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Trade Elasticities and the Marshal Lerner Condition for India

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Abstract

In this paper, we attempt to empirically verify the Marshall Lerner condition in relation to India's external trade. These conditions ensure that a devaluation of the exchange rate causes an improvement in the trade balance. Alongside, we also produce estimates of equilibrium export and import elasticities using a multivariate cointegration approach.

Keywords: Marshal Lerner condition, trade elasticities, cointegration, India.

1. Introduction

According to economic theory, a devaluation of the nominal exchange rate exerts its influence on the trade balance of a country through three ways. Firstly, it reduces real volume of imports as they become costlier. Imports are usually denominated in foreign currency and so the amount of foreign currency spent on imports falls. Secondly, devaluation encourages exports as these become cheaper for the outside market. And lastly, lesser foreign currency is earned by a given quantity of exports as exports are denominated in domestic currency. Clearly, while the first two factors help improve the trade balance, the third factor worsens it. The overall effect that a devaluation produces on the trade balance remains unknown and is determined by the relative sizes of each of these three effects. The latter, in turn, depend upon the amounts by which exports and imports respond to a given extent of devaluation. In other words, it is the elasticity of exports and the elasticity of imports with respect to the exchange rate that will determine the overall impact of the devaluation on the trade balance. According to the Marshal Lerner condition, in order for a devaluation to improve the trade balance, it is necessary and sufficient that the sum of the elasticities of export demand and import demand exceeds one. Any combination of export and import elasticities that satisfies the Marshall-Lerner condition will cause the first two effects described above to outweigh the third, leading to an improved trade balance.

The purpose of this paper is to estimate trade elasticities in the case of India and to determine whether the Marshall-Lerner condition is satisfied in the Indian case. To the extent that the exchange rate can be influenced by monetary authorities, a confirmation of the theorem would mean that policy makers can estimate the extent to which a given movement in the exchange rate can improve the balance on goods and services account.

Empirical testing of the Marshall-Lerner equation has a rich heritage and the evidence in favour of the condition is mixed. We cite here only the relatively recent literature on the problem. Wilson and Takacs (1979) study major industrial countries for the period 1957-1971 and estimate the responsiveness of their exports and imports to the nominal exchange rate although the authors do not estimate the Marshall- Lerner condition directly. Noland (1989) estimates a generalized gamma distributed lag model of Japanese trade. Evidence supports long lags on responses for price changes. The estimates are then used to construct a J-curve for Japan. Reinhart (1995) studies a sample of 12 developing countries and finds that although relative prices have a systematic effect on exports and imports, the elasticities tend to be low and below unity. This suggests large devaluations being required to produce appreciable improvements in the trade balance. Also, the elasticities for industrial countries are well above developing countries except those of Arica. Bahmani-Oskooee (1998) finds support for the Marshall-Lerner condition from cointegration studies o a sample of developing countries. Bahmani-Oskooee and Niroommand (1998) use stationary data and Johansen's cointegration analysis to provide new trade elasticities for almost 30 countries. Caporale and Chui (1999) present further evidence regarding trade elasticities. Income and price elasticities of trade are estimated for 21 countries in a cointegration framework. More specifically, the autoregressive distributed lag (ARDL) modeling approach and the DOLS procedure are adopted to estimate the long-run structure. The empirical results confirm the existence of a systematic relationship between growth rates and income elasticity estimates: faster growing economies have high income elasticities of demand for their exports but lower import elasticities, which implies that faster growth can be observed without any marked secular trend in real exchange rates. Bahmani- Oskooee and Kara (2008) test the relative responsiveness of the trade flows to changes in exchange rate and changes in relative prices by drawing data from developing countries and find no systematic differences in the effect of nominal exchange rate and relative prices on the trade balance. Bahmani-Oskooee, Harvey and Hegerty (2013) survey the literature that has tested the Marshall-Lerner condition, examining in particular whether previous studies' results are statistically significant. The authors then conduct their own estimation of 29 countries' trade elasticities, over the past few decades. Eita(2013) finds evidence in favour of

Marshall-Lerner condition for Namibia using a cointegration model and also estimates income elasticities of trade for the country.

2. Methodology and Data

2.1 Methodology

We try to estimate long run relationships of the following form:

$$log\ (exports) = \beta_o + \beta_1\ log\ (world\ income) + \beta_2\ log(real\ exchange\ rate) + \varepsilon \quad (1)$$

for estimating exports demand elasticity, and

$$log\ (imports) = \pi_o + \pi_1\ log\ (domestic\ income) + \pi_2\ log(real\ exchange\ rate) + \xi \quad (2)$$

for estimating exports demand elasticity, where ε *and* ξ denote error terms. These long-run equations can be estimated within the framework of an error correction model where they arise naturally in the form of cointegrating relationships between the concerned variables.

Time series data for the real exchange rate for India (q_t), India's exports (X_t) and imports (M_t), India's annual income (Y_t) as well as world annual income (Y^*_t) are converted into logarithms and tested for stationarity using the KPSS test for stationarity testing. If the series are found to be integrated of the same order, we test subsets of the 5 series for possible cointegration using Johansen's maximum eigenvalue test. Guidance for deciding on the number of lags for the test specification is provided by various information based criteria like Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Hannan-Quinn Criterion (HQC) and the Final Prediction Error criterion (FPE). If cointegration is indicated among variables of each subset, we look for the eigenvector corresponding to the largest statistically significant eigenvalue. This eigenvector will give the long run equilibrium relationship between variables in the subset. From this relation, the trade elasticities can be directly computed. The first subset consists of (X_t , Y^*_t , q_t) and tests the relation between India's exports, world income and the real exchange rate. The second subset consists of (M_t , $Y_{t,}$ q_t) and tests the relation between India' imports, domestic income and the real exchange rate.

2.2 Data

Annual data series from 1993 to 2011 have been used for each variable. The real exchange rate (q_t) corresponds to the export weighted annual real exchange rate. Monthly values provided by the Reserve bank of India (RBI) with base 1993-94=100 are averaged to get annual values. Annual export (X_t) and import (M_t) volumes in Dollar terms for India are also taken from RBI's database. Dollar Gross National Income (GNI) estimate for India (Y_t) is taken from the database of the World Bank. World income (Y^*_t) is taken as the sum of Dollar GNI's of 22 countries that account for the bulk of India's external trade as suggested by the RBI in its data on the direction of India's foreign trade. These countries are the US, the UK,, UAE, Thailand, Sri Lanka, Singapore, Saudi Arabia, South Korea, Netherlands, Nepal, Malaysia, Japan, Italy, Iran, Indonesia, Germany, France, China, Canada, Belgium, Bangladesh and Australia, in reverse lexicographic ordering. This data is also taken from the World Bank database.

3. Results and Discussion

Results of the KPSS Unit Root test performed on all the five time series are shown in Table 1 below. They indicate that all the variables can plausibly be taken to be non stationary in levels but stationary in their first differences. (Only the real exchange rate is stationary in levels but we nevertheless assume it to also be non stationary as is confirmed by the Elliott Stock Rothenberg Unit Root test. (Result not shown here) That is, these series are integrated of the first order. This means that there is a possibility of subsets of these variables being cointegrated in long run equilibrium relationships with each other. We proceed to estimate a vector error correction model (VECM) with a lag length of 3 for each of the above two models\sets of variables. This lag length is indicated by the various information based criteria mentioned above. Results of these tests are not included here. The actual estimates of all the coefficients are not relevant to our discussion and hence are also left out. Results of the Johansen maximum eigenvalue cointegration tests for both the imports model and the exports model are shown in Table 2.For each set/model, results indicate the presence of at least one cointegration relationship between each set of variables. We focus our attention on the largest eigenvalue in each case and the corresponding eigenvectors are given in Table 3.

Table 1: KPSS test results with a null of stationarity.

Series	Test Statistic	5% Critical Value	Inference for Series
qt	0.1711	0.463	Stationary
Δqt	0.1674	0.463	Stationary
Xt	0.7225	0.463	Nonstationary
ΔXt	0.3094	0.463	Stationary
Mt	0.7180	0.463	Nonstationary
ΔMt	0.2157	0.463	Stationary
Yt	0.7185	0.463	Nonstationary
ΔYt	0.2816	0.463	Stationary
Y*t	0.7222	0.463	Nonstationary
ΔY*t	0.1790	0.463	Stationary

Table 2: Johansen cointegration test results.

	Test statistic (exports model)	Test Statistic (imports model)	5% Critical Value
r ≤ 2	6.31	9.73	12.25
r ≤ 1	14.62	14.98	18.96
r =1	26.81	47.47	25.54

Table 3: Eigenvectors corresponding to the largest eigenvalue in Johansen's test.

Variable	Coordinate	Variable	Coordinate
Import equation		Export equation	
Mt	1	Xt	1
Yt	-1.77	Y*t	-2.096
qt	-0.97	qt	-1.854

Hence the cointegrating eigenvectors are estimated as

M_t - 1.77 Y_t - 0.97 q_t *(for the import equation)* and

X_t - 2.096 Y^*_t - 1.854 q_t *(for the export equation)*

From these cointegrating vectors, we can calculate the various trade elasticities and these are $\varepsilon_m = \Delta M / \Delta q = 1.03$, $\Delta M / \Delta Y = 0.56$, $\varepsilon_X = \Delta X / \Delta q = 0.54$ and $\Delta X / \Delta Y^* = 0.48$. The Marshall Lerner condition is satisfied for India as $\varepsilon_m + \varepsilon_X = 1.03 + 0.54 = 1.57$ is greater than one. A 1% depreciation in the real exchange rate causes a 1.03% rise in imports and a 0.54% rise in exports. Further a 1% increase in domestic income increases India's imports by 0.56% whereas a 1% increase in world income causes Indian exports to increase by 0.48%.

4. Conclusion

In this paper, we have tried to analyze the factors affecting India's balance of trade on the goods and services account. We find that a rise in the real exchange rate boosts India's exports as expected in theory. This is due to a change in the international terms of trade in India's favour. However, the depreciation in the real exchange rate also causes a rise in India's imports. This surprising result may be due to the indirect impact of rising export incomes overwhelming the effect of rise in relative import prices, leading to increase in import volumes. Further, as expected, imports rise with increase in domestic gross national income and exports rise with increase in world gross income. We are able to estimate the elasticities of all these four effects. In particular, the sum of export elasticities and import elasticities of the real exchange rate exceeds unity, meaning that the Marshall Lerner condition holds for the Indian case.

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