Journal of Economic Cooperation and Development, **30**, 2 (2009), 75-98

Existence of a J-Curve-The Case of Pakistan

Abid Hameed[1] and Shehla Kanwal[2]

In this paper an attempt has been made to identify J-curve phenomenon for Pakistan vis-à-vis her ten major trading partners by employing disaggregated quarterly data from 1972-I to 2003-IV. Results from the study support the traditional view that devaluation leads to improvement in trade balance; but due to a very rapid impact of devaluation on trade balance we fail to identify a J-curve. This finding fails to lend credence to the view that devaluation can be an effective policy tool for developing countries facing persistent balance of payment deficits. Furthermore, results from Granger causality test indicate that causality runs from Pakistan's real income to trade balance. This suggests that policy should be focused on improving Pakistan's real income in order to improve trade balance. Finally, we find that increase in foreign country's income can also lead to improvement in Pakistan's trade balance by increase in imports from Pakistan, provided imports exhibit an inelastic demand. The policy prescription that follows from this finding is that policy makers in Pakistan should pursue an active strategy of encouraging production of manufactured and semi-manufactured goods in order to improve the trade balance through the above channel.

1. Introduction

Economic theory postulates that currency depreciation improves the trade balance, but only after a passage of time, implying that the impact of currency devaluation on trade balance is not instantaneous. There is enough evidence in the published literature that currency devaluation leads to worsening of the trade balance in short-run but with a

[1] ECO-Trade and Development Bank.
[2] Habib Bank.

subsequent turn around in the long-run. The pattern of the movement of the trade balance over time resembles the letter J and is labeled as the J-Curve phenomenon. The J-Curve phenomenon has been explained by several factors.

Magee (1973) characterized the phenomenon as consisting of a period during which contracts already in transit, in specified currencies and at old prices, dominate the short-run (SR) response of the trade balance. Overtime new contracts are made after devaluation begins to dominate and the “pass-through” of the devaluation or depreciation is achieved. Junz and Rhomberg (1973) identified at least five lags between devaluation and its ultimate impact on trade balance. They argued that if the trade balance was deteriorating before devaluation, it would continue to deteriorate even after devaluation until these lags are realized and trade balance begins improving[3]. It has also been argued that the phenomenon originates from the fact that at the time an exchange rate change occurs, goods already in transit and under contract have been purchased, and the completion of those transactions dominates the short-term change in the trade balance. Therefore, the trade balance deteriorates first, but after the passage of time it begins to improve (Bahmani-Oskooee, 1985).

In theory currency devaluation may affect the trade balance through two channels: devaluation of the real exchange rate and a direct effect on domestic absorption. The first channel stresses on the fact that a nominal devaluation is assumed to affect real exchange rate (a relative price) and hence improves competitiveness which in turn improves the trade balance *ceteris peribus.* The second channel is related to the absorption affect of devaluation. In a world in which all goods and assets are perfect substitutes, prices are exogenously given for the small country case and wages and prices are flexible both in nominal and real terms, devaluation increases the price level by the same percentage and the increase in real price reduces real balances and thus domestic absorption (Baharumshah, 2001).

---

[3] These lags are recognition lags, decision lags, delivery lags, replacement lags, and production lags.

A cursory review of the literature up to late 1990’s reveals that the majority of the studies undertaken to investigate the impact of currency depreciation on the trade balance have relied upon estimating the Marshall-Lerner condition, which posits that depreciation improves the trade balance in the long-run, if sum of import demand elasticities are greater than one. Furthermore, the above studies have employed aggregate data for identification of Marshal-Lerner condition.

In case of Pakistan, Hassan and Khan (1994) attempt to identify the positive impact of devaluation on trade balance by testing if the Marshall-Lerner condition holds and their results show that this condition is binding for Pakistan. Aftab and Aurangzeb (2002) examine the long-run and short-run impact of currency devaluation on Pakistan’s trade performance by using quarterly data and conclude that devaluation deteriorates the trade balance in short-run while it improves it in the long-run.

A new body of literature criticizing the above studies points out that the lack of any significant relation between the trade balance and real exchange rate could have been due to aggregation bias. Notable among this literature include the study by Bahmani-Oskooee and Brooks (1999) who investigate the J-Curve pattern between US and her major trading partners by employing cointegration and error correction modeling. They show that in short-run the trade balance does not necessarily follow the J-Curve phenomenon, while in the long-run it shows improvement. Furthermore, Bahmani-Oskooee and Kantipong (2001) test the J-Curve phenomenon between Thailand and her larger trading partners by employing cointegration analysis and find evidence supporting J-curve in the case of US and Japan. Another study conducted by Arora, Bahmani-Oskooee and Goswami (2003) tested J – Curve phenomenon between India and her major trading partners and their results show no evidence of J-curve pattern in the short-run, while in long-run currency depreciation of the rupee against the currency of Australia, Germany, Italy and Japan has positive impact on India’s trade balance.

The main purpose of this study is to investigate the short-run and long-run impact of real depreciation of the rupee on Pakistan’s trade balance using bilateral trade and real exchange rate data comprising 10 major trading partners viz. United States of America, United Kingdom, Canada, Germany, France, Italy, Netherlands, Singapore, Korea and Japan.

In this paper disaggregated quarterly data for the period 1971-I to 2003-IV is employed to examine the long-run and short-run impact of currency devaluation on trade balance of Pakistan. The present paper has attempted to extend the earlier literature regarding J-Curve phenomenon in Pakistan by using disaggregated bilateral quarterly data and employing Granger causality test embodied in a Vector Error Correction (VECM) framework.

The organization of the paper is as follows. Section two presents the analytical framework. Section three describes the data. Section four elaborates the empirical methodology. Section five presents and discusses results. Finally, section six sums up the conclusions and makes recommendations.

2. Theoretical Framework

In order to analyze the impact of currency devaluation on trade balance the present study employs the "imperfect substitute model'' as developed by Rose and Yellen (1989). Following are the main assumptions of the model: (i) domestically produced goods and imported goods are imperfect substitute; (ii) the model assumes two countries, home and foreign (or home and rest of the world); (iii) each country produces a single tradable good and price of this goods is assumed to be sticky; (iv) consumers in each country maximize their utility subject to their budget constraint by consuming both goods; and (v) producers in both countries maximize their profit subject to their cost constraint.

The above model is composed of the following equations. The import demand function for home country is given as follows:

$$M_d = M_d(P_{mr}, Y) \qquad (1)$$

Where M_d is the import demand for the home country and represents the quantity demanded as a function of real income (Y) measured in domestic output and the relative price of imported (P_m) to domestically produced goods (P), both measured in domestic currency. The relative price of imported goods in home country is denoted by P_{mr}. The import demand function for foreign country is given as follows:

$$M_d^* = M_d^*\left(P_{mr}^*, Y^*\right) \quad (2)$$

Where M_d^* is the import demand for the foreign country and represents quantity demanded as a function of real income of foreign country and relative prices of imported goods $\left(P_m^*\right)$ to domestically produced goods $\left(P^*\right)$. The relative price of imported goods in foreign country is denoted by P_{mr}^*. The export supply function is given as:

$$X_s = X_s\left(P_{xr}\right) \quad (3)$$

Where X_s is the supply of exports in home country and depends upon the relative price of exported goods at home (P_{xr}), defined as the ratio of the price of exportable at domestic currency (P_x) to the domestic price level (P).

$$X_s^* = X_s^*\left(P_{xr}^*\right) \quad (4)$$

Where X_s^* is the supply of exports in foreign country and depends on the relative price of exported goods in foreign country $\left(P_{xr}^* = P_x^* / P^*\right)$. Given the above, the relative import price in home country defined as the ratio of price of domestically produced goods at home (P) and abroad $\left(P^*\right)$ is given as follows:

$$P_{mr} = \left(e.P_x^*\right)/ P = \left(e.P^* / P\right)\left(P_x^* / P^*\right) = \left(Q.P_x^*\right)/P^*\big) = Q.P_{xr}^* \quad (5)$$

Where e is the price of foreign exchange in domestic currency units or the nominal exchange rate and Q = eP*/P is the real exchange rate. Similarly, the relative import price in foreign country is given as:

$$P^*_{mr} = P_{xr} / Q \qquad (6)$$

Traded quantities and their relative prices are determined by the following two equilibrium conditions:

$$M_d = X^*_s \qquad (7)$$

$$M^*_d = X_s \qquad (8)$$

The above conditions ensure equality between home/foreign country's imports and foreign/home country's exports. In this model the real incomes (Y, Y*), price levels (P, P*) and the nominal as well as real exchange rates in two countries are assumed to be exogenous. From the above model the following set of reduced form equations can be derived:

$$P_{mr} = P_{mr}(Q, Y) \qquad (9)$$

$$M = M(Q, Y) \qquad (10)$$

$$P_{xr} = P_{xr}(Q, Y^*) \qquad (11)$$

$$X = X(Q, Y^*) \qquad (12)$$

The trade balance of home country in real terms is defined as:

$$TB = P_{xr}.X - P_{mr}.M$$

The real trade balance can be expressed as a "partial reduced form" that depends on Q, Y and Y^*.

$$TB = TB\ (Q, Y, Y^*) \qquad (13)$$

Equation (13) is the basic equation for the analysis and can be written it as in log- linear form:

$$Ln(\mathrm{TB})_{jt} = \alpha_0 + \alpha_1 Ln(\mathrm{Y}_{pkt}) + \alpha_2 Ln(\mathrm{Y}^*_{jt}) + \alpha_3 Ln(REX_{jt}) + \mu_t \qquad (14)$$

Where TB_j is Pakistan's trade balance with its trading partner j, defined as ratio of Pakistan's exports to country j over her imports from country j. $\mathrm{Y}_{pk}, \mathrm{Y}^*_{jt}$ is Pakistan's real GDP and its trading partner's real GDP, respectively expressed in index form to make it unit free. REX_j is the real bilateral exchange rate between Pakistan and each trading partner's currency. It is defined as $REX_j = \left(e.\mathrm{P}^* / \mathrm{P}\right)$, where P^* is trading partner's consumer price index (CPI), P is Pakistan's CPI and e is the nominal bilateral exchange rate defined as number of rupee per unit of trading partner's currency. It is defined in a way that an increase reflects a real depreciation of Pakistani rupee against the currency of trading partner j.

The expected sign on α_1 is equation (14) is ambiguous. It can either assume a positive sign, if an increase in Y_{pk} is due to an increase in the production of imports substitute goods or a negative sign, if the increase in Y_{pk} enhances imports. In case of α_2 the expected sign will be positive if an increase in foreign income results in an increase in Pakistan's exports. However, if an increase in foreign income is due to an increase in the production of import substitutes Pakistan's exports will suffer which will imply a negative sign. Finally, the expected sign on α_3 is positive as real depreciation will improve the trade balance.

3. Data

The main purpose of this study is to analyze the long-run and short-run relationship between exchange rate and trade balance of Pakistan vis-à-vis her ten major trading partners' viz. UK, USA, France, Germany, Netherlands, Singapore, Korea, Japan, Canada, and Italy. Quarterly data from 1972-I to 2003-IV has been employed. Data has been collected from various issues of *International Financial Statistics, Direction of Trade Statistics,* and *International Trade Statistics Year Book.* The present study has employed the following variables; real GDP of Pakistan and her trading partners, real bilateral exchange rates of Pakistan and her trading partners, and trade balance with a particular country, defined as ratio of Pakistan's exports to imports from trading partners.

Real GDP of Pakistan (base year 1980-81) is transformed into index form. GDP of trading partners is taken at the current prices and converted into base year prices by using the GDP deflator. Exchange rate of all countries is taken as national currency per US Dollar at average period from 1972-2003. GDP of all countries has been transformed into dollars in order to maintain consistency. Annual data of Pakistan's exports and imports from 1972-1990 has been interpolated into quarters by using the technique employed in Weliwita and Ekanayake (1998). Annual data on GDP and GDP deflator series for Singapore from 1972-2003 has also been interpolated into quarters by using the same technique. Annual GDP deflator of Netherlands from 1972-2003 is also interpolated into quarters by using the above method. Quarterly GDP of Pakistan from 1972-2003 is taken from Kemal and Arby (2004). All variables are expressed in logs.

4. Econometric Estimation

First step in the estimation process involves testing all the variables for stationarity by conducting unit root tests. If a unit-root is found in a variable it is labeled as non-stationary and some transformation must be applied to make it stationary. In order to test for the presence of unit root in $\mathrm{TB}, \mathrm{Y}_{pk}$, Y_j^* and REX_j Augmented-Dicky-Fuller (ADF) test is applied. If the variables have unit roots then it is feasible to test for the existence of long-run relationship between the variables by applying cointegration test. The purpose of cointegration test is to determine whether a group of non-stationery series is cointegrated. For this purpose the Johansen (1988) procedure is applied which employs a maximum likelihood procedure for the estimation and determination of the presence of cointegrating vectors in a vector autoregressive system (VAR).

Suppose the vector of P-variables, $Z_t = (Z_{1t,} ..., Z_{pt})$ is generated by the k order vector autoregressive process with Gaussian error is given as follows:

$$Z_t = A_1 Z_{t-1} + ... + A_k Z_{t-k} + \mu + \varepsilon_{t,} \qquad t = 1,...,T \qquad (15)$$

Where Z_t is P× 1 vector of I(1) variables, the A's are estimable parameters, $\varepsilon_1, \ldots, \varepsilon_t$ are iid NP (0, Σ) and μ is the vector of constants. As it is essential to distinguish between stationarity by linear combination and by differencing this process can be written in error correction form as:

$$\Delta Z_t = \Pi \Delta Z_{t-1} + ... + \Pi_{k-1} \Delta Z_{t-k+1} + \Pi Z_{t-k} + \mu + \varepsilon_t \qquad t = 1,...,T \qquad (16)$$

Information about the number of cointegrating vectors is found by ascertaining the rank of Π. Specifically the rank of Π determines how many linear combination of Z_t are stationary. In the case where 0< rank (π) = r < P, Π can be factored as αβ′ (or Π = αβ′) where α and β are both P× r matrices. The Johansen method suggests two statistics to determine the number of cointegrating vectors: trace and maximum eigenvalue.

Although cointegration implies the presence of Granger causality, however it does not necessarily identify the direction of causality between the variables. This aspect of temporal Granger causality can be captured through the vector-error-correction model (VECM) derived from the long-run cointegrating vectors. Engel and Granger (1987) and Toda and Phillips (1993) point out that in the presence of cointegration the standard VAR (P) representation in the first difference is mis-specified and suggest vector-error correction representation as the correct alternative specification, given as follows:

$$\Delta Z_t = \alpha + \sum_{i=1}^{P} A_i \Delta Z_{t-1} - (d\beta' Z_{t-1}) + \nu_t \qquad (17)$$

Where Z_t is an $n \times 1$ column vector of variables, Δ is difference operator, P is the lag length, d is an $n \times r$ matrix of coefficient, ν is an $n \times 1$ column vector of disturbances. The Pth-order VAR is constructed in terms of first differences, the I(0) variable, with the addition of an error-correction term ($\beta' Z_{t-1}$). Incorporating the error-correction term (ECT) into the equation reintroduces the information lost in the first-difference process, thereby capturing both long-run as well as short-run dynamics. Incorporation of ECT term in VECM framework establishes an additional channel to test for Granger causality. After the estimation of VECM a Wald test is applied to test the joint significance of the sum of the lags of each explanatory variables and the *t*-test is applied to the lagged error-correction terms. The non-significance of the ECT is referred to as long-run non-causality which means that the variable is weekly exogenous with respect to long-run parameters. The absence of the short-run causality is established from the non-significance of the sum of the lags of each explanatory variable in the VECM indicating the weak exogeneity of the dependent variable (Baharumshah, 2001). In order to capture the dynamics responses of all endogenous variables to the affect of the shock in one of the endogenous variable in the model, the present study employs impulse response functions. Impulse response functions map out the dynamic responses path of a variable (trade balance) due to one –period standard deviation shock to another variable (exchange rate). They have been employed in the present study to evaluate whether impulse response function trace out a J-Curve pattern for the case of Pakistan.

5. Results

Before discussing the main empirical results, findings from unit root tests are discussed. Unit-root tests developed by Fuller (1976) and Dickey and Fuller (1979) known as ADF tests are employed to investigate whether the series under investigation contain a stochastic or non-stochastic trend. For ADF test each variable is regressed on a constant, a linear deterministic trend, a lagged dependent variable, and q lags of first difference using the following equation:

$$x_t = \alpha_t + \beta_t t + \rho x_{t-1} + \sum_{i=1}^{q} \delta \Delta x_{t-1} + \mu_t \qquad (18)$$

Where x_t is measured in level terms, t denotes time trend and μ_t is normally distributed random error term with zero mean and constant variance.

Lag length is picked up with the help of Schwarz Criterion by setting the maximum lag length at 9. In E-view 5, within the maximum lag length, automatic lag length option is picked which assigns different lag lengths to variables. Results from the unit-root test provide strong evidence of non-stationarity. The estimated statistic for all these variables does not exceed their critical values at standard significant levels. The unit-root test for the series in first difference confirms that all the series are non-stationery in their level but stationery in their first difference. To conserve space results of unit root testing are not reported here.

From the unit-root testing it is concluded that all the variables appear to have a unit-root. If series are integrated of the same order there is possibility of cointegration among them. In this paper multivariate Johansen cointegration test has been employed in order to check for the existence of long-run relationship among the variables. As results of Johansen procedure are sensitive to lag length, the choice of optimal lag length (*K*) for the VAR model is important, and is guided by the need for the model to have desirable statistical properties and also to span the time period in order to capture the effect of devaluation on trade balances. In this study Akaike Information criteria (AIC) has been used to pick lag length. The results of cointegration tests based on λ-max (Eigen) and trace tests statistics among variables for all the countries are reported in the Table 1 and 2. It is evident from the results that the null hypothesis of no cointegration (r = 0) is rejected by the λ- max and trace statistics at the 95% critical values in case of Canada, Italy, France, Japan, UK, and USA, while no cointegration has been found among the variables for Singapore, Germany and Korea by the λ-max and trace statistics. In case of Netherlands null hypothesis for r = 1 is rejected only by the trace statistics while accepted by the λ-max. The null hypothesis of r = 1 versus r = 2 is also rejected in case of Pak/France, based on λ-max and trace statistics. And null hypothesis of r = 1 versus r = 2 is rejected by trace statistics in case of UK while accepted by λ-max. In case of UK there are three cointegration equations by trace test, while one cointegration equation by λ-max test. Overall results support cointegration rank of 1 for Pak/Canada, Pak/Italy Pak/Netherlands, and Pak/USA, 2 cointegration relationships for Pak/France, and Pak/Japan and 3 cointegrating vectors for Pak/UK, while no cointegration relationship for Pak/Singapore, Pak/Germany and Pak/Korea. Based on the above analysis it can be concluded that there is at least one stochastic term shared by these four variable (TB, Y, Y*, REX) in the long run for Canada, France, Italy, UK, USA, Netherlands and Japan.

Estimated cointegrated vectors are normalized on the trade balance to assess the impact of other variables on the TB. Normalized cointegrating vectors are presented in Table 3. The positive sign on exchange rate variable suggests that devaluation leads to an improvement in trade balance in the long-run, while increase in foreign income results in an increase in home country exports and hence improvement in the trade balance. The present study has used the common practice to normalize on the variables of interest in order to interpret the long-run parameters of the model. For the case of Pak/Canada, Pak/France, Pak/Italy, Pak/Japan, Pak/Singapore, Pak/UK and Pak/USA, all the variables have expected signs, which show that in long-run currency devaluation improves the trade balance in case of Pakistan's trade with Canada, France, Italy, Japan, Singapore and USA. While in case of Pak/Germany, Pak/Korea and Pak/Netherlands exchange rate coefficient carries a negative sign implying a negative impact of currency devaluation on trade balance in a long-run. Y* has the expected positive sign which indicates that an increase in foreign income leads to an increase in Pakistan's exports and leads to improvement in the trade balance. In case of Pak/UK exchange rate has a positive sign and Y* has a negative sign.

Table 1: Test for Cointegration using the Johansen Method

Test			**Trace Test**				
			Pak/Canada	**Pak/France**	**Pak/Italy**	**Pak/Germany**	**Pak/Japan**
H_0	H_1	C.V (0.05)	Trace Statistics	Trace Statistics	Trace Statistics	Trace Statistics	Trace Statistics
r = 0	r = 1	63.87	73.65***	76.12**	88.30***	61.89	107.92***
r < 1	r = 2	42.91	38.05	43.91**	37.97	38.07	49.62***
r < 2	r = 3	25.87	19.46	17.10	16.01	20.58	22.28
r < 3	r = 4	12.51	7.52	4.29	3.63	6.92	7.46
			Eigenvalue Test				
		C.V	Max-Eigen Statistics	Max-Eigen Statistics	Max-Eigen Statistics	Max-Eigen Statistics	Max-Eigen Statistics
r = 0	r > 1	32.11	35.59***	32.21*	50.32***	23.82	58.30***
r < 1	r >2	25.82	18.59	26.81**	21.95	17.48	27.33**
r < 2	r > 3	19.38	11.43	12.81	12.38	13.66	14.82
r < 3	r > 4	12.51	7.52	4.29	3.63	6.92	7.46

♦ C.V stands for 5% critical value. We chose r number of cointegrating vectors which are significant under both tests. These statistics are computed with a constant in the unrestricted VAR equation.
*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

Table 2: Test for Cointegration using the Johansen Method

Test			Trace Test				
			Pak/Korea	**Pak/Netherlands**	**Pak/Singapore**	**Pak/UK**	**Pak/USA**
H_0	H_1	C.V (0.05)	Trace Statistics	Trace Statistics	Trace Statistics	Trace Statistics	Trace Statistics
r = 0	r = 1	63.87	55.46	64.89**	59.92	91.39***	71.46***
r < 1	r = 2	42.91	25.30	40.90	36.51	52.86***	35.92
r < 2	r = 3	25.87	12.18	17.77	18.78	27.66**	15.98
r < 3	r = 4	12.51	4.88	3.99	6.46	11.49	4.86
			Eigenvalue Test				
		C.V	Max-Eigen Statistics	Max-Eigen Statistics	Max-Eigen Statistics	Max-Eigen Statistics	Max-Eigen Statistics
r = 0	r > 1	32.11	30.15	23.98	23.41	38.52***	35.54***
r < 1	r >2	25.82	13.11	23.12	17.72	25.20	19.93
r < 2	r > 3	19.38	7.30	13.78	12.32	16.16	11.11
r < 3	r > 4	12.51	4.88	3.99	6.46	11.49	4.86

♦ C.V stands for 5% critical value. We chose r number of cointegrating vectors which are significant under both tests. These statistics are computed with a constant in the unrestricted VAR equation.

*** Significant at 1% level

** Significant at 5% level

* Significant at 10% level

Table 3: Estimated Cointegrating Vectors

Countries	TB♦	REX♦♦	Y♦♦♦	Y*♦♦♦♦	Trend
Pak/Canada	1.00	1.08	1.03	5.22	-0.028
Pak/Germany	1.00	-0.10	-0.12	2.03	-0.019
Pak/France	1.00	0.64	2.62	0.46	0.000132
Pak/Italy	1.00	0.16	3.63	0.19	-0.0056
Pak/Japan	1.00	0.32	-0.18	1.29	-0.028
Pak/Korea	1.00	-2.95	6.29	-0.05	0.0788
Pak/Singapore	1.00	7.46	6.61	2.15	-0.068
Pak/Netherlands	1.00	-2.13	-0.98	1.27	0.0223
Pak/UK	1.00	0.39	-0.59	-0.11	0.0078
Pak/USA	1.00	0.75	-0.74	4.46	-0.0170

♦ Trade balance
♦♦ Real Bilateral exchange rate
♦♦♦ Real GDP of Pakistan
♦♦♦♦ Real GDP of trading partner
Note: the estimated coefficients have been obtained by normalizing the Trade balance (TB) variable.

The next step in modeling process is the estimation of vector error correction model (VECM) and the identification of embodied Granger causality. In order to examine the overall significance of the variables in the short-run χ^2-*statistics* (P values) can be used to see whether real exchange rate effects trade balance in short-run or not. It is obvious from the Table 4 that in case of Pak/Canada the χ^2-*statistics* is significant at 5 % level implying Granger causality running among all the variables in TB equation. This means that in short-run exchange rate affects the trade balance, while in case of Pak/Canada error correction term is also significant at 1% level. So in case of Pak/Canada it is evident from the results that real exchange rate affects the trade balance in short-run and long-run. In case of Pak/France, overall χ^2-*statistics* is significant at 10% level indicating existence of

Table 4: Granger Causality Results; χ^2-*statistics*♦ *(p-value)*

Dependent Variable	ΔTB	ΔY	ΔY*	ΔREX	$\Sigma\chi^2$	ECT
Pak/Canada						
ΔTB	-	13.51***	5.75	6.70	22.86**	-2.90***
ΔY	1.73	-	2.76	43.21***	73.31***	-1.65
ΔY*	1.52	21.59***	-	7.13	29.46**	1.15
ΔREX	6.66	10.89**	5.73	-	34.92***	-2.86
Pak/France						
ΔTB	-	1.79	1.97	7.62	18.63*	-1.70**
ΔY	1.89	-	59.65***	65.47***	83.85***	-0.39
ΔY*	2.90	7.26	-	11.75***	27.08***	3.71
ΔREX	1.30	3.92	3.46	-	6.64	3.03
Pak/Germany						
ΔTB	-	2.73	2.60	14.18***	24.02***	-
ΔY	4.49	-	53.68***	19.15***	69.00***	-
ΔY*	3.41	25.54***	-	6.45*	41.17***	-
ΔREX	0.59	2.43	0.99	-	4.95	-
Pak/Italy						
ΔTB	-	10.53**	1.47	0.90	30.81***	-2.28***
ΔY	2.46	-	55.10***	56.96***	66.52***	-0.39
ΔY*	8.53*	15.04***	-	15.98***	22.41**	5.16
ΔREX	7.95*	15.14***	13.27***	-	22.60**	4.82
Pak/Japan						
ΔTB	-	12.06**	5.81	2.76	40.26***	-6.82***
ΔY	3.39	-	14.18***	8.08	22.65*	0.23
ΔY*	5.73	32.60***	-	22.15***	48.60***	0.01
ΔREX	4.68	18.27***	6.44	-	39.73***	0.89

♦The χ^2-*statistics* tests the joint significance of the lagged values of the independent variables and significance of the error-correction term(s).
*** Significant at 1%
** Significant at 5%
* Significant at 10%

short-run relationship among all the variables while ECT term is significant at 5% level, which indicates the existence of a long-run relationship among all the variables.

The long-run and short-run relationship among all the variables has also been analyzed in case of Pak/Italy and Pak/Japan. The overall χ^2-*statistics* is significant at 1% level implying that null hypothesis of no short-run relationship among all the variables can be rejected at 1%

level. This implies causality between exchange rate and trade balance in the short-run. The ECT term in both cases is significant at 1% level indicating strong evidence of long-run relationship among all the variables in case of Pak/Italy and Pak/Japan.

Looking at Table 5 it is evident that in case of Pak/Netherlands and Pak/UK overall χ^2-*statistics* is not significant implying that there is no short-run relationship among the variables, while ECT is significant at 1% level in both cases, implying long-run relationship among the variables. While in case of Pak/USA there is a strong evidence of short-run and long-run relationship among the variables as indicated by χ^2-statistic and ECT term which are significant at 5% and at 1% level, respectively. In Table 5 if one focuses on uni-directional relationship among the variables, it can be said that in case of Pak/Canada, Pak/France, Pak/Italy, and Pak/Japan one reason in improving the trade balance through the level of economic activity prevailing in Pakistan, which can be useful in improving the trade balance e.g. when Pakistan's real income increases, the production of import substitute goods increases, which will result in reduction in Pakistan's imports and increase in exports, hence the trade balance will improve. While in case of Pak/USA income of USA has significant impact on Pakistan's trade balance, which indicates that as USA's income increases it will expand its exports from Pakistan and as a result Pakistan trade balance will improve.

Table 5: Granger Causality Results; χ^2-*statistics*♦ *(p-value)*

Dependent Variable	ΔTB	ΔY	ΔY*	ΔREX	$\Sigma\chi^2$	ECT
Pak/Korea						
ΔTB	-	8.32	4.04	7.35	16.89	-
ΔY	2.58	-	9.48*	6.84	17.25	-
ΔY*	4.26	18.36***	-	20.73***	45.51***	-
ΔREX	1.22	12.47**	11.29**	-	20.56*	-
Pak/Netherlands						
ΔTB	-	3.44	1.96	3.00	13.27	-2.92***
ΔY	5.51	-	21.64	14.22***	35.87***	2.11
ΔY*	1.37	8.16*	-	13.05	26.37	0.93
ΔREX	4.11	1.78	1.49	-	12.0	-1.21
Pak/Singapore						
ΔTB	-	4.29	2.01	3.73	8.24	-
ΔY	2.32	-	3.04	4.32	12.94	-
ΔY*	2.42	10.19**	-	5.67	30.75***	-
ΔREX	6.17	12.91***	11.73***	-	35.43***	-
Pak/UK						
ΔTB	-	5.90	3.38	2.26	16.85	-4.52***
ΔY	5.73	-	39.34	10.70	65.21	-0.06
ΔY*	4.80	15.45**	-	36.47	58.15***	-2.90
ΔREX	11.06**	2.73	6.40	-	23.64**	2.57
Pak/USA						
ΔTB	-	8.07	11.03*	6.04	30.34**	-4.11***
ΔY	14.35**	-	10.21	47.54***	76.92***	-2.38
ΔY*	2.06	9.97	-	4.98	17.53	1.58
ΔREX	9.46	10.87*	8.27	-	45.33***	2.63

♦The χ^2-*statistics* test the joint significance of the lagged values of the independent variables and significance of the error-correction term(s).
*** Significant at 1%
** Significant at 5%
* Significant at 10%

In case of Pak/Germany, Pak/Korea, and Pak/Singapore no cointegrating vector has been reported, which indicates that there is no long-run relationship among the variables of these countries. In order to capture the short-run relationship among all the variables of these countries, an un-restricted VAR model has been employed and Granger causality has been tested in this framework. The results are reported in Table 4 and 5. In case of Pak/Germany it is evident from the results that in short-run overall relationship among the variables is significant at 1% level, while there is also significant relationship between trade balance and real exchange rate showing the positive impact of currency devaluation on trade balance. In case of Pak/Singapore and Pak/Korea no short-run relationship has been captured among the variables and there is also no significant relationship between trade balance and real exchange rate in short-run. It can be concluded from these results that in case of Pak/Singapore and Pak/Korea there is no long-run and short-run impact of currency devaluation on trade balance. While in case of Pak/Germany there is only short-run relationship between real exchange rate and trade balance. In case of Pak/Canada, Pak/France, Pak/Italy, Pak/USA and Pak/Japan there is long-run and short-run relationship among all the variables; Y*, Y, Tb and REX. In case of Pak/Netherlands and Pak/UK there is only long-run relationship among the variables.

In order to provide an additional insight into the dynamic responses pattern of trade balance, generalized impulse response functions (IRF's) have been used in this paper. Through these functions the response of the trade balance to innovations in exchange rate can be captured. The main purpose of this function is to discover whether a J-Curve exists or not for Pakistan, if it does, then the response of trade balance to devaluation traces out a J-shape, indicating devaluation at first causes a worsening of the trade balance, and after some quarters leads to an improvement. Figure 1 plots the impulse response function of trade balance to shock in the exchange rate in case of Pak/France. It is evident from the figure that Pakistan's trade balance responds quickly in case of devaluation but there is no evidence of the existence of J-Curve. Figure 2 shows the impulse response of trade balance to shock in exchange rate in case of Pak/Canada J-Curve phenomenon. It can be observed from the Figure 2 that in case of Pak/Canada, currency devaluation deteriorates the trade balance in the long run. The results from impulse response functions lead us to conclude that the classical J-curve phenomenon is not observed for Pakistan vis-à-vis any trading partner, implying that currency devaluation does not lead to improvement in the trade balance in long-run. To conserve space we haven't reported the IRF's for rest of the trading partners.

Figure 1: Generalized Impulse Response of Trade Balance to Shock in Exchange Rate (Pak/France)[4]

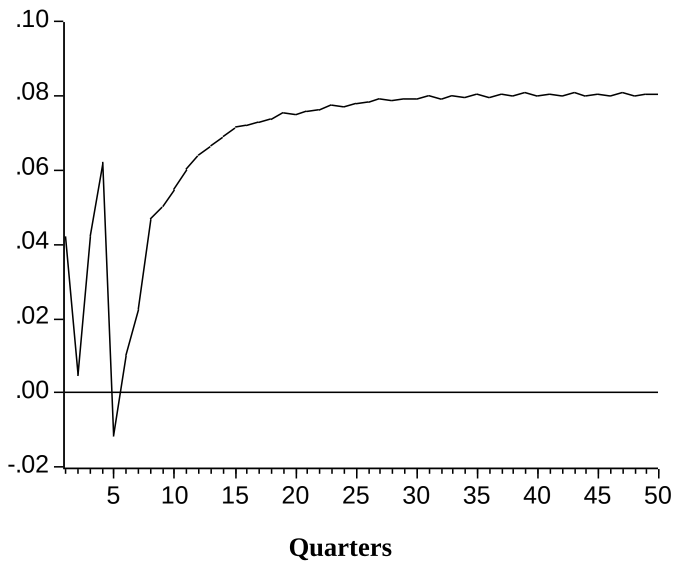
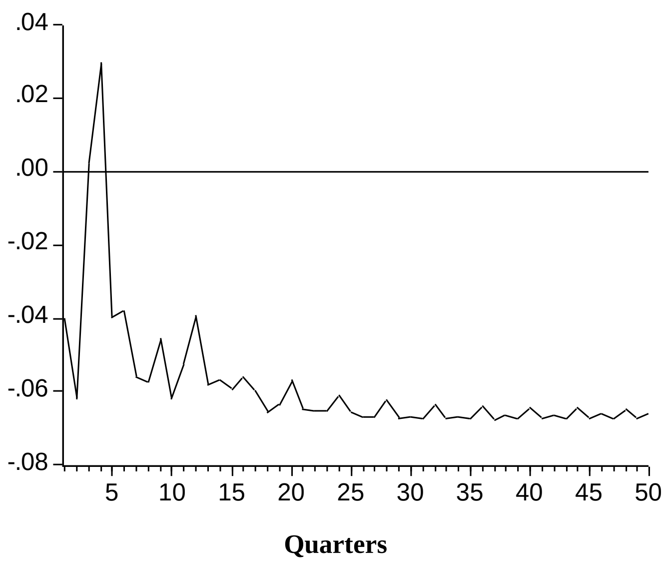


Figure 2: Generalized Impulse Response of Trade Balance to Shock in Exchange Rate (Pak/Canada)



[4] Generalized impulse response functions are invariant to ordering of the variables

6. Conclusion

The main objective of this paper has been to investigate the long-run and short-run impact of currency devaluation on trade balance of Pakistan vis-à-vis her ten major trading partners employing disaggregated quarterly data from 1972-I to 2003-IV. Theoretical framework for this study relies on "imperfect substitute model" as developed by Rose and Yellen (1989). Stationarity of the variables is tested by employing unit root tests and results indicate that all variables are non-stationary in levels. Cointegration test is carried out to capture long-run relationship among the variables of interest. An error correction model has been employed to test for Granger causality in a cointegrated framework. Results of this study support the traditional view that devaluation improves the trade balance but the effect of devaluation on trade balance is very rapid providing no evidence of a J-curve.

Furthermore, in the long-run a causal relationship is established among all variables for the cases of Pak/Italy, Pak/France, Pak/Japan, Pak/Canada, Pak/USA, Pak/Netherlands and Pak/UK. In the above cases ECT term is significant indicating that depreciation of Pakistani rupee causes the trade balance to improve. In the short-run, Granger causality is established among the variables for the case of Pak/Italy, Pak/USA, Pak/France, Pak/Germany, Pak/Japan and Pak/Canada. Uni-directional Granger causality is also established from Pakistan's real income to trade balance as is evident in the case of Pak/Canada, Pak/Italy and Pak/Japan. The estimated coefficient on real income of Pakistan is significant implying that an increase in Pakistan's real income leads to an expansion in the domestic production of import substitutes, with a consequent reduction of Pakistan's imports and a concomitant improvement in the trade balance. In case of Pak/USA, increase in the real income of USA (Y*) lead to expansion in exports from Pakistan and resultantly Pakistan's trade balance will improve.

The traditional view contends that currency devaluation can be an effective policy tool for improving the trade balance of developing countries facing persistent BOP deficits. The findings from this paper fail to lend any credence to the above contention as exhibited by lack of evidence for a J-curve phenomenon. This finding has important lessons for policy makers in charge of formulating trade policies. In context of bilateral trade, currency devaluation does not improve trade balance in the long-run. Furthermore, our findings suggest that policy should be aimed at improving Pakistan's real income so as to improve its trade balance. Also, results indicate that increase in foreign country's real income also leads to an improvement in Pakistan's trade balance through an increase in its imports from Pakistan, provided imports exhibit an inelastic demand. The policy lesson that can be derived from the above statement is that Pakistan should pursue an active strategy of encouraging production of manufactured and semi-manufactured goods to improve its trade balance through the above channel.

References

Aftab, Z. and Aurangzeb (2002), "The Long-run and Short-run Impact of Exchange Rate Devaluation on Pakistan's Trade Performance," *Pakistan Development Review,* 41(3), 227-286.

Arora, S. Bahmani-Oskooee, M. and Goswami, G. (2003), "Bilateral J-Curve Between India and Her Trading Partners," *Applied Economics*, 35(9), 1037-1041.

Baharumshah, A. Z. (2001), "The Effects of Exchange Rate on Bilateral Trade Balance: New Evidence From Malaysia and Thailand," *Asian Economic Journal*, 15(3), 291-312.

Bahmani-Oskooee, M. (1985), "Devaluation and the J-Curve: Some Evidence From LDCs," *The Review of Economic and Statistics,* 67(3), 500-4.

Bahmani-Oskooee, M. and Kantipong, T. (2001), "Bilateral J-Curve between Thailand and Her Trading Partners," *Journal of Development Economics*, 26(2), 107-117.

Bahmani-Oskooee, M. and T. J. Brooks (1999), "Bilateral J-Curve Between U.S. and Her Trading Partners," *Weltwirtschaftliches Archive*, 135(1), 156-165.

Dickey, D., and W. Fuller (1979), "Distribution of the Estimators of Autoregressive Time Series with a Unit Root," *Journal of the American Statistical Association*, 74(366), 427-31.

Engle, R. F., and C. W. Granger (1987), "Co-integration and Error Correction:
Representation, Estimation, and Testing," *Econometrica*, 55(2), 251-276.

Fuller, Wayne A. (1976), Introduction to Statistical Time Series. John Wiley and Sons, New York.

Hassan. M. A & Khan. A. H. (1994), "Impact of Devaluation on Pakistan's External Trade: An Econometric Approach," *The Pakistan Development Review (PDR)*, 33(4) Part II Winter, 1205-1215.

International Monetary Fund, International Financial Statistics Yearbook**,** various issues. Washington, DC: Monetary Fund.

International Monetary Fund, International Trade Statistics Yearbook, various issues. Washington, DC: Monetary Fund.

International Monetary Fund, Direction of Trade Statistics, various issues. Washington, DC: Monetary Fund.

Johansen, J. (1988), "Statistical Analysis of Cointegrating Vectors," *Journal of Economic Dynamic and Control,* 12(2-3), 231-254.

Junz, H. B., and R. R. Romberg (1973), "Price Competitiveness in Export Trade Among Industrial Countries," *American Economic Review*, 63(2), 412-18.

Kemal, A.R. and M. F. Arby (2004), Quarterization of Annual GDP of Pakistan; Pakistan Institute of Development Economics, Statistical Papers Series No. 5. Islamabad, Pakistan.

Magee, Stephen P. (1973), "Currency Contracts, Pass Through and Devaluation," *Brookings Papers on Economic Activity*? 4(1973-1), 303-325.

Rose. A. K. and Yellen, J. L. (1989), "Is There a J-Curve?" *Journal of Monetary Economics*, 24(1), 53-68.

Toda, H.Y. and P.C.B Phillips (1993), "Vector Autoregressions and Causality," *Econometrica*, 61(6), 1367-93.

Weliwita, A and Ekanayake, E. M. (1998), "Demand for Money in Sri Lanka During the Post-1977 Period: A Co-integration and Error Correction Analysis," *Applied Economics*, 30(9), 1219-1229.