Title	The impact of the exchange rate regime on exports: evidence from the European Monetary System.
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Publication Date	1999
Publication Information	Fountas, S., & Aristotelous, K. (1999). The impact of the exchange rate regime on exports: evidence from the European Monetary System. (Economics Working Paper no. 38): Department of Economics, National University of Ireland, Galway.
Publisher	National University of Ireland, Galway
Item record	http://hdl.handle.net/10379/1687

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The Impact of the Exchange Rate Regime on Exports: Evidence from the European Monetary System

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Working Paper No. 38 June 1999

Department of Economics
Roinn na hEacnamaíochta

Working Paper Series

http://www.ucg.ie/ecn/

Abstract

We employ the econometric techniques of multivariate cointegration and error-correction models to investigate the impact of the creation of the European Monetary System (EMS) on the volume of intra-European Union (EU) exports for eight EU countries. We find that for France, Germany and Ireland, the EMS boosted the volume of intra-EU exports. In the rest of the countries, there has not been a significant effect. Another important result is that exchange rate volatility had no statistically significant long-run or short-run effect on the volume of intra-EU exports in the majority of the countries in our study.

Keywords: Exchange Rate Volatility, Exports, European Monetary System

JEL Classification: F14, F33

1. Introduction

The volume of research focusing on the determinants of export demand in industrial and developing countries, alike, has grown significantly in recent years. The increasing interest in the topic has been sparked by developments in the econometrics of nonstationary macroeconomic time series and the theoretical ambiguity that surrounds the relationship between exports and exchange rate volatility. An important issue that has been left out of the discussions, however, is the impact of the exchange rate regime on the volume of trade. This study attempts to close, at least partially, the gap in the existing literature by investigating the impact of the creation of the Exchange Rate Mechanism (ERM) associated with the launch of the European Monetary System (EMS) in March 1979 on the volume of trade between European Union (EU) member countries.

Following the launch of the last stage of the Economic and Monetary Union (EMU) on January 1, 1999, the relationship between the exchange rate regime and the volume of exports within the EU acquires increasing importance since the EU-member countries proceeded to lock their currencies in a system of irrevocably fixed exchange rates and eventually a single currency. Evidence in favour of a positive association between exchange rate stability obtained by the ERM and export volume would provide an indication of potentially additional benefits in terms of output growth in the EU (the export-led growth hypothesis) and, thus, give additional ammunition to the proponents of EMU.

The launch of the EMS, a system of fixed, but adjustable, exchange rates would be expected to affect intra-EU trade in a number of ways. First, the lower nominal and real exchange rate volatility resulting from the ERM[1] would be expected to have a direct impact on the volume of intra-EU exports and imports. According to the existing theoretical literature, this direct impact might be positive or negative

[1] Gros and Thygesen (1998) report evidence of a lower nominal and real exchange rate variability in intra-ERM exchange rates following the creation of the EMS.

depending on whether we allow for risk-averse traders. Second, the reduction in exchange rate uncertainty brought by the ERM would lead to higher output as interest rates would tend to converge to a lower level, and, hence, have an *indirect* impact on export growth. More specifically, lower exchange rate uncertainty associated with a smaller exchange rate variability would increase the quality of information provided by the price mechanism of resource allocation. The fall in risk would reduce the risk premium incorporated in the expected return on investment projects and, hence, the real interest rate, thus, boosting output growth (De Grauwe, 1996a). The result of output growth would be an increase in the demand for exports in foreign countries.

Changes in exchange rate uncertainty related to the ERM represent one of the factors accounting for the change in the volume of intra-EU trade in recent years. An additional factor is the application of contractionary monetary and fiscal policies in most member countries in preparation for their participation in the EMU, as required under the Maastricht Treaty convergence criteria. These policies would be expected to lead to a reduction in the volume of intra-EU trade due to negative output effects.

In light of the above discussion, the effect of a change in the exchange rate regime (the creation of the EMS) in the EU on intra-EU trade is, a priori, ambiguous. An empirical investigation is, therefore, needed to resolve this ambiguity. To this end, we make use of a relatively recent approach to model the determinants of export volume. In this paper, we specifically look at eight EU countries, namely, Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands and UK.

Our econometric methodology is in line with the recent literature that has applied developments in the econometrics of nonstationary time series in order to estimate long-run and short-run export functions. However, we deviate from this literature in a number of ways: First, we focus on member countries of the EU and analyse explicitly intra-EU trade flows. Our motivation derives from the special exchange rate arrangement that applied in these countries since the inception of the EMS. Second, we are especially interested in estimating the impact of the EMS on intra-EU

exports in a framework that is general enough to account for several economic determinants of export volumes. To accomplish our objectives, for each country, we estimate an export function and test for the influence of the exchange rate regime on export volume. We are also interested in the impact of changes in exchange rate uncertainty on export volume, as our findings on this issue will allow us to project the impact of the launch of the single European currency on intra-EU exports.

The empirical results of the study suggest two main conclusions: First, the EMS did not have a significant effect on the export volumes of Belgium, Denmark, Italy, Netherlands and the UK, the majority of countries included in the study. For France, Germany and Ireland, the EMS had a positive and significant impact on their intra-EU exports. Second, in the majority of countries, exchange rate volatility did not have a long run or short-run effect on export volumes. The only exceptions are Italy, in the long run, and France and the Netherlands, in the short run.

The paper is organised as follows: Section 2 discusses the theoretical model and outlines the literature and section 3 outlines our econometric methodology. Section 4 describes our data, summarises our results and provides an interpretation of these results. Finally, section 5 provides some policy implications and concludes.

2. Theoretical Background and Literature

The empirical literature on the estimation of export functions uses the following long-run export function (see, e.g., Chowdhury, 1993, and Arize, 1995):

$$\ln X_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln P_t + \beta_3 V_t + \beta_4 D_t + u_t \qquad (1)$$

where X_t stands for real exports, Y_t for real foreign income, P_t for relative prices (a measure of competitiveness), V_t for exchange rate volatility, D_t for a dummy variable, and u_t is the error term.

Gotur (1985) shows that equation (1), excluding the volatility and dummy variables, is the long-run solution to a system of behavioural demand and supply functions for exports. Economic theory suggests that the impact of real foreign income on real exports should be positive and the impact of relative price on real exports negative. Traditional trade theory suggests that exchange rate volatility would depress trade because exporters would view it as an increase in the uncertainty of profits on international transactions, under the assumption of risk aversion. On the other hand, a number of authors such as De Grauwe (1988), Giovannini (1988), Franke (1991), Sereu and Vanhulle (1992) and Viaene and de Vries (1992) illustrate, in the context of theoretical models, that exchange rate volatility might benefit trade. Hence, the sign of β_3 in equation (1) is ambiguous from a theoretical point of view.

De Grauwe's (1988) thesis is that higher exchange rate risk will raise the "expected marginal utility of export revenue and, therefore, induce them [i.e., exporters] to increase their export activity" (p. 66). Assuming a utility function with constant relative risk aversion, an increase in risk causes both a substitution and an income effect. The substitution effect shows how an increase in exchange rate volatility will lead to a fall in exports. The income effect works in the opposite direction. The lower expected export revenue means that trade will increase in order to offset the loss in revenue. In the case where the income effect is greater than the substitution effect, higher exchange rate volatility will lead to more exports.

The international empirical evidence on the influence of volatility on exports is also mixed. IMF (1984), Cote (1994) and McKenzie (1999) provide comprehensive reviews of the empirical literature. Early empirical studies disregarded the issue of nonstationarity of macroeconomic time series and used classical regression analysis. These studies, therefore, are subject to the "spurious regression" criticism (Granger and Newbold, 1974). They include Gotur (1985), Kenen and Rodrik (1986), Koray and Lastrapes (1989), Peree and Steinherr (1989) and Pozo (1992). A number of recent studies test for stationarity of the relevant time series and, in some cases,

employ cointegration techniques, e.g., Lastrapes and Koray (1990), Asseery and Peel (1991), Chowdhury (1993), Arize (1995, 1997), Holly (1995) and Fountas and Aristotelous (1999). Kenen and Rodrik (1986), Koray and Lastrapes (1989), Peree and Steinherr (1989), Pozo (1992), Chowdhury (1993), Holly (1995), and Arize (1995, 1997), among others, find evidence of a negative relationship between exchange rate volatility and trade. Asseery and Peel (1991) show evidence of a positive relationship between exchange rate volatility and trade, while Gotur (1985), Bailey, Tavlas and Ulan (1986), Peree and Steinherr (1989), and Gagnon (1993) were unable to find evidence of any significant effect of exchange rate volatility on trade.

Most of the above literature uses US dollar exchange rates and, hence, is not directly related with our study that concentrates on ERM exchange rates and intra-EU trade. There are, however, a few exceptions, e.g., De Grauwe (1987), Bini-Smaghi (1991) and Stokman (1995). De Grauwe (1987) and Bini-Smaghi (1991) consider aggregate intra-EMS trade and find evidence that the greater exchange rate stability achieved by the ERM has had a positive effect on intra-ERM trade. Stokman (1995) focuses on the relationship between exchange rate volatility and the volume of intra-EU trade at the sectoral level. He finds that exchange rate volatility is negatively and highly significantly related to intra-EU trade in 90% of all cases examined. These three studies do not perform stationarity tests and, hence, the common finding of a negative and significant relation between volatility and trade might be spurious. Moreover, these studies do not consider the effect of the exchange rate regime on intra-EU exports, but only the relationship between exports and volatility. However, as mentioned in our introduction, and as further explained below, exchange rate stability obtained by the ERM represents one of the several factors explaining the recent change in the volume of intra-EU trade. A very recent study by Fountas and Aristotelous (1999) attempts to address the issue of the impact of the ERM on intra-EU trade. The authors consider the four largest EU countries only and find no evidence of an impact of the exchange rate regime on intra-EU exports. Therefore,

given this setting, the present study considers all EU countries that were ERM-members at its launch and attempts to close this gap in the existing literature.

The dummy variable in equation (1) takes the value one when the exporting country was an ERM member. It captures a number of factors that can account for the impact of the exchange rate regime on intra-EU exports. The most obvious factor is the decline in intra-EU exchange rate volatility that would be expected to affect exports both directly and indirectly, as discussed earlier. Another important factor is the change in the monetary policy stance in ERM-member countries as national monetary policies converged gradually to the German monetary policy stance. Monetary contractions had negative effects on output and, hence, would be expected to lead to a lower demand for exports. Similar negative effects on export volumes would be expected also due to the contractionary fiscal policies applied in several EU-member countries since the early 1990s in preparation for their participation in the last stage of the EMU. In addition, the ERM period has been one of large real appreciation of the currencies of several member countries (e.g., Ireland and Italy) as relative inflation rates vis-a-vis other member countries were not matched by proportional nominal exchange rate changes due to the quasi-fixed exchange rate nature of the ERM. These relative price effects on intra-EU exports would also be captured by the inclusion of our ERM dummy variable. De Grauwe (1996b) provides anecdotal evidence that the ERM has been associated with a slowdown in the volume of intra-EU trade.

3. Econometric methodology

Most of the previous empirical research on the estimation of export functions used classical regression analysis and did not examine the integration properties of the relevant time series. These studies can be criticized along the following lines. First, the conventional statistical tests employed are inappropriate if the individual series are non-stationary as the OLS estimators are not consistent and the standard t and F

statistics do not follow the Student's t and F distributions. Second, even if the non-stationary series are cointegrated, classical statistical inference is invalid since the estimated standard errors are inconsistent (Stock, 1987).

In agreement with developments in the econometrics of non-stationary time series, we start by estimating a long-run relationship between exports and its determinants implied by equation (1). We have decided to use the Johansen multivariate cointegration approach. Our choice is justified by Phillips (1991) who finds that the Johansen approach is optimal in terms of symmetry, unbiasedness and efficiency. A Monte Carlo study by Gonzalo (1994) supports the superior properties of the Johansen technique relative to several other single and multivariate techniques. In the Johansen framework, all variables, including exchange rate volatility, are treated as endogenous. The ERM dummy is the only exogenous variable. The treatment of volatility as an endogenous variable is particularly important in the context of the EU where Central Banks have tried systematically to stabilize the nominal exchange rates against the DM and hence against the currencies of the other ERM-member countries.

According to the Granger representation theorem (Engle and Granger, 1987), if the variables in equation (1) are cointegrated, then it can be shown that the error-correction model (ECM) for exports will be of the following form:

$$\Delta \ln X_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 D_t + \sum_{i=1}^{n} \gamma_i \Delta \ln X_{t-i} + \sum_{i=1}^{n} \delta_i \Delta \ln Y_{t-i} + \sum_{i=1}^{n} \varepsilon_i \Delta \ln P_{t-i} + \sum_{i=1}^{n} \zeta_i \Delta V_{t-i} + e_t \qquad (2)$$

where Δ is the first-difference operator, R_{t-1} is the error-correction term (ECT), i.e., the one-period lagged error term in the cointegrating regression, D_t is a dummy variable that takes the value one when the exporting country was a member of the

ERM and zero otherwise[2], X_t, Y_t, P_t and V_t are as defined earlier, and e_t is an error term. The rest of the equations in the ECM (not given) are analogous to equation (2) with the only difference being in the left-hand side variable of the equation. This ECM allows us to estimate the short-run relationships between exports and its determinants. It includes both the short-run dynamics and the long-run relation between the series. The parameter α_1 measures the response of real exports in each period to departures from the long-run equilibrium. With the cointegrating equation normalised on exports, α_1 is expected to have a negative sign and be statistically significant.

4. Data and results

4.1 Data

We use quarterly data for the period 1973-1996 and our sample includes eight EU countries, namely, Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands and UK. The beginning of the sample period coincides with the start of the floating exchange rate regime following the collapse of the Bretton-Woods system.

The export variable includes each country's exports to the other seven countries of our sample. Its real value is created through division by the unit export value. Our first explanatory variable in the export function is foreign income. For each country, this series is constructed by taking the weighted average of the industrial production indexes of the other seven countries. The choice of industrial production is due to the absence of quarterly GDP data in several countries in our sample. Each country's trade weights are calculated by determining the share of bilateral trade (exports and

[2] The dummy variable takes the value one post 1979.II for Belgium, Denmark, France, Germany, Ireland and the Netherlands, and for the periods 1979.II-1992.III and 1990.IV-1992.III for Italy and the UK, respectively.

imports) in total trade between each country and its seven trading partners. The source of the export data is the OECD Monthly Statistics of Foreign Trade. The source of the rest of the series is the International Financial Statistics (IFS) published by the IMF. The quarterly industrial production index data were converted to the domestic currency. For this purpose, US dollar exchange rates were taken from the IFS and were converted to exchange rates between the eight EU countries.

The second right-hand side variable in equation (1) is a measure of competitiveness. It is defined as the ratio of the exchange rate-adjusted price of domestic country exports to the price of exports of the other seven countries. Hence, it is the ratio of the domestic unit export value to the weighted average of the unit export values of the other seven countries, denominated in the domestic currency. The weights are identical to those used in the construction of the income variable.

Finally, as a measure of time-varying exchange rate volatility we use the moving standard deviation of the growth rate of the nominal effective exchange rate:

$$V_t = [\,(1/m)\sum_{i=1}^{m} (\ln Z_{t+i-1} - \ln Z_{t+i-2})^2]^{1/2} \qquad (3)$$

where Z is the nominal effective exchange rate and m, the order of the moving average, is set equal to 10[3]. The nominal effective exchange rate is calculated by the weighted average of the exchange rates where the trade weights are the ones used in creating foreign income and relative prices.[4] This measure of exchange rate volatility is adopted by several authors, including Lastrapes and Koray (1990) and Chowdhury (1993).

[3] Our main results turned out to be robust to alternative specifications of the order of the moving average.

[4] Although we use nominal exchange rates to calculate our volatility measure, Chowdhury (1993), Lastrapes and Koray (1990) and Thursby and Thursby (1987) obtain similar results using nominal and real exchange rates.

4.2 Results

We first employed Augmented Dickey Fuller (ADF) and Phillips-Perron unit root tests to determine the integration properties of each time series. The results of these tests, available upon request from the authors, imply that all series are I(1). Then, we proceeded to test for cointegration following the Johansen maximum likelihood approach among the variables in equation (1). The dummy variable is included in the cointegration procedure as an exogenous variable. We chose the lag length in the VAR using a likelihood ratio test. The results of the trace and maximum eigenvalue tests, also available upon request from the authors, illustrate that there exists a unique cointegrating vector for the majority of countries included in the study. For the remaining countries included in the study, the tests indicate that there exists more than one cointegrating vector. Following the convention, in this latter group of countries, we have chosen the most significant vector, i.e., the one that corresponds to the largest eigenvalue, in the analysis that follows.

Table 1 reports the estimated cointegrating vectors normalized on exports and likelihood ratio tests of the statistical significance of the cointegration parameters. The estimated income and relative price parameters are long-run trade elasticities. Three results stand out in Table 1. First, some of these trade elasticities are quite large compared to estimates obtained by other studies (e.g., Chowdhury, 1993; Arize, 1997; Senhadji and Montenegro, 1998). These differences arise from a number of discrepancies between our approach and other approaches in the literature. For example, for each country, our foreign income and relative price variables have been constructed with reference to the other seven countries in the sample. Hence, we have included only countries from the same common market (i.e., the EU), thus leading to large estimated income and price elasticities, due to strong economic ties among the countries considered. In contrast, most of the other studies have considered the overall exports of each of the countries that were analyzed. In addition, our foreign income has been measured by industrial production, as opposed to GDP, as in other studies. The second important observation in Table 1 is that foreign income and

relative prices are significant determinants of exports in most countries. Finally, exchange rate volatility does not appear to be a significant long-run determinant of real exports. This result is very robust as it applies in all countries of our sample, except Italy.

Using the cointegration vectors normalized on exports, we estimated the ECMs for exports and report the results for each country in Tables 2(a)-2(h). To decide the final forms of the ECMs, we started with the maximum lag suggested by the likelihood ratio test for each variable included in the VAR and eliminated insignificant lags unless this introduced serial correlation in the error term. This allowed us to derive a parsimonious model.

Before we discuss the results, we need to determine the adequacy of the ECMs. For that reason, we performed a number of tests which are reported in the last column of each table. These tests indicate that the ECMs are adequate for further analysis. The adjusted R^2 ranges from a low 0.30 to a high 0.59. Such values compare well with the adjusted R^2 values of other studies for regressions based on first differences in variables. The Breusch-Godfrey Serial Correlation LM test (F-statistic) indicates that there is no serial correlation in the residuals of the estimated equations at the 5% level. Moreover, autoregressive conditional heteroskedasticity (ARCH) does not seem to be a problem according to the ARCH LM test (F-statistic).

Having provided evidence supporting the adequacy of the estimated ECMs, we can make a number of observations regarding the estimates presented in Tables 2(a)-2(h). First, the ECM results show that changes in foreign income and relative prices have statistically significant short-run effects (in some cases at the 10% level of significance) on exports. Second, the dynamics of the ECM equations also indicate that exchange rate variability has a significant short-run impact on export volume only in France, Ireland and the Netherlands. The sign of the effect differs across countries. It is negative for France, positive for the Netherlands and ambiguous for Ireland. An F test performed on the lagged coefficients of volatility for Ireland

indicates that the joint null of no short-run volatility effects for Ireland cannot be rejected even at 10%.[5]

The error-correction coefficients are correctly signed for all countries except Ireland. In some cases (Denmark, Italy and the Netherlands), these coefficients are not significant. The positive sign of the error-correction coefficient for Ireland indicates that exports do not restore the long-run equilibrium. A possible explanation for this sign is that multinational corporations, that make up a large part of Irish exporters, are price setters and, therefore, the adjustment towards long-run equilibrium takes place through changes in relative prices and not export volumes. These results on the error-correction coefficients for these countries are still consistent with the finding of cointegration, since it is only necessary that one of the error-correction coefficients in the system of the error-correction regressions be negatively signed and statistically significant.

Finally, and perhaps most importantly, the statistical significance of the EMS dummy variable differs widely across the eight countries included in this study. The coefficient of the EMS dummy is positive and statistically significant for France, Germany and Ireland and insignificant in the rest of the countries. Therefore, one can conclude that the creation of the ERM has led to an increase in intra-EU exports directly and/or indirectly in these three countries only. Our interpretation of these results is as follows: For Belgium, and the Netherlands (and perhaps less so for Denmark), the ERM did not represent a genuine policy regime change, as these countries, being small open economies with strong economic ties with Germany, historically pegged their currencies to the DM. As the ERM did not represent a large shift in their exchange rate policy, we would expect exchange rate volatility changes due to the launch of the ERM not to be an important factor in determining export

[5] Note that short-run volatility effects on exports can also take place through the error-correction term. However, as volatility is insignificant in the long run, it cannot affect exports through the error-correction term. For Italy, the only country where volatility is significant in the long-run, volatility does not have any short-run effects on exports, due to the insignificance of the error-correction coefficient.

volumes. In addition, as a significant share of trade in these countries is with Germany, we would not expect considerable income effects taking place due to the ERM, as the ERM did not imply a monetary policy shift for Germany. These factors explain the insignificance of the dummy in the above three countries.

Our finding of a lack of association between the EMS and the volume of intra-EU exports in some countries is also consistent with the literature that has supplied a number of possible explanations for this, a priori, puzzling result (De Grauwe, 1996b). They include, the restrictive fiscal policies followed by the major EMS countries, the supply side problems of many European countries, and the slow-down in the trade integration process within the EU since the 1960s. These factors could have been strong enough to swamp the possible beneficial effects of exchange rate stability resulting from the implementation of EMS.

On the other hand, the big players in the ERM (France and Germany) are countries for which the ERM implied a genuine shift in the existing exchange rate policy regime, and, hence, can explain why intra-EU exports increased. Italy could, perhaps, be included in this group. However, the lack of an ERM effect for Italy, according to our results, could be due to the on/off approach to the ERM, as the country left the system for more than four years in the 1990s. The same explanation applies for the UK that was not part of the system for most of our sample period. Finally, for Ireland the ERM represented a large change in exchange rate policy as in March 1979 Ireland broke the one-to-one link with Sterling. Despite the reduction in the share of Irish exports to the UK in total Irish exports, there has been a large increase in Irish exports to the continent that can be justified by the fall in exchange rate uncertainty resulting from the implementation of the EMS.

5. Summary and Conclusions

This paper primarily investigated the impact of the creation of the ERM associated with the launch of the EMS in March 1979 on the volume of intra-EU exports using the techniques of multivariate cointegration and error-correction models. The models were estimated using quarterly data for eight EU-member countries, namely, Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, and the UK for the sample period 1973.I-1996.IV. The empirical results support a number of conclusions.

First, foreign income and relative price had statistically significant long-run and short-run effects on the volume of intra-EU exports, as expected. Second, in the majority of countries included in the sample, exchange rate volatility had no statistically significant long-run or short-run effect on the volume of intra-EU exports. Specifically, exchange rate volatility had a significant long-run effect on the exports of Italy to the other EU countries only. Exchange rate volatility did not have a statistically significant short-run effect on the volume of intra-EU exports in the case of Belgium, Denmark, Germany, Italy, and the UK. The short-run effect of exchange rate volatility was negative and statistically significant in the case of France and positive and statistically significant in the case of the Netherlands. In the case of Ireland the short-run exchange rate volatility effect was ambiguous. An F-test performed on the overall short-run impact of volatility on the intra-EU exports of Ireland indicated that the hypothesis of no short-run volatility effects could not be rejected.

Finally, and perhaps most importantly, the statistical significance of the EMS dummy variable differs across the eight countries included in this study. The coefficient of the EMS dummy is positive and statistically significant for France, Germany, and Ireland and insignificant for Belgium, Denmark, Italy, the Netherlands, and the UK. As pointed out in the previous section, the ERM had a statistically positive effect on the intra-EU exports of countries for which the ERM implied a genuine shift in their exchange rate policy regime. The finding of lack of association betwen the EMS and

the volume of intra-EU exports in some countries can be explained, to a large degree, by the restrictive fiscal policies followed by the major EMS countries, the supply side problems of many European countries, and the slow-down in the trade integration process within the EU since the 1960s. These factors could have been strong enough to swamp the possible beneficial effects of exchange rate stability resulting from the implementation of the EMS.

In light of the above discussion, it can be argued that the empirical results of our study provide evidence that suggests that the ERM influenced the volume of intra-EU trade, at least for some EU countries. Put differently, there is evidence that a genuine change in a country's exchange rate regime is an important determinant of its volume of exports.

References

Arize, A.C. 1995. The Effects of Exchange Rate Volatility on U.S. Exports: An Empirical Investigation. *Southern Economic Journal*, 62: 34-43.

Arize, A.C. 1997. Conditional Exchange Rate Volatility and the Volume of Foreign Trade: Evidence from Seven Industrialized Countries. *Southern Economic Journal*, 64: 235-254.

Asseery, A. and D.A. Peel. 1991. The Effects of Exchange Rate Volatility on Exports-Some New Estimates. *Economics Letters*, 37: 173-177.

Bailey, M.I., G.S. Tavlas and M. Ulan. 1986. Exchange Rate Variability and Trade Performance: Evidence for the Big Seven Industrial Countries. *Weltwirtschaftliches Archiv*, 122: 466-477.

Bini-Smaghi, L. 1991. Exchange Rate Variability and Trade: Why Is It So Difficult to Find any Empirical Relationship ? *Applied Economics*, 23: 927-935.

Chowdhury, A.R. 1993. Does Exchange Rate Volatility Depress Trade Flows ? Evidence from Error-Correction Models. *The Review of Economics and Statistics*, 75: 700-706.

Cote, A. 1994. Exchange Rate Volatility and Trade, Bank of Canada Working Paper 5.

De Grauwe, P. 1987. International Trade and Economic Growth in the European Monetary System. *European Economic Review*, 31: 389-398.

De Grauwe, P. 1988. Exchange Rate Variability and the Slowdown in Growth of International Trade. *IMF Staff Papers*, 35: 63-84.

De Grauwe, P. 1996a. *The Economics of Monetary Integration*. Oxford: Oxford University Press.

De Grauwe, P. 1996b. *International Money*. Oxford: Oxford University Press.

Engle, R., and C. W. J. Granger. 1987. Cointegration and Error-Correction: Representation, Estimation, and Testing. *Econometrica*, 55: 251-276.

Fountas, S. and K. Aristotelous. 1999. Has the European Monetary System Led to More Exports ? Evidence from Four European Union Countries. *Economics Letters*, 62: 357-363.

Franke, G. 1991. Exchange Rate Volatility and International Trading Strategy. *Journal of International Money and Finance*, 10: 292-307.

Gagnon, J. 1993. Exchange Rate Variability and the Level of International Trade. *Journal of International Economics*, 34: 269-287.

Giovannini, A. 1988. Exchange Rates and Traded Goods Prices. *Journal of International Economics*, 24: 45-68.

Gonzalo, J. 1994. Five Alternative Methods of Estimating Long-Run Equilibrium Relationships. *Journal of Econometrics,* 60: 203-233.

Gotur, P. 1985. Effects of Exchange Rate Volatility on Trade: Some Further Evidence. *IMF Staff Papers*, 32: 475-512.

Granger, C.W.J. and P. Newbold. 1974. Spurious Regression in Econometrics. *Journal of Econometrics,* 2: 111-120.

Gros, D. and N. Thygesen. 1998. *European Monetary Integration*. Essex: Longman.

Holly, S. 1995. Exchange Rate Uncertainty and Export Performance: Supply and Demand Effects. *Scottish Journal of Political Economy*, 42: 381-391.

International Monetary Fund. 1984. Exchange Rate Volatility and World Trade, Occasional Paper No. 28.

Kenen, P. and D. Rodrik. 1986. Measuring and Analyzing the Effects of Short-term Volatility in Real Exchange Rates. *The Review of Economics and Statistics,* 68: 311-315.

Koray, F. and W. Lastrapes. 1989. Real Exchange Rate Volatility and US Bilateral Trade: A VAR Approach. *The Review of Economics and Statistics*, 71: 708-712.

Lastrapes, W.D. and F. Koray. 1990. Real Exchange Rate Volatility and US Multilateral Trade Flows. *The Journal of Macroeconomics,* 12: 341-362.

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

Peree, F. and A. Steinherr. 1989. Exchange Rate Uncertainty and Foreign Trade. *European Economic Review*, 33: 1241-1264.

Phillips, P.C.B. 1991. Optimal Inference in Cointegrated Systems. *Econometrica,* 59: 283-306.

Pozo, S. 1992. Conditional Exchange Rate Volatility and the Volume of International Trade: Evidence from the Early 1900s. *The Review of Economics and Statistics*, 74: 325-329.

Senhadji, A. and C. Montenegro. 1998. Time Series Analysis of Export Demand Equations: A Cross-Country Analysis, Working Paper No. 98/149, International Monetary Fund, Washington, DC.

Sereu, P. and C. Vanhulle. 1992. Exchange Rate Volatility, Exposure and the Value of Exporting Firms. *Journal of Banking and Finance*, 16: 155-182.

Stock, J. 1987. Asymptotic Properties of Least Squares Estimators of Cointegrating Vectors. *Econometrica*, 55: 1035-1056.

Stokman, A.C.J. 1995. Effect of Exchange Rate Risk on Intra-EC Trade. *De Economist,* 143: 41-54.

Thursby, J, and M. Thursby. 1987. Bilateral Trade Flows, the Linder Hypothesis, and Exchange Risk. *The Review of Economics and Statistics*, 69: 488-495.

Viaene, J-M. and C. de Vries. 1992. International Trade and Exchange Rate Volatility. *European Economic Review,* 36: 1311-21.

TABLE 1: Cointegrating Vectors and Likelihood Ratio Tests

1973:I - 1996:IV

Country	Normalized Cointegrating Vector	H_0: $\beta_1=0$	H_0: $\beta_2=0$	H_0: $\beta_3=0$
Belgium	$\ln X_t = -29.9 + 4.16 \ln Y_t + 4.69 \ln P_t - 21.37 V_t$	4.18*	1.39	2.1
Denmark	$\ln X_t = -46.1 + 2.30 \ln Y_t - 8.01 \ln P_t + 14.68 V_t$	4.61*	0.67	1.58
France	$\ln X_t = 8.29 + 3.57 \ln Y_t - 4.68 \ln P_t - 31.92 V_t$	2.20	8.88*	0.38
Germany	$\ln X_t = 4.73 \ln Y_t - 2.74 \ln P_t + 4.04 V_t$	7.25*	4.64*	0.006
Ireland	$\ln X_t = 76.1 + 7.58 \ln Y_t - 12.4 \ln P_t - 14.17 V_t$	5.12*	4.23*	1.5
Italy	$\ln X_t = -7.10 + 5.81 \ln Y_t - 4.76 \ln P_t + 0.096 V_t$	2.02	2.50	4.68*
Netherlands	$\ln X_t = 54.3 + 1.1 \ln Y_t - 7.37 \ln P_t - 4.89 V_t$	3.53**	6.70*	0.96
UK	$\ln X_t = 2.05 + 0.84 \ln Y_t + 0.76 \ln P_t + 13.18 V_t$	11.14*	6.84*	0.006

Note: The tests H_0: $\beta_i=0$, i=1, 2, 3, in the equation $\ln X_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln P_t + \beta_3 V_t + \beta_4 D_t$ have a $\chi^2(1)$ distribution under the null hypothesis. * and ** denote significance at the 5% and 10% levels, respectively.

TABLE 2a: Error-Correction Regression Results - BELGIUM

1973:I - 1996:IV

Dependent Variable: ΔlnX

lag	R	Dummy	ΔlnX	ΔlnY	ΔlnP	ΔV	Summary Statistics
0		-0.012 (0.96)					Adjusted R^2 = 0.49 F-statistic = 7.44 (0.00) AR F(4,68) = 0.84 (0.50) ARCH F(4,68) = 1.22 (0.31)
1	-0.05* (2.02)		-0.12 (1.32)		-0.16 (1.35)		
2				0.97** (1.91)	-0.22 (1.77)	2.07 (1.35)	
3			-0.13 (1.39)			-1.84 (1.48)	
4			0.63* (6.39)	0.92** (1.79)	0.72** (1.93)	2.01 (1.24)	

Note: The figures in parentheses are the absolute t-statistics. * and ** denote significance at the 5% and 10% levels, respectively. F statistics are followed by marginal significance levels in parentheses.

TABLE 2b: Error-Correction Regression Results - DENMARK

1973:I - 1996:IV

Dependent Variable: ΔlnX

lag	R	Dummy	ΔlnX	ΔlnY	ΔlnP	ΔV	Summary Statistics
0		-0.003 (0.29)					Adjusted R^2 = 0.32 F-statistic = 5.12 (0.00) AR F(4,72) = 0.64 (0.66) ARCH F(4,72) = 1.60 (0.18)
1	-0.01 (1.26)			0.56 (1.38)	-1.02* (2.63)		
2				0.84* (2.11)	-0.79* (2.02)		
3						-4.40 (0.92)	
4			0.55* (6.01)	0.62 (1.50)	0.65** (1.67)		

Note: The figures in parentheses are the absolute t-statistics. * and ** denote significance at the 5% and 10% levels, respectively. F statistics are followed by marginal significance levels in parentheses.

TABLE 2c: Error-Correction Regression Results - FRANCE

1973:I - 1996:IV

Dependent Variable: ΔlnX

lag	R	Dummy	ΔlnX	ΔlnY	ΔlnP	ΔV	Summary Statistics
0		0.06* (3.68)					Adjusted R^2 = 0.59 F-statistic = 13.76 (0.00) AR F(4,67) = 1.12 (0.36) ARCH F(4,67) = 0.78 (0.54)
1	-0.07* (3.76)		-0.32* (3.78)		-0.81* (2.34)	-17.32* (2.60)	
2			-0.28* (3.23)	2.32* (4.39)	-2.71* (4.84)		
3			-0.22* (2.69)				
4			0.42* (4.94)				

Note: The figures in parentheses are the absolute t-statistics. * and ** denote significance at the 5% and 10% levels, respectively. F statistics are followed by marginal significance levels in parentheses.

TABLE 2d: Error-Correction Regression Results - GERMANY

1973:I - 1996:IV

Dependent Variable: ΔlnX

lag	R	Dummy	ΔlnX	ΔlnY	ΔlnP	ΔV	Summary Statistics
0		0.03* (2.86)					Adjusted R^2 = 0.50 F-statistic = 7.15 (0.00) AR F(4,62) = 0.95 (0.44) ARCH F(4,62) = 1.69 (0.16)
1	-0.11* (6.94)		-0.28* (2.54)			15.21 (1.03)	
2			-0.47* (4.71)	1.44* (2.93)	-1.82* (4.03)		
3			-0.53* (5.03)	2.15* (4.03)	-1.42* (2.77)		
4							
5			-0.36* (3.34)	1.86* (3.33)	-1.97* (3.83)		

Note: The figures in parentheses are the absolute t-statistics. * and ** denote significance at the 5% and 10% levels, respectively. F statistics are followed by marginal significance levels in parentheses. A dummy variable is included to capture Germany's reunification.

TABLE 2e: Error-Correction Regression Results - IRELAND

1973:I - 1996:IV

Dependent Variable: ΔlnX

lag	R	Dummy	ΔlnX	ΔlnY	ΔlnP	ΔV	Summary Statistics
0		0.022* (2.20)					Adjusted R^2 = 0.46 F-statistic = 8.45 (0.00) AR F(4,71) = 0.91 (0.46) ARCH F(4,71) = 1.76 (0.15)
1	0.024* (2.62)		-0.31* (3.08)	0.53** (1.92)		-59.23* (2.56)	
2				0.42 (1.29)	-1.09* (3.75)		
3					0.36 (1.26)		
4			0.41* (4.57)			50.38* (2.12)	

Note: The figures in parentheses are the absolute t-statistics. * and ** denote significance at the 5% and 10% levels, respectively. F statistics are followed by marginal significance levels in parentheses.

TABLE 2f: Error-Correction Regression Results - ITALY

1973:I - 1996:IV

Dependent Variable: ΔlnX

lag	R	Dummy	ΔlnX	ΔlnY	ΔlnP	ΔV	Summary Statistics
0		0.08 (1.38)					Adjusted R^2 = 0.30 F-statistic = 8.14 (0.00) AR F(4,73) = 1.92 (0.12) ARCH F(4,73) = 0.12 (0.98)
1	-0.05 (1.16)		-0.46* (4.80)				
2				2.49* (2.99)	-2.68* (3.64)	0.05 (1.18)	

Note: The figures in parentheses are the absolute t-statistics. * and ** denote significance at the 5% and 10% levels, respectively. F statistics are followed by marginal significance levels in parentheses.

TABLE 2g: Error-Correction Regression Results - NETHERLANDS

1973:I - 1996:IV

Dependent Variable: ΔlnX

lag	R	Dummy	ΔlnX	ΔlnY	ΔlnP	ΔV	Summary Statistics
0		0.01 (0.76)					Adjusted R^2 = 0.32 F-statistic = 4.73 (0.00) AR F(4,71) = 1.71 (0.16) ARCH F(4,71) = 0.79 (0.53)
1	-0.05 (0.94)					37.75 (1.22)	
2			-0.22* (2.00)				
3				0.77 (1.30)	0.70** (1.94)		
4			0.34* (3.01)	0.46** (1.64)	-0.36 (1.52)	69.32* (2.37)	

Note: The figures in parentheses are the absolute t-statistics. * and ** denote significance at the 5% and 10% levels, respectively. F statistics are followed by marginal significance levels in parentheses.

TABLE 2h: Error-Correction Regression Results - UK

1973:I - 1996:IV

Dependent Variable: ΔlnX

lag	R	Dummy	ΔlnX	ΔlnY	ΔlnP	ΔV	Summary Statistics
0		0.003 (0.09)					Adjusted R^2 = 0.42 F-statistic = 9.13 (0.00) AR F(4,69) = 1.03(0.40) ARCH F(4,69) =0.72(0.58)
1	-0.08* (2.32)		-0.15 (1.53)			33.15 (0.73)	
2							
3				0.46* (2.32)			
4			0.57* (5.88)	-0.61 (1.33)	0.93** (1.86)		

Note: The figures in parentheses are the absolute t-statistics. * and ** denote significance at the 5% and 10% levels, respectively. F statistics are followed by marginal significance levels in parentheses.