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THE EFFECT OF EXCHANGE RATE CHANGES ON TRADE BALANCES IN NORTH AFRICA: EVIDENCE

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Abstract

This paper examines the effects of exchange rate changes on the bilateral trade balances of Morocco and Tunisia vis-à-vis the United States and Japan. It also sheds some light on unresolved issues surrounding the J-curve phenomenon.

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INTRODUCTION

Accurate understanding of trade balance response to changes in exchange rate is a crucial factor in the coordination and implementation of trade and exchange rate policies. The conventional wisdom is that a nominal depreciation/devaluation of exchange rate improves the trade balance in the long run while causing it to worsen in the short run. A change in the exchange rate has two effects on the trade balance; the price effect and volume effect. While the price effect works to make imports more expensive to foreigners, it causes domestic exports to be cheaper for foreign buyers, at least, in the short run and as the volume of exports and imports do not adjust instantaneously in the short run, trade balance may initially experience some deterioration in the short run, following the currency depreciation/devaluation. However, following eventual adjustment process of exports and imports to the currency depreciation/devaluation, price effect will tend to dominate the volume effect in the short run whereas volume effect will dominate in the long run, hence, reversing the overall effect in favor of the trade balance improvement, assuming that the Marshall-Lerner condition holds.

In the literature, the two main theories that attempt to explain the effect of exchange rate depreciation/devaluation on the trade balance are the elasticity approach and the monetary approach. The elasticity approach focuses on demand conditions by assuming that the supply of domestic exports and foreign imports are perfectly elastic so that changes in demand volumes have no unambiguous effect on prices. In effect, the assumption implies that domestic and foreign prices are fixed so that changes in relative prices are solely caused by changes in nominal exchange rate. In addition, the approach identifies two direct effects of depreciation/devaluation on the current account balance, one that works to reduce the deficit and the other that works to worsen the deficit more than before.

The Marshall-Lerner condition upon which the theory is built states that, starting from a position of equilibrium in the current account; a depreciation/devaluation of a domestic currency improves the current account only as long as the sum of elasticity of foreign demand for exports and elasticity of domestic demand for imports exceeds unity. However, if this sum is less than unity then devaluation will worsen the current account. This follows from the belief[1] that transaction completed at the time of depreciation/ devaluation may dominate a short-term change in the trade balance, leading to the deterioration of trade balance during the contract period, before quantities of exports and imports adjust. As the elasticities of exports and imports improve over time, quantities adjust to the new effective prices, causing the trade balance to rise. However,

[1] See Krueger (1983).

Williamson (1983) points out that such higher import prices resulting from depreciation/devaluation could raise domestic prices of non-traded goods, generating an overall inflation that may raise the effective real exchange rate, hence, eliminating the every potential for improving the trade balance.

On the other hand, the monetary approach which views the balance-of-payments surpluses and deficits as monetary flow resulting from stock disequilibrium in the money market, assumes that the balance of payments is essentially a monetary phenomenon in international monetary economy, which requires the analysis in terms of monetary concepts. The approach contends that a deficit in the balance of payments is due to an excess supply of stock of money in relation to money demand whereas a surplus is a flow resulting from an excess demand for money in relation to the stock of money supply. Based on this premise, the monetary approach regards the balance of payments disequilibrium as a reflection of disequilibrium in the money market. The immediate effect of depreciation/devaluation is to make domestic goods competitive in relation to PPP compared with foreign goods, raising the demand for domestic currency. As the demand for domestic currency exceeds its supply, the comparative advantage of deprecation/devaluation would improve the balance of payments as domestic demand for foreign goods falls while foreign demand for more domestic goods increases. In the monetarist's view, the effect of the currency depreciation/devaluation on the balance of payments should be transitory only as long as the monetary authorities do not simultaneously engage in expanding money supply through open market operations. However, if the monetary authorities increase money supply via open market operations, aggregate demand and domestic prices will rise, eliminating the very comparative advantage the currency depreciation/ devaluation was meant to generate.

The objectives of this paper are twofold: first, to examine the effects of exchange rate changes on the bilateral trade balance; and secondly, to attempt to establish the existence of a J-curve phenomenon. The study employs the Johansen cointegration and error-correction model on the annual data on three non-oil exporting North African countries of Egypt, Morocco and Tunisia vis-à-vis the US and Japan in the period 1970-2003. The choice of these Sub-Saharan North African countries is motivated by a number of factors. First, these countries were among the first on the Sub-Saharan African continent in implementing the IMF Structural Adjustment Programs (SAPs) since early 1980s in which exchange rate adjustment was among the instruments targeted for bringing about the intended economic liberalization. Hence they may offer invaluable lessons in the area of exchange rate –trade balance adjustment. Secondly, flowing the implementation of the mentioned programs, these countries, among others, were thought to have experienced the J-curve kind of adjustment that characterizes the behaviour of trade balance that follows exchange-rate adjustment. For these reasons, they merit

being chosen for study to analyse the effect of exchange rate changes on bilateral trade balance during this adjustment period.

In general, the findings confirm the existence of both short-run dynamics and long-run causal relationships between trade balance and the set of specified independent variables. However, the results produce mixed evidence about the existence of the J-curve effect. A classic J-curve pattern is observed only in case of Morocco/Japan in which the trade balance deteriorates almost immediately following the devaluation of the real exchange rate and recovers after two years. In cases of Egypt/Japan and Tunisia/US, we could observe some kind of delayed J-curve effects in which, following the currency devaluation, trade balances experience short-term improvement first that lasts for about one year in both countries. However, in cases of Egypt/US, Morocco/US and Tunisia/Japan, no clear evidence of the J-curve phenomenon is found.

The rest of the study will be organized as follows. Section II describes the exchange rate policies that existed in Egypt, Morocco and Tunisia prior to and during this period of study. Section III presents the empirical model and econometric methodology that will be employed in investigating the effects of exchange rate changes on the trade balance. While section IV presents the discussion of empirical results, section V summarizes the conclusions.

EXCHANGE RATE POLICIES IN EGYPT, MOROCCO AND TUNISIA IN THE PERIOD 1970S 1990S

During 1970 and much of 1980s, Egypt and the two Maghreb nations of Morocco and Tunisia, like many of their counterparts in developing countries by the time, pursued inward-looking development strategies in which the financial systems were heavily controlled. Interest rates were set administratively and consequently, were sometimes negative in real terms. Monetary policy was conducted chiefly through direct allocation of credit and refinancing. In addition, money markets were in nascent stage of development with complete absence of bond and equity markets. Commercial banks were forced to lend to the so-called priority sectors with little attention paid to the borrowing firm's profitability and default risk. Capital flows were tightly regulated with entry of foreign investment to the financial sector severely restricted.

When these inefficiencies and distortions exacerbated the economic problems and almost crippled the prospects of economic growth, the governments of these countries undertook comprehensive stabilization and structural reform programs in 1986 with IMF and World Bank support. The reforms aim at reducing direct government intervention and strengthening the role of market forces in the allocation of financial resources, improving the capacity of financial

institutions to mobilize domestic savings, enhancing competition among banks, and strengthening their financial soundness.

In Egypt, the second[2] largest economy in the Arab world with a GDP of $85.5 billion (2002 estimates), the exchange rate has been pegged to the US dollar since the 1960s. In the early 1980s, the country was operating at a multiple exchange rate regime in which there was the Central Bank's rate, which continued until 1979 when the pound was devalued in 1990; the commercial banks' rate that continued until its abolition in1989 and lastly, the rate at which foreign exchange was traded at a premium in the so-called exchange rate pool. With beginning of the economic reform program in 1991, the unification of exchange rate in "managed floating" regime was an important component of the policy package. To streamline the economy further, successions of exchange rate devaluation were undertaken between 1991 and 2000. Following the policy of gradual devaluation of the currency in the first eight month of 2001, the government announced another new exchange rate regime, known as the central rate, around which banks and exchange bureaus were to buy and sell within a trading band of 1%. Not long enough, in June of the same year, the Central Bank adjusted the central rate and increased the trading band to 1.5% for dollars and 2% for other currencies. Finally, in January 2003, the Egyptian currency was finally floated and by mid-October, the exchange rate had depreciated by about 33% to settle at LE 6.15/US$.

The establishment of interbank foreign exchange markets in Tunisia in 1994 and in Morocco in 1996 marked an important step toward decentralizing the management of foreign exchange and allowing market forces to play a greater role in exchange rate determination. The national currencies of both countries (the Moroccan dirham and the Tunisian dinar) experienced significant upheavals in early 1970 due to the instability of French franc (FF) to which the two currencies were pegged. In case of the Moroccan dirham, the link to FF was severed in 1973 and the currency underwent a managed-float regime. The move was to maintain dirham's relative effective exchange rate in relation to a basket of major foreign currencies. Like in many developing countries, a dual exchange rate system was set up for dirham in 1973 and 1978 respectively. In 1980, in order to accommodate the changes in Moroccan foreign trade pattern and structure of currencies used in external settlement, the weights in the currency basket were adjusted, paving the way for a gradual depreciation of the dirham. In the subsequent years the worsening terms of trade and the accompanying deterioration in the balance of payment position that started in 1986 forced the real depreciation of the dirham by about 9% in 1990.

[2] Second only to the Kingdom of Saudi Arabia, which has the GDP of US$ 191 billion (2002 estimates).

On the other hand, the Tunisian dinar was also linked to the German mark (DM) in addition to the FF and the US dollar in 1978. Numerous attempts, including changing the weights of the currency baskets, were embarked upon to stabilize the currency, however, the trade and balance of payments difficulties that cropped up in the mid-1980s forced the authorities in August 1996 to fully liberalize the currency.

THE EMPIRICAL MODEL AND METHODOLOGY

Trade balance, sometimes referred to as visible balance, represents the difference between receipts for exports of goods and expenditure on imports of goods. In other words, it is the difference between the monetary value of total exports and imports. As suggested[3] that trade balance is determined by a number of macro variables such as real outputs, exchange rates, money supplies, etc., the existence of direct or indirect casual feedback between trade balance and such macro variables cannot be ruled out. With this in mind, the Krugman-Baldwin (1987) model is adopted[4] for this study. An advantage of this model, in addition to its simplicity, is its ability to capture the effect of all the specified macro variables on trade balance. This two-country model stipulates that the demand for imported goods by domestic residents is positively related to real domestic income and negatively to relative price of imported goods. Hence, trade balance is given as

$$TB = TB(Q, Y, Y^*) \tag{1}$$

where $Q \equiv e.P^*/P$. In this expression, an increase in e would denote a depreciation of the domestic real exchange rate and vice-versa. Equation (1) can be estimated in a log-linear form by taking the logs on both sides to obtain the following estimating equation

$$tb_t = \alpha_0 + \alpha_1 q_t + \alpha_2 y + \alpha_3 y^* + \mu_t \tag{2}$$

$$\alpha_1 > 0,\ \alpha_2 > 0 \text{ or } < 0 \text{ and } \alpha_3 > 0.$$

where lower-case letters represent logarithm of a variable and μ_t is white-noise process.

In the model, a four-variable system will be set up, denoted by the notations: log of trade balance is *tb*, log of real effective exchange rate (real exchange rate for Egypt) is *q*, log of domestic income (GDP) is *y*, and the log of foreign income is y^*, compactly written as $x = \{tb, q, y, y^*\}$. In this study, trade balance is expressed as a ratio of exports to imports (e.g., Weixian, 1998; Gupta-Kapoor and Ramakrishnan, 1999; Baharumshah, 2001; Bahmani-Oskooee 2002; and Onafowora, 2003). The advantage of this ratio is that it is insensitive to the unit of

[3] See Baharumshah (2001) for more details.

[4] For detailed discussion of the model, see Rose and Yellen (1989), Rose (1991), Bahmani-Oskooee (1991), Brada et al. (1993), and Baharumshah (2001)

measurement as it can be easily interpreted as nominal or real exchange rate. Secondly, it is emphasized (Boyd et al., 2001) that in logarithmic model it gives the Marshall-Lerner condition exactly rather than approximating it. Furthermore, following studies by Rose (1991), Bahmani-Oskooee (1991) and Baharumshah (2001), this study will use real effective exchange rate instead of nominal bilateral exchange rate. Finally, trade balance, domestic and foreign incomes will be in real terms while consumer price index will be used as the price deflator. The data series for this study, which are seasonally unadjusted, are drawn mainly from the IMF International Finance Statistics (IFS. A dummy variable is included with value unity before 1986 when the exchange rates were fixed and a zero otherwise.

As a standard practice, this study employs the cointegration and vector error-correction model because of its ability to examine the short-run dynamics and long-run relationship between trade balance and the specified set of independent variables. The model is based on four crucial steps. Firstly, the properties of individual time series are investigated by applying the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) tests for unit roots in the variables. Estimating vector error-correction mechanism (VECM) requires the use of stationary data in order to avoid spurious results.

Secondly, Johansen maximum likelihood method (Johansen, 1988 and Johansen and Juselius 1990) is applied to test the degree of integration among the variables. In addition to yielding maximum likelihood estimators of unconstrained cointegrating vectors, the procedure allows for explicit testing for the number of cointegrating vectors. In this method, Johansen and Juselius write the distributed lag model of a vector of variables, X**,** in the following vector error-correction form

$$\Delta X_t = \pi X_{t-k} + \sum_{k=1}^{n} \Gamma_{k-t} \Delta X_{t-k+1} + \in_t \qquad (3)$$

where $\Gamma_i = -I + \pi_1 + \pi_2 + \ldots + \pi_i \qquad (i = 1, \ldots, k-1)$

and $\pi = -(I - \pi_1 - \pi_2 - \ldots - \pi_k)$.

It is the term π that contains the information concerning the long-run relationship among Xt variables. This term is a *n* x *n* matrix of long-run parameters whose rank determines the number of independent cointegrating vectors; say *r* (< *n*). If this matrix is of full rank, all variables in the system are stationary and the model may be estimated with variables in levels. However, if the matrix is of zero rank, there is no cointegrating relationship among the variables and, hence, the model could be estimated in first difference without error-correction term. When the matrix is of reduced rank, i.e., $0 < r <$ n, there are *r* (linearly independent) cointegrating vectors. Matrix π can be decomposed into two (*n x r*) dimensional

matrices α and β: written as $\pi = \alpha\beta'$, where α, also called loadings, is the matrix containing the adjustment coefficients, and β comprises the cointegration vectors. Following Engle and Granger (1987), a variable is integrated of order *d*, or I(*d*), if it has to be differenced *d*-times to become stationary. A vector x_t is integrated of order *d* if the maximum order of integration of the variables in x_t is *d*, while a vector x_t is cointegrated, or CI (*d*, *b*) if there exists a linear combination βx_t that is integrated of lower order ($d - b$) than x_t. It has been shown (Johansen and Juislius, 1990) that β can be interpreted as a matrix of cointegrating vectors and can be estimated as the eigenvector associated with the largest *r*, statistically significant eigenvalues. The rank of a matrix is equal to the number of its characteristic roots that differ from zero, determined by testing the significance of the characteristic roots of π.

Thirdly, if the variables are cointegrated, then tests involving differenced variables will be misspecified and some important information lost unless a lagged error-correction term is included. Therefore, we estimate the error-correction model in which the error-correction terms (ECT), derived from long-run cointegrating vectors, are included as independent explanatory variables in the estimation process of equation (3) in order to recover all the long-run information that was lost in the original estimation process. Assuming that equation (3) is cointegrated with all its non-stationary variables, the system can be rewritten as:

$$\Delta \ln(tb)_t = \alpha_t + \lambda \mu_{t-1} + \sum_{i=1}^{k} \beta_i \Delta \ln(tb)_{t-i} + \sum_{i=1}^{l} \delta_i \Delta \ln(q)_{t-i} + \sum_{i=1}^{m} \gamma_i \Delta \ln(y^*)_{t-i} + \sum_{i=1}^{n} \eta_i \Delta \ln(y)_{t-i} + \varepsilon_t \quad (4)$$

where all the variables in equation (4) remain defined as before. μ_{t-1} is the error-correction term (one lagged error) generated from Johansen multivariate process and ε_t is the disturbance term. The coefficient of the lagged error-correction term, λ, is the adjustment coefficient that defines the proportion by which long-run disequilibrium in dependent variable is corrected in a given period of time.

The application of the Johansen method produces two types of relationships; short-run dynamics and long-run causal relationships between the trade balance and the specified set of independent variables. The long-run causal relationship is captured by the coefficients of the lagged value of the error-correction term, μ_{t-1}, while the short-run causal effects are implied by the coefficients of the lagged explanatory variables (in first difference). If only the vector error-correction term (ECT) is statistically significant, this implies that the variable is weakly endogenous with respect to the long-run parameters. Similarly,

if only the coefficients of the lagged explanatory variables (in first difference) are statistically significant, this implies that the variable is weakly endogenous with respect to the short-run parameters. Finally, if the lagged explanatory variables and error-correction terms are not statistically significant, then the dependent variable is econometrically strongly exogenous.

Finally, in order to discover whether the J-curve effects exist, generalized impulse response functions must be computed and plotted to identify the response of trade balance to shocks in the real effective exchange rate for these three countries vis-à-vis the US and Japan. This is one way of visualizing the response of endogenous series to various shocks. Expressing vector autoregression in vector moving average allows the time path of the various shocks on the variables included in VAR system to be traced out.

There is no unanimity on the empirical evidence in literature concerning the relationship between exchange rate and trade balance, to say the least. For example, Miles (1979) for seven European, three Latin American and two South Asian countries in addition to Israel and New Zealand, Rose and Yellen (1989) for G-7, Rose (1991) for UK, Canada, Japan and USA, Upadhyaya and Dhakal (1997) for eight developing countries from Europe, Africa and Latin America and Wilson (2001) for Singapore, Malaysia and Korea and Wilson and Tat (2001) for Singapore have empirically shown that currency depreciation/devaluation does not necessarily lead to improvement in the trade balance. On the other side, Himarios (1985) for ten Latin American, European, Asian and Middle Eastern countries, Rawlins and Praveen (1993) for selected nineteen Sub-Saharan African countries, Bahmani-Oskooee (1991) for eight Latin American and Asian countries in addition Greece, Weixian (1998) and Zhang (1999) for China, Gupta-Kapoor and Ramakrishnan (1999) for Japan, Baharumshah (2001) for Malaysia and Thailand, Lal and Lowinger (2002) for five South Asian countries, Stučka (2003) for Croatia, Onafowora (2003) for Indonesia, Malaysia and Thailand, and Narayan (2004) for New Zealand, provide an empirical evidence that currency depreciations/devaluations in general do lead to improvements in trade balances.

Nevertheless, differences over the existence of the J-curve phenomenon remain common as well. Baharumshah (2001), Wilson (2001) and Onafowora, (2003), for example, reach different conclusions regarding the existence of J-curve effects in case of Malaysia. While the first two find no evidence of the existence of J-curve for Malaysia, Singapore and Thailand, with the exception of Korea, the later confirms the evidence of short-run J-curve effect in case of Indonesia and Malaysia in their trade with both US and Japan. On the other hand, Rawlins and Praveen (1993), in a study of nineteen Sub-Saharan African

countries[5], fail to report any evidence supporting the existence of a J-curve effect. Nevertheless, Narayan (2004) finds that New Zealand's trade balance exhibits a J-curve effect.

RESULTS OF THE EMPIRICAL MODEL

The empirical analysis is carried out using annual data on exports, imports, real effective exchange rate and/or real exchange rate, domestic output (GDP) and foreign output (GDP) for Egypt, Morocco and Tunisia in the period 1970-2003. The length of the sample period was dictated by the availability of the relevant data.

We employ the standard Dickey-Fuller and Phillips-Perron tests for all the variables at levels and first differences with trend and without. While the test results at levels indicate that the null hypothesis of a unit root could not be rejected for all the variables, the statistical significance of absolute value of test statistics at least at five percent level indicates that the series are stationary at first differences and should be employed in VAR/VECM process in their present form. To conserve a space, the results of unit-root tests are not reported here but available with the author upon request.

After confirming the stationarity of the variables at I(1), the Johansen maximum likelihood method (Johansen, 1988 and Johansen and Juselius 1990) is applied to examine the question of cointegration among the variables. Before conducting the cointegration tests, the dynamic specification of the Johansen model is determined first by estimating the initial equations using the full data set, setting *k*, the optimal lag length, arbitrarily. The unrestricted model is then tested against a restricted version where *k* varies from 3 to 1. In case of Egypt, we employ a lag length of 3 while for Morocco and Tunisia, a lag length of 2 was found to be appropriate as indicated by Akaike and Schwarz information criteria. The computed test statistic is asymptotically distributed as χ^2 with n^2 $(\rho_1 - \rho_0)$ degrees of freedom. As the Johansen procedure is notorious in over-rejecting the null hypotheses in small samples, however, Reimers (1992) and Psaradakis (1994) recommend making adjustment for the degrees of freedom by placing *T* by *T- nk* in trace and Maximal eigenvalue test equations where *T* is the sample size, *n* is the number of variables in the model and *k,* is the lag length. This adjustment could improve the small-sample behavior of likelihood ratio statistics. Therefore, we use 22 in case of Egypt and 26 in other two cases rather than 34 observations in this study. In addition, a constant was included in the cointegrating vector for all the

[5] The countries were: Burkina Faso, Cameroon, Central African Republic, Côte d'Ivoire, Gabon, The Gambia, Ghana, Kenya, Madagascar, Mauritius, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Togo, Zaire and Zambia.

models except in cases of Morocco/Japan and Tunisia/Japan where constants and deterministic trends were included in cointegrating vectors.

The results of cointegration tests are reported in table 1 in which the Johansen test rejects the null hypothesis of no cointegration in favour of at least one cointerating vector in all cases. Whereas both the Max-eigen and trace statistics indicate two cointegration vectors in case of Egypt/US, only the Max-eigen statistic identifies two cointegrating vectors in case of Egypt/Japan. In cases of Morocco/US and Morocco/Japan, both statistics indicate the existence of a single cointegrating vector. However, in case of Tunisia/US, the trace statistic indicates one cointegrating vector whereas in case of Tunisia/Japan, the Max-eigen statistic indicates a single cointegrating vector.

Table 1: Results of Johansen's Test for Multivariate Cointegrating Vectors

H_o	Max-Eigen		Trace	
Egypt/US	Statistic	95% critical value	Statistic	95% critical value
$r \leq 0$	40.00***	27.078	71.073***	47.21
$r \leq 1$	26.34***	20.97	31.07**	29.68
$r \leq 2$	4.25	14.07	4.73	15.41
$r \leq 3$	0.48	3.76	0.48	3.76
Egypt/Japan				
$r \leq 0$	25.63	31.46	68.68**	62.99
$r \leq 1$	21.75	25.54	43.05**	42.44
$r \leq 2$	14.21	18.96	21.30	25.32
$r \leq 3$	7.07	12.25	7.07	12.25
Morocco/US				
$R \leq 0$	27.24**	27.07	50.58**	47.21
$R \leq 1$	13.02	20.97	23.35	29.68
$R \leq 2$	9.06	14.07	10.33	15.41
$R \leq 3$	1.27	3.76	1.27	3.76
Morocco/Japan				
$R \leq 0$	69.62***	31.46	108.69***	62.99
$R \leq 1$	21.30	25.54	39.07	42.44
$R \leq 2$	13.86	18.96	17.77	25.32
$R \leq 3$	3.91	12.25	3.91	12.25
Tunisia/US				
$R \leq 0$	24.82	27.078	47.44**	47.21
$R \leq 1$	14.78	20.97	22.62	29.68
$R \leq 2$	7.60	14.07	7.83	15.41
$R \leq 3$	0.23	3.76	0.23	3.76
Tunisia/Japan				

$R \leq 0$	32.03**	31.46	61.85	62.99
$R \leq 1$	14.51	25.54	29.82	42.44
$R \leq 2$	11.27	18.96	15.31	25.32
$R \leq 3$	4.04	12.25	4.04	12.25

Notes: Notes: ***, ** and * indicate 1%, 5% and 10% significance level respectively.

In models where there is one cointegrating vector, identifying the equation that represents the trade balance is straightforward. By normalizing on the log of the trade balance[6], we could obtain the cointegrating vector, which can be interpreted as the long-run relationship between trade balance and the independent variables. However, in case of the Egypt/US and Egypt/Japan models where two cointegrating vectors were identified, although the choice of which cointegrating vector to represent the trade balance equation is debatable, we normalize on the trade balance variable since it is the variable of the interest. The results of the estimated cointegrating equations are reported in table 2.

Table 2: Estimated Cointegrating Vectors in Johansen System

COUNTRY/VAR	tb	q	y^*	y	Constant
Egypt/US	1.00	-0.111	-5.421***	4.263***	45.004
Egypt/Japan	1.00	-1.181***	4.214***	0.925**	-136.654
Morocco/US	1.00	-0.036***	0.001	-0.015	-1.227
Morocco/Japan	1.00	-0.031***	-0.032**	0.093***	-1.950
Tunisia/US	1.00	-0.028***	0.009	0.013	-1.475
Tunisia/Japan	1.00	-0.059***	0.001	0.053***	-2.189

Notes: ***, **, and * denote 1%, 5% and 10% significance level.

In all cases, the coefficients of real exchange rates have correct positive signs and significant at 1% level as the theory predicts except in case of Egypt/US, suggesting that a depreciation/devaluation of real exchange rate would stimulate exports and discourage imports, hence, improving the trade balance of these countries. The insignificance of the coefficient of RER in case of Egypt/US

[6] See Charemza and Deadman (1992).

implies that Egyptian trade balance does not respond to changes in real exchange rate vis-à-vis the US dollar in the long run, but is driven by short-run adjustments. The finding could be an implication of the shrinking trade between Egypt, which is a non-oil exporting country, and the USA. More importantly, this could be the case since cotton, which used to be the major foreign exchange earner in the Egyptian economy vis-à-vis the USA, has lost its importance in international trade since the 1970s.

Foreign real income variable is significant at least at 1% level in cases of Egypt/US, Egypt/Japan and Morocco/Japan, but carries correct positive sign only in cases of Egypt/US and Morocco/Japan, implying that an increase in American and Japanese incomes improves trade balances of Egypt and Morocco in the long run. Although significant at 1% level, foreign real income surprisingly carries positive sign in case of Egypt/Japan, which suggests that an increase in Japanese income causes trade balance to deteriorate in Egypt in a long run.

In cases of Egypt/US, Egypt/Japan, Morocco/Japan and Tunisia/Japan, domestic real incomes carry correct negative signs and are significant at least at 5% level, suggesting that a rise in domestic income of these countries encourages their consumers to demand more foreign goods, leading to a deterioration of trade balance in favor of US and Japan, which is consistent with the theory. Furthermore, the fact that the estimated long-run exchange rate elasticities are less than 1 implies that the Marshall-Lerner condition is not satisfied except in case of Egypt/Japan where it is greater than 1 (1.181).

Having established the existence of long-run relationship among the relevant variables by employing the Johansen test, the next task is to set up the error-correction model in which error correction terms (ECT) are included. The results of the short-run version of the model, specified as a vector error correction model, are presented in Table 3, in which all the insignificant variables are omitted from the model. In addition, since the interpretation of these short-run relations does not have any significance, we ignore them. In this regard, Masih and Masih (2004, p.597) caution against attaching too much significance to such short-run relationships since the nonsignificance or otherwise of any of the differenced explanatory variables, which reflect only short-run relationship, do not violate the theory. That is because the theory says little about such short-run relationships. The value of Durbin-Watson statistics lying around 2 rejects the presence of any serious problem of serial correlation among the residuals.

The speed of adjustment, defined by the coefficient associated with the error-correction term, are correctly negative and significant at least at 5% level in each model. Since this value lies between 0 and –1, (except in case of Egypt/Japan), the correction of disequilibrium in the present period is a fraction of the error in the previous period. In this case, the ECT tends to cause trade balance to converge monotonically to its long-run equilibrium paths in relation to changes

in the exogenous variables in each case. This implies that about 37%, 62%, 64%, 98% and 60% of disequilibrium in bilateral trade between Egypt and US, Morocco and US, Morocco and Japan, Tunisia and US and Tunisia and Japan respectively is being eliminated per a year. From our estimates in this study, to dissipate 50% of a shock to trade balance requires about one-and-half years, eight months, seven months, two months and nine moths between Egypt and US, Morocco and US, Morocco and Japan, Tunisia and US and Tunisia and Japan respectively. In case of Egypt/US, disequilibrium in the trade balance does not respond to long-run adjustment, however, in case of Tunisia/US, the speed of adjustment is considered to be very fast compared to other models.

Table 3: Results of Error-Correction models with Trade balance as the dependent variable

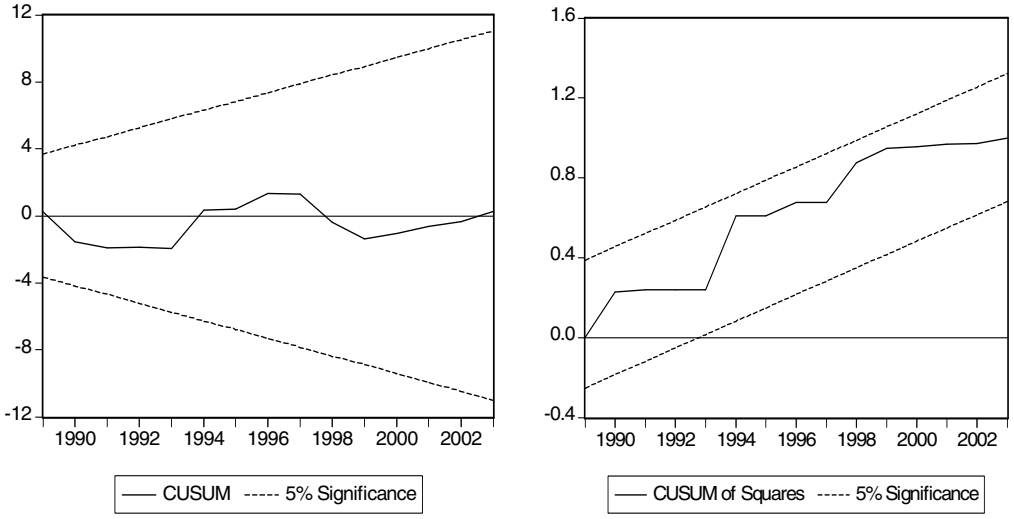
	Independent Variables					
	Egypt/ US	Egypt/ JP	Morocco/ US	Morocco/ JP	Tunisia /US	Tunisia/ JP
Constant	-0.211	-0.197	0.000	-0.002**	0.001	0.001
ECT_{t-1}	-0.208	0.507	-0.619***	-0.640***	-0.977***	-0.603***
ECT_{t-2}	-0.369***	-	-	-	-	-
$\Delta TB(-1)$	-	-0.804**	-	-	0.608***	0.328*
$\Delta TB(-2)$	-	-0.443*	-	-0.206*	0.517***	0.451**
$\Delta TB(-3)$	-	-	-	-	-	-
$\Delta E(-1)$	2.061**	0.506*	-	-0.030***	-0.026***	-
$\Delta E(-2)$	-	-	-0.017*	-0.06***	-	-0.036***
$\Delta Y^*(-1)$	-	11.937***	-0.065**	-	-	-
$\Delta Y^*(-2)$	-	-	0.098***	0.113***	-	-
R^2	0.71	0.68	0.70	0.76	0.70	0.60

D-W Stat	2.224	1.968	2.064	2.493	2.077	2.160

Notes: ***, ** and * indicate 1%, 5% and 10% significance level respectively.

When the final models were subjected to a number of diagnostic tests, there was neither serious misspecification problem nor any evidence of autocorreclation in the disturbance term. The results of the ARCH and Jarque-Bera normality tests confirm the homoscedasticity of errors, independence of the included regressors and the normality of the estimated equations. In addition, to check whether the estimation regression equations were stable throughout the sample period, the plots of CUSUM and CUSUM (cumulative sum) of squares tests (Brown et al; 1975) fall inside 5% critical lines[7] as shown in Figures 1-6. The importance of these tests is that a movement of the CUSUM and CUSUM squared residuals outside the critical lines is suggestive of the instability of the estimated coefficients and parameter variance over the sample period. In this study, the tests could not reject the null hypothesis that the regression equations are correctly specified at 5% level of significance, implying that there has not been systematic changes in the regression coefficients.

Figure 1: CUSUM and CUSUM of Squares Tests (Egypt/US)



[7] The test results are not reported here.

Figure 2: CUSUM and CUSUM of Squares Tests (Egypt/Japan)

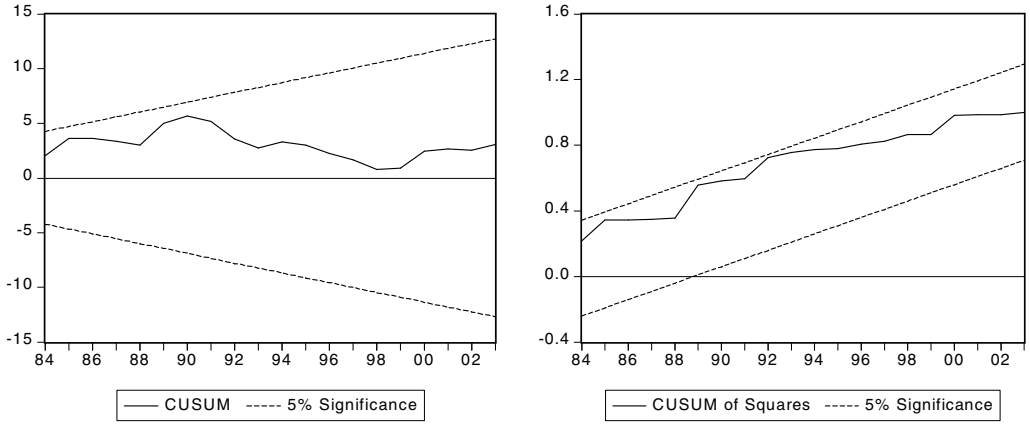


Figure 3: CUSUM and CUSUM of Squares Tests (Morocco/US)

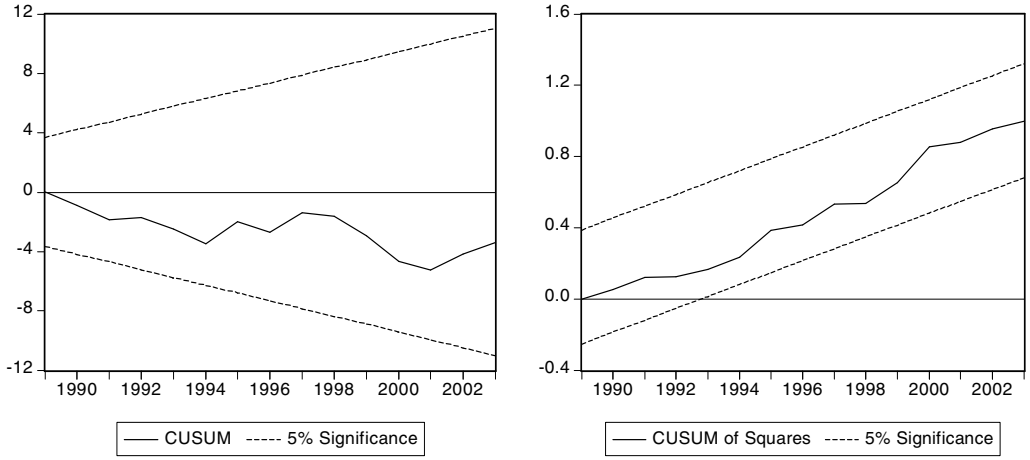


Figure 4: CUSUM and CUSUM of Squares Tests (Morocco/Japan)

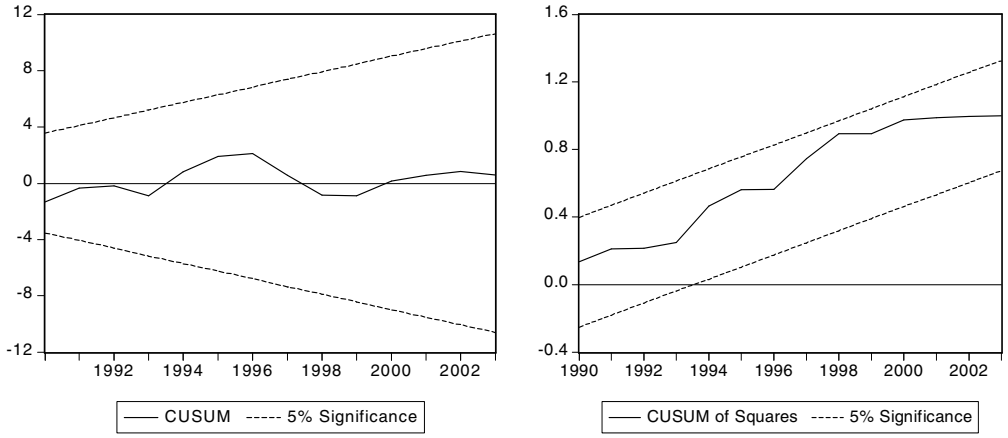


Figure 5: CUSUM and CUSUM of Squares Tests (Tunisia/US)

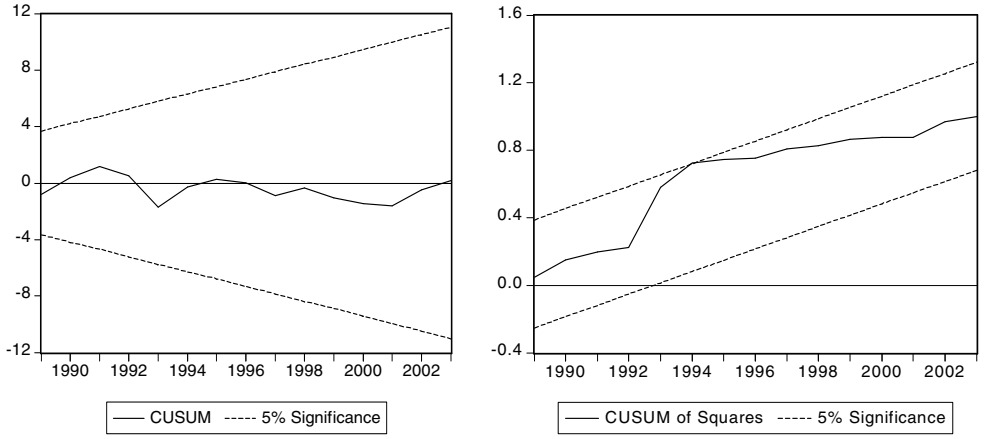
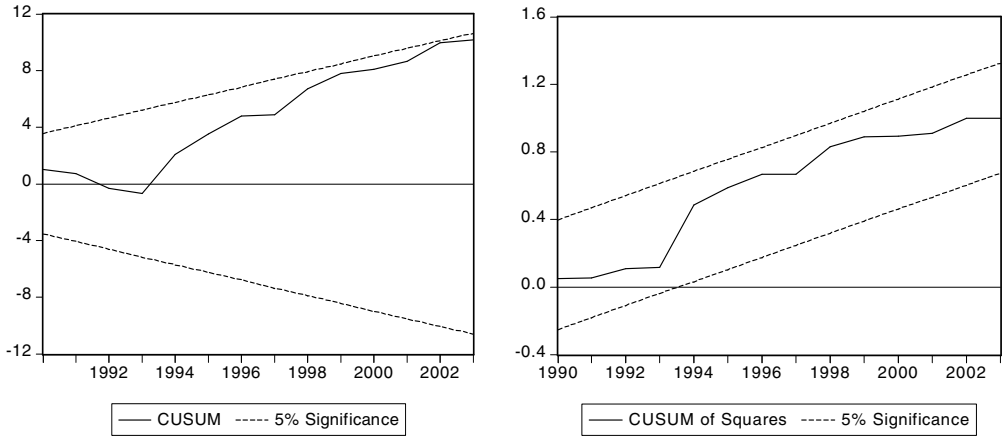


Figure 6: CUSUM and CUSUM of Squares Tests (Tunisia/Japan)



In order to establish the existence or absence of a J-curve phenomenon in these countries, we employ impulse response function to trace the effect of real effect exchange rate on the trade balance of these countries. As impulse response functions (IRFs) are generated from a cointegrated system, a shock in any variable is expected to exert a permanent effect on the system, which gradually adjusts to a new equilibrium. The impulse response functions plotted in Figures 7-12 indicate 10-year response of trade balance to an initial and one-time shock in real effective exchange rate. As to whether the lagged effects present the J-curve phenomenon, the evidence in this paper is as mixed.

A classic J-curve pattern is observed in case of Morocco/Japan in which the trade balance deteriorates almost immediately following the devaluation of the real exchange rate and recovers after two years. Long-run equilibrium is established after about 7 years. Furthermore, in cases of Egypt/Japan and Tunisia/US, we could observe some kind of delayed J-curve effects in which, following the currency devaluation, trade balances experience short-term improvement that lasts for about one year in both countries. After the second year, trade balances elapses into deterioration and continue to worsen up to the 7^{th} year in case of Egypt and 10^{th} year in case of Tunisia. In case of Egypt/US, Morocco/US and Tunisia/Japan, there seem to be no clear evidence of the J-curve phenomenon. So, in general, the results of impulse response function analysis in this study reveal that the effects of exchange rate changes on the trade balance are more pronounced in cases of Egypt/Japan, Morocco/Japan and Tunisia/US.

Figure 7: Impulse Response of TB to RER (Egypt/US)

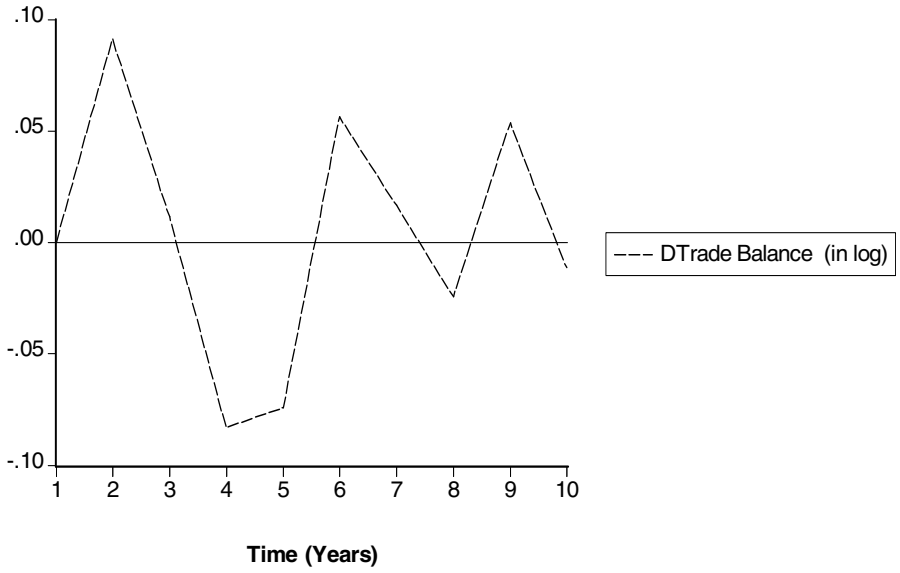


Figure 8: Impulse Response of TB to RER (Egypt/Japan)

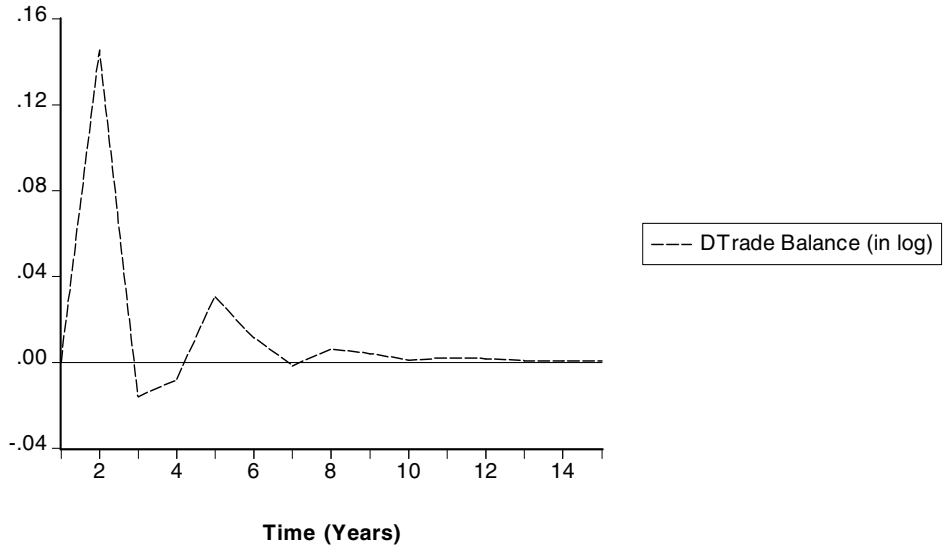


Figure 9: Impulse Response of TB to RER (Morocco/US)

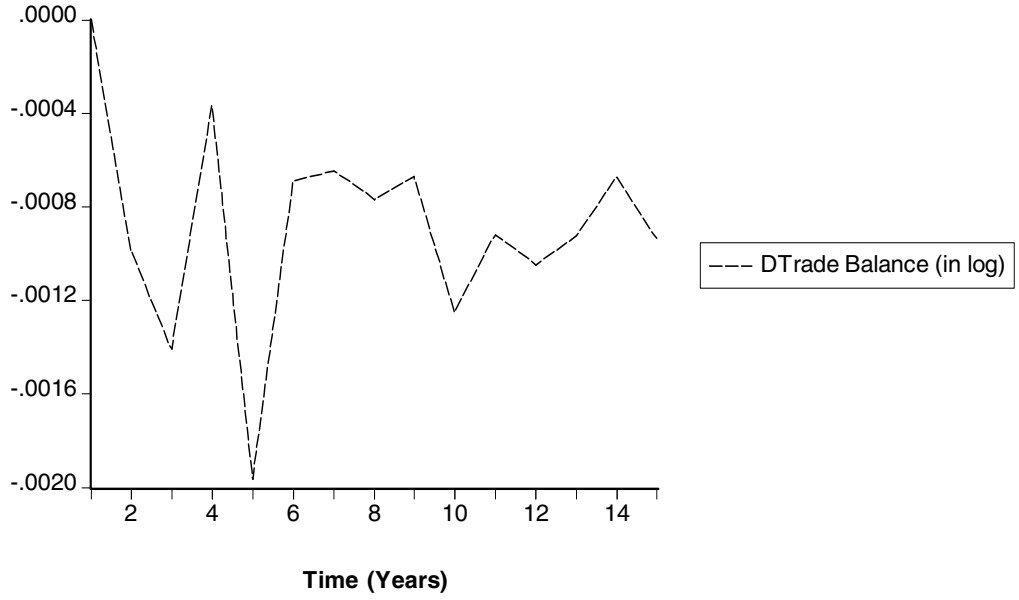


Figure 10: Impulse Response of TB to REER (Morocco/Japan)

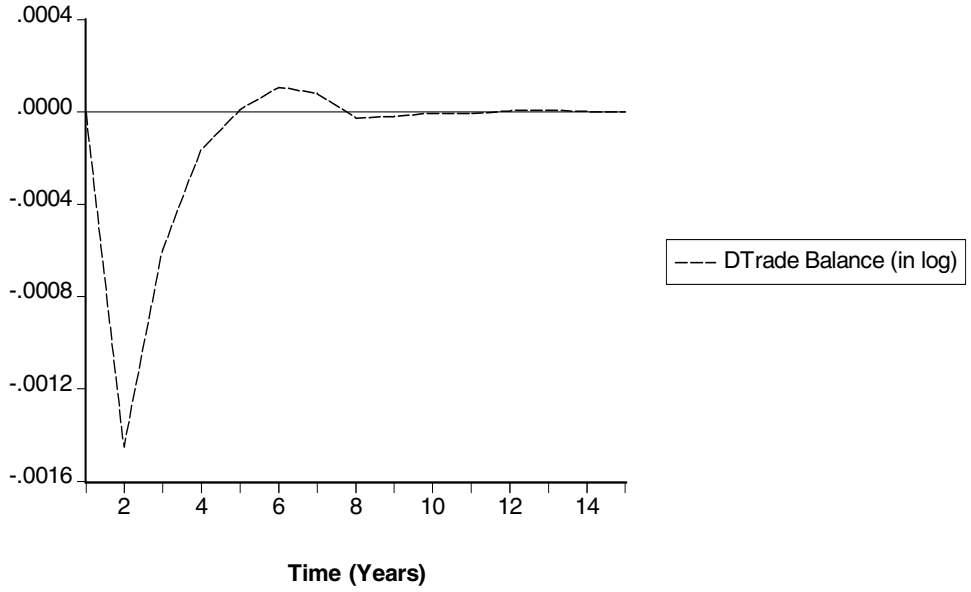


Figure 11: Impulse Response of TB to REER (Tunisia/US)

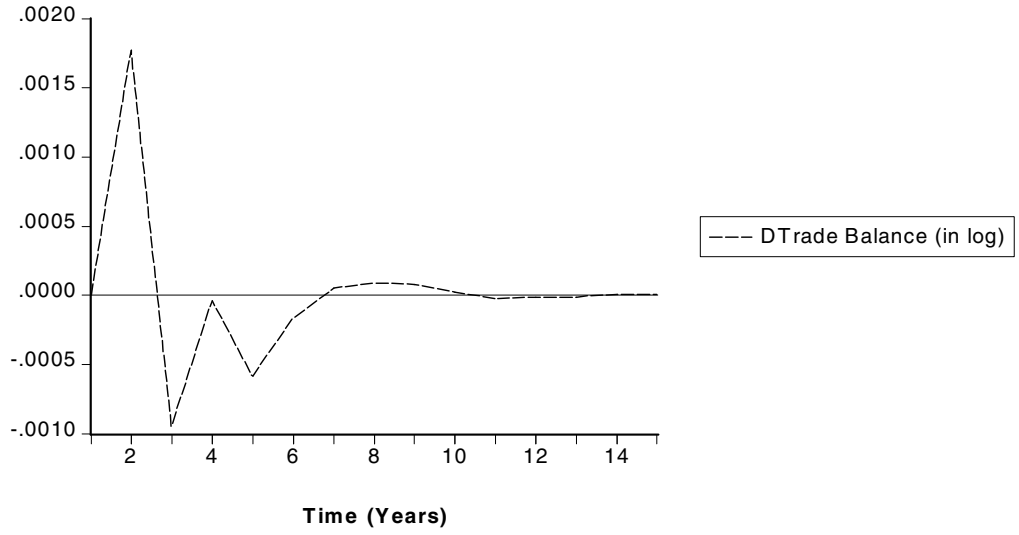
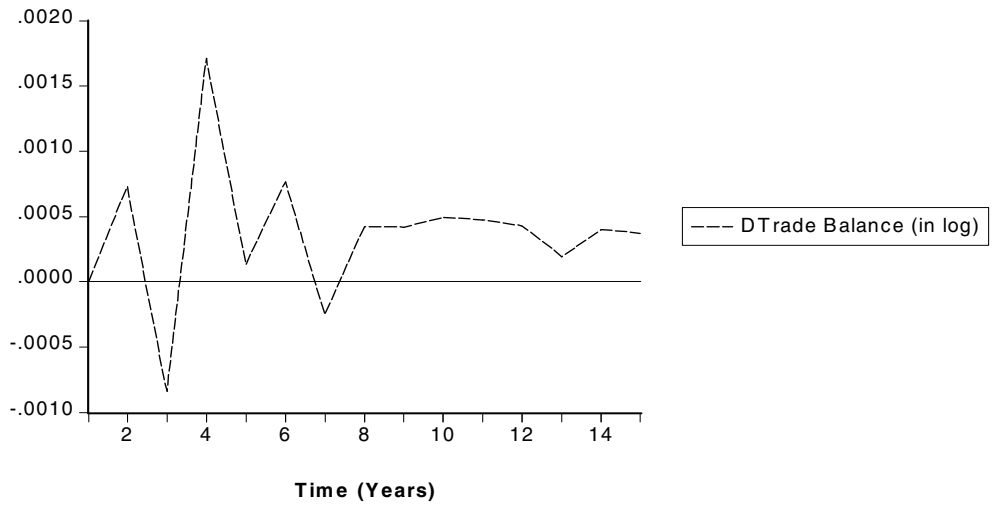


Figure 12: Impulse Response of TB to RER (Tunisia/Japan)



CONCLUSIONS

This paper examines the effects of exchange rate changes on the bilateral trade balance of Egypt, Morocco and Tunisia vis-à-vis the US and Japan, in addition to attempting to establish whether these effects produce a J-curve phenomenon. The study employs the Johansen cointegration and error-correction model on the annual data in the period 1970-2003.

In general, the findings confirm the existence of both the short-run dynamics and long-run causal relationships between trade balance and the set of specified independent variables. However, the results produce mixed evidence about the existence of the J-curve effect. A classic J-curve pattern is observed only in case of Morocco/Japan in which the trade balance deteriorates almost immediately following the devaluation of the real exchange rate and recovers after two years. In cases of Egypt/Japan and Tunisia/US, we could observe some kind of delayed J-curve effects in which, following the currency devaluation, trade balances experience short-term improvement first that lasts for about one year in both countries. However, in cases of Egypt/US, Morocco/US and Tunisia/Japan, no clear evidence of the J-curve phenomenon is found.

The findings that exchange rate depreciation/devaluation improves trade balance (in cases of Egypt/Japan, Morocco/Japan and Tunisia/US) corroborate the conjecture in the literature that a country's trade balance may deteriorate following a currency depreciation/devaluation before improving in the long run.

The finding of J-curve in three cases out of six in this paper does not help much in clearing the murk surrounding the issue of the J-curve phenomenon in the literature. These findings underscore the important implication that the effect of real exchange rate changes on the trade balance of any given country depends largely on the volume of trade activities between the countries concerned. However, more research is needed to find conclusive evidence about the existence of J-curve phenomenon that have commonly characterized the responses of trade balances of many countries to exchange rate changes.

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