

ESTIMATING EXPORT EQUATIONS

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Abstract

Accurate estimates of the price and income elasticities of exports are valuable for growth policies based on trade promotion. However, not sufficient attention seems to have been paid to the specification of the relative price variable in some influential empirical works. This paper estimates the export equation for Fiji to show that inappropriate specification of the relative price variable may give under estimates of the price elasticity and over estimates of the income elasticity.

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1. INTRODUCTION

Estimating export demand functions for developing countries is important because the relative price and income elasticities indicate the scope for export-lead growth policies. The higher are these elasticities, the higher is the scope for export based growth policies. Therefore, it is important to avoid misspecification biases. However, in the current empirical literature the specification of the export equations are unsatisfactory. The usual specification for a country's exports X in the log-linear form is:

$$\ln X_t = \alpha_0 - \alpha_1 \ln \left[\frac{P_D}{E \times P_F} \right] + \alpha_2 \ln Y_F \quad (1)$$

where P_D is domestic price of exports, P_F is price level of trading partners, E is exchange rate, measured as the price of foreign currency in domestic currency and Y_F is income of trading partners. Note that the relative price variable has three components viz., P_D , E and (P_F). A 1% percent decline in relative prices could be due to a 1% decline in P_D or a 1% increase in E (depreciation) or P_F .

However, in some influential empirical works e.g., Senhadji and Montenegro (1999), E is ignored in the relative price variable. This procedure seems to be widely used to quickly obtain expected empirical results with techniques like the fully modified OLS (FMOLS) of Phillips and Hansen (1990) and the bounds test (ARDL) of Pesaran and Shin (1995); see Senhadji (1998) and Dutta and Ahmed (2004) for ignoring E in imports. Although the effects of omitting E on the estimated elasticities are difficult to estimate, it may be said that this could lead to an under estimation (over estimation) of the absolute value of price elasticity (α_1) if devaluations (appreciations) dominate the sample. It is hard to say how this omission affects the estimate of income elasticity.¹ This paper illustrates the

¹ A formal econometric proof is complicated because we have used non-linear estimation methods. The approximate bias in OLS estimates can be computed by estimating three equations: (A) is the correct specification, (B) is the misspecified equation and (C) is an auxiliary regression:

aforesaid biases by estimating the export demand function for Fiji (1970-2002). We shall estimate the long run export equation, using the Phillips-Hansen FMOLS, the Johansen (1988) cointegration approach (*JML*) and the LSE-Hendry general to specific approach (GETS); see Hendry (1987). We have ignored the bounds approach of Pesaran and Shin because of its large range of indeterminacy for the cointegration test statistic. Although *JML* gave plausible point estimates of these two elasticities, they were insignificant. In comparison, both GETS and FMOLS gave good and significant estimates.

2. EMPIRICAL RESULTS

The specifications of export equation, with and without E in the relative price variable, are:

$$\ln X_t = \alpha_0 - \alpha_1 \ln \left[\frac{P_D}{E \times P_F} \right] + \alpha_2 \ln Y_F \quad (2)$$

$$\ln X_t = \beta_0 - \beta_1 \ln \left[\frac{P_D}{P_F} \right] + \beta_2 \ln Y_F \quad (3)$$

Definitions of the variables and sources of data are in the Appendix.

JML estimates of (2) and (3) are given in the first two columns of Table-1.² The point estimates of the implied price and income elas-

$$\ln X_t = \alpha_0 - \alpha_1 \ln \left[\frac{P_D}{E \times P_F} \right] + \alpha_2 \ln Y_F \quad (A)$$

$$\ln X_t = \beta_0 - \beta_1 \ln \left[\frac{P_D}{P_F} \right] + \beta_2 \ln Y_F \quad (B)$$

$$\ln P_F = \gamma_0 + \gamma_1 \ln \left[\frac{P_D}{P_F} \right] + \gamma_2 \ln Y_F \quad (C)$$

Maddala (1992) shows that the expected values of the estimated coefficients from the misspecified equation (B) are: $E(\beta_1) = (1 + \gamma_1) \times \alpha_1$ and $E(\beta_2) = (1 + \gamma_2) \times \alpha_2$. Thus, the magnitude of this bias depends on the coefficients in the auxiliary equation.

² We have used a VAR(1) model, after determining its optimal order with both AIC and SBC. However, we faced problems with the Johansen JML procedure. The null that there is at least one cointegrating vector for equation (2) could be

ticities are correctly signed but in neither equation they are significant. Exogeneity tests showed that both the relative price variables are weakly exogenous and the lagged ECM term is significant only at the 11.8% and 10% levels, respectively, in the VAR of equations for (2) and (3). These estimates, normalized on $\ln X$, are reported as JML(2) and JML(3). They should be interpreted only as an indication that ignoring E , in the relative price variable, would lead to an under estimation of the absolute value of relative price elasticity, -2.578 against -1.357 and to an over estimation of income elasticity, 1.147 against 1.641 .

Using these insights, we have estimated equations (2) and (3) with GETS.³ The GETS estimates are in columns (3) and (4) of Table-1. The estimated elasticities, in both equations, are correctly signed and significant. However, the point estimates of price elasticities show that it is only slightly higher in (3) but the null that these two estimates are equal could not be rejected at the 5% level of significance. The computed test statistic is $\chi_1^2 = 1.022$ ($p = 0.312$). In contrast, there are significant difference in the estimates of income elasticities. While equation (2) implies an income elasticity of 1.164 , equation (3) gives an estimate of 1.652 . The computed test statistic for the null that these are equal is $\chi_1^2 = 15.683$ ($p = 0.000$) and the null is rejected.

Estimates with FMOLS are in columns (5) and (6). Unlike the Johansen JML and GETS, FMOLS does not seem to have the option to restrict the intercept and trend in the underlying VAR. Consequently, it became necessary to add a supply shock variable (SS) with a lag of two periods to get meaningful estimates of equation (2). SS is retained in equation (3) for comparable results.⁴ The estimated coefficients in both equations, except that of SS , are significant and have the expected signs. It is noteworthy that, like in GETS, there

accepted only at the 90% level by the trace test. For equation (3) this null is accepted by both the eigenvalue and trace tests at the 95% level.

³ In the Johansen JML, it was necessary to use a restricted intercept in the VAR. Therefore, we have estimated the GETS equations with NLLS to allow for this restriction. However, the intercept was significant only in (2).

⁴ SS is found be I(1) with a long lag structure of 7 periods in the ADF test.

Table 1

Export Equations for Fiji
Alternative estimates

Variable	JML(2)	JML(3)	GETS(2)	GETS(3)	FMOLS(2)	FMOLS(3)
$\ln \frac{P_D}{E \times P_F}$	-2.578		-0.862 (2.56)		-1.018 (3.27)	
$\ln \frac{P_D}{P_F}$		-1.357		-1.202 (3.78)		-1.024 (4.74)
$\ln Y_F$	1.147	1.641	1.164 (9.44)	1.652 (64.48)	0.995 (8.88)	1.379 (15.88)
<i>Const.</i>	2.431	0.056	1.971 (3.75)		2.536 (4.37)	0.974 (1.99)
<i>SS</i>					-0.001 (0.12)	-0.001 (0.16)

Notes: The cointegrating vectors are normalized on $\ln X$. JML(2) means JML estimate of equation (2) etc. t -ratios are in the parentheses. t -ratios for the GETS equations are based on the Newey-West adjustment. t -ratios for the JML equations in columns (1) and (2) are not reported because they are highly insignificant. Microfit 4.1 of Pesaran and Pesaran (1997) is used for estimation.

is no significant differences in the estimated relative price elasticities of -1.018 against -1.024 , but income elasticities are significantly different at 0.995 against 1.379 . The test statistics for the null of no significant difference between them is $\chi^2 = 11.710$ [$p = 0.001$] and the null is rejected.

From these alternative estimates, it can be said that excluding the exchange rate in the relative price variable is perhaps less serious for the estimates of the price elasticity. This may be partly due to the fact that depreciation regimes are relatively less dominant in our sample for Fiji. The Fiji dollar was stable or appreciated in 19 out of 33 periods. It would be interesting to know whether the price elasticity estimates would be close if depreciation regimes dominate in

the samples of other developing countries. However, in these alternative methods, the income elasticity is unequivocally overestimated by 40% to 65% when E is excluded in the relative price variable.⁵ Such a magnitude of overestimation gives the misleading implication that by liberalizing trade, a developing country can substantially increase exports if its trading partners grow faster. What seems to be necessary for the success of an export-lead growth policy is a substantial reduction in the relative prices, either by decreasing domestic costs of exports or through timely adjustments to the exchange rate.

3. CONCLUSIONS

In this paper we have empirically shown that neglecting the exchange rate in the relative price variable of the export equation causes an overestimation of the income elasticity. Although it could not be conclusively shown that this leads to an underestimation of the relative price elasticity, because our sample is not dominated by depreciation regimes, we conjectured that underestimation is likely for countries in which depreciation regimes dominated the sample. Therefore, we hope that our conjecture will be tested by other investigators. A clear cut policy implication of our findings is that, since income elasticities are substantially overestimated in the existing empirical works that exclude the exchange rate in the relative prices, fresh estimates are necessary to determine the scope for export-driven growth policies. It is also reasonable to conjecture that the relative price and income elasticities in the import equations will be similarly biased if the relative price variable is improperly specified. Since these biases can be avoided by including the exchange rate in the relative price variable, the current popular practice of ignoring the exchange rate is unwarranted.

⁵ The insignificant bias in the relative price elasticity is due to a small value of 0.046 for γ_1 in the auxiliary regression. In contrast, the estimate of γ_2 is 0.370 implying that income elasticity could be overestimated, in the misspecified equation, by about 40%. See footnote 2.

Data Appendix

Y_F is the trade weighted average real income of Fiji's major trading partners, viz., Australia, New Zealand, USA, UK/EU and Japan. Trade weights are computed as the share of trade to each of these countries relative to Fiji's total trade.

X_t is Fiji's total exports of goods and services (FOB) deflated by the export price index.

P_D is the price of Fiji's export goods, computed as the weighted average of Fiji's unit value index of major domestic exports.

E_t is the weighted average exchange rate and is the price of a unit of foreign currency in domestic currency.

P_F is the import weighted average of major trading partners' export price indices. Import weights are computed as the share of respective imports to total imports.

SS is a proxy for export productivity proxied with the average productivity of sugar per hectare from the Key Economics Statistics, various years. Sugar is the major export of Fiji.

Notes: Data on the are from the IFS CD-ROM 2003 and the Reserve Bank of Fiji Quarterly Review, for various years.

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