthesis below the test statistics.
4. Lag lengths for the variables are selected using AIC and SBC criteria. For example [0,1] indicates that lag 0 and 1 are significant in the respective test.
5. The sample periods are (1970-2002) for the levels and (1971-2002) for the first difference variables.
6. An alternative KPSS test on \(\ln \left[\frac{P_t}{E_t \times P_F_t}\right]\) indicates that it is I(1) in levels and I(0) in first difference at 5% level.

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