SHORT-RUN VERSUS LONG-RUN EFFECTS OF DEVALUATION:

ERROR-CORRECTION MODELING AND COINTEGRATION

Mohsen Bahmani-Oskooee
The University of Wisconsin-Milwaukee

and

Janardhanan Alse
Indiana University-Southeast

INTRODUCTION

The advent of current floating exchange rates has directed renewed attention to the effects of devaluation on the trade balance of both developed and less developed countries (DCs and LDCs hereafter). A few studies have followed the policy prescription of the elasticity approach by testing a simple or a general form of the Marshall-Lerner condition under which devaluation improves the trade balance if the sum of import demand elasticities exceeds one. For example, Gylfason and Schmid [1983]used parameter estimates of a macro model for five DCs and five LDCs and showed that devaluations improved the trade balance of all countries except the United Kingdom and Brazil. Gylfason and Risager [1984] included the foreign debt in their model and assessed the effects of devaluation on the current accounts of eight LDCs and seven DCs (all highly indebted). They showed that devaluations improved the current account of all 15 countries except Argentina.

Rather than checking the Marshall-Lerner condition, some authors established a direct link between the trade balance and the exchange rate. Such an approach provided mixed results. Miles [1979] related the trade balance/income ratio to the exchange rate, in addition to income (domestic and foreign) and monetary (domestic and foreign) aggregates. By using the first differenced variables and measuring the trade balance in terms of domestic currency, he investigated the experience of 14 countries (DCs and LDCs) and concluded that devaluations did not improve the trade balances of most of those countries. Miles's model and results were criticized by Himarios [1985] on the grounds that the dependent variable in the model should be the trade balance itself and not the ratio of the trade balance to income. After making this change, Himarios showed that devaluations improved the trade balance in most of those countries. In addition to this change in definition, Himarios used the level of each variable in his regression analysis, while Miles used first differenced variables. Given the existing econometric literature and unit roots evident in most macroeconomic variables, it is safe to say that first-differenced data used by Miles were stationary, whereas levels used by Himarios were non-stationary. When data are not stationary, standard critical values used in determining the significance of estimated coefficients are not valid. Concentrating on this last issue, we can also discount the results of other studies that have employed non-stationary data [Bahmani-Oskooee, 1985; Himarios, 1989].

The purpose of this paper is to reexamine the long-run and the short-run relation between the trade balance and the exchange rate by using the cointegration and error-correction modeling techniques. These methods are briefly explained in the following section. We then provide the definition of variables and report empirical results, mostly supporting the notion that there is no long-run relation between the trade balance and the exchange rate. Lastly, ~~concluding remarks are~~ presented. Data ~~definition and sources are~~ cited in an Appendix.

THE METHODS

The long-run equilibrium relation between two variables could be detected by the cointegration technique of Engle and Granger [1987]. Consider a non-stationary time series X_t. It is said to be integrated of order d if it achieves stationarity after being differenced d times, denoted by $X_t \sim I(d)$. According to Engle and Granger [1987] two $I(d)$ variables are cointegrated if in the simple OLS regression of one variable on the other, the residuals (as a proxy for a linear combination) are integrated at any order less than d [Bahmani-Oskooee, 1992].

For short-run analysis, we follow Granger [1986, 226] who concluded that the error-correction models produce better short-run forecasts and provide the short-run dynamics necessary to obtain the long-run equilibrium. For two $I(1)$ variables (X and Y), the error-correction models are usually formulated as follows:

$$(1) \quad (1-L)X_t = a_o + b_0\mu_{t-1} + \sum_{i=1}^{M} c_{0i}(1-L)X_{t-i} + \sum_{i=1}^{N} d_{0i}(1-L)Y_{t-i} + \upsilon_t$$

$$(2) \quad (1-L)Y_t = a_1 + b_1\mu'_{t-1} + \sum_{i=1}^{M} c_{1i}(1-L)Y_{t-i} + \sum_{i=1}^{N} d_{1i}(1-L)X_{t-i} + \upsilon'_t$$

where L is the lag operator and the error correction terms μ (μ') are the stationary residuals from the OLS regression of X on Y (Y on X). In equation (1), Y Granger causes X if either the d_{0i}'s are jointly significant, or b_0 is significant. Since our interest is in the short-run effects of devaluation, we follow Jones and Joulfaian [1991, 146] and interpret the lagged changes in the independent variable as the short-run causal impact, and the error-correction term as the long-run impact [Bahmani-Oskooee and Payestesh, 1993].

EMPIRICAL RESULTS

In this section we try to apply the cointegration technique and the error-correction models to the trade balance and real effective exchange rate of 19 DCs and 22 LDCs using quarterly data from 1971I to 1990IV for a total of 80 observations for each country.[3] Following Haynes and Stone [1982] we define the trade balance as the ratio of a country's imports to its exports (*IM/EX*). Bahmani-Oskooee [1991, 404] provided two justification for using this ratio. First, the ratio is not sensitive to units of measurement. Second, traditionally when the trade balance is defined as the difference between exports and imports, this difference is deflated by a domestic price index to obtain the real trade balance. Thus, the results could be sensitive to the choice of a price index. Our measure overcomes this issue too, because regardless of the price index used, the ratio will not be altered. Therefore, following Bahmani-Oskooee [1991] we can interpret our measure of the trade balance in real or nominal terms. The real effective exchange rate is denoted by *REFX* and its construction is explained in the Appendix.

We can now apply the cointegration technique between the real trade balance (*IM/EX*) and the real effective exchange rate (*REFX*). We first need to determine the degree of integration of each time series using the ADF test.[2] Table 1 reports the results of the ADF test for the level as well as for the first-differenced variables.

After comparing the estimates of the ADF statistic to its critical value reported at the bottom of Table 1 we classify the 41 countries into four groups. The first group includes countries for which the two variables are not integrated of the same order. For example, for Australia, since the level of *IM/EX* has achieved stationarity, it is $I(0)$. However, Australia's *REFX* variable has achieved stationarity after being differenced once, thus, it is $I(1)$. This is also true for Finland, France, Italy, Japan, New Zealand, Sweden, Argentina, Ecuador, Egypt, Indonesia, Malaysia, the Philippines, South Africa, Thailand and Tunisia. The second group includes Norway and Pakistan for which $(IM/EX) \sim I(1)$ and $REFX \sim I(0)$. The third group includes Switzerland, Greece and Korea for which both variables are $I(0)$. The cointegration technique cannot be applied to any country in these three groups. This is because either both variables are stationary (for countries in the third group) or they are not integrated of the same order (for countries in the first or the second group). The fourth group includes the remaining 20 countries for which both variables are $I(1)$ and to which we can apply the cointegration technique. As indicated before, if two $I(1)$ variables are to be cointegrated, the residuals from regression of one on the other must be $I(0)$. Thus, we formulate the cointegration equations as equations (3) and (4) below.

$$(3) \quad (IM/EX)_t = a + b\, REFX_t + \epsilon_t\, ;$$

$$(4) \quad REFX_t = c + d(IM/EX)_t + \epsilon'_t\, .$$

TABLE 1
The ADF Test of the Level and First Differenced Variables

Country	(IM/EX)	REFX	(1-L)(IM/EX)	(1-L)REFX
19 DCs				
Australia	-2.60[1][b]	-1.23[1]	–	-3.07[4]
Austria	-1.67[4]	-1.38[1]	-9.55[1]	-7.02[1]
Belgium	-1.68[3]	-1.54[4]	-10.90[2]	-3.19[3]
Canada	-2.08[3]	-1.54[1]	-7.23[2]	-4.47[1]
Denmark	-1.26[1]	-2.45[4]	-5.82[4]	-6.71[1]
Finland	-2.61[1]	-1.80[1]	-	-5.28[1]
France	-3.37[2]	2.65[1]	-	-5.26[3]
Germany	-2.09[4]	-1.59[1]	-5.44[1]	-5.76[1]
Ireland	-0.96[4]	-1.68[1]	-4.53[3]	-7.22[1]
Italy	-4.04[4]	-0.96[3]	-	-4.26[2]
Japan	-3.24[4]	-0.99[1]	-	-4.47[4]
Netherlands	-1.99[3]	-2.15[1]	-8.86[2]	-5.44[1]
New Zealand	-3.69[4]	-1.88[4]	-	-5.25[3]
Norway	-2.28[1]	-2.72[1]	-8.54[1]	-
Spain	-1.63[4]	-1.06[1]	-2.79[4]	-5.01[1]
Sweden	-3.43[1]	-1.76[1]	-	-7.61[1]
Switzerland	-3.04[4]	-2.68[1]	-	-
U.K.	-2.55[4]	-1.86[1]	-3.88[3]	-6.03[1]
U.S.	-1.56[4]	-2.34[1]	-3.80[3]	-5.09[1]
22 LDCs				
Argentina	-2.88[4]	-2.03[1]	-	-5.43[1]
Brazil	-1.67[4]	-1.76[1]	-5.01[4]	-4.56[1]
Colombia	-1.51[1]	-0.05[1]	-9.70[1]	-5.08[1]
Costa Rica	-2.29[3]	-1.32[3]	-9.53[2]	-4.09[2]
Ecuador	-3.73[1]	-0.67[1]	-	-6.55[1]
Egypt	-2.61[3]	-1.49[1]	-	-5.64[1]
Ethiopia	-0.37[4]	-2.14[1]	-4.19[3]	-4.89[1]
Greece	-3.63[3]	-3.01[1]	-	-
India	-2.32[1]	-0.71[1]	-6.92[2]	-3.79[4]
Indonesia	-3.53[1]	-0.74[1]	-	-4.90[1]
Korea	-4.83[2]	-3.39[1]	-	-
Malaysia	-3.56[4]	-0.16[1]	-	-4.51[1]
Mexico	-1.33[2]	-2.44[1]	-9.13[1]	-4.83[1]
Pakistan	-1.64[3]	-3.42[1]	-8.80[2]	-
Philippines	-2.86[1]	-1.46[2]	-	-5.66[4]
Portugal	-1.89[4]	-2.22[4]	-4.33[3]	-3.08[3]
Singapore	-1.85[1]	-2.39[4]	-7.86[1]	-3.42[4]
S. Africa	-4.22[4]	-1.98[3]	-	-3.86[2]
Sri Lanka	-2.26[4]	-2.32[1]	-5.04[3]	-6.01[1]
Thailand	-3.25[4]	-1.41[1]	-	-6.11[1]
Tunisia	-2.74[4]	-0.24[2]	-	-4.29[4]
Turkey	-2.06[4]	-0.96[1]	-10.50[1]	-5.54[3]

a: The critical value of the ADF statistic from Fuller's [1976, 373] table for 50 observations is -2.93 at the usual 5% level and -2.60 at the 10% level of significance.
b: Numbers inside the brackets are number of lags in the ADF test.

TABLE 2
The ADF Test of the Stationarity of ϵ and ϵ'[a]

Country	ϵ	ϵ'
19 DCs		
Australia	-	-
Austria	-2.18[4][b]	-1.90[1]
Belgium	-1.78[3]	-1.57[4]
Canada	-2.63[1]	-1.78[1]
Denmark	-1.27[1]	-2.43[4]
Finland	-	-
France	-	-
Germany	-1.95[1]	-1.44[1]
Ireland	-2.94[4]	-3.15[4]
Italy	-	-
Japan	-	-
Netherlands	-3.40[3]	-2.60[1]
New Zealand	-	-
Norway	-2.28[1]	-2.69[1]
Spain	-1.66[4]	-1.06[1]
Sweden	-	-
Switzerland	-	-
U.K.	-2.25[1]	-1.96[4]
U.S.	-1.54[1]	-2.40[1]
22 LDCs		
Argentina	-	-
Brazil	-3.10[4][b]	-2.93[4]
Colombia	-2.01[2]	-0.60[2]
Costa Rica	-3.62[2]	-3.00[2]
Ecuador	-	-
Egypt	-	-
Ethiopia	-0.38[4]	-2.64[4]
Greece	-	-
India	-2.44[1]	-1.26[4]
Indonesia	-	-
Korea	-	-
Malaysia	-	-
Mexico	-1.67[4]	-2.98[4]
Pakistan	-	-
Philippines	-	-
Portugal	-1.76[4]	-2.04[4]
Singapore	-3.01[1]	-2.85[2]
S. Africa	-	-
Sri Lanka	-2.67[4]	-1.97[4]
Thailand	-	-
Tunisia	-	-
Turkey	-3.05[4]	-1.70[2]

a: The critical value of the ADF statistic for 50 observations from Engle and Yoo [1987, Table 3] is -3.29 at the 5% and -2.90 at the 10% level of significance.
b: Numbers inside the brackets are number of lags.

Equations (3) and (4) were estimated by OLSQ and the residuals were used to carry out the ADF test for the fourth group. The results are reported in Table 2. Note that no statistic is reported for countries in the first three groups.

Comparing the calculated ADF statistic to its critical value from Engle and Yoo [1987], reported at the bottom of Table 2, we find that only for Ireland, the Netherlands, Brazil, Costa Rica, Singapore, and Turkey the calculated ADF is less than its critical value for the residuals of equation (3), i.e., $\epsilon_t \sim I(0)$. This indicates that there is a long-run relation between the trade balance and the effective exchange rate of these six countries. We reach this same conclusion even if we consider the stationarity of ϵ'_t, except in the results for Turkey, but with the addition of Mexico. For the remaining countries, the results show that the degree of integration of ϵ_t and ϵ'_t is no less than the degree of integration of the *(IM / EX)* and *REFX* variables, an indication of the lack of any long-run relation between them. This is true for most of DCs as well as LDCs.

As the Appendix indicates, the real effective exchange rate is defined as units of foreign currency per unit of domestic currency. Thus, if a depreciation of domestic currency (i.e. a decline in the exchange rate) is to discourage imports and encourage exports, we would expect the slope coefficient in cointegration equation (3) to be positive. Our results showed that this was exactly the case in the results for the Netherlands, Brazil, Costa Rica, Singapore, and Turkey, but not for Ireland, indicating that with the exception of Ireland, devaluations have a long-run favorable impact on the trade balance of these countries. The fact that ϵ'_t was $I(0)$ in the results for the Netherlands, Brazil, Costa Rica, Singapore, and Mexico and the slope coefficient in cointegration equation (4) was positive, is an indication that the trade deficit brings about a real depreciation in each of these countries.

How do our findings compare to those of the other authors who did not use the cointegration technique? Comparing those countries for which the cointegration technique could be applied and for which there were earlier studies, pares the comparable country list to fourteen: Brazil, Canada, Costa Rica, Denmark, Germany, India, Ireland, Mexico, Portugal, Spain, Sri Lanka, Turkey, and the U.K. The comparison is summarized in Table 3. Countries for which results are consistent are in bold print.

It appears that for most countries our finding of no cointegration or lack of any long-run favorable effects of devaluation contradicts the previous research. The Miles [1979] results are most consistent with ours. Three factors could explain this inconsistency. First, authors have employed data from different periods. Second, authors have defined the trade balance in terms of different currencies (domestic versus foreign). On this regard, our measure is at least unit free. Finally, except for Miles [1979], previous results are based on non-stationary data. As indicated before, when data are non-stationary, the standard tests such as the t-test cannot yield valid results.

It should be mentioned that Bahmani-Oskooee [1991] provided some preliminary results pertaining to the cointegration between the trade balance and the real effective exchange rate of only eight LDCs. None of our cases could be compared to

Table 3
Comparison of Current Results with Past Research

Study	Effect of Devaluation on Trade Balance Positive	Negative	No Effect
Miles [1979]		U.K.	Costa Rica **Denmark** Ireland **Spain** **Sri Lanka**
Himarios [1985][b]	**Costa Rica** Spain Sri Lanka U.K.		
Gylfason and Schmid [1983][b]	Canada Germany U.S. India **Turkey**	Brazil	**U.K.**
Gylfason and Risager [1984][b]	Canada Denmark Ireland[c] Spain **Brazil** Portugal **Turkey**		
Bahmani-Oskooee [1985][b]			**India**
Himarios [1989][b]	India Mexico Sri Lanka		
Marquez [1990][a,b]	Canada Germany U.S.		**U.K.**
Current Study	*Costa Rica* *Brazil* *Turkey*	*Ireland*[c]	*Canada, Denmark* *Germany, India* *Mexico, Portugal* *Spain, Sri Lanka* *U.K., U.S.*

Our study includes almost all countries included in all previous studies. However, we can only make a comparison of the results for those countries for which the cointegration technique could be applied. Countries for which results are consistent with current study are in bold typeface.

a: Marquez [1990] estimated the Marshall-Lerner condition from bilateral trade elasticities using quarterly data from 1973I to 1985II.

b: Used non-stationary data.

c: Although we found cointegration for Ireland, the slope coefficient in the cointegration equation was negative, making our findings different from those of Gylfason and Risager for Ireland.

Bahmani-Oskooee's due to the different order of integration of individual time series. For example, for Argentina or the Philippines our measure of the trade balance is $I(0)$ whereas his was $I(1)$. For India, Korea, and Thailand, Bahmani-Oskooee showed that their real effective exchange rates were $I(2)$, whereas we have shown that it is $I(0)$ for Korea and $I(1)$ for India and Thailand. Indeed, there is no country in our sample for which the real effective exchange rate is $I(2)$ and for most countries it is actually $I(1)$. Besides different study periods that may contribute to this inconsistency, the construction of the real effective exchange rate could be a major source of the problem. Bahmani-Oskooee [1991] as well as others like Himarios [1985; 1989] proxied the real effective rate as $P^{*}E/P$. They have defined P^{*} as a weighted average of the price level of a country's trading partners. P is defined to be the domestic price level, and E is either the weighted average of index of nominal bilateral exchange rates [Bahmani-Oskooee, 1991] or just bilateral exchange rate [Himarios, 1985; 1989]. As the Appendix indicates, the most appropriate definition and construction of the *real effective exchange rate* is the one that is defined as the *weighted average of the index of the real bilateral exchange rates*.[3] When all data needed to construct the real effective exchange rate is available, why proxy it by other measures.

Finally, as indicated before, to assess the short-run effects of devaluation and to see whether we can provide some evidence in support of the J-Curve phenomenon, we estimate the following error-correction model.

$$(5) \qquad (1-L)(IM/EX)_t = a_o + b_0\mu_{t-1} + \sum_{i=1}^{M} c_{0i}\,(1-L)(IM/EX)_{t-i} + \sum_{i=1}^{N} d_{0i}(1-L)REFX_{t-i} + \upsilon_t$$

In an autoregressive model such as (5) where there is more than one lagged variable, one must select a strategy for choosing the optimum number of lags on each variable. Engle and Granger [1987, 272] have recommended starting with fewer lags and then testing for added lags, proceeding in a "simple to general" specification search. Following this recommendation, we used the t-test for the significance of individual lags. The results are reported in Table 4.

From Table 4 we gather that in almost all cases the lagged error-correction term denoted by EC_{t-1} carries a significant coefficient, providing further evidence on the long-run effects of devaluation on the trade balance. The short-run effects, as indicated before, could be inferred by the estimated lagged coefficients of the $(1-L)REFX$ variable. Except in the results for Brazil and Singapore, in the remaining cases we observe that the trade balance worsens before getting better, an outcome consistent with the J-Curve phenomenon.[4]

TABLE 4
Full Information Estimate of Error-Correction Model (8)

Exogenous Variables	Brazil	Costa Rica	Ireland	Netherlands	Singapore	Turkey
Constant	-0.0016	0.0160	-0.0113	-0.0047	-0.0067	0.0085
	(0.09)	(0.73)	(0.92)	(1.34)	(1.08)	(0.14)
EC_{t-1}	-0.2317	-0.4343	-0.2570	-0.3699	-0.1479	-0.2244
	(2.89)	(2.23)	(2.51)	(3.55)	(1.72)	(2.27)
$(1-L)(IM/EX)_{t-1}$	0.2018	-0.3979	-0.1748	-0.2991	-0.4508	-0.0119
	(1.61)	(2.17)	(1.49)	(2.68)	(3.72)	(0.11)
t-2	-0.1249	-0.4770	-0.3362	-0.2245	-0.0344	-0.2818
	(1.04)	(3.35)	(3.08)	(2.26)	(0.31)	(2.64)
t-3	-0.1133	-0.3088				
	(0.98)	(2.73)				
t-4	0.2425					
	(2.08)					
$(1-L)REFX_{t-1}$	-0.0015	0.0012	0.0007	-0.0036	0.0039	-0.0088
	(0.61)	(0.50)	(0.13)	(1.91)	(1.70)	(1.09)
t-2		-0.0010	-0.0059	0.0018	-0.0059	0.0045
		(0.45)	(1.06)	(0.91)	(2.33)	(0.55)
t-3		0.0049	-0.0053	0.0059	0.0029	0.0184
		(2.23)	(1.06)	(3.02)	(1.28)	(2.29)
t-4		0.0057	0.0113		0.0015	
		(2.64)	(2.09)		(0.69)	
t-5		0.0046			-0.0041	
		(2.04)			(1.71)	
t-6					0.0084	
					(3.89)	
Other Statistics						
R^2	0.19	0.49	0.38	0.42	0.34	0.26
D-W	1.8715	1.7489	2.3573	2.1232	1.7837	1.9262
SEE	0.1420	0.1781	0.1049	0.0305	0.0507	0.5296

Numbers in parentheses are the absolute values of the t-ratios. EC denotes the error-correction term. SEE is the standard error of the regression.

SUMMARY AND CONCLUSION

Most recent studies have used non-stationary time series data and reduced form models to assess the effects of devaluations on the trade balance, with mixed results. Several sources could contribute to such mixed results. The first source could be different periods of study employed by different authors. The second source could be the non-stationary versus stationary data used by different authors. The third source could be the currency (domestic versus foreign) in which the trade balance is denominated. Finally, the fourth source could be the different proxies for real effective exchange rate used by different authors.

After taking into consideration most of the problems associated with previous studies, we reexamined the statistical relation between the trade balance and the real effective exchange rate of 19 DCs and 22 LDCs. The cointegration technique was used to assess the long-run relation between the trade balance and the effective exchange rate, using quarterly data from 1971I to 1990IV. Out of 20 countries for which the technique could be applied, only 6 countries yielded results which indicated that the trade balance and the real effective exchange rate are cointegrated. For most countries, the two variables were found to be not cointegrated, indicating that devaluations cannot have any long-run effects on the trade balance. For those 6 countries for which there was evidence of cointegration, we also estimated an error-correction model and provided some evidence in support of the J-Curve phenomenon.

APPENDIX
Data Sources and Definition of Variables

Variables (Quarterly, 1971:I to 1990:IV)

IM = f.o.b. imports, International Financial Statistics of IMF, various issues.
EX = f.o.b. exports, International Financial Statistics of IMF, various issues.
REFX = index of real effective exchange rate. To construct this variable following Bahmani-Oskooee [1992] and Bahmani-Oskooee and Payesteh [1993] we took four steps. First, the bilateral exchange rates between currency *i* and *j* denoted by EX_{ij}'s and defined as number of units of trading partner *i*'s currency per unit of *j*'s currency were calculated from the exchange rate data involving the U.S. dollar [International Financial Statistics of IMF, various issues]. In the second step we calculated the *real bilateral exchange rates* using EX_{ij}'s and CPI indexes [International Financial Statistics of IMF, various issues] as follows:

$$REX_{ij} = (CPI_j \cdot EX_{ij}/CPI_i), \quad i \neq j,$$

where CPI_j is country *j*'s price level, CPI_i is the price level in trading partner *i*, and REX_{ij} is the real bilateral exchange rate defined as units of *i*'s currency per unit of *j*'s currency. The third step involves setting the real bilateral exchange rates in index form to make them homogenous across countries. Thus, denoting the *index of real bilateral exchange rates* by $IREX_{ij}$ and selecting 1985 as the base year, we have:

$$IREX_{ij} = (REX_{ij}^t/REX^{85}_{ij})*100.$$

Finally, we need to take the weighted average of $IREX_{ij}$ in order to obtain the index of *real effective exchange rate* for country *j*, which we denote by $REFX_j$ in the text. Thus

$$REFX_j = \sum_{i=1}^{n} \alpha_{ij} IREX_{ij},$$

where α_{ij} is the share of country *j*'s import from trading partner *i* and $\Sigma\alpha_{ij} = 1$. Fixed shares [Direction of Trade Statistics, Yearbook of 1988, IMF] in the base period (1985) were used to construct *REFX*. If *j* is a DC, the trading partners are the remaining 18 DCs out of 19 DCs in Table 1 plus India, Indonesia, Korea, Malaysia, the Philippines, Singapore, and Thailand (total of 25 partners for each DC). The 7 LDCs are included in this construction to take account of the growing importance of those countries in the trade with DCs. However, if *j* is an LDC, then 19 DCs are used as each LDC's trading partner. For list of DCs and LDCs, see Table 1 or 2 in the text.

NOTES

While we remain responsible for any errors, we would like to thank two anonymous referees for their valuable comments.

1. Due to unavailability of the data, the study period for Germany was 1971I- 1987IV, for Argentina it was 1971I-1990II, and for Turkey it was 1971I-1990III.
2. For the ADF formulation, see Bahmani-Oskooee [1992].
3. To determine whether nominal devaluations have different effects than real devaluations, we used the nominal effective exchange rate, *MERM*, published by IMF. IMF publishes the *MERM* series only for 14 industrial countries since 1973. Thus quarterly data were used over 1973I-1990IV. The cointegration technique could be applied in the cases of Austria, Belgium, Canada, Denmark, Germany, the Netherlands, Norway, Sweden, U.K. and U.S. Only in the case of Sweden was there evidence of cointegration between *MERM* and our measure of the trade balance. In the remaining 9 countries, the trade balance and nominal effective exchange rate were not cointegrated.
4. For more on the J-Curve see Bahmani-Oskooee [1985].

REFERENCES

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

_________. Is There a Long-Run Relation Between the Trade Balance and the Real Effective Exchange Rate of LDCs? *Economics Letters*, August 1991, 403-407.

_________. What are the Long-Run Determinants of the U.S. Current Account? *Journal of Post Keynesian Economics*, Fall 1992, 85-97.

Bahmani-Oskooee, M. and Payesteh, S. Budget Deficits and the Value of the Dollar: An Application of Cointegration and Error-Correction Modeling. *Journal of Macroeconomics*, Fall 1993, 661-77.

Engle, R. F. and Granger, C. W. J. Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, March 1987, 251-76.

Engle, R. F. and Yoo, B. S. Forecasting and Testing in Co-Integrated Systems. *Journal of Econometrics*, May 1987, 143-59.

Fuller, W. A. *Introduction to Statistical Time Series*. New York: John Wiley, 1976.

Granger, C. W. J. Developments in the Study of Cointegrated Economic Variables. *Oxford Bulletin of Economics and Statistics*, August 1986, 213-28.

Gylfason, T. and Risager, O. Does Devaluation Improve the Current Account? *European Economic Review*, June 1984, 37-64.

Gylfason, T. and Schmid, M. Does Devaluation Cause Stagflation? *Canadian Journal of Economics*, November 1983, 641-54.

Haynes, S. E. and Stone, J. A. Impact of the Terms of Trade on the U.S. Trade Balance: A Reexamination. *The Review of Economics and Statistics*, November 1982, 702-706.

Himarios, D. The Effects of Devaluation on the Trade Balance: A Critical View and Reexamination of Miles's New Results. *Journal of International Money and Finance*, December 1985, 553-63.

__________. Do Devaluations Improve the Trade Balance? The Evidence Revisited. *Economic Inquiry*, January 1989, 143-68.

Jones, J. D. and Joulfaian, D. Federal Government Expenditures and Revenues in the Early Years of the American Republic: Evidence from 1792 to 1860. *Journal of Macroeconomics*, Winter 1991, 133-55.

Marquez, J. Bilateral Trade Elasticities. *The Review of Economics and Statistics*, February 1990, 70-77.

Miles, M. A. The Effects of Devaluation on the Trade Balance and the Balance of Payments: Some New Results. *Journal of Political Economy*, June 1979, 600-620.