Oil Exporting Countries and the Impact of Exchange Rate Volatility on International Trade*

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Abstract

This paper examines impact of exchange rate volatility on international trade. The relationship between exchange rate volatility and export has been discussed a lot. However, this paper includes real export earnings of oil exporting economies as a determinant of export volumes. A generalized method of moments (GMM) is employed on panel data for OECD countries. Contrary to recent studies, this paper finds little evidence that volatility has a negative and significant impact on international trade when oil exporting countries are included.

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Introduction

Much empirical literature has examined the relationship between exchange rate volatility and international trade flows. Although earlier literature that employed time series and ordinary least squares (OLS) estimation did not in general find a negative and significant effect of exchange rate volatility on trade volume, recent studies that use panel data and elaborate estimation techniques of statistics and econometrics show evidence of a negative significant relationship[1].

This paper focuses on the differences in results obtained in early and

more recent studies. Also, it includes the effects of oil exporting profits on other countries. Since the early 1970s, oil exporting economies have provided important and large markets for exporters in developed countries, and given their levels of economic development, the income elasticities of demand of the oil exporters for other countries' exports might well differ from the income elasticities of demand for those goods in other countries. Moreover, oil exporting countries have gained much profit since the middle of the 2000s.

This short paper is organized as follows. Section 2 reviews recent literature on panel data estimation for exchange rate volatility and international trade. Section 3 provides a theoretical relationship between exchange rate volatility and international trade. Section 4 provides a model for estimation. Section 5 shows the results of empirical analyses. Finally this paper ends with a brief summary.

Overview

In the past, much empirical literature examined the relationship between exchange rate volatility and international trade. It would be difficult to review the literature briefly. As explained above, previous literature that employs panel data has tended to find evidence of a negative and statistically significant relationship between exchange rate volatility and trade. Wei (1999) is often listed as the typical example. It covered a panel of 63 countries for 1975, 1980, 1985, and 1990. Dell'Ariccia (1999) analyzed the effect of exchange rate volatility on the bilateral trade of European Union and Switzerland over the period 1975-1994. Rose (2000) employed a gravity model and examined 186 countries for five years: 1970, 1975, 1980, 1985, and 1990. In these basic OLS regression analyses, exchange rate volatility had a small but significant negative impact on trade. After that, analysts have made frequent use of the

gravity model, which analyzes the relationship between exchange rate volatility and international trade.

Recently, Tenreyro (2004) conducted a study that suggested some doubt about Rose's (2000) results. Tenreyro used a similar method (annual data, 104 countries, gravity model, endogeneity) and found that volatility had an insignificant effect on trade. Clark et al. (2004) applied this method, including fixed and random effects, and concluded that although there is evidence that increased exchange rate volatility reduces the volume of trade, this finding depends on the particular estimation technique employed. Given such analyses, recent study has suggested some doubt about the negative relationship between exchange rate volatility and trade.

It seems to be unrealistic to exclude oil exporting countries from such analyses. These countries have contributed to international trade volume and exerted much influence on developed countries. This paper takes this trend into account and includes these countries for analyses.

Theoretical Model

Following Hondroyiannis et al. (2008), the model employed here is as shown in equation (1):

$$\log X_{it}, = \alpha_1 + \alpha_2 \log Y_{it} + \alpha_3 \log P_{it} + \alpha_4 \log OIL_t + \alpha_5 Vol_{it} + u_{it} \quad (1)$$

where X_{it} is the volume of exports of OECD countries i, Y is real GDP, P is a measure of relative price of exports, OIL is a real export earnings of oil exporters, V is real exchange rate volatility, u is a random error term, and t is time. This paper applies this model to OECD countries. The data are quarterly and the sample period is from 1985: 1-2006: 4. All data are from the IFS of the International Monetary Fund (IMF).

The relative price variables in the equation should be the ratio of export prices in country i to the domestic prices of similar goods produced by its trading partners. Because that measure is not available, this variable is based on unit labor costs in manufacturing.

Although OECD countries' trading partners trade the bulk of exports of the countries under study here, oil exporting countries have been major purchasers of the exports of these OECD countries. Accordingly, the oil exporter's income variable enters the export equation separately from the GDPs of OECD trading partners. The oil exporter income variable is the sum of the oil exporters' export earnings deflated by the dollar denominated export unit value of all OECD countries. The countries are Iran, Iraq, Kuwait, Saudi Arabia, the United Arab Emirates, and Venezuela.

Over time, exchange rate volatility has been measured in many ways. The typical measure is shown in equation (2)[2], the log of the eight quarter moving standard deviation of the real effective exchange rate:

$$s_{it} = [\frac{1}{8}\sum_{k=1}^{8}(E_{i,t+k-1} - E_{i,t+k-2}]^2]^{1/2} \quad (2)$$

This measure is employed to test for a stable and significant response of exports to a one year cent change.

Some papers have captured exchange rate volatility by employing the conditional second moment as a proxy (Chou, 2000; Clark et al., 2004; Siregar and Rajan, 2004). The idea is that the volatility can be predicted based on past values of the exchange rate. This paper uses a GARCH measure of volatility as follows:

$$E_{it} = a_0 + a_1 E_{i,t-1} + u_{it} \quad (3)$$

$$g_{it} = a + bu^2_{i,t-1} + cg_{i,t-1} \quad (4)$$

where the exchange rates are expressed in logs and uit is a random error. It follows from the specification of a time-varying coefficient model that the conditions of the coefficient are constant and $E[u_{it} \mid E_{i,t-s-1}] = 0$ for all $s > 0$.

Estimation Method

This section explains the four estimation techniques based on Baltagi (2001).

OLS (Ordinary Least Squares)

This method needs little explanation. The technique applies OLS (ordinary least squares) to the panel data, which allows the intercept and slopes of the equation to be the same for all countries and all time periods.

Fixed effects

Suppose that certain unobserved country-specific variables that are constant over time influence the dependent variable in the equation and are correlated with the explanatory variables in the equation. Under this assumption, a country-specific constant term is added to the equation to allow it to contain the country-specific variables (Anderson and van Wincoop, 2003).

GLS (Generalized Least Squares)

If the unobserved country-specific variables represented by a country-specific constant term are uncorrelated with the explanatory variables in the equation, the random effects approach specifies that the country's only term is a country-specific random element. The composite error is nonspherical, so that GLS is employed.

GMM (Generalized Method of Moments)

The equation is extended to include $\log X_{i,t-1}$, $\log X_{i,t-2}$, and $\log X_{i,t-3}$, as additional explanatory variables. GMM is employed to estimate this extended equation with lagged independent variables acting as instruments. For OECD countries, five lags of each of the independent variables are used[3].

Empirical Results

Specifications of those with the moving standard deviation method use

Table. Panel Data Estimation of Export Equations

Estimation method	Constant	OECD income	Oil exporting countries earnings	Real exchange rate volatility	Standard errors of regression
OLS					
MS	-2.657 (-1.77)	0.719 (3.03)	0.201 (3.50)	-0.021 (-0.25)	0.276
GARCH	-3.201 (-1.81)	0.723 (3.12)	0.208 (3.41)	-1.821 (-0.48)	0.277
Fixed effects					
MS	-8.349 (-16.22)	1.828 (20.21)	0.088 (2.12)	-0.012 (-0.48)	0.09124
GARCH	-8.408 (-16.32)	1.902 (21.36)	0.089 (2.13)	-0.160 (-0.22)	0.09128
GLS					
MS	-9.684 (-11.06)	1.543 (13.21)	0.060 (2.44)	-0.012 (-0.55)	0.132
GARCH	-9.774 (-12.82)	1.562 (13.29)	0.062 (2.45)	-0.245 (-0.24)	0.134
GMM					
MS	-9.872 (-7.29)	1.708 (15.23)	0.070 (2.99)	-0.006 (-0.18)	0.0354
GARCH	-9.867 (-7.08)	1.711 (15.82)	0.071 (3.01)	-0.380 (-0.08)	0.0364

Note. The figures in parentheses are the t-ratios.

the subscript *MS* and those using the GARCH method have the subscript *GARCH*.

The table provides regression results using the panel data method explained above.

The coefficients for exchange rate volatility variables are insignificant. As the hedge methods of exchange rate variability and financial innovation have developed, they might have influenced these results. The coefficients of the oil exporter income variable are significant and positive in each equation and lower than the coefficient of the OECD countries' income variable. The result shows that oil exporters and OECD countries have different income elasticities. Other aspects show small differences.

Conclusions

This study found no evidence of a negative and significant impact of volatility on trade using panel data sets. Although it is difficult to draw generalizations from this study, the finding of a negative and significant effect of volatility on trade appears to arise from omitted variables and/-or error biases. As suggested by Hondroyiannis et al. (2008), to investigate the robustness of the results, the application of second generation technology to alternate models would appear to be worthwhile. Also, it might be interesting to investigate whether our results can apply to groups of developing countries. Further study is needed.

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Notes

1. Recent literature was surveyed by McKenzie (1999), Clark et al. (2004), and

Coric and Pugh (2006). It is interesting to note that recent study finds a significant and positive relationship between exchange rate volatility and trade.

2. Kurihara (2003) employed this method, for example.
3. The validity of the different specifications were computed by Sargan's (1964) method and AR1 and AR2.

References

Anderson, J. E., and E. van Wincoop, 2003, Gravity with Gravitas: A Solution to the Border Puzzle, American Economic Review 93 (1), 170-192.

Baltagi, B., 2001, Econometric Analysis of Panel Data, Chichester: Wiley.

Chou, W., 2000, Exchange rate Variability and China's Exports, Journal of Comparative Economics 28, 61-79.

Clark, P., N. Tamirisa, and S. J. Wei, 2004, A New Look at Exchange Rate Volatility and Trade Flows, Occasional Paper 235, International Monetary Fund.

Coric, B., and G. Pugh, 2006, The Effects of Exchange Rate Variability on International Trade: A Meta Regression Analysis, IESR Working Paper 01-2006, Stanford University.

Dell'Ariccia, G., 1999, Exchange Rate Fluctuations and Trade Flows: Evidence from the European Union, IMF Staff Paper 46 (3), 315-334.

McKenzie, M. D., 1999, The Impact of Exchange Rate Volatility on International Trade Flows, Journal of Economic Surveys 13 (1), 71-106.

Rose, A., 2000, One Money, One Market: Estimating the Effects of Common Currencies on Trade, Economic Policy 15 (3), 7-46.

Sargan, J. D., 1964, Wages and Prices in the United Kingdom: A Study in Econometric Methodology, in P. E. Hart, G. Mills, and J. K. Whitaker (Eds.), Econometric Analysis for National Economic Planning, London: Butterworths.

Siregar, R., and R. S. Rajan, 2004, Impact of Exchange rate Volatility on Indonesia's Trade Performance in the 1990s, Journal of the Japanese and International Economies 18 (2), 218-240.

Tenreyro, S., 2004, On the Trade Impact of Nominal Exchange Rate Volatility, Federal Reserve Bank of Boston.

Wei, S. J., 1999, Currency Hedging and Goods Trade, European Economic Review 43 (7), 1371-1394.