

Real Exchange Rates And U.S. Bilateral Trade

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Abstract

The persistence of the U.S. trade deficit despite the significant depreciation of the dollar in the second half of the 1980s prompted several studies seeking an explanation for this phenomenon. There has been a renewed interest on the exchange rate trade linkage as the U.S. trade deficit reached a record high despite steady depreciation of the dollar in early 1995. This paper presents an empirical analysis of the relationship between real exchange rate and U.S. exports to Canada and Japan. The major finding of this paper is that real income and real exchange rates changes are important determinants of bilateral trade flows.

I. Introduction

Traditional trade theory explains much of the fluctuations in trade by changes in the exchange rates. The emphasis on the link between exchange rates and trade became prominent when the trade deficit widened following a sharp increase in the value of the dollar in early 1980s (Fielke, 1985, Hickock, Bell and Ceglowski, 1988; and Orr, 1989).

Policy makers and market participants expected that a dollar depreciation following the Plaza Accord in early 1985 would improve the U.S. trade balance. The proposed adjustment mechanism rested on a traditional scenario that a lower dollar should mean more American exports and fewer imports. The persistence of a trade deficit even as the dollar had been plunging against major currencies prompted several studies seeking an explanation for this phenomenon (see chart 1).

Bergsten and Cline (1985), McKinnon and Ohno (1986), and Mundell (1987), relate the trade balance to the difference between national income and national expenditure or equivalently to the difference between saving and investment. Their

analysis suggests the irrelevance of the exchange rate to the current account.

Helkie and Hooper (1987) and Rosenweig and Koch (1988) argue that the persistence of a trade deficit reflects for the most part normal lags in the adjustment to the depreciation of the dollar that follow a long period of appreciation. The sharp rise of the dollar in the last few months before its peak in early 1985 may have created expectations for further appreciation and led traders to reorient their export and import business in a way that was difficult to reverse in the short run. Similarly, Baldwin (1987) relates the persistence of a trade deficit to hysteresis which describes the structural loss prompted by the appreciation of the dollar. According to this explanation, because of a fixed cost of entry, markets once lost are not easily regain. Likewise, once foreign exporters gained a foothold in the local market, they are not easily dislodged.

An alternative explanation rooted in the modern theory of trade balance is presented by Greenwood (1984), Razin (1984), and Hill

(1990). According to this theory, the cause of a trade deficit is intertemporal shock such as changes in the world interest rate or intertemporal preferences which have no direct effect on the real exchange rate but directly impact the trade balance by shifting time distribution of domestic consumption and production. These disturbances create a gap between aggregate spending and output which manifests itself in an external trade imbalance. The trade balance situation alters the relative availability of non-traded goods in the economy and induces changes in the real exchange rate.

There are also those who argue that the dollar really has not fallen as much in real terms as some exchange rate indices would suggest. While the dollar has fallen against major currencies, its value has risen, particularly against currencies of key developing countries. This argument prompted the construction of new comprehensive dollar indices to accurately measure the foreign exchange value of the dollar [see Rosenweig, 1986; Cox, 1987; and Harvey and Strauss, 1987].

There was renewed interest on exchange rate trade-linkages as the U.S. trade deficit reached a record high in the face of a sharp fall in the dollar in early 1995. The purpose of this paper is to re-examine the empirical relationship between the dollar exchange rates and U.S. bilateral exports. More specifically, the paper examines the effect of real bilateral exchange rates on U.S. exports to Canada and Japan. The remainder of the paper is organized as follows: Section II presents the model, Section III describes the empirical presentation and Section IV provides summary and concluding remarks, and section V provides suggestion for further research.

II. Model Specification

The export demand model is basically like any other demand model. The price and quantity are inversely related, *ceteris paribus*, with equilibrium price and quantity determined by the interaction of supply and demand. In the vast majority of empirical studies, own price is assumed to be exogenous i.e., supply is perfectly elastic and the export supply equation is not explicitly considered in

many of the trade models (see Murray and Ginnman, 1976; Houthakker and Magee, 1969; Warner and Kreinen, 1983; and Krugman, 1989).

The assumption of infinite supply elasticity reduces the export model to a single equation. Following the conventional demand theory, the traditional demand equation relates the quantity of exports demanded to income and relative prices for U.S. goods and foreign goods (the real exchange rate). Specifically, it is assumed that the foreign real income, (RGDP) and real exchange rate (REXR), are the basic determinants of the U.S. exports in real terms (REXP) :

$$\ln \text{REXP}_t = \alpha_1 \ln \text{RGDP}_t + \alpha_2 \ln \text{REXR}_t + \varepsilon_t \quad (1)$$

All the regressors are expressed in logarithm and ε_t is a disturbance term. If foreign income rises, the demand for exports will rise so that α_1 is expected to be positive. If the real exchange rate rises, the demand for U.S. exports falls so that α_2 is expected to be negative.

Estimating equation 1 directly would imply that there is no time lag in the adjustment of actual imports. However, it is generally agreed that imports will not adjust instantaneously to their long run equilibrium level following a change in any of their determinants (Khan, 1974; Wilson and Tackas, 1979). Thus, the actual level of exports observed in any period is commonly expressed as a distributed lag function of the independent variables. The export demand adjusts to changes in the exogenous variables with a lag because of various reasons including long-term contracts, transaction costs associated with changing suppliers, recognition lags, and short run capacity constraints. To allow for the adjustment of export demand to changes in the regressors, some studies have employed a partial adjustment model (see Goldstein and Khan, 1985). Such partial adjustments while theoretically plausible are often criticized for imposing a stringent restriction on the lag behavior of the regressors. In addition, such partial adjustment models are subject to estimation problems due to correlation between the error term and the lagged dependent variable even when adjusted

for serial correlation. As a result, many empirical trade studies have employed polynomial or other distributed lag specifications with the intention of allowing the regressors to display differently shaped lag profiles (see Deyak and *et al.*, 1990; Stern and *et al.*, 1979; and Haynes and *et al.*, 1986).

In this paper distributed lag models for both Canada and Japan were fitted in double logarithmic form. One reason why an export demand equation is specified in a logarithmic form is because this form allows exports to react proportionally to a rise or fall in explanatory variables; that is based on the assumption of constant elasticity. The logarithmic form avoids the problem of change in the elasticities as quantities change (Goldstein and Khan, 1976). We used second-degree polynomials in the Almon lags in the belief that a single turning point might best describe the lagged influences. We have also imposed a far end point restriction on the assumption that the economic impact of the lags would at some point reach zero. No lag structure is assumed on the income term, as it has been shown to be very short (see Deyak, *et al.*, 1990; and Haynes and Stones, 1983). The lag structure on the real exchange rate was set at a maximum of twelve quarters. We looked at the signs and the behavior of the coefficients in the distributed lags to determine the optimal lag. Imposing the lag structure on the exchange rate, equation 1 is rewritten as :

$$\ln \text{EXP}_t = \alpha_1 \alpha_{2i} \ln \text{RGDP}_{ti} + \sum_{i=0}^n \alpha_{3i} \ln \text{REXR}_{ti} \quad (2)$$

The sum of individual elasticities for exchange rate and income measures the comparative static elasticities.

III. Empirical Results

The distributed lag model discussed above was estimated for U.S. exports to Canada and Japan using quarterly data for 1975:3 to 1993:4. All data comes from IMF *International Financial Statistics*. The procedure used for estimation was the Almon polynomial distributed lag model of degree two. All the results reported have been corrected for first degree serial correlation and Gener-

alized Least Square (GLS) estimates are reported.

The results of the estimation procedure are given in Table 1 and Table 2. Also shown in the tables are the values of the estimated coefficients and their t-values. The coefficients of determination, and the long run elasticities along with their respective F-values are also reported.

As can be seen in Table 1, the estimated long run foreign income elasticity for U.S. exports to Canada has the correct sign and is significantly different from zero at 5 percent level of significance. This implies that U.S. exports to Canada are highly sensitive to the real income of Canada. The real exchange rate coefficients also have the correct signs over the entire lag structure and five of the nine lags are statistically significant at the 5 percent level. The estimated long run exchange rate elasticity of U.S. exports to Canada has the correct sign and is statistically significant at the 5 percent level. An F-test is used to test the significance of the sum of coefficients of the real exchange rate. These results suggest that real exchange rates do play an important role in determining the variations in real exports.

The empirical results for the export equation for Japan are reported in Table 2. The real income variable has the correct positive sign and is statistically significant at the 1 percent level. Except for the first two lags, all the coefficients of lagged real exchange rate have the expected negative sign. Nine of the twelve lags used in the estimation are also statistically significant at the 5 percent level. The long run exchange elasticity has the correct sign and is statistically significant at the 5 percent level. The magnitude of the long run elasticity (-1.162) indicates that the U.S. exports to Japan are also elastic with respect to the real exchange rates.

IV. Conclusion

The U.S. trade balance registered a substantial deficit in the early 1980s. The most important explanatory factor for the deterioration of the trade balance was the mix of fiscal and monetary policy that led to a substantial increase in the

Table 1
Coefficient Estimates of U.S. Exports To Canada, 1975:3-1993:4

$$\text{Model: } \ln \text{REXP}_t = \alpha_0 + \alpha_1 \ln \text{RGDP}_t + \sum \alpha_{2i} \ln \text{RXR}_t$$

Coeff.	Estimate	Lag ₀	Lag ₁	Lag ₂	Lag ₃	Lag ₄	Lag ₅	Lag ₆	Lag ₇	Lag ₈	Lag ₉
α_0	-34.81(5.18)										
α_1	1.65(6.70)										
α_{2i}		-0.017 (0.12)	-0.066 (0.67)	-0.103 (1.57)	-0.128 (2.36)	-0.144 (2.38)	-0.147 (2.14)	-0.140 (1.94)	-0.121 (1.80)	-0.092 (1.70)	-0.052 (1.62)

$$\sum \alpha_{2i} = -1.013$$

$$(F=5.61, p=0.02)$$

REXP = Index volume of U.S. exports to Canada

RXR = Real exchange rate of U.S. dollar against Canadian dollar

RGDP = Real GDP of Canada

Table 2
Coefficient Estimates of U.S. Exports To Japan, 1975:3-1993:4

$$\text{Model: } \ln \text{REXP}_t = \alpha_0 + \alpha_1 \ln \text{RGDP}_t + \sum \alpha_{2i} \ln \text{RXR}_t$$

Coeff.	Estimate	Lag ₀	Lag ₁	Lag ₂	Lag ₃	Lag ₄	Lag ₅	Lag ₆	Lag ₇	Lag ₈	Lag ₉	Lag ₁₀	Lag ₁₁	Lag ₁₂
α_0	-18.75(4.97)													
α_1	2.57(6.34)													
α_{2i}		0.205 (0.76)	0.104 (0.54)	0.016 (0.13)	-0.056 (0.76)	-0.115 (3.24)	-0.159 (4.70)	-0.189 (3.43)	-0.205 (2.81)	-0.206 (2.49)	-0.194 (2.30)	-0.17 (2.17)	0.13 (2.08)	-0.069 (2.02)

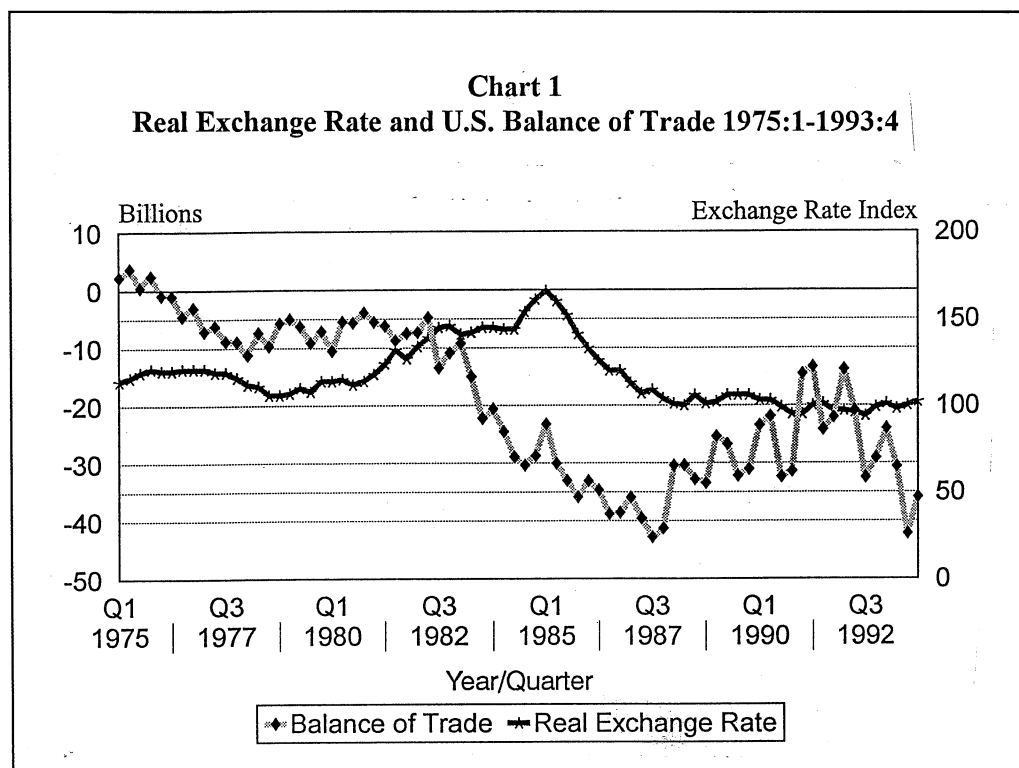
$$\sum \alpha_{2i} = -1.162$$

$$(F=8.36, p=0.005)$$

REXP = Index volume of U.S. exports to Japan

RXR = Real exchange rate of U.S. dollar against Japanese Yen

RGDP = Real GDP of Japan



exchange value of the dollar. The deterioration of the trade balance continued even after the real exchange rate of the dollar declined casting some doubt on the traditional trade model that link exchange rates to the trade account. This doubt prompted several studies that attempted to explain the persistence of the trade deficit. This paper examined the empirical relationship between the real exchange rate and real exports. Specifically, we examined U.S. exports to Canada and Japan.

The overall results show that both income and real exchange rates are important determinants of trade flows. In both cases the long run elasticities of real exports with respect to real exchange rates were greater than one, indicating that exports are highly responsive to changes in real exchange rates. In particular, the results suggest that exchange rate depreciation by making the products of the United States internationally more competitive helps correct the trade deficit. However, because a persistent depreciation may lower the standard of living, a lasting solution to the trade deficit should focus more on increased labor productivity and quality improvement.

V. Suggestions for Future Research

Evidence presented here shows that there is a significant relationship between the real exchange rate and U.S. exports to Canada and Japan. The methodology used here can be extended beyond the two countries we examined. Rather than looking at exchange rates and export linkages,

one could also assess the effect of the exchange rate on the U.S. trade balance. Lag specification is very critical in distributed lag models; examining the issue using other methodology such as VAR that accounts for lags in the response of trade to the exchange rates, would also be of interest.

Appendix

All data are quarterly, for the period 1975:3-1993, and are taken from International monetary Fund, International Financial Statistics, CD-ROM. The variables are defined as follows:

REXP= Index volume of U.S. exports

RGDP= Foreign real GDP

RXR= U.S. bilateral real exchange rate.

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