Using Currency Devaluations as a Tool to Improve the Trade Balance: The Experience of Central America and the Caribbean

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This paper examines the relationship between the trade balance and the real exchange rate in two regions of the western hemisphere: Central America and the Caribbean. This is a bilateral approach between a panel of 12 countries from the region and each of four industrialized countries; The US, Britain, France and Japan. After a brief review of the history of the trade balance and of individual cases of devaluation, the paper employs OLS and the Fisher-Johansen Panel Cointegration technique, to investigate the existence of a stable long term relationship between bilateral currency depreciations, income levels and the trade balance for the panel. The results are generally strong, with the implication that in the experience of these countries, currency devaluations do impact the trade balance.

INTRODUCTION

Two established schools of thought contend that a devaluation improves the trade balance, although they differ greatly on how this happens. The Elasticities approach suggests that a nominal devaluation by exerting a negative impact on the real exchange value of a nation's currency will improve the global competitiveness of its tradable goods. In the Monetary approach a devaluation leads to a reduction in real balances, a fall in expenditures and hence to an improvement in the trade balance. The obvious disagreement is on the role accorded relative prices in the adjustment process.[1]

A clear statement on the role of relative pieces in channeling the effects of devaluations is especially important for developing countries, since increasingly they effect most devaluations. A further reason is that an increasing proportion of these devaluations are carried out under the aegis of the IMF as part of an austerity adjustment program which is informed by an essentially Monetarist view of the economy.

For a panel of 12 Central American and Caribbean countries, this study investigates whether devaluations significantly alter the real exchange rate, and then examines the relationship between the real exchange rate and the trade balance.

The model that is initially employed is essentially monetarist, with the trade balance regressed on domestic and foreign income levels and the real exchange rate. The domestic and foreign readings on these variables would reflect the "one world" assumption that is so basic to

Monetarism. However, the presence of the real exchange rate as a determinant of the trade balance, endows the model with a Keynesian flavor.[2]

This study uses the bilateral exchange rate between each panel member and each of four developed countries [the US, the UK, France and Japan] as well as the SDR exchange rate between the panel and a composite Developed Country variable representing these four countries. The disadvantage of using an aggregate exchange rate such as the SDR for each panel member is that a rise in the bilateral exchange rate against one developed country can be negated by a fall against another country. This would cancel effective rate fluctuations and perhaps lead to an otherwise unwarranted finding of inefficacy of the exchange rate as a potential tool for influencing the trade balance.

Many studies done on the trade balance prior to the last decade used level data, with notable exceptions being Miles (1979) who used first differenced data, and Bahmani and Oskooee and Alse (1994) who used a Unit Root test to ascertain that the data was in fact non-stationary. Unfortunately both used aggregate data. Meanwhile Marwah and Klein (1996) did use level disaggregated data. It is now generally accepted that most macroeconomic variables are non-stationary, carrying the risk that Ordinary Least Squares (OLS) estimates performed on them can unearth potentially spurious relationships.

The next section develops the traditional exchange rate cum trade balance model complete with an estimable OLS framework. This is followed by an initial examination of data used in this study, especially the trade balance, and both the nominal and real exchange rates of the panel countries. After a brief look at panel Unit Root and Cointegration test constructs, the main empirical findings of the paper are presented. This is followed by a concluding section.

THE TRADE BALANCE EQUATION IN REGRESSION FORMULATION

A devaluation of the nominal exchange rate will improve the trade balance if two conditions are met. First, that the nominal devaluation results in a lasting real depreciation of the nation's currency. The fear here is not merely that a given devaluation would induce a proportionate offsetting increase in inflation, but also that repeat devaluations could involve the economy in a devaluation-inflation spiral.[3]

The second condition is that the nation's foreign trade flows must be sufficiently responsive to changes in the real prices of imports and exports. Several studies have established that for most countries that have devalued, the real depreciation lasts for six or more quarters (see Himarios, 1989). This is a period long enough for a policy package (including a devaluation component) to have a significant impact on the trade balance.

To pursue the second condition, this section advances a model to provide the framework for analysis. Following Kruger (1983), the simple Keynesian equation for the trade balance equation may be written as:

$$B = B\,(Y,\ R_N / P) \qquad (1)$$

where: B is the trade balance

Y is real income

R_N is the nominal exchange rate (here measured as the domestic currency price of the numeraire currency)

P is the domestic price level.

Such a model can be broadened to take account of the Monetarist view of the open economy. Following Branson (1983) the two following assumptions are made. First, that the neoclassical assumption of price and wage flexibility assures full employment. Second, that there is a global market, so that all goods are perfect substitutes. This is the so-called "law of one price" whereby the domestic price and the foreign currency price of each good are equal. Third, that the domestic and foreign financial instruments are perfect substitutes; thus domestic and foreign interest rates would be equal except for any expected changes in the exchange rate.

The simple Keynesian trade balance equation can be rewritten as:

$$B = B\ (R, Y, Y^*,) \qquad (2)$$

where: Y, Y* are the domestic and foreign real income levels
R is the real exchange rate that conforms to the relative version of the Purchasing Power Parity Theory or:

$$R = \frac{R_n P^*}{P} \qquad (3)$$

where: P,P* represent the domestic and foreign price levels.

It has long been accepted that devaluations take several quarters to exert the greater part of their eventual effect upon the trade balance. Junz and Rhomberg (1973) and others have analyzed the lags in decision, replacement, delivery and production [see Salvatore (2007)] that intervene to delay the expected increase and decrease in the volume of exports and imports respectively.[4]

In fact, these delays are often sufficient to give rise to a temporary worsening of the trade balance before there is improvement. This is known as the J-curve phenomenon. To take account of this delayed effect of a devaluation, an Almon distributed lag process is employed and thus the actual equation estimated may be written as:

$$B_i = a_o + a_1\ (L)\ R + a_3 Y + a_4 Y^* + e_i \qquad (4)$$

where the variables are previously defined and L represent the unconstrained Almon polynomial distributed lag. This study uses a one period lag.

In this empirical study, the sign on the real exchange rate coefficient is important in determining whether a devaluation is successful in improving the trade balance. Assuming that a devaluation effects a real devaluation of a nations' currency, then the Marshall-Lerner condition suggests an improvement in the trade balance.[5] Since R measures the home currency price of a unit of foreign currency, the sign on a_1 would have to be positive to suggest that a devaluation has improved the trade balance.

In discussing the sign on the coefficient of R, a few points should be noted. First, in the first one or two quarters after the devaluation the presence of the J-curve may cause it to be negative before it takes on positive values. Next, Himarios (1989) has argued that in view of the fact that the nominal exchange rate is the policy variable examined and modified by governments, perhaps it should be the exchange rate variable in the equation to be estimated. In his estimation procedure he regressed that ratio of foreign to domestic price levels on the nominal exchange rate. The residuals represent all factors other than the exchange rate that determine relative prices. He then proceeds to introduce into an alternative estimation for an equation similar to equation 4, a nominal exchange rate variable, and a separate variable representing the relative price residuals. Given that this study will progress to conducting a stationarity test, our OLS estimation of Equation 4 will use only the real exchange rate.

There is ambiguity as regards to the coefficients on real income. The reason is that a rise in real income stimulates increased import demand, as well as increased production of tradable goods causing the ultimate effect on the trade balance to be uncertain.

PRELIMINARY DATA ANALYSIS

This study uses annual data for 12 Caribbean and Central American nations from 1960 to 2006. The trade balance variable used is the ratio of exports to imports. This is employed to avoid the need to have to choose a price index to deflate the difference between exports and imports, and also to facilitate the use of a log form model. As Equation 3 shows the real exchange rate used is the nominal exchange rate (measured as the individual panel member's currency per unit of the developed country's currency) multiplied by the ratio of the developed country to individual panel country's consumer price index. Finally we note that the nominal exchange rates and the price indices, as well as an index of real GDP levels for both panel and developed countries, are obtained from the International Financial Statistics (IFS) from the IMF, while the bilateral trade statistics come from the IMF's Direction of Trade Statistics (DOT). As the exchange rate and the trade balance are the focal points of this paper, we now take a cursory look at their behavior over the relevant time period. Table 1 shows the ratio of exports to imports, for the earliest and latest year for which it is available, the highest and lowest level, as well as the actual dollar value of exports and imports in these years. A ratio of 1 indicates that exports equal imports. A value of 2 says that exports are twice imports and 0.5 means that exports are half the value of imports.

Several patterns are easily discernible. First, with the exception of Panama and Trinidad and Tobago, the ratio of exports to imports turned less favorable over the period, but with the former being weak at both ends. Second, in five of the twelve countries the ratio declined by more than 50 percent with the worst case being the Dominican Republic where the decline was 91 percent. Further in only three of the 12 cases did the average of the last 10 years exceed the overall average and then only by a slender margin. A more disturbing observation is that the entire time series for this ratio shows that for more than half of these countries, over 50 percent of the deterioration occurred within the last 10 years.

Another way of observing this fact is to note that the end of period ratio was generally just above the lowest value recorded over the sample period, while just about every country's highest value is significantly above the beginning year's value. While four of the twelve nations began

TABLE 1
A SUMMARY OF INDIVIDUAL COUNTRY TRADE

Country \ Ratio of Exports to Imports	Beginning of Period		End of Period		Highest Value	Lowest Value	Average Value	Average Last 10 Years
BARBADOS	**0.49**		**0.24**		**0.71**	**0.20**	**0.38**	**0.23**
	Exports	Imports	Exports	Imports				
	24	49	385	1586				
BELIZE	**0.60**		**0.35**		**0.67**	**0.30**	**0.50**	**0.43**
	Exports	Imports	Exports	Imports				
	8	13	207	593				
COSTA RICA	**0.76**		**0.71**		**1.05**	**0.61**	**0.79**	**0.82**
	Exports	Imports	Exports	Imports				
	84	110	8216	11520				
DOMINICAN REPUBLIC	**2.07**		**0.19**		**2.07**	**0.14**	**0.69**	**0.19**
	Exports	Imports	Exports	Imports				
	180	87	1398	7207				
EL SALVADOR	**0.48**		**0.46**		**0.65**	**0.43**	**0.54**	**0.56**
	Exports	Imports	Exports	Imports				
	725	1516	3513	7628				
GUATEMALA	**0.93**		**0.36**		**1.10**	**0.36**	**0.76**	**0.46**
	Exports	Imports	Exports	Imports				
	113	121	3665	10157				
HONDURAS	**0.88**		**0.36**		**1.06**	**0.36**	**0.79**	**0.46**
	Exports	Imports	Exports	Imports				
	63	72	1929	5418				
JAMAICA	**0.73**		**0.35**		**0.91**	**0.31**	**0.59**	**0.38**
	Exports	Imports	Exports	Imports				
	159	217	1838	5211				
NICARAGUA	**0.88**		**0.33**		**1.57**	**0.26**	**0.62**	**0.35**
	Exports	Imports	Exports	Imports				
	63	72	858	2595				
PANAMA	**0.18**		**0.24**		**0.41**	**0.17**	**0.27**	**0.26**
	Exports	Imports	Exports	Imports				
	21	120	1018	4180				
ST.KITTS AND NEVIS	**0.33**		**0.19**		**0.88**	**0.13**	**0.34**	**0.19**
	Exports	Imports	Exports	Imports				
	4	12	50	270				
TRINIDAD ANS TOBAGO	**0.98**		**1.68**		**1.77**	**0.73**	**1.13**	**1.17**
	Exports	Imports	Exports	Imports				
	286	293	8462	5041				

* Exports and Imports are based on units of Billion dollars

and ended with a ratio of less fifty percent, only Panama remained there for all 46 recorded years. This implied that Panama's recorded exports never climbed to half of its exports. Finally beside Trinidad and Tobago, Costa Rica came closest to maintaining a merchandise trade balance, over the period with its ratio dipping below 70 percent only 5 times scattered over the years 1965 to 1979.

These are the bare facts to be gleamed from Table 1, but several explanations of this dismal trade performance are relevant at this point. First, over almost five decades, most of these countries moved from primary products being the chief foreign exchange earning sector, to a mix of some light manufacturing with tourism and other services (Schipe, 2005). Meanwhile the latter half of the sample period witnessed an even broader range of consumer imports, ranging from electronics to entertainment, that was spurred on by ubiquitous media over-exposure.

For some nations there was a significant decline in agricultural exports, with sugar being the most notable example of this in the case of Jamaica, Barbados, St. Kitts and perhaps most decisively the Dominican Republic after Gulf and Western withdrew (Cardemil et. al., 2000). While the Dominican Republic's exports were more than twice its imports in 1960, this ratio had dropped to 20 percent by 2005. For other nations regional conflicts or civil wars exacted a significant toll on their trade balance. Nicaragua's ratio fell from a high of 1.5 in 1979 to 0.51 the following year.

On the other hand for some nations, events over which they had no control proved to be truly serendipitous. Trinidad's ratio went from 0.88 in 1973 to well above 1.0 the following year; where it would remain for all but four of the next 32 years. Trinidad of course is a primary petroleum producer and exporter. Finally some nations enjoyed success in their attempts to diversify the agricultural produce export sector and thus experienced little deterioration in the trade balance ratio, Costa Rica for example. The implication of this analysis is that a host of factors other than the real exchange rate have had a significant bearing on the trade balance of these nations.

Table 2 presents a dozen cases of significant currency devaluations involving 10 of these countries. In every case except one, a devaluation effects a depreciation of the real exchange rate by the end of the following year and for the most part the percentage change in the real exchange rate reasonably mirrors the devaluation. The major exception was Nicaragua where the hyper inflation of the early 1990's meant that a devaluation of as much as 733% not only failed to induce a depreciation of the real exchange rate but instead brought about a 71 percent appreciation of the real exchange rate by the end of year 1 which was then followed by a 24 percent depreciation over the next two years (also the only case where such a depreciation occurred).

Unfortunately for half of the countries by the end of the third year after the initial depreciation of the real exchange rate, a substantial part of the depreciation had been cancelled out by unfavorable price differentials with trading partners. In only 3 of the 12 devaluations analyzed was the percentage slippage of the real exchange rate kept to below 30 percent. The slippage is measured as the percentage change in the real devaluation between years one and three. Only in the first of the two devaluations by Trinidad and Tobago is there a continued depreciation (by a slender 4 percent) of the real exchange rate into the third year.

Finally we note that the two countries with the two largest devaluations (Costa Rica and Nicaragua) sport the largest slippages of the real exchange rate. In the case of Nicaragua almost all of this occurs in the year of the devaluation. The implication being that even when policy

TABLE 2

SELECTED CASES OF NOMINAL AND REAL DEVALUATION

		(1)	(2)			(3)
		Nominal	Real Devaluation (%)a after [a]			Total [b, c]
		Devaluation	t	t+1	t+2b	Slippage
	Year	(%)	(one year)	(two years)	(three years)	(%)
BARBADOS	1966	15.96	15.00	12.40	11.39	24.07
COSTA RICA	1980	321.12	238.95	98.28	71.09	70.25
	1990	30.78	5.91	-8.94	-5.42	191.68
DOMINICAN REPUBLIC	1984	194.00	109.49	102.46	79.72	27.19
EL SALVADOR	1985	100.00	54.41	28.29	11.41	79.02
GUATEMALA	1985	150.00	85.97	71.76	68.30	20.55
HONDURAS	1989	167.85	128.92	78.90	76.96	40.30
JAMAICA	1977	86.45	48.78	33.02	20.18	58.63
	1990	167.40	84.50	10.32	19.64	76.76
NICARAGUA	1990	733.32	-71.48	-76.23	-54.17	24.22
TRINIDAD AND TOBAGO	1966	15.96	16.68	13.26	16.00	4.11
	1984	50.00	44.34	36.52	27.88	37.13

a. The real devaluations are the authors calculation from the IFS data.
b. The slippage is measured as the % change in real devaluation from the first to the third year after the nominal devaluation.
c. The Total slippage is measured after removing the effect of any subsequent change in the nominal devaluation.

makers muster the courage to take bold action in the face of withering inflation, it does not mean that they will achieve the desired change in the exchange rate to underpin the improvement in the trade balances that they seek.

PANEL TEST CONSTRUCTS

Unit Root Test

For a single country series, an autoregressive process specification is set up in the form:

$$Y_t = \rho Y_{t-1} + \delta X_t + \varepsilon_t \qquad (5)$$

Where X_t represent regressors such as a time trend or a constant, δ any parameter and ε….the residual. The basic test for stationarity consists of evaluating whether ρ takes on the value absolute 1 in which case we can say that the series Y has a unit root and thus is non-stationary. This construct is quickly extended to the Augmented Dickey Fuller test to handle higher order series lag correlation. For multiple cross-sections (such as panel data) Equation 1 may be rewritten as:

$$Y_{it} = \rho_i Y_{it-1} + \delta_i X_{it} + \varepsilon_{it} \qquad (6)$$

Where there are now i = 1 ……. n series and periods t = 1…..Ti
Once again if $|\rho_i| = 1$ …., then Y_i contains a unit root

Cointegration Test

Engle and Granger (1987) state that if two variable X and Y are shown to contain a unit root (i.e. are both integrated of order 1, [I (1)], then upon regressing Y upon X, the regression equation can be rewritten with the residual as the dependent variable, in a form such as:

$$\mu_t = Y_t - \beta_0 - \beta_1 X \qquad (7)$$

Provided that a unit root test shows that it is stationary, i.e. integrated of order 0, we can state that the variable Y and X are cointegrated thus affirming that there exists a long run relationship between them.

Pedroni (2004, 1999) and Maddala and Wu (1999) in different constructs extend Engle-Granger to panel data situations. For example Pedroni starts out in much the same way as Engle Granger with an equation such as:

$$Y_{it} = \alpha_i + \theta_{it} + \beta_1 X_{it} + \ldots\ldots\ \beta_{mt} X_{mi,t} + \mu_{it} \qquad (8)$$

Where Y and X are integrated of order 1 and where α_i and θ are individual country and trend effects respectively. As in the Engle-Granger case above, the residuals from this equation are then run in a second regression for each country as:

$$\mu_{it} = \rho_i \mu_{it-1} + \sum it \qquad (9)$$

The null hypothesis of no cointegration then becomes (ρ=1), implying that μ_t is I (1)

EMPIRICAL RESULTS

Analysis of OLS Regressions

Table 3 presents the results of the OLS regressions in which the trade balance is regressed on the contemporaneous and one-period lagged real exchange rate and the domestic and foreign income levels according to Equation 4. The regressions are performed for the bilateral relationship between the "Caribbean Central American Panel and each of the US, the UK, France and Japan and separately against the composite Developed World."

The results are mixed. With the exception of the UK and the US, all of the contemporaneous real exchange rate coefficients have the expected positive sign suggesting that in the year that it was carried out a devaluation does improve the trade balance. For Britain both the current and the one period lagged coefficient are negative indicating that any possible J curve impact had not been completely removed by the end of the second year after the devaluation. For the US while the contemporaneous coefficient is negative the one period lagged coefficient is positive suggesting the possible presence of a J curve effect. However for France, Japan and the Developed World the lagged real exchange rate is negative, implying a delayed deterioration on the trade balance. All of the conclusions are tempered by the fact that none of the coefficients on the exchange rate are significant at the five percent level.

The opposite is true for the domestic and foreign income levels. For most countries the coefficient on domestic income has the expected negative sign while that for the foreign income is mostly positive, the exception being the US which has signs opposite of the expected. In slightly more than half of the cases the T statistics are significant at the one percent level. Thus the initial examination appears to suggest that domestic and foreign income levels have a greater impact on the trade balance than does exchange rate variation. However another cautionary note here is that in no case does the Durbin Watson statistic rise above **1.26**, implying the likely presence of Autocorrelation, while a comparison of the size of this statistic with the relatively high coefficient in determination (R^2) suggests that the regression could be spurious.

Panel Unit Root Test

Table 4 presents the level and the first difference stationarity test for each variable used in this study. The specific form of the test is that by Levin, Lin and Chu (2002), mostly employing the Schwartz Information Criterion automatic lag length where the maximum is set at 2. For the all variables the null hypothesis in both level and first difference form is the existence of a unit root. For the level test the p values are high with the sole exception of the World GDP, meaning that we cannot reject the null hypothesis. As the reverse is true universally for these variables in the first difference test, it can be definitively concluded that each variable is non-singular possessing one root. All of this evidence points to the possibility of a long run underlying relationship between the trade balance and the exchange rate and real income variables. This in turn clears the way for us to test for cointegration to further investigate the existence of, and to explore the nature of any such relationship.

TABLE 3
REGRESSION RESULT 1960 - 2006

Country 1960 - 2006	a_0	a_1	a_2	a_3	a_4	R_2 / D.W.
United Kingdom	-2.8688	-0.2547	-0.4748	-1.2510	0.2760	0.76
	(-4.8266)	(-0.8241)	(-1.4443)	(-2.9341)	(0.4158)	0.83
United States	0.7790	-0.0021	0.0184	0.7371	-1.3833	0.88
	(3.0922)	(-0.0114)	(0.0972)	(3.7004)	(-5.7698)	0.75
France	-6.4015	0.5120	-0.6062	-2.3514	5.8577	0.48
	(-5.6879)	(1.2456)	(-1.4358)	(-3.8628)	(5.3795)	1.09
Japan	-3.1171	0.2715	-0.1189	-0.6145	1.8260	0.56
	(-2.3320)	(0.7166)	(-0.3191)	(-1.3810)	(2.0878)	1.00
Developed World	1.2320	0.0401	-0.0213	-0.1601	-0.7612	0.69
	(3.7900)	(0.3223)	(-0.1679)	(-1.0823)	(-3.1734)	1.26

** Note: The t-statistices are in brackets under the respective coefficient*
** Note that the coefficients a $_1$ and a $_2$ represent the contemporaneous and the one period lagged real exchange rate respectively*

TABLE 4
UNIT ROOT TEST RESULT

	Level Test		First Difference Test	
Variable	Statistic	Probability	Statistic	Probability
LTB2	0.84285	0.8003	-14.7337	0
LRNX	1.60122	0.9453	-13.6267	0
LWGDPV	-6.58726	0	-3.10837	0.0009
LOG RGDP	17.5316	0.8251	-2.38535	0.0085
LTBUS	1.84853	0.9677	115.108	0
LTBUK	2.38646	0.9915	-2.83162	0.0023
LTBF	1.78583	0.9629	-2.97005	0.0015
LTBJ	0.57249	0.7165	-3.25477	0.0006
LRBXUS	0.85401	0.8034	-2.27189	0.0115
LRBSUK	2.82138	0.9976	-0.79657	0.2128
LRBXF	0.73648	0.7693	-3.16663	0.0008
LRBXJ	3.29811	0.9995	-21.0009	0

Panel Cointegration Test

Table 5 presents the cointegration results that make use of the Johansen-Fisher construct (see Johansen (1995) and Johansen and Juselius (1990)) displaying the Trace test followed by the Maximum Eigen Value test (MEV). These were derived from a Johansen-Fisher construct. In all cases a cointegration test is carried out on the panel's trade balance, the exchange rate and the domestic and foreign income levels. In column 2 the cointegrating relationship is with the developed country composite and in each of the next four columns it is run bilaterally with the US, UK, France and Japan. Next to each such column the number of the cointegrating relations is shown based upon the ***p*** values for the null hypothesis of the number of cointegrating equations shown in column1.

TABLE 5
OVERALL COINTEGRATION TEST [P-VALUES]

Null	World		U.S.		U.K		France		Japan	
Trace test										
r = 0	0		0		0		0		0	
r = 1	0		0		0		0		0	
r = 2	0.01		0.032		0.0146		0.0895		0.0223	
r = 3	0.2337	3	0.276	3	0.3449	3	0.3748	2	0.3369	3
Maximum Eiqen Value Test										
r = 0	0		0		0		0		0	
r = 1	0.0002		0.0003		0		0		0	
r = 2	0.0205		0.0447		0.023		0.1639		0.0278	
r = 3	0.2357	3	0.276	3	0.3449	3	0.3748	2	0.3369	3

** Note: r denotes the number of cointegrating equations.*
the number at the bottom of the column after the P-value for
each country represents the number of identified cointegrating vectors

In the test of our panel with the world, Table 5 (both versions of the test are in agreement) reveals that there are three cointegrating relations with the composite developed countries. It also shows that there are three cointegrating relations when the bilateral trade balance and exchange rate are combined with the domestic and foreign income levels with the US, UK, Japan, but only two with France. The clear implication is that bilateral currency depreciations with the developed world are associated with some improvements in the panel's trade balance with the developed countries.

Having established multiple cointegrating relations for the trade balance and the three variables we now turn to an examination of the Johansen-Fisher cross section for individual countries that produced these results. Tables 5 and 6 provide a summary of the results of the Trace and MEV cointegration tests respectively for the individual countries with the composite developed countries and these countries individually. The results overall indicate at least one cointegating relationship in more than a third of the cases with multiple relations being established fairly consistently in the case of Nicaragua, Costa Rica and El Salvador. As we had anticipated, a quick comparison with outcomes of the selected devaluation in Table 3 fails to establish any necessary association between the slippage of the real exchange rate two years after the devaluation and the likelihood of an underlying relationship between the trade balance and the real exchange rate. This was because Table 3 was merely showing the degree to which one episode of significant nominal devaluation was translating into a sustained real depreciation.

A more interesting exercise would be to see whether there is any link between the establishment of cointegration and an individual country's experience under inflation. Table 8 sorts these countries by ascending order of the annualized rate of inflation over the study period, includes the rate over the last 10 years, and reports the number of cases of no observed cointegration from Tables 6 and 7. The results are mixed. Panama and St Kitts two of the countries with the lowest rates of inflation each report only one case (that is one case for each of the Trace and MEV Tests) of no cointegration. On the other hand it is significant that three of the four countries with the highest rates of inflation (El Salvador, Costa Rica and Nicaragua) are the only countries for which there is not only no case of no cointegration, but where a closer examination of Table 8 reveals the largest incidence of multiple cointegrating equations. It is beyond the scope of this paper but a worthwhile follow up study should well be to investigate more thoroughly the precise role that inflation plays (beyond utilizing the domestic and foreign price level in calculating the real exchange rate) in determining the success or failure of policies that manipulate the nominal exchange rate to determine the trade balance.

TABLE 6
CROSS-SECTION COINTEGRATION TEST [p -VALUE] TRACE TEST

Country	Null	World		U.S.		U.K		France		Japan	
BARBADO	r = 0	0.0004		0.1015		0.0674		0.0078		0	
	r = 1	0.0072		0.3931		0.1346		0.065		0.1274	
	r = 2	0.1288		0.3721		0.2486		0.2837		0.2786	
	r = 3	0.1526	2	0.0719	0	0.4522	0	0.4736	1	0.5817	1
BELIZE	r = 0	0.014		0.0327		0.0986		0.0045		0.0109	
	r = 1	0.0751		0.0486		0.3604		0.2103		0.2135	
	r = 2	0.3561		0.1094		0.5931		0.6757		0.4203	
	r = 3	0.2595	1	0.2324	1	0.7119	0	0.6887	1	0.5711	1
COSTA RICA	r = 0	0.004		0.0027		0.0005		0.0167		0.0006	
	r = 1	0.5145		0.6825		0.5579		0.5999		0.0271	
	r = 2	0.5661		0.6146		0.7556		0.6173		0.0784	
	r = 3	0.2989	1	0.6821	1	0.9925	1	0.5849	1	0.2836	2
DOMINICAN REPUBLIC	r = 0	0.401		0.0815		0.1245		0.0222		0.263	
	r = 1	0.4679		0.2752		0.9769		0.0804		0.5987	
	r = 2	0.6075		0.3709		0.9996		0.4773		0.6653	
	r = 3	0.7854	0	0.9024	0	0.8158	0	0.7602	1	0.2786	0
EL SALVADOR	r = 0	0		0		0		0		0	
	r = 1	0.0027		0.0018		0.0003		0		0	
	r = 2	0.0683		0.1412		0.0409		0.007		0.1285	
	r = 3	0.2534	2	0.5246	2	0.844	1	0.1817	3	0.0594	2
GUATEMALA	r = 0	0.0013		0.001		0.0001		0		0.0011	
	r = 1	0.013		0.0069		0.0012		0.0036		0.0503	
	r = 2	0.0487		0.0393		0.042		0.8094		0.2175	
	r = 3	0.6964	3	0.8508	3	0.9805	1	0.3991	2	0.188	1
HONDURAS	r = 0	0.0522		0.5688		0.0005		0.0138		0.0037	
	r = 1	0.4312		0.9842		0.1284		0.2862		0.4954	
	r = 2	0.5512		0.8187		0.6615		0.7458		0.4608	
	r = 3	0.7946	0	0.2625	0	0.2385	1	0.879	1	0.9046	1
JAMAICA	r = 0	0.0101		0.0271		0.0175		0.0884		0.0096	
	r = 1	0.0672		0.0897		0.1187		0.4367		0.1412	
	r = 2	0.1278		0.3314		0.1876		0.683		0.1999	
	r = 3	0.442	1	0.892	1	0.234	1	0.5983	0	0.1547	1
NICARAGUA	r = 0	0		0		0		0		0	
	r = 1	0		0.0001		0.0001		0.0019		0.0005	
	r = 2	0.0032		0.0237		0.0059		0.0223		0.7346	
	r = 3	0.0147	3	0.1376	3	0.0218	1	0.0276	3	0.9924	2
PANAMA	r = 0	0.0088		0.1093		0		0.0375		0.0011	
	r = 1	0.2512		0.2268		0.0667		0.4431		0.0498	
	r = 2	0.3961		0.1309		0.4571		0.5591		0.1979	
	r = 3	0.9129	1	0.0225	0	0.1179	1	0.8705	1	0.2446	2
ST. KITTS AND NEVIS	r = 0	0.0042		0.0004		0.0743		0		0	
	r = 1	0.0789		0.0162		0.267		0.001		0.0002	
	r = 2	0.2156		0.2514		0.3638		0.06		0.0038	
	r = 3	0.1486	1	0.6251	2	0.0807	0	0.0368	2	0.3143	3
TRINIDAD AND TOBAGO	r = 0	0.0238		0.018		0.0001		0.0245		0.0354	
	r = 1	0.1075		0.0895		0.0055		0.108		0.1821	
	r = 2	0.4529		0.4332		0.0415		0.386		0.26	
	r = 3	0.536	1	0.4804	1	0.834	2	0.5706	1	0.6146	1

**** Note: These are parts of the results from the panel cointegration results reported in Table 5***

TABLE 7
CROSS - SECTION COINTEGRATION TEST [p - VALUE] MAXIMUM EIQET VALUE TEST

Country	Null	World		U.S.		U.K		France		Japan	
BARBADO	r = 0	0.025		0.1357		0.2985		0.0612		0	
	r = 1	0.0198		0.5955		0.2637		0.102		0.2238	
	r = 2	0.1759		0.6535		0.2205		0.2508		0.2306	
	r = 3	0.1526	2	0.0719	0	0.4522	0	0.4736	0	0.5817	1
BELIZE	r = 0	0.1003		0.3508		0.1489		0.0066		0.0196	
	r = 1	0.0934		0.1838		0.3578		0.1454		0.2707	
	r = 2	0.3962		0.1214		0.5215		0.6123		0.3674	
	r = 3	0.2595	0	0.2324	0	0.7119	0	0.6887	1	0.5711	1
COSTA RICA	r = 0	0.001		0.0002		0.0001		0.0045		0.0099	
	r = 1	0.5872		0.7692		0.487		0.6591		0.1347	
	r = 2	0.6106		0.5478		0.6801		0.567		0.0779	
	r = 3	0.2989	1	0.6821	1	0.9925	1	0.5849	1	0.2836	1
DOMINICAN REPUBLIC	r = 0	0.618		0.1697		0.0087		0.1541		0.2543	
	r = 1	0.4892		0.4083		0.8397		0.07		0.6172	
	r = 2	0.5288		0.2924		0.9993		0.3998		0.7314	
	r = 3	0.7854	0	0.9024	0	0.8158	1	0.7602	0	0.2786	0
EL SALVADOR	r = 0	0		0		0.0015		0		0	
	r = 1	0.0134		0.0037		0.0022		0		0	
	r = 2	0.0711		0.113		0.026		0.008		0.2787	
	r = 3	0.2534	2	0.5246	2	0.844	3	0.1817	3	0.0594	2
GUATEMALA	r = 0	0.0486		0.0674		0.0513		0.0004		0.0086	
	r = 1	0.0963		0.0618		0.0096		0.0005		0.1007	
	r = 2	0.0327		0.0248		0.0264		0.8283		0.2723	
	r = 3	0.6964	1	0.8508	0	0.9805	0	0.3991	2	0.188	1
HONDURAS	r = 0	0.0472		0.1705		0.001		0.0165		0.0009	
	r = 1	0.4852		0.9969		0.0778		0.1889		0.6551	
	r = 2	0.4703		0.8942		0.7546		0.6719		0.3758	
	r = 3	0.7946	1	0.2625	0	0.2385	1	0.879	1	0.9046	1
JAMAICA	r = 0	0.079		0.1704		0.077		0.0948		0.0304	
	r = 1	0.2249		0.1249		0.2934		0.3909		0.3327	
	r = 2	0.108		0.2573		0.2125		0.6353		0.2725	
	r = 3	0.442	0	0.892	0	0.234	0	0.5983	0	0.1547	1
NICARAGUA	r = 0	0		0		0		0		0	
	r = 1	0.0009		0.0009		0.0027		0.0283		0.0001	
	r = 2	0.0185		0.033		0.0257		0.0805		0.6564	
	r = 3	0.0147	3	0.1376	3	0.0218	3	0.0276	2	0.9924	2
PANAMA	r = 0	0.0115		0.2992		0		0.0284		0.0088	
	r = 1	0.3474		0.6655		0.059		0.495		0.1095	
	r = 2	0.3151		0.4448		0.6606		0.4734		0.2203	
	r = 3	0.9129	1	0.0225	0	0.1179	1	0.8705	1	0.2446	1
ST. KITTS AND NEVIS	r = 0	0.0241		0.0117		0.1574		0.0009		0.0124	
	r = 1	0.1677		0.0232		0.4014		0.005		0.0167	
	r = 2	0.2991		0.2017		0.6175		0.1754		0.0031	
	r = 3	0.1486	1	0.6251	2	0.0807	0	0.0368	2	0.3143	3
TRINIDAD AND TOBAGO	r = 0	0.1221		0.1096		0.0095		0.1259		0.1043	
	r = 1	0.1075		0.0907		0.0464		0.1312		0.3512	
	r = 2	0.4063		0.3985		0.0265		0.3339		0.2104	
	r = 3	0.536	0	0.4804	0	0.834	3	0.5706	0	0.6146	0

**** Note: These are parts of the results from the panel cointegration results reported in Table 5***

TABLE 8
AVERAGE ANNUAL INFLATION RATES FOR PANEL COUNTRIES

Country	Number of case of No cointegration	1960 to 2006	Last 10 year Available
PANAMA	2	2.64	1.10
BELIZE	4	2.88	1.87
ST. KITTS AND NEVIS	2	3.69	3.04
BARBADOS	5	6.87	2.95
TRINIDAD AND TOBAGO	4	7.81	4.37
GUATEMALA	2	8.96	7.04
EL SALVADOR	0	8.96	3.07
HONDURAS	3	9.80	13.27
DOMINICAN REPUBLIC	8	12.78	12.99
COSTA RICA	0	13.79	11.34
JAMAICA	5	15.40	9.43
NICARAGUA	0	837.47	9.10

** Note: These are the authors calculations using IFS data.*
The number of case of no cointegration reported in the sum
of the Trace and Eigen Value tests shown in Table 6

CONCLUSION

This paper examines the relationship between the real exchange rate and the trade balance by employing several investigative methods. The subject of this study is the trade relationship between a panel of 12 Caribbean and Central American countries with the developed world and also individually with four developed countries, the US, UK, France and Japan. An initial examination of the trade balance of the panel countries reveals a general deterioration over the forty five year study period with an especially sharp drop over the final ten years from 1995 to 2005. The paper advances several structural changes that perhaps in addition to real exchange rate changes might have accounted for the worsening trade balance.

We next examined selected episodes of nominal devaluation and discovered that not only had each translated into smaller real depreciations but that after a further two years, almost all of this depreciation had disappeared. An OLS examination of the modified Keynesian and Monetarist model yielded some weak evidence that real currency depreciations as well as the domestic and foreign income level do work in the expected manner to boost the trade balance, but also serves to raise issues as to the reliability of these results because of stationarity questions.

An empirical evaluation of these variables quickly confirms that just about everyone possesses a unit root. Finally the cointegration test using the Fisher-Johnson Panel method shows that there are multiple cointegration relationships between the panel and the developed world but also, bilaterally with each of the developed countries individually. When we look at the individual country cross section of the panel, there is evidence of cointegrating relationships for most countries and even some slight evidence of a greater likelihood that countries with a higher pattern of inflation tending to exhibit such cointegration.

The clear conclusion is that manipulating the nominal exchange rate and having this successfully change the real exchange rate can improve a nation's trade balance in the experience of these countries. However the brief ad hoc examination of these nations' inability to turn these currency manipulations into real depreciation appears to be an additional reason why their trade balance has been worsening so significantly of late.

NOTES

1. It should be mentioned that while the channels of transmission appear to be diametrically opposed, several theoretical and empirical studies have indicated that these processes are closely integrated; see, for example, Frenkel, J.A.T., Gylfacon and J.F. Helliwell, "A Synthesis of Monetary and Keynesian Approaches to Short Run Balance of Payments Theory." Economic Journal, September 1988.

2. The Keynesian approach to analyzing the effects of devaluation does go beyond the relative price switching effects. It encompasses the deleterious impact of excessive domestic spending and income increases upon the trade balance.

3. Using correlation analysis, Himarios (1989) has shown that for both the Bretton Woods and the post Bretton Woods period, changes in nominal exchange rate did appear to be correlated with changes in real exchange rates, thus contradicting one of the principal conclusions of the strict Purchasing Power Parity Theory.

4. See Salvatore (2007) for a discussion of the issues attendant to these lags and an analysis of the manner in which they produce a J-curve.

5. The Marshall-Lerner condition states that the trade balance will improve following devaluation if the sum of the elasticity of demand for exports and the elasticity of demand for imports (facing a given country) exceeds unity. Given this condition, we are accepting the considerable weight of evidence that in practice the sum of these demand elasticities exceeds one.

6. The number reported in Table 6 is the number of times an individual country had a finding of no cointegration with either the developed country variable or each of the four developed countries. The actual number reported is the sum for the Trace and Maximum Eigen Value Tests.

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