

## **Impact of Devaluation on Pakistan's External Trade: An Econometric Approach\***

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### **I. INTRODUCTION**

Exchange rate policy to improve external competitiveness has now become the centre piece of any adjustment effort. It is expected that a nominal devaluation will result in expenditure switching, increased production of tradeable, higher exports, and in an improvement of the external accounts of the country in question.

Recently, the traditional stabilisation packages, and especially their devaluation component, have come under attack by a number of authors.<sup>1</sup> It has been argued that devaluation can be counterproductive because exports and imports are relatively insensitive to price and exchange rate changes, especially in developing and semi-industrialised countries.<sup>2,3</sup> If the price elasticities of imports and exports are sufficiently low, the trade balance expressed in domestic currency may worsen. Grubel (1976) has argued that a country's persistent payments imbalances can be due only to faulty monetary policy and cannot be corrected by either devaluation (exchange rate policy) or the use of fiscal policy. In a recent article, Miles (1979) claims to have provided the requisite evidence to support Grubel's argument. Miles (1979) shows that devaluation does not improve the trade balance but improves the balance of payments. This results implies that the improvement comes through the capital account. He, therefore, concludes that the devaluation mechanism involves only a portfolio stock adjustment and is essentially monetary in nature. If

\*Owing to unavoidable circumstances, the discussant's comments on this paper have not been received.

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<sup>1</sup>It is not possible to list all the authors, however, a good reference to this debate is provided in Edwards (1986) and Nunnenkamp and Schweickert (1990).

<sup>2</sup>See Gylfason and Risager (1984).

<sup>3</sup>Devaluation has also become controversial because of its negative effect on output which has come to be known as the contractionary devaluation. See Khan (1988) and Nunnenkamp and Schweickert (1990). We do not, however, discuss this issue in the paper.

valid, these results have important policy implications. If exchange rate changes (devaluation) do not improve the trade balance then the various IMF stabilisation packages that include some exchange rate realignment cannot be justified.

The main objectives of the study are to examine the validity of the argument that exchange rate policy (devaluation) does not improve the trade balance using Pakistani data. Pakistan provides an ideal opportunity to examine the above issue as in recent years its trade balance has deteriorated considerably (7.6 percent of GNP in 1992-93). On the other hand, it has pursued a fixed exchange rate policy for a long time until January 1982 when a change in the exchange rate regime took place. Beginning from January 1982, Pakistan has pursued a managed floating exchange rate policy to maintain external competitiveness. The cumulative depreciation of the Pak rupee, since the introduction of the managed floating exchange rate system, has been of the order of 63.5 percent. At the beginning of the fiscal year 1993-94, the Pak rupee was devalued to a total of 10 percent to improve the country's trade balance. What are the chances that the exchange rate management can improve the trade balance? This is the subject-matter of the present study. We examine the issue by specifying export and import functions along with a price equation.

The plan of the paper is as follows. The model is discussed in Section II and the results are presented in Section III. The final section contains the concluding remarks.

## II. THE MODEL

In order to examine the impact of devaluation on the trade balance we need equations for exports and imports. However, it is generally argued that devaluation causes the domestic price level to rise through higher import prices in rupee terms. We, therefore, also need a price equation which will feed into the export and import equations.

In specifying an export function the prevailing practice has been to specify an export demand or export supply function. However, following Goldstein and Khan (1978); Balassa *et al.* (1989); Khan and Saqib (1993) and Khan and Khanum (1994) we specify export demand and export supply functions simultaneously on the grounds that the relationship between quantities and prices is simultaneous in nature.

The export demand function is specified to depend upon foreign income, relative price, and nominal exchange rate variables. The world GDP index (WGDP) is used to represent foreign income while the relative price variable is defined as

the ratio of the index of domestic price of exports to world export prices ( $PX_i/PXW$ ,  $i = 1, 2$ ). Using the Cobb-Douglas functional form export demand is specified as:

$$X_i^d = A WGDP^{\alpha_1} [PX_i/PXW]^{\alpha_2} ER^{\alpha_3} e^v \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

Where  $X_i^d$  real value of exports demanded; and  $A$  is efficiency parameter. Taking logarithmic transformation to linearise Equation (1) we have

$$\ln X_i^d = \ln A + \alpha_1 \ln WGDP + \alpha_2 \ln (PX_i/PXW) + \alpha_3 \ln ER + V \quad \dots \quad (2)$$

where  $\alpha_1, \alpha_2$ , and  $\alpha_3$  are respectively foreign income, reactive price and exchange rate elasticities. It is expected that  $\alpha_1 > 0, \alpha_2 < 0$  and  $\alpha_3 > 0$ .

The supply function of Pakistan's exports is specified to depend upon domestic production of exportable and relative price variables. The gross domestic product (GDP) is used to represent domestic production of exportable and relative price is defined as the ratio of Pakistan's export price index to domestic price index (implicit GDP deflator). Again using the Cobb-Douglas functional form the export supply function is specified as:

$$X_i^s = C GDP^{\beta_1} [PX_i/P]^{\beta_2} e^w \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

Taking logarithmic transformation to linearise Equation (3) we have:

$$\ln X_i^s = \ln C + \beta_1 \ln GDP + \beta_2 \ln (PX_i/P) + W \quad \dots \quad \dots \quad \dots \quad \dots \quad (4)$$

where  $\beta_1$  and  $\beta_2$  are respectively domestic income and relative price elasticities. It is expected that  $\beta_1 > 0$  and  $\beta_2 > 0$ . Assuming equilibrium in the export sector we have  $X_i^d = X_i^s = X_i$  where  $i = P, M$  representing primary and manufacturing exports respectively. Equation (4) can be normalised for the price of exports,  $PX_i$ , to yield

$$\ln PX_i = \gamma_0 + \gamma_1 \ln GDP + \gamma_2 \ln P + \gamma_3 \ln X_i + \eta \quad \dots \quad \dots \quad \dots \quad \dots \quad (5)$$

where  $\gamma_0 = -1/\beta_2 \ln C$ ;  $\gamma_1 = -\beta_1/\beta_2 < 0$ ;  $\gamma_2 = 1$ ;  $\gamma_3 = 1/\beta_2 > 0$

The import demand function is specified to depend upon domestic economic activity, relative prices, foreign exchange reserves (FERC) and exchange rate (ER). Domestic economic activity is represented by GDP and we expect that higher economic activity would lead to higher demand for imports.

The relative price variable is defined as the ratio of import price index to domestic price index. *A priori*, we expect that higher relative prices would discourage imports. As regards foreign exchange reserves, it is well-known that in a developing country like Pakistan import restrictions are usually imposed depending upon the country's foreign reserves position. An improvement in the foreign exchange reserves is likely to lead to a relaxation of import controls and consequently results in higher imports. Finally, the exchange rate depreciation (devaluation) would increase the price of imports and consequently imports would decline.

Using the Cobb-Douglas functional form the import demand function is specified as:

$$M_i = Z GDP^{\delta_1} [PM/P]^{\delta_2} FERC^{\delta_3} ER^{\delta_4} e^K \quad \dots \dots \dots \quad (6)$$

Taking logarithmic transformation to linearise Equation (6) we have

$$\ln M_i = \ln Z + \delta_1 \ln GDP + \delta_2 \ln (PM/P) + \delta_3 \ln FERC + \delta_4 \ln ER + K \quad \dots \dots \dots \quad (7)$$

where  $\delta_1, \delta_2, \delta_3,$  and  $\delta_4$  are respectively income, relative price, foreign exchange reserves, and exchange rate elasticities. It is expected that  $\delta_1 > 0, \delta_2 < 0, \delta_3 > 0,$  and  $\delta_4 < 0$ . Furthermore,  $i = IR$  and  $MG$  stand respectively for industrial raw materials and manufactured goods.

Finally, we need a price equation such that the impact of devaluation through higher import prices can increase the domestic price level which may, then, alter the relative prices in the import and export equations. The price equation is specified to depend upon money supply ( $m_2$  definition), import prices and the ratio of potential GDP to last year's actual GDP. The last variable is included to capture the supply-side effect i.e. an improvement in the supply of goods would put downward pressure on the price level.

$$\ln P = \lambda_0 + \lambda_1 \ln M_2 + \lambda_2 \ln PM_i + \lambda_3 \ln (GDPP/GDP (-1)) + q \quad \dots \quad (8)$$

where  $i = IR$  and  $MG$  and stand for industrial raw material and manufactured goods

import prices. *A priori*, we expect  $\lambda_1 > 0$ ,  $\lambda_2 > 0$  and  $\lambda_3 < 0$ . Thus, to examine the impact of devaluation on the trade balance we estimate Equations (2), (5), (7), and (8). Exports are divided into primary and manufactured while imports are divided into industrial raw materials and manufactured goods. Separate equations for each exports and imports are estimated.

The variables used in the above model are as defined below:

- XP* = Exports for primary product in real terms;
- WGDP* = Index of world gross domestic product (GDP) in real terms;
- PXP* = Rupee price index of primary product;
- PXW\$* = Dollar price index of world exports;
- ER* = Exchange rate (price of one US dollar in Rupees);
- XM* = Exports for manufactured product in real terms;
- PXM* = Rupee price index of export manufactured product;
- P* = Implicit GDP deflator;
- PXM* = Rupee price index of manufactured product;
- MIR* = Import of industrial raw material in real terms;
- PMIR* = Rupee price index of imported industrial raw material;
- PMMG* = Rupee price index of imported manufactured product;
- FERC* = Foreign exchange reserves;
- MMG* = Import of manufactured products in real terms;
- PM* = Rupee price index of total imports;
- M2* = Money supply;
- GDPP* = Potential GDP in real terms; and
- In* = Natural logarithm.

### III. DATA AND RESULTS

Data on all variables are taken primarily from various issues of the "Pakistan Economic Survey" and "International Financial Statistics" of the International Monetary Fund (IMF). It covers the period between 1972 to 1991 on an annual basis and the variables in real terms are defined in 1981 constant values.

In order to get efficient and consistent estimates, the model as represented by Equations (2), (5), (7), and (8) has been estimated simultaneously using a three stage least squares (3SLS) technique based on the *TSP* Version 7 computer programme. It should be noted that, in general, though 3SLS technique is preferable over other single equation methods, namely, OLS and 2SLS, there are

certain deficiencies of 3SLS which cannot be undermined. In particular, if the model is misspecified, the errors from one equation may overflow to other equations in the system and thus the estimated coefficient(s) may be biased.

Although the model has been estimated in both linear and log-linear form, in this paper we have reported the latter only. The estimated 3SLS regression results of the model and the instrument set used are reported in Table 1. In general, the estimated results have reasonable Durbin Watson (*DW*) statistics (indicating no serial correlation) and the explanatory power of the equations in most cases are fairly high.

### Export Sector

The estimated 3SLS results of the export sector are given by Equations (1) to (4) in Table 1. Equations (1) and (2) represent the export demand for primary and manufactured products while the supply of these exportable commodities are presented in Equations (3) and (4) respectively.

The estimated coefficients for the index of world gross domestic product (*WGDP*) and the relative export prices of primary product in export demand (*XP*) Equation (1) have the expected positive and negative signs respectively. However, they are statistically insignificant based on *t*-values. Insignificant *t*-values for these two variables can be justified on the grounds that the export demand for primary product is essential but relatively small in value and, therefore, the export need for this commodity may be insensitive with respect to its prices as well as the income of the world. However, in the case of exports of manufactured product (*XM*), both *WGDP* and *PXM/PXW* in Equation (2) are not only statistically significant with expected signs but the size of these coefficients are also greater than that in Equation (1).

Exchange rate (*ER*) variables in both export demand functions have positive and significant estimated coefficients implying that a devaluation (or depreciation) of exchange rate has a positive impact on both primary and manufactured exports.

In terms of actual values of the coefficients, it indicates that a one percent depreciation in the exchange rate may lead to a 0.617 percent and 1.278 percent increase in exports, respectively.

As for the supply price of primary exports Equation (3), the persistent lagged effects of price (*PXP*(-1)) seem to dominate the estimated results. On the other hand, the export supply of manufactured products Equation (4) seems to be influenced by the implicit price deflator (*P*).

Table 1

*Estimated 3SLS Regression Results for Trade Model***EQUATION 1 (Export Demand for Primary Product):**

$$\ln(XP) = 6.54 + .255\ln(WGDP) - .111\ln(PXP/PXW\$) + .617\ln(ER)$$

(2.7)                      (.39)                      (-.39)                      (1.94)

$R^2 = 0.58,$                        $DW = 1.92$

**EQUATION 2 (Export Demand for Manufactured Product):**

$$\ln(XM) = -0.466 + 1.34\ln(WGDP) - .353\ln(PXM/PXW\$) + 1.278\ln(ER)$$

(.29)                      (2.78)                      (-2.27)                      (4.37)

$R^2 = 0.92,$                        $DW = 2.1$

**EQUATION 3 (Export Supply for Primary Product):**

$$\ln(PXP) = -2.02 - .208\ln(XP) + .395\ln(GDP) + .25\ln(P) - .537\ln(PXP(-1))$$

(-.53)    (-1.59)                      (.80)                      (.50)                      (3.02)

$R^2 = 0.967,$                        $DW = 1.78$

**EQUATION 4 (Export Supply for Manufactured Product):**

$$\ln(PXM) = -9.801 - .490\ln(XM) + 1.311\ln(GDP) + .6201\ln(P)$$

(-1.39)                      (-2.02)                      (1.55)                      (1.65)

$R^2 = 0.90,$                        $DW = 1.55$

**EQUATION 5 (Import Demand for Industrial Raw Material):**

$$\ln(MIR) = -10.55 + 1.367\ln(GDP) + 0.446\ln(PMIR/P) + 0.095\ln(FERC)$$

(-2.5)                      (2.7)                      (2.12)                      (1.54)

$$- 1.134\ln(ER) + 0.558\ln(MIR(-1))$$

(-3.23)                      (3.77)

$R^2 = 0.976,$                        $DW = 1.40$

**EQUATION 6 (Import Demand for Manufactured Product):**

$$\ln(MMG) = -7.01 + 1.42\ln(GDP) - .79\ln(PM/P) + .054\ln(FERC) - .383\ln(ER)$$

(-1.67)                      (3.26)                      (-4.62)                      (0.65)                      (-1.09)

$R^2 = 0.60,$                        $DW = 1.41$

**EQUATION 7 (Price Equation):**

$$\ln(P) = 0.252 + .047\ln(M2) + .141\ln(PMIR) + .106\ln(PMMG)$$

(1.33)                      (2.13)                      (5.64)                      (4.79)

$$- .038\ln(GDPP/GDP(-1)) + .593\ln(P(-1))$$

(.52)                      (7.79)

$R^2 = 0.99,$                        $DW = 2.69$

**INSTRUMENT SET:**

$\{\ln(WGDP), \ln(GDP(-1)), \ln(PXW\$), \ln(PMIR), \ln(FERC), \ln(GDPP), \ln(XP(-1)),$   
 $\ln(XM(-1)), \ln(PXM(-2)), \ln(MIR(-1)), \ln(MMG(-1)), \ln(MMG(-2)), \ln(PXP(-1)),$

## Import Sector

Estimates of import demand functions for industrial raw materials (*MIR*) and manufactured goods (*MMG*) are given in Equations (5) and (6), respectively. As expected, *GDP* and foreign exchange reserves influence imports positively for both *MIR* and *MMG*. The impact of relative prices ( $PMIR/P$ ) on manufactured goods import (*MMG*) is negative while for, industrial raw material imports, the influence is positive. This positive impact may appear to be contrary on theoretical grounds, however, it can be justified on a more pragmatic basis. Imports of industrial raw material, though essential and accounting for over forty percent of the total import, Pakistan being a small open economy, cannot influence the prices of these essential items. Thus, even if the price of industrial raw material increases, Pakistan may have to import them at a higher price. An increase in the foreign exchange reserves (*FERC*) is also expected to have a positive effect on the import demand for both *MIR* and *MMG*.

The estimated coefficients of the exchange rate for both *MIR* and *MMG* in Equations (5) and (6) are positive implying that a devaluation of the Pakistani rupee may have a dampening effect on imports of these items. The negative effect of devaluation on *MMG* is, however, smaller (-0.383) in magnitude compared to estimates in *MIR* function (-1.13).

## General Price Level

Parameter estimates of the general price in Equation (7) have the expected signs with statistically significant coefficients in most cases. Every thing else being equal, a one percent increment in the money supply leads only to 0.115 percent increase in the general price (*P*) level in the long run. The import prices of *MIR* and *MMG* will individually add to 0.346 percent and 0.26 percent, respectively in the long run.<sup>4</sup> The supply side variable ( $GDPP/GDP(-1)$ ) as measured by potential *GDP* relative to previous year's *GDP*, bears an expected negative sign suggesting that improvement in supply situation would put downward pressure on the price level. Having discussed the estimated regression results of the trade model, in the following, we analyse the impact of devaluation policies on the trade balance in Pakistan.

## Marshall/Lerner Condition

In order to understand the implications of devaluation policies and its impact

<sup>4</sup> The long run coefficient is calculated by dividing each parameter by one minus the coefficient of lagged dependent variable. For example,  $0.047/1-0.593 = 0.115$ .



on the trade deficit in Pakistan, we test the validity of the *Marshall/Lerner Condition (MLC)* in the context of Pakistan's economy. *MLC* simply implies that the sum of total export ( $\xi_x$ ) and total import ( $\xi_m$ ) elasticities must be greater than one if the initial trade gap (*TG*) is to be balanced. In the event, if *TG* is non zero then *MLC* simply requires that the weighted sum of these two elasticities exceeds unity and thus mathematically it may be written as:

$$\xi_x \bullet \omega + (-\xi_m) > 1, \quad \dots \dots \dots (9)$$

where the weight  $\omega$  is defined as:

$$\omega = (X / (E \bullet M)).$$

In the context of this study, the coefficients of the exchange rates in export demand Equations (1) and (2) and import demand Equations (5) and (6) functions only represent the estimated sectoral elasticities. However, to test *MLC* we need the elasticities for total exports and imports. Given the information at hand, we can easily derive the total elasticities for exports and imports as follows:

$$\xi_x = \xi_{xp} \bullet \alpha_{xp} + \xi_{xm} \bullet \alpha_{xm} ; \quad \dots \dots \dots (10)$$

$$\xi_m = \xi_{mp} \bullet \alpha_{mp} + \xi_{mm} \bullet \alpha_{mm} ; \quad \dots \dots \dots (11)$$

where

- $\xi_{xp}$  = Export Elasticity of Primary Product (=0.617).
- $\alpha_{xp}$  = Share of Primary Product Exports to Total Exports .  
[( $XP/X$ )<sub>93</sub> = .204].
- $\xi_{xm}$  = Export Elasticity of Manufactured Product (1.278).
- $\alpha_{xm}$  = Share of Manufactured Product Exports to Total Exports.  
[( $XM/X$ ) = .796].
- $\xi_{mir}$  = Import Elasticity of Industrial Raw Material (1.134).
- $\alpha_{mir}$  = Share of Industrial Raw Material Import to Total Import.  
[( $MIR/M$ ) = .663].
- $\xi_{mmg}$  = Import Elasticity of Manufactured Goods (0.383).
- $\alpha_{mmg}$  = Share of Manufactured Goods Import to Total Import.  
[( $MMG/M$ ) = .881].

Given the estimated sectoral export and import elasticities and its respective share figures (measured at 1993) from above the total estimated export and import

elasticities for the year 1993 can be computed as follows:

$$\begin{aligned}\xi_{x_{93}} &= 0.617 * 0.204 + 1.278 * 0.796 ; \\ &= 1.1434 \quad \dots \dots \dots \dots (12)\end{aligned}$$

$$\begin{aligned}\xi_{m_{93}} &= -1.134 * 0.663 - 0.383 * 0.337 ; \\ &= -0.881. \quad \dots \dots \dots \dots (13)\end{aligned}$$

Based on 1993 ratio of total export to import as  $\omega$  ( $=X/M=0.66$ ) and the elasticities figures from above, *MLC* for Pakistan from Equation (1) can be estimated as:

$$\begin{aligned}MLC &= 1.1434 * 0.66 + (-(-0.881)) \\ &= 1.64 > 1 \quad \dots \dots \dots \dots (14)\end{aligned}$$

Thus, the above estimated result seems to support *MLC* for Pakistan implying that a policy of devaluation may not necessarily result in a deterioration of the trade balance. These results are important and may have crucial policy implications in terms of recent devaluation policies adopted by the government.

#### IV. CONCLUDING REMARKS

The purpose of this paper has been to examine the impact of devaluation on the trade balance in Pakistan. The policy of devaluation (exchange rate management) has been criticised on the ground that it does not improve trade balance. If this is the case then the SAP of the IMF and the World Bank of which, exchange rate policies are the centre piece, become meaningless. We have examined this issue by specifying exports, imports, and general price level equations. By estimating these equations simultaneously we arrived at the conclusion that devaluation may improve the trade balance in Pakistan. The Marshall Learner conditions have been tested and were found to be satisfying the conditions for devaluation to be successful in improving the trade balance. These results are important and may have crucial policy implications in terms of recent devaluation policies adopted by the government.

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