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EXCHANGE RATE VOLATILITY AND SECTORAL EXPORTS: EMPIRICAL EVIDENCE FROM TWELVE E.U. MEMBER COUNTRIES (1973–2004)

Abstract

This paper examines potential effect of exchange rate volatility for a set of twelve E.U. member countries (Austria, Denmark, Finland, France, Greece, Ireland, Italy, The Netherlands, Spain, Sweden, Portugal and The U.K.) for sectoral exports of agricultural products during the period of 1973-2004. After critically reviewing the empirical literature we are able to conclude that empirical researchers often examine the hypothesis that exchange rate volatility is a major source of risk. As a result it is often claimed by some researchers that exchange rate volatility causes individual producers to switch their production from foreign to domestic markets where there is less risk. This switch will therefore cause a reduction in the overall level of trade. The review of the literature has identified mixed results with regard to the effects of exchange rate volatility and its potential effects on the level of trade. Therefore the ranges of expected relationships are: a negative relation-

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ship, a positive relationship, an indeterminate or no relationship between exchange rate volatility and the level of exports. We therefore examine the effects of exchange rate volatility by utilizing a measure of the standard deviation of the moving average of the logarithm of real exchange rate as a measure of exchange rate volatility and by adopting a conceptual framework of the imperfect substitution reduced form export quantity model similar to that of Arize. Overall our results have proved to be consistent with our past examinations which for the main part did not estimate any overall significant sectoral effects from volatility to exports with a few notable exceptions. Out of the fourteen sample countries examined in this study for only two the exchange rate volatility coefficient proved to be significant leaving the remaining countries with an insignificant relationship.

Key words:

Exports, E.U., Exchange Rate Volatility.

JEL: F10, E00.

1. Introduction

This paper looks at the sectoral impact of exchange rate volatility on real aggregate exports for the countries: Austria, Denmark, Finland, France, Greece, Ireland, Italy, The Netherlands, Spain, Sweden, Portugal and The U.K. for 1973–2006. We use the standard deviation of the moving average of the logarithm of real exchange rate as a measure of exchange rate volatility. Overall our results suggest that exchange rate volatility (with the exception of two countries in our sample: Portugal and France) has no major effects on sectoral exports for these European countries.

With the move from fixed to flexible exchange rates in Europe in 1973, there was an increasing concern about effects of exchange rate variability on trade. Economic theory (Clark P., 1973, p. 302–313) suggests that exchange rate variability creates uncertainty with regard to the prices exporters would have to pay and receive in the future. More specifically, since most trade contracts incorporate payment lags to allow time for delivery or to provide trade credit they produce uncertainty over the future price of foreign currency and the importers' own

profits. As a result, producers may prefer the possibility of more certain profits to the possibility of uncertain ones. Therefore, uncertain revenue will encourage producers to switch away from foreign markets to domestic ones, which in turn will cause a reduction in the level of exports. This is an argument for negative effects although it is possible, in certain theoretical models to have positive effects. Early empirical work seemed to favor negative effects although there were many findings of an insignificant relationship between export quantity and exports. (Hooper P. and Kohlagen S., 1978, p. 483–511).

In the 1980's (1980-1989) some positive and negative statistically significant relationships were found (Thursby J. and Thursby M, 1987, p. 488–495) along with null results (Bailey M., Tavlas G. and Ulan M., 1986, p. 465–477). Cushman published a series of studies (Cushman D., 1983, p. 45–63, 1986, p. 361–379, 1988, p. 317–330), using more advanced time-series methods than earlier studies finding mixed results. Later researchers have identified a positive relationship (Asseery A. and Peel D., 1991, p. 173–177) while others identify negative (Arize A., 1995, p. 37–51, 1996, p. 187–205, 2000, 345–369) or in some cases no relationship at all (Arize A., 1999, p. 345–369). In the last period starting from 2000 and onwards there is some variation in the empirical research (Abbott A., Darnell A. and Evans, 2001, p. 47–49; Doganlar M., 2002, p. 859–863; Du H. and Zhu Z., 2001, p. 106–121; Bredin, Fountas and Murphy, 2003, p. 193–208). This variation is with regard to the different sample countries, time periods as well as different volatility measures and different types of exchange rates used. With regard to the empirical estimation of the equations the bulk of the research utilizes mainly either ECM or ARCH-GARCH estimation techniques. The variation with regard to the sample countries consists of four categories. These countries are: developed countries, developing countries, a mixed sample, containing European as well as other countries and finally a sample containing only European countries. For the most part the literature seems to examine developing countries although there is some empirical work containing a mixture of various countries of the world. Finally the smallest part of the literature examines only European countries. With regard to the different types of effects the bulk of the literature examines aggregate effects of volatility on exports leaving a very small number of empirical work estimating sectoral effects. The range of the estimated relationships between exports and exchange rate volatility remains the same as in the previous periods.

2. The countries and data

Our previous empirical work on the effects of exchange rate volatility to aggregate exports (Serenis D., 2006, p. 117–167; Serenis D., Cameron S. and Serenis P., 2008, p. 375–376; Serenis D. and Serenis P. 2010) has not been able to identify a significant relationship between exports and exchange rate volatility. However our empirical work on exchange rate volatility to sectoral trade

(Serenis D. 2009, p. 117–118) seems to suggest that for some countries and some products it is possible to estimate a significant relationship. Therefore in this paper we would like to provide some additional empirical examination by extending our investigation to include the effects of exchange rate volatility on a set of twelve European countries. The reason for the selection of these sample countries and these products is on the basis that empirical literature has provided limited examination on the effects of exchange rate volatility to exports. We therefore examine the effects of exchange rate volatility for: Austria, Denmark, Finland, France, Greece, Ireland, Italy, The Netherlands, Spain, Sweden, Portugal and The U.K. and for the time period of 1973–2004. All the data will be derived from FAO (Food and Agriculture Organization of the United Nations). with the exception of GDP figures which will be derived form Eurostat. Due to the different varieties of products that these countries export us does not use the same product for each of the selected countries since other countries night not export it. We therefore have selected one product belonging to the agricultural sector for which the country exports the most. The selection of products appears on table 1.

Table 1

Selected products

Country	Product
Austria	Wheat
Denmark	Pig meat
Finland	Barley
France	Wheat
Greece	Tomatoes
Ireland	Pig meat
Italy	Tomatoes
Netherlands	Maize
Spain	Orange fruit
Sweden	Wheat
UK	Barley
Portugal	Tomatoes

3. Methodology and results

Our research will utilize a reduced form equation similar to that of Arize. More specifically:

$$log(X)= \lambda 0+\lambda 1*log(PX/Pw) +\lambda 2*log(GDP)+\lambda 3 +\lambda 4*(V) + \omega$$

Where:

X is real exports (volume of exports deflated by unit value of exports),

PX/Pw the relative prices,

GDP real domestic GDP,

V volatility (defined as the standard deviation of the moving average of the logarithm of real exchange rate).

ω an error term

Furthermore we will estimate potential effects of volatility to the level of exports through the utilization of the error correction methodology. If the index of domestic capacity raises the country's capacity to produce increases and so will exports. We would therefore, expect *λ*2 to be positive, on the other hand if the relative prices rise the demand for exports will fall so we would expect *λ*1 to be negative (Goldstein and Khan, 1976). With regard to the effects of exchange rate volatility the expected result could be either positive, negative, or will have no effect.

4. Unit root and co-integration

Consistent with the error correction methodology we continue by presenting the results of the augmented Dickey Fuller unit root test as well as the Engle Granger co-integration test results. The augmented Dickey Fuller unit root tests are presented in table 2.

As we can see the results of the unit root tests indicate that most of the countries in our sample contain at least one unit root of order no higher than 3.

Table 2

Augmented Dickey Fuller unit root test

Country	Variables and relationship			
	Vex	GDP	V2	P
Austria	I(1)	I(2)	I(0)	I(1)
Denmark	I(1)	I(1)	I(0)	I(1)
Finland	I(1)	I(2)	I(0)	I(1)
France	I(0)	I(0)	I(0)	I(2)
Greece	I(1)	I(1)	I(0)	I(1)
Ireland	I(1)	I(2)	I(0)	I(1)
Italy	I(3)	I(1)	I(0)	I(1)
Netherlands	I(1)	I(3)	I(0)	I(0)
Spain	I(1)	I(2)	I(0)	I(0)
Sweden	I(0)	I(0)	I(0)	I(1)
UK	I(2)	I(1)	I(0)	I(0)
Portugal	I(0)	I(1)	I(0)	I(1)

All tests are performed using the 5% level of significance
Vex the export quantity, GDP represents the real gross domestic product, V2 volatility and P is the relative prices of each country to the world price
For Ireland, Greece, Portugal industrial production has been used as a proxy for gross domestic product
All tests are performed to a maximum of three lags

5. Engle Granger Co-integration test

In addition to the augmented Dickey Fuller unit root test we will also examine the results of the Engle Granger co-integration test. The results of the co-integration test are presented in table 3. As we can see form this table 3 all the countries in our table have no co-integration with the exception of France and the U.K.

Table 3

Engle Granger co-integration test

Country	Relationship
Austria	No co-integration
Denmark	No co-integration
Finland	No co-integration
France	co-integration
Greece	No co-integration
Ireland	No co-integration
Italy	No co-integration
Netherlands	No co-integration
Spain	No co-integration
Sweden	No co-integration
UK	co-integration
Portugal	No co-integration

All tests are performed using the 5% level of significance

6. Results

Given the presence of co-integration for France and the U.K. we use an error correction model. The results are presented in Table 4.

Table 4

Error correction model results

Countries	Variables					
	Constant	P	GDP	V2	EC	Statistics
France	0.025246 (0.531768)	-0.179033 (-0.537111)	-0.626212 (-0.312721)	-12.83381 (-2.30511)	-0.873274 (-3.610892)	*D.W*=1.808 *S.E*=0.1220 R^2=0.56211
UK	0.148153 (1.218109)	-0.701384 (-1.144320)	-3.428434 (-0.874710)	4.866488 (0.657798)	-0.457364 (-3.850872)	*D.W*=2.282 R^2=0.45680 *S.E*=0.4030

Vex represents the export quantity, GDP represents the real gross domestic product, V2 volatility and P is the relative prices of each country to the world price
For Ireland, Greece, Portugal industrial production has been used as a proxy for gross domestic product
All variables are in a linear form
For Greece real effective exchange rate based on labour costs has been used due to lack of availability of the CPI one

For the most part all the control variables contain the expected signs (GDP, P). With regard to the remaining variable, volatility for both of these counties had a negative coefficient for volatility. However, only one of the volatility coefficients did turn out to be significant at the standard 5% level of significance for France. Due to the absence of co-integration for the remaining countries of our sample a model in first differences will be estimated. The results of this estimation are presented in table 5.

Table 5

First difference regressions

Countries	Variables				
	Constant	P	GDP	V2	Statistics
Austria	0.116336 (0.928192)	-0.633552 (-2.168615)	-4.398354 (-1.013329)	23.26562 (1.211780)	*D.W*=1.830 *S.E*=0.2373 R^2=0.40767
Denmark	0.002644 (0.102247)	1.316939 (1.764516)	-0.766718 (-0.830571)	-4.008632 (-0.974367)	*D.W*=0.181 *S.E*=0.0918 R^2=1.85787
Finland	0.390264 (0.1666)	-3.693313 (-14.38846)	-10.96361 (-1.582590)	42.50514 (1.558656)	*D.W*=2.042 *S.E*=1.1484 R^2=0.89949
Greece	-0.016501 (-0.09214)	-1.165167 (-2.236538)	1.951706 (0.433929)	-16.81688 (-0.96092)	*D.W*=2.145 R^2=0.27042 *S.E*=0.8594
Ireland	0.050891 (0.483020)	0.300050 (0.528242)	0.562837 (0.525967)	-12.43234 (-1.406416)	*D.W*=1.474 *S.E*=0.2923 R^2=0.09623
Italy	0.098021 (1.319966)	-0.345680 (-1.017466)	-0.618054 (-0.181288)	-0.049911 (-0.011800)	*D.W*=1.830 *S.E*=0.2373 R^2=0.40767
Nether-lands	-0.189968 (-1.027642)	-1.505225 (-8.817653)	6.192257 (0.945018)	-1.778244 (-0.073847)	*D.W*=2.192 *S.E*=0.5676 R^2=0.78504
Portugal	0.172168 (0.838403)	-0.609111 (-1.500130)	0.894829 (0.237800)	-48.76328 (-1.390467)	*D.W*=2.827 *S.E*=0.8383 R^2=0.12770
Spain	-0.016039 (-0.130560)	-0.108185 (-0.126698)	1.488223 (0.369602)	-0.519504 (-0.065872)	*D.W*=3.467 *S.E*=0.2805 R^2=0.00822
Sweden	-0.228404 (-0.928580)	-2.599160 (-2.700771)	12.51713 (1.431381)	-2.565302 (-0.149213)	*D.W*=2.352 *S.E*=0.7565 R^2=0.33767

Vex represents the export quantity, GDP represents the real gross domestic product, V2 volatility and P is the relative prices of each country to the world price
For Ireland, Greece, Portugal industrial production has been used as a proxy for gross domestic product
All variables are in a linear form
For Greece real effective exchange rate based on labour costs has been used due to lack of availability of the CPI one

As in the error correction model so as in the first difference model for the most part all the control variables contain the expected signs (GDP, P). With regard to the volatility variable all of the countries examined here present a negative relationship with the exception of Finland and Austria which present a positive relationship. However out of all these estimated volatility coefficients only the coefficient for Italy has proven to be significant at the standard 5% level of significance leaving the remaining ones with an insignificant relationship.

7. Conclusion

It has been argued by some empirical researchers that exchange rate volatility has a negative effect on the level of exports. However, our previous examination has shown that exchange rate volatility over all does not affect the level of exports and that the aggregate effects can be quite different than the sectoral ones. In this study we have been able to estimate sectoral effects of exchange rate volatility using a sample of twelve countries. The results of our estimation has proven that although for the most part exchange rate volatility does not have any major effects on the sectoral level of exports it is possible for some countries and some products to estimate significant sectoral effects which is consistent with our previous empirical work. In this study out of the twelve sample countries only two have proven to have a negative and significant relationship leaving the remaining ones with a negative (for the most part) but with an insignificant relationship. We therefore conclude that over all exchange rate volatility has not been able to produce any significant overall effects to real sectoral exports for agricultural products in Europe although it is possible for a small number of countries and some products to have some significant negative effects.

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