THE BILATERAL J-CURVE BETWEEN YEMEN AND HER GULF COOPERATION COUNCIL TRADING PARTNERS: AN EMPIRICAL ANALYSIS OVER (1991-2005) PERIOD

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ABSTRACT: This study empirically analyses the bilateral J-Curve dynamic of Yemen with her Gulf Cooperation Council (GCC) trading partners using quarterly time series data over 1991-2005 period. Short-run and long-run impacts of the depreciation of Yemeni Rial on the trade balance between Yemen and her GCC trading partners are estimated from the bound testing approach and error-correction modeling. The empirical results indicate that while there was no specific short-run pattern supporting the J-Curve phenomenon, the long-run results supported the economic theory, indicating that a real depreciation of the Rial has a favorable long-run effect on Yemen trade balance with five of her six trading partners (the GCC). To ascertain the stability of bilateral trade balance relationships, CUSUM and CUSUMQ tests were implemented and 1 out of 6 cases was found to be stable in terms of both tests.

Keywords: Bilateral J-Curve, Bounds Testing, Co-integration, Error-Correction Model, Stability Test, Yemen.

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1. INTRODUCTION

Quantifying the short-run and the long-run responsiveness of the trade balance to exchange rate changes is important to economic policy for several reasons.

First, it establishes whether there is a stable long-run relationship between the exchange rate and the trade balance. If such a stable long-run relationship does not exist, then depreciating the exchange rate does not seem to be a reasonable solution for improving the country's competitiveness on a long-term basis.

Second, if a long-run relationship does exist, then it is necessary to establish whether it is likely that depreciation leads to a net improvement of the trade balance in the long-run.

Third, quantifying the extent of the trade balance improvement would be desirable to weight the trade balance benefits against costs of permanent depreciation.

Fourth, the estimate of the short-run dynamics provides information regarding the immediate and medium run impact of exchange rate changes on the trade balance. More specifically, the question here is whether depreciation has an adverse short-run impact on the merchandise trade balance.

If it does, it seems reasonable to estimate the persistence and extent of the adverse effect. This is usually an empirical question and in the literature, it is referred to as the J-Curve effect.

1.1 STUDY OBJEVTIVES

The main objectives of this study are as follows:

1) Investigate the existence of J-Curve effect both in the short-run and long-run by implementing recent advances in time series econometrics in the case of Yemen and her trading partners (GCC).

2) Implement parameter stability tests of Brown et. al. (1975) to ascertain stability or instability in the trade balance model.

The rest of the paper organized in the following manner. Section 2 presents the literature review. Section 3 introduces a reduced-form of the bilateral trade balance model. Section 4 presents the methodology and results. Section 5 concludes. Data definition and sources are cited in an Appendix.

2. LITERATURE REVIEW

Many studies that have tested the J-Curve phenomenon have employed aggregate trade data. The list includes Bahmani-Oskooee (1985), Felmingham and Divisekera (1986), Felmingham (1988), Rosensweig and Koech (1988). Hamaios (1989), Bahmani-Oskooee and Malxi (1992) and Bahmani-Oskooee and Alse (1994), Bahmani-Oskooee and Goswami (2003), Bahmani-Oskooee et. al. (2005), Bahmani-Oskooee et. al. (2006) and Bahmani-Oskooee and Ratha (2007).

Many of these studies also employed the effective exchange rate. A problem with this approach is that a country's currency could appreciate against one currency and simultaneously depreciate against another currency. The weighted average will therefore smooth out the effective exchange rate fluctuations, yielding an insignificant link between the effective exchange rate and the total trade balance.

Furthermore, as Rose and Yellen (1989) argue, when estimating a trade balance model using aggregate data one needs to construct a proxy for the rest-of-the-world income. This construct is ad hoc at best and at worst misleading. These problems can be avoided altogether by employing disaggregated data.

Two studies, Rose and Yellen (1989) and Marwah and Klein (1996), have employed disaggregated data in testing the J-Curve phenomenon. Rose and Yellen did not find a long-run effect nor any evidence supporting the J-Curve phenomenon between the U.S. and her major trading partners. Such negative findings could be due to several deficiencies.

First, they define the real trade balance to be the "difference between merchandise exports and imports, measured in current. U.S. dollars, deflated by the American GNP deflator." (p.58). The evidence in Miles (1979) versus Himarios (1985) suggests that the results are sensitive to the units of measurements.

Second, their method was based on Engle-Granger cointegration analysis which uses the DF or the ADF tests. Since no evidence was found in favor of cointegration, the short-run analysis was based on simple autoregressive analysis, rather than an error-correction modeling. However, as Kremers et. al. (1992)

demonstrates, when using the Engle and Granger (1987) method, the DF test may reject cointegration due to its low power. At the same time the coefficient on the error-correction term in the corresponding dynamic model could be highly significant supporting cointegration.

They argue that "the error-correction-based test is preferable because it uses available information more efficiently than the Dickey-Fuller test (Kremers et. al. (1992: p. 325)." Finally, in estimating their simple VAR model, no attempt was made to use an objective criterion when selecting the lag length of each variable.

The second study, Marwah and Klein (1996), also employs bilateral data between U.S. and her five largest trading partners and between Canada and her five largest trading partners with mixed results. One major deficiency in this later study is the use of nonstationary data. Since the model is estimated using the level of each time-series variable without checking for unit roots, the estimates can suffer from the "spurious regression" problems. Thus, the main purpose of this paper is to expand the literature on the short-run and the long-run relationship between the trade balance and the exchange rate on a bilateral basis, after correcting the shortcomings of previous research.

3. THE TRADE BALANCE MODEL

The model employed here will be similar to that of Rose and Yellen (1989).[1] However, the trade balance is measured as the ratio of Yemen imports from trading partner j over her exports to the same trading partner rather than the difference between imports and exports. Bahmani-Oskooee (1991) has argued that this measure is not sensitive to the units of measurement and it reflects the movement of the trade balance in real or nominal terms. Furthermore, it allows us to specify the model in Log form such that the first-differenced variables measure the rate of change.

Thus, the model takes the following form:

$$LnTB_{jt} = a + bLnY_{yet} + cLnY_{jt} + dLnEX_{jt} + \varepsilon_t , \quad (1)$$

where TB_j is the ratio of the Yemen imports from country j to her exports to the same country; Y_{ye} is the Yemen real GDP set in index to make it unit-free; Y_j is the index of real GDP of trading partner j and EX_j is the real bilateral exchange rate defined in a way that a decrease reflects a real depreciation of the Yemeni Rial against the currency of trading partner j.

As far as the expected signs are concerned, under normal condition we would expect Yemen income to carry a positive coefficient. As Y_{ye} rises, Yemen will import more causing the TB variable to rise. However, if the increase in

[1] For theoretical derivation of the reduced-form model, see Rose and Yellen (1989: 54-55).

Yemen income is due to an increase in the production of import-substitute goods, imports may actually decline, yielding a negative estimate for b.

By the same token, country $j's$ income could carry a negative or positive coefficient as well. If real depreciation of the Rial, i.e. a decrease in EX is to discourage Yemen imports and encourage her exports (thus, improve the trade balance), we would expect the estimate of d to be positive.

Equation (1) along with its short-run dynamic adjustment, to be explained in the next section, is the basis of our empirical analysis to which we turn next.

4. THE METHODOLOGY AND THE RESULTS

Since our interest is to detect the short-run as well as the long-run response of the bilateral trade balance to real bilateral exchange rate changes, the appropriate method is to employ error-correction modeling and cointegration techniques.

The first step in applying such techniques is to identify the size and location of the autoregressive roots. To determine whether the variables in the model are characterized by unit roots requires the application of one of many possible tests. However, the existing tests for unit roots can at times yield different outcomes (Bahmani-Oskooee 1998).

Due to this uncertainty Pesaran and Shin (1995) and Pesaran et. al. (1996) introduce yet another method of testing for cointegration. The approach known as the Autoregressive Distribution Lag (ARDL) approach has the advantage of avoiding the classification of variables into I(1) or I(0), so unlike standard cointegration tests, there is no need for unit root pre-testing.

The error-correction version of the ARDL model pertaining to the variables in equation (1) is as follows:

$$\Delta LnTB_{j,t} = a_0 + \sum_{i=1}^{n} b_1 \Delta LnTB_{j,t-i} + \sum_{i=1}^{n} c_i \Delta LnY_{ye,t-i}$$

(2)

$$+ \sum_{i=1}^{n} d_i \Delta LnY_{j,t-i} + \sum_{i=1}^{n} f_i \Delta LnEX_{j,t-i}$$
$$+ \delta_1 LnTB_{j,t-1} + \delta_2 LnY_{ye,t-1} + \delta_3 LnY_{j,t-1}$$
$$+ \delta_4 LnEX_{j,t-1} + \varepsilon_t$$

The ARDL procedure then involves two stages. In the first stage, the null hypothesis of "non-existence of the long-run relationship" defined by $H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ is tested against the alternative of $H_A : \delta_1 \neq 0, \delta_2 \neq 0, \delta_3 \neq 0, \delta_4 \neq 0$. The relevant statistic to test the null (H_0)is the familiar F-statistic.

However, the asymptotic distribution of this F-statistic is non-standard irrespective of whether the variables are I(1) and another assumes that they are all

I(0). This provides a band covering all possibly classifications of the variables into I(1) and I(0) or even fractionally integrated.

If the calculated F-statistic lies above the upper level of the band, the null is rejected, indicating cointegration. If the calculated F-statistic falls below the lower level of the band, the null cannot be rejected, supporting lack of cointegration.

If, however, it falls within the band, the result is inconclusive. In such an inconclusive case, following Kremers et. al. (1992), the error-correction term will be a useful way of establishing cointegration. Since data are quarterly, we impose four lags on each first differenced variable in equation (2) and provide the result of F-test for cointegration in table 1.[2]

Recall that a significant F-statistic which tests the lagged level of the variables in equation (2) will be an indication of cointegration among the variables involved. It is clear from table 1 that in the results for Kuwait, Saudi Arabia, and the United Arab Emirates (UAE), the calculated F-statistic is greater than or close to the upper-bound critical value, rejecting the null of no cointegration. However, in the case of Bahrain we have an inconclusive outcome because the calculated F-statistic is less than the upper-bound critical value but greater than the lower bound.

Table 1: The Results of F-Test for Cointegration Among the Variables of the Bilateral Trade Balance between Yemen and Trading Partner j

Trading Partner j	Calculated F-statistic
Bahrain	2.56
Kuwait	3.74
Oman	3.07
Qatar	2.77
Saudi Arabia	5.70
United Arab Emirates (UAE)	3.49

Note: At the 10 percent level of significance when there is an intercept but no trend in the error-correction model, the critical value bounds of the F-statistic are (2.04 and 3.48).

As indicated above, the results in Table 1 were obtained after imposing only four lags on each of the first-differenced term in equation (2).

Once we have established the existence of cointegration, we move to the second stage of the procedure which involves estimating the error-correction model (Equation 2). The main aim here is to detect the short-run dynamics.

If the variables were found to be cointegrated, the lagged level of the variables which jointly together form the lagged error-correction term must be retained. However, even if there is no cointegration, we still retain the lagged error term to determine its significance and thus the long-run relationship. As mentioned above, this is an alternative, but an efficient way of establishing cointegration in the sense of Engle and Granger (1987).

In this stage, we employ the adjusted R^2 criterion to select the lag length of each variable. For brevity of presentation, we only report the coefficient

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[2] All calculations are carried out by EVIEWS3.1, a statistical package by Quantitative Micro Software (QMS).

estimates of exchange rate $(\Delta LnREX_{t-i})$ and the lagged error-correction term denoted by (EC_{t-1}) in Table 2.[3]

As indicated before, the short-run effects of depreciation are reflected in the coefficient estimates obtained for the lagged value of the first-differenced exchange rate variable. Furthermore, negative coefficients followed by positive ones will support the J-Curve phenomenon.

Table 2: Coefficient Estimate of Exchange Rate and Error-Correction Term

	Trading Partner					
	Bahrain	Kuwait	Oman	Qatar	Saudi A.	U.A.E.
$\Delta\Delta LnRX$				0.611 (0.607)		
$\Delta LnRX_{t-1}$	-0.38 (0.30)	-1.06 (0.57)	0.66 (0.42)		-0.02 (0.16)	-0.04 (0.14)
$\Delta LnRX_{t-2}$	-0.93 (0.75)	-2.61 (1.21)	0.60 (0.29)		-0.09 (0.74)	0.076 (0.30)
$\Delta LnRX_{t-3}$	-1.16 (1.20)	-4.34 (2.37)	0.55 (0.22)		-0.14 (1.19)	0.32 (1.10)
$\Delta LnRX_{t-4}$		0.04 (0.14)	1.78 (0.60)		0.15 (1.40)	
$\Delta LnRX_{t-5}$			1.37 (0.64)			
$\Delta LnRX_{t-6}$			0.94 (0.56)			
$\Delta LnRX_{t-7}$			0.48 (0.48)			
$\Delta LnRX_{t-8}$						
$\Delta LnRX_{t-9}$						
$EC(-1)$	-0.12 (0.60)	0.04 (0.14)	0.01 (0.01)	-0.04 (0.20)	-0.11 (0.46)	-0.07 (0.29)

Note: Number inside the parentheses below each coefficient is the absolute value of t-statistic.

It is clear from Table 2 that in none of the cases, the coefficient estimates follow any specific pattern. For example, while in the case of Bahrain, all three coefficients are negative, in the results for Kuwait, Oman, Qatar, Saudi Arabia, and the U.A.E. there are positive as well as negative coefficients with no specific pattern. The negative coefficients obtained for the exchange rate variable in most cases, however, should not be interpreted as an averse effect of depreciation on the trade balance.

Hasiao (1981:95) has argued that "the negative autoregressive coefficients are not counter-intuitive because they are coefficients of the filtered data. If the model is represented in terms of the original variables, then most autoregressive coefficients will become positive".

[3] Full information estimates of each model between Yemen and each trading partner of the GCC which include coefficient estimates of all variables in (Equation 2) are available from the author upon request.

In this paper, after representing the error-correction models in terms of the original variables (level rather than first difference), I gather that in each case there are positive and negative coefficients with no specific short-run pattern. This general finding supports Magee (1973) who was the first to analyze the short-run effects of exchange rate changes on the trade balance at the theoretical level. He concluded that, theoretically, the trade balance can go either way in each period.

We can now turn to the long-run effects of depreciation on the trade balance. Again, it is clear from Table 2 that the lagged error-correction term $EC(-1)$ carries its correct negative sign and it is significant in all cases except Kuwait and Oman, supporting cointegration.

Unfortunately, the long-run sign and coefficient estimates of variables cannot be inferred from the error-correction terms. Thus, we need to report the estimates of δ_1, δ_2, δ_3, and δ_4 from (Equation 2) that were used to form the error-correction term in table 2. These estimates are reported in Table 3.

It is clear from Table 3 that in all cases the real exchange rate caries a positive coefficient except the case of Oman. Furthermore, out of those cases carrying positive coefficient only two cases (Kuwait and the U.A.E) are significant.

The implication is that even though the short-run effects were mixed, the long-run effects of a real depreciation of the Yemeni Rial against each trading partner's currency, except Oman, seems to have a favorable effect on their bilateral trade balances.

Table 3: Long-Run Coefficient Estimates of the Bilateral Trade Balance Model

Country j	Constant	LnY_{ye}	LnY_j	$LnREX$
Bahrain	-2..44	3.97	-5.10	0.39
	(0.41)	(0.33)	(0.54)	(0.57)
Kuwait	18.29	-5.50	-3.59	1.45
	(0.89)	(0.83)	(0.68)	(1.70)
Oman	-19.66	6.03	-7.86	-0.27
	(0.64)	(0.71)	(0.81)	(0.72)
Qatar	29.60	-10.35	4.74	0.37
	(1.09)	(1.85)	(1.02)	(0.67)
Saudi A.	3.58	-0.12	-0.61	0.02
	(1.53)	(0.22)	(0.77)	(0.67)
U.A.E.	12.13	-2.73	-0.26	0.22
	(2.11)	(1.15)	(0.12)	(1.13)

Note: Numbers inside the parentheses are absolute values of the t-ratio.

Finally, the stability of the short-run and long-run coefficients is checked through the CUSUM and CUSUMQ tests proposed by Brown, Durbin and Evans (1975), by using the residuals of equation (2) for each trading partner. The CUSUM test is based on the cumulative sum of recursive residuals based on first set of r observations. The CUSUM statistic is updated recursively and is plotted against the break points.

If the plot of CUSUM statistic stays within 5% significance level (portrayed by two straight lines whose equations are given in Brown et. al (1975, section 2.3), then coefficient estimates are said to be stable. Similar procedure is used to carry out the CUSUMQ which is based on the squared recursive residuals.

Figure 1 and 2, report graphical representation of these two tests for the last trading partner, United Arab Emirates (U.A.E.).

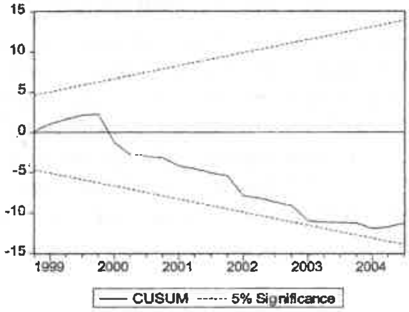

Figure 1: The **CUSUM** Stability Test

Figure 2: The **CUSUMQ** Stability Test

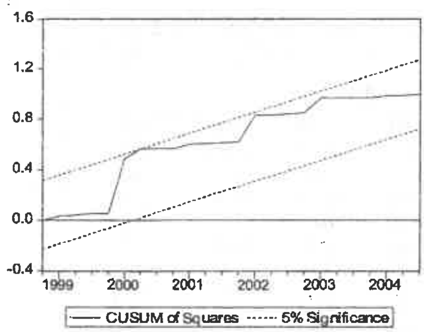

Figure 1 and 2 indicate a stable bilateral trade relationship between Yemen and the U.A.E. The graphical results for the remaining countries are not displayed here for brevity.

However, both CUSUM and CUSUMQ tests indicate stable relationships with one (the U.A.E.) of six cases in both tests. The summary results of these tests are given in table (4)

Table 4: Stability Test results based on CUSUM and CUSUMQ Tests

Trading Partner	CUSUM	CUSUMQ
Bahrain	Stable	Unstable
Kuwait	Unstable	Stable
Oman	Unstable	Stable
Qatar	Unstable	Stable
Saudi Arabia	Stable	Unstable
United Arab Emirates	Stable	Stable

5. CONCLUSION AND SUMMARY

Almost all previous research which investigated the relationship between the trade balance and its determinants employed aggregate data. In this paper we employed disaggregated bilateral data from Yemen and six of here trading partners (the GCC) to investigate the short-run and the long-run response of the trade balance to a currency depreciation.

The methodology was based on a new cointegration technique advanced by Pesaran and Shin (1995) and Pesaran et. al. (1996), known as the ARDL approach.

The main conclusion of the paper could be summarized by saying that while there was no specific short-run pattern supporting the J-Curve phenomenon, the long-run results supported the economic theory, indicating that a real depreciation of the Rial has a favorable long-run effect on Yemen trade balance with five of her six trading partners (the GCC). To ascertain the stability of bilateral trade balance relationships, CUSUM and CUSUMQ tests were implemented and 1 out of 6 cases was found to be stable in terms of both tests.

References

Bahmani-Oskooee, M. (1985). Devaluation and the J-Curve: Some Evidence from LDCs. *The Review of Economics and Statistics*, 67 (3), pp. 500-504.

Bahmani-Oskooee, M. (1991). Is There a Long-Run Relation Between the Trade Balance and the Real Effective Exchange Rate of LDCs? *Economics Letters*, 36 (4), pp. 403-407.

Bahmani-Oskooee, M. (1998). Do Exchange Rates Follow a Random Walk Process in Middle Eastern Countries? *Economics Letters*, 58 (3), pp. 339-344.

Bahmani-Oskooee, M., and M. Malixi (1992). More Evidence on the J-Curve from LDCs. *Journal of Policy Modeling*, 14 (5), pp. 641-653.

Bahmani-Oskooee, M., and J. Alse (1994). Short-Run versus Long-Run Effects of Devaluation: Error-Correction Modeling and Co-integration. *Eastern Economic Journal*, 20 (4), pp. 453-464.

Bahmani-Oskooee, M. and Gour Gobinda Goswami (2003). Bilateral J-Curve between India and her Trading Partners. *Journal of Applied Economics*, 35 (9), pp. 1037-1041.

Bahmani-Oskooee, M., Gour Gobinda Goswami and Bidyut Kumar Talukdar (2005). The Bilateral J-Curve: Australia versus her 23 Trading Partners. *Australian Economic Papers*, 44 (2), pp. 110-120.

Bahmani-Oskooee, M., Charikleia Economidou and Gour Gobinda Goswami (2006). Bilateral J-Curve between the UK versus her Major Trading Partners. *Journal of Applied Economics*, 38 (8), pp. 879-888.

Bahmani-Oskooee, M. and Artatrana Ratha (2007). The Bilateral J-Curve: Sweden versus her 17 Major Trading Partners. *International Journal of Applied Economics*, 4 (1), pp. 1-13.

Brown, R. L., J. Durbin, and J. M. Evans (1975). Techniques for Testing the Constancy of Regression Relations Over Time. Journal of the Royal Statistical Society, Series B, 37, pp. 149-163.

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

Felmingham, B. S. (1988). Where is the Australian J-Curve? *Bulletin of Economic Research*, 40 (1), pp. 43-56.

Felmingham, B. S., and S. Divisekera (1986). The Response of Australia's Trade Balance Under Different Exchange Rate Regimes. *Australian Economic Papers*, 25 (June), pp. 33-46.

Himarios, D. (1985). The Effects of Devaluation on the Trade Balance: A Critical View and Reexamination of Mile's New Results. *Journal of International Money and Finance*, 4 (4), pp. 553-563.

Himarios, D. (1989). Do Devaluation Improve the Trade Balance? The Evidence Revisited. *Economic Inquiry*, 27 (1), pp. 143-168.

Hsiao, C. (1981). Autoregressive Modeling and Money-Income Causality Detection. *Journal of Monetary Economics*, 7 (1), pp. 85-106.

Kremers, J. J., N. R. Ericsson and J. J. Dolado (1992). The Power of Co-integration Tests. *Oxford Bulletin of Economics and Statistics*, 54 (3), 325-348.

Magee, S. P. (1973). Currency Contracts, Pass Through, and Devaluation. *Brookings Papers on Economic Activity*, 1, pp. 303-325.