EKONOMETRIA ECONOMETRICS 4(50) • 2015

ISSN 1507-3866
e-ISSN 2449-9994

George Agiomirgianakis
Hellenic Open University, School of Social Sciences, Parodos Aristotelous, Greece
e-mail: gmagios@eap.gr

Dimitrios Serenis
School of Economics, Finance and Accounting, Coventry University, UK
e-mail: dseren01@yahoo.com

Nicholas Tsounis
Technological Institute of Western Macedonia, Hellenic Open University, Greece
e-mail: tsounis@kastoria.teikoz.gr

FLUCTUATIONS IN EXCHANGE RATE AND AGGREGATE EXPORTS IN UKRAINE

WAHANIA KURSÓW WALUT I ICH WPŁYW NA ZAGREGOWANY EKSPORT NA UKRAINIE

DOI: 10.15611/ekt.2015.4.01
JEL Classification: F31, F32

Summary: This paper examines the effect of Exchange Rate Volatility (ERV) on the aggregate exports of Ukraine during the period of 1990 to 2013 using quarterly data. In the literature, it is found that exchange rate volatility causes a reduction in the overall level of trade. The paper tests this finding for Ukrainian foreign trade in the aforementioned period using the Autoregressive Distributed Lags (ARDL) method to co-integration. Overall, our findings suggest that there is a negative effect of ERV on Ukrainian exports. From a policy prospective, this result is important because it suggests that policy makers should consider the negative effect of ERV on exports when exercising exchange rate policy for balance of payment purposes.

Keywords: exchange rate volatility, exports, Ukraine, ARDL method.

Streszczenie: W artykule analizowane są efekty wpływu zmienności kursów walut (ERV) na zagregowany eksport na Ukrainie. Analizę przeprowadzono na podstawie kwartalnych danych z lat 1990-2013. W literaturze można znaleźć wskazania, że zmienność kursów walut wpływa na redukcję ogólnego poziomu handlu. W artykule sprawdzono prawdziwość tego stwierdzenia na podstawie danych ze wspomnianego okresu, dotyczących handlu zagranicznego na Ukrainie, z użyciem metody ARDL (*Autoregressive Distributed Lags*) badającej współzależność. Uzyskane wyniki wskazują negatywny wpływ ERV na poziom ukraińskiego eksportu. Uzyskany wynik badań jest ważny z politycznego punktu widzenia, gdyż sugeruje, że decydenci powinni brać pod uwagę negatywny wpływ ERV na poziom eksportu w trakcie ustalania polityki kursowej dla celów związanych z bilansem płatniczym.

Słowa kluczowe: zmienność kursów walut, eksport, Ukraina, metoda ARDL.

1. Introduction

In the theoretical and empirical papers that examine the relationship between Exchange Rate Volatility (ERV) and export flows, the main notion is on one hand that a rise in ERV increases the uncertainty of profits on contracts denominated in foreign currency and force risk averse agents to redirect their activity to the lower risk home market, and on the other hand that higher levels of ERV offer greater opportunity for profit and therefore will lead to an increase in exports. Furthermore, it has been pointed out that exporters it is possible to offset potential unexpected movements of the exchange rate by investing in the forward market, thus ERV will have no effect on exports. These allegations have been supported by a large variety of empirical studies causing the effects of ERV on exports to be one of the most controversial topics of international trade.

This paper aims to examine the effects of ERV for Ukraine, a country for which empirical evidence is both limited and ambiguous, and to utilize a new measure of volatility which captures unexpected movements of the exchange rate. Overall, our results contribute to the existing literature in the following ways: first, our investigation attempts to shed some light on a topic for which literature is ambiguous. Second, our investigated country is Ukraine, for which literature on empirical studies on ERV are limited[1]. Third, we model the effects of ERV on exports taking into account data sample properties such as unit roots and cointegration, and estimate the results with the use of a recently developed method, the Autoregressive Distributed Lags (ARDL) methodology. Fourth, in addition to the common measure of volatility (logarithm of the moving average of the exchange rate), we will also examine a second measure which allows us to capture unexpected fluctuations of the exchange rate.

The results suggest that ERV measured by both methods produces a negative long-term effect. The paper is organised as follows: first, the existing literature is presented; second, the model is described; third, various measurement issues of ERV are discussed; fourth, the methodological framework is presented; fifth, the results of the utilised statistical tests, the estimated equations, and an analysis of the main empirical findings are discussed. Finally, the last section addresses the issue of policy implications and presents the main conclusions of the paper.

2. Literature review

The literature on the issue is quite large. Both theoretical as well as empirical studies show the ambiguous effects of ERV on exports. An extensive overview in the literature for both theoretical and empirical results can be found in Serenis-Tsounis [2015].

[1] See for example [Égert, Morales-Zumaquero 2008; Dubas et al. 2005; Frankel 2003; Korhonena, Wachtel 2006].

Overall, three conclusions can be drawn from ERV studies. First, earlier studies rely mainly on the OLS methodology which proves to be inadequate to cope with and account for some of the statistical properties that the samples often may contain, such as unit roots which may put the correctness of the conclusions in doubt due to the fact that the existence of unit roots in OLS may lead to spurious results (see [Clark 1973; Hooper, Kohlhagen 1978; Akhtar, Hilton 1984; De Grauwe 1988; Peree, Steinherr 1989; Kroner, Lastrapes 1993; Arize 1995; 1996, 1999a; 1999b; Arize et al. 2000; Asseery, Peel 1991; McKenzie 1999]). Second, the empirical research has provided limited or no evidence of the effects of ERV on exports for Ukraine (the only studies for the effects of ERV on Ukrainian exports are Devereux et al. [2003] and Schnabl [2008]). Thirdly, for the most part the empirical research uses the standard deviation of the moving average of the logarithm of the exchange rate as a measure of ERV, not accounting for the effects of large ERV on specific points in time (e.g. [Awokuse, Yuan 2006; Bahmani-Oskooee et al. 2008; Kargbo 2006; Javed, Farooq 2009; Shehu, Youtang 2012; Hall et al. 2010]).

3. Methodology for the ERV measurement

The model used for analysing the effects of ERV on Ukrainian exports is that used in Serenis and Tsounis [2011; 2012; 2015]. The model can be summarised by:

$$X_t = f(P_t, GDP_t, V_t) \tag{1}$$

where *X* is an index of the real value of aggregate exports, *P* is calculated as P_X/P_w are relative consumer price indices between the domestic country and the rest of the world, GDP is real world GDP and *V* represents the two different measures of ERV.

The real export value is created using the unit value method. The first explanatory variable is the relative prices and it is constructed by the division of the export price into an index comprised of world export prices for each corresponding sector. The second variable is real world GDP, and the third variable is volatility which is measured in two ways: firstly as the standard deviation of the moving average of the logarithm of the real effective exchange rate, and secondly as the value of the moving average plus the values of a second moving average. The values of the second moving average are calculated between the current value of the moving average and the average of all the values of the moving average.

One of the most fundamental issues of the topic in question is the ERV measure. Most empirical studies have utilized the standard deviation of the moving average of the logarithm of the exchange rate (see [Serenis et al. 2011; Serenis, Tsounis 2012]).

The application of such a measure has its benefits but it also has disadvantages, for example it fails to capture and incorporate the effects of high and low peak values of the exchange rate. High and low peak values of the exchange rate capture the unpredictable factor which may alter the exporters' behaviour. In this study, we examine the effects of ERV using both measures: the first, contains the standard deviation of the moving average of the logarithm of the real effective exchange rate as a measure of ERV (*V*1), and the second contains a variable capturing the high and low values of the exchange rate (*V*2).

In order to derive the second measure of volatility, the average value of the moving average of the exchange rate is calculated. *V*2 is constructed to capture the moving average of the exchange rate plus an index of unexpected movements of the exchange rate. This index is composed of the application of the moving average formula between the average value (of the moving average) and the moving average value of the exchange rate, which has been calculated from volatility measure one (*V*1).

4. Data, estimating methodology and results

All the data is derived from the IMF International Financial Statistics database [International... 2015] with the exception of the GDP figures which are derived from Eurostat GDP and the main components database [2015]. Quarterly data is used from 1992q1 to 2013q1. The choice of the years has to do with data availability for Ukraine taking into account that 1992 was the first year after the collapse of the Soviet regime.

Before examining the existence of a long-term relationship (cointegration) between the variables, we must analyze first, the order of integration of the variables considered. This analysis is performed using a unit root test, in our case the Phillips-Perron (P-P) test.

The values of the P-P test are presented in Table 1. The bandwidth length is four lags; both a trend and an intercept were used in the test equation and the critical values were determined using the Bartlett Kernel estimation method.

Table 1. Phillips-Peron unit root test results

Series	Level	First difference	Second difference
ln*X*	–2.493648*	–4.548290*	–6.550781*
ln*GDP*	–1.493138	–4.591368*	–5.906085*
*V*1	–3.899332*	–8.655787*	–9.633323*
ln*P*	–4.247864*	–5.652165*	–5.023659*
*V*2	–3.399438*	–6.653871*	–7.255309*

Note: All tests are performed using the 5% level of significance; ln*X* is the logarithm of real aggregate export value, lnGDP represents the logarithm of a weighted index composed of the world's countries, *V*1 is volatility measured as the moving average of the standard deviation of the exchange rate, *V*2 is the volatility measured as the moving average plus a moving average value capturing unexpected fluctuation of the exchange rate and *ln*P is the logarithm of an index capturing the country's relative prices to the world's relative prices. All the tests are performed to a maximum of three lags. The null hypothesis of a unit root is tested against the alternative. The asterisk denotes significance at least at 5% level.

Source: authors' calculations.

From Table 1 it is seen that the ln*X*, ln*P*, *V*1 and *V*2 series are *I*(0), while ln*GDP* is *I*(1). When there are only *I*(1) variables, the maximum likelihood approach of Johansen and Juselius [1990] can be used. In our case, the system contains variables with different orders of integration and therefore, the ARDL method suggested by Pesaran et al. [1999; 2001] will be used. The ARDL method can be applied on a time series data irrespective of whether the variables are *I*(0) or *I*(1), and it generally provides unbiased estimates of the long-run model and validates the t-statistics even when some of the repressors are endogenous. However, it is necessary to check that the variables are not *I*(2) because here ARDL would produce spurious results. In our case, as can be seen from Table 1, none of the variables are *I*(2). As a result the ARDL representation of (1) can be formulated as follows:

$$\Delta \ln X_t = a_0 + \vartheta \ln X_{t-1} + \sum_{i=1}^{\mu} \theta_i G_{i,t-1} + \sum_{j=1}^{p} a_j \Delta \ln X_{t-j} + + \sum_{i=1}^{\mu} \sum_{j=0}^{p} \beta_{ij} \Delta G_{i,t-j} + \tau T + \sum_{k=1}^{3} \delta_k D_k + u_t \qquad (2)$$

where Δ is the first-difference operator, X is the value of aggregate exports, G = (ln*P*, ln*GDP*, *V*1 or *V*2) is the vector with the explanatory variables; P is the relative prices, *GDP* weightedworld GDP, *V*1 and *V*2 represents the first and second measure of exchange rate volatility, D_k; $k = 1, ..., 3$, are seasonal dummies, T is a time trend, u is a white noise error term, $\mu = 3$ is the number of explanatory variable, ϑ, θ_i are the coefficients that represent the long-term relationship, α_j, β_{ij} are the coefficients that represent the short-run dynamics of the model, and p is the number of lag length.

The ARDL method to co-integration requires that first, equation (2) is estimated and the lag order of the ARDL determined using a lag selection criterion which, in our case, is the Akaike Information Criterion (AIC). To find the order of the ARDL model $8^{\mu} \times 7 = 3584$ regressions were estimated, for each measure of ERV. Then a test was conducted that the errors in equation (2) are serially independent. The Lagrange Multiplier (LM) test was used to test the null hypothesis that the errors in equation (2) are serially independent against the alternative that there are autoregressive or moving average relationships in the errors. Next, the model is tested for dynamic stability. The requirement is that the inverse roots of the Autoregressive (AR) polynomials lie strictly inside the unit circle, hence the plot of the inverse roots of the AR polynomial was made. From equation (2) a test for the existence of long-term relationship was made. This is called the 'bounds testing' approach to co-integration and it is associated to the hypothesis testing $H_0 : \vartheta = \theta_1 = \ldots = \theta_i = 0;$; *i.e.* the long-term relationship does not exist against the alternative $_1 : \vartheta \neq \theta_1 \neq \quad \neq \theta \neq 0;$ that the long-term relationship exists.

Assuming that the bound test described above is conclusive and there is a cointegrating relationship, the coefficient of the Error Correction Term (ECT) in the Error Correction Model (ECM) and its statistical significance is estimated (*e*); *e* should be negative and statistically significant, meaning that there is a co-integration between the dependent and the explanatory variables. The value of this coefficient shows the percentage change of any disequilibrium between the dependent and the explanatory variables that is corrected within one period (one quarter).

Finally, the long-term impact of the explanatory variables to the dependent variable is calculated using the expression [Bardsen 1989]:

$$\hat{\gamma}_i = -\frac{\hat{\theta}_i}{\hat{\vartheta}}, \tag{3}$$

where $\hat{\theta}_i$ and $\hat{\vartheta}$ are the estimated long-term coefficients in equation (2). The $\hat{\gamma}_i s$ show how the dependent variable, in this case the logarithm of export flows, responds in the long run to any change in the explanatory variables *i.e.* the logarithm of the per capita GDP, the logarithm of the relative prices and the logarithm of the measure of the ERV. However, the $\hat{\gamma}_i s$ provide a single value to quantify the long-term effect and they do not provide any information about the degree of variability associated to them [Gonzalez-Gomez et al. 2011]. Furthermore, confidence intervals for each coefficient cannot be constructed using traditional statistical inference because they do not follow the normal distribution since they are calculated as the division of two normally distributed variables. Following Efron and Tibshirani [1998] the bootstrap method, which is a non-parametric method, can be used in order to calculate empirically confidence intervals without assuming a specific distribution of the γ_is and this was made for 95% level of statistical significance. If the zero is contained in the interval then the effect of the explanatory variable will not be statistically significant.

5. The results

The lag order of the ARDL model found with the procedure described in the section above is (5, 2, 0, 4)[2] for measure 1 and (3, 2, 2, 4) for measure 2 of the ERV. The first number represents the distributed lags of *ln*X, the second the distributed lags of *ln*P, the third the distributed lags of *ln*GDP and the fourth the distributed lags of *V*1 or *V*2. The regression results and the necessary diagnostic statistics for the ARDL models are presented in the Appendix. The long-term impact of the ERV on Ukrainian exports is shown in Table 3 and will be discussed below.

The Lagrange Multiplier (LM) test was used to test the null hypothesis that the errors in equation (3) are serially independent. The F-statistic of the LM test had

[2] For the determination of the lag order of the ARDL model the maximum number of eight lags ($p = 8$) in equation (2) was considered.

a value of 0.214144 for the measure 1 model and 0.222596 for the measure 2 model and was not statistically significant so the null hypothesis of no-serial correlation was not rejected for both models.

The Breusch-Pagan-Godfrey heteroskedasticity test was also performed (column 6 of the Table in the Appendix); the F-statistic had a value of 1.018882, for the measure 1 model; 1.434187 for the measure 2 model, it was not statistically significant signifying that the null hypothesis of homoschedasticity failed to be rejected for both models.

The next step was to establish the dynamic stability of the model. When a model has AR terms it will be dynamically stable when the roots of the AR polynomials lie strictly outside the unit circle or the inverse roots of the AR polynomials lie strictly inside the unit circle. In our case, the plot of the inverse roots of the AR polynomial was made and this is seen in Figure 1 below.

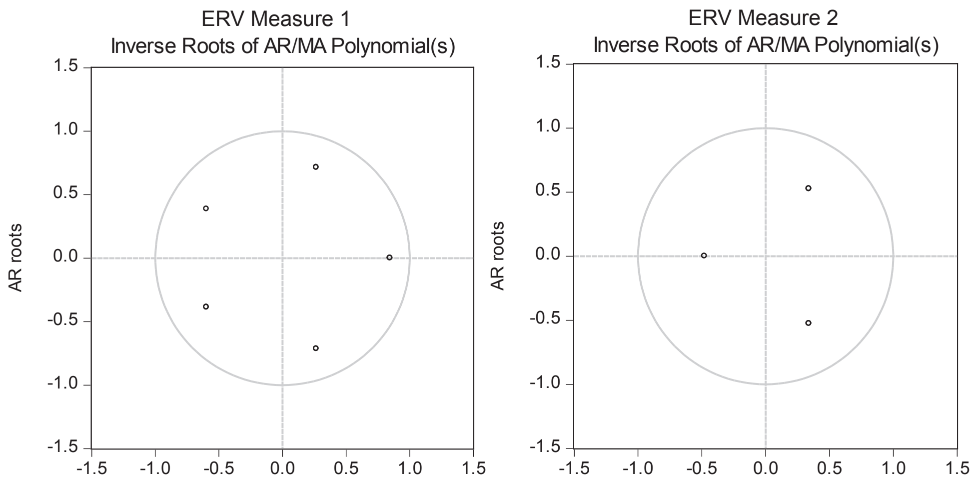

Fig. 1. Dynamic stability test: ERV Measure 1 and ERV Measure 2

Source: own elaboration.

All the inverse roots of the AR polynomials lie strictly inside the unit circle therefore the model is dynamically stable (stationary).

The next step was to test for the existence of a long-term relationship between the dependent and the explanatory variables. The Wald ‘bounds test’, described in the fourth step above, was performed and its results are reported in Table 2. According to the computed F-statistic which is higher than the appropriate upper bound of the critical value (column 4 of Table 2), the null hypothesis of no-cointegration is rejected and the alternative is adopted and it is concluded that there is a long-term relationship between the variables. In other words, the computed F-statistic values using ERV measure 1 is 8.17 and using ERV measure 2 is 15.25.

Table 2. Wald 'bounds test' for the existence of co-integration

	ARDL order	F-statistic, Wald bound test	Critical values for the F-statistic, lower and upper bound (from Perasan 2001)
1	2	3	4
Volatility measure 1	(5,2,0,4)	8.172732	4,066-5,119
Volatility measure 2	(3,2,2,4)	15.24631	4,066-5,119

Note: All tests are performed using the 5% level of significance.

Source: authors' calculations.

Table 3. Long-term impact of exchange rate volatility on export flows

Country-exchange rate volatility measure	$\hat{e}$	$\hat{\gamma}_i$	Confidence intervals for $\hat{\gamma}_i$
1	2	3	4
Volatility measure 1	–0.1688	ln*P*: –2.16503* ln*GDP*: 0.75860* *V*1: –16.5780*	**[–2.756969 –1.573102]** **[0.013475 1.50373]** **[–28.65324 –4.502778]**
Volatility measure 2	–0.2510	ln*P*: –1.91805* ln*GDP*: 0.843898* *V*2: –1.573271*	**[–2.400899 –1.435212]** **[0.3367965 1.351002]** **[–2.340872 –0.805671]**

Notes: ln*P* and ln*GDP* represents the logarithm of a weighted index composed of the world GDP's. *V*1 represents the long-term value of volatility measured as a moving average and *V*2 is the value of the moving average plus a value representing the unexpected movement of the exchange rate and lnP is the logarithm of the country's relative prices to the world's relative prices; the asterisk indicates statistical significant coefficients at 5% level of statistical significance, the relevant confidence intervals are indicated in bold.

Source: authors' calculations.

After establishing by the Wald test that there is a cointegrating relationship, the coefficient of the Error Correction Term (ECT) in the Error Correction Model (ECM) and its statistical significance was estimated and they are presented in Table 3. The sign of the ECT coefficient is of the expected value, it is negative and is statistically significant. Its value ranges from –0.1688 for ERV measure 1 to –0.2510 for ERV measure 2 and shows that 90% of any disequilibrium between the dependent and the explanatory variables is corrected within a three-year period for the model with ERV measure 1 and 90% of any disequilibrium between the dependent and the explanatory variables is corrected within a two-year period for the model with ERV measure 2.

Finally, the long-term impact of the explanatory variables to the dependent variable is calculated using the expression given in (3). The $\hat{\gamma}_i s$ show how the dependent variable, in our case the logarithm of value of exports, responds in the long run to any change in the explanatory variables *i.e.* the logarithm of world GDP, the logarithm of relative prices and the logarithm of the measure of ERV. The statistical significance of the long-term coefficients are shown by the bootstrap confidence intervals (column 5). The results from the examination of the effects of ERV (measures 1 and 2) on exports indicate that ERV has a strong negative effect on Ukrainian exports in both models with the different ERV measures

The relative price variable is negative and significant. This finding suggests that an increase in prices in Ukraine reduces exports, irrespectively of the measure of ERV.

The world GDP variable was included as a measure of world income. The coefficient of the logarithm of the GDP was of the value expected from the theory, it was positive and statistically significant confirming that the income of the importing countries is an important factor for exports.

6. Conclusions and policy implications

In this study the relationship between exports, in value terms, and ERV has been examined for the whole of the post-Soviet era of Ukraine using the ARDL method of co-integration and two different ERV measures. Our results can be summarized as follows. First, ERV, in both models, has a significant negative effect on exports for Ukraine. The estimated ERV coefficients are considerably high in both models, indicating that an increase in ERV reduces Ukrainian exports.

Second, the world GDP variable approximating world income, is positive and statistically significant indicating that a change in world income affects positively Ukrainian exports.

Third, an increase in the consumer prices in Ukraine relative to the rest of the world reduces exports irrespectively of what measure of ERV is used.

Our findings have some direct policy implications: policy makers in Ukraine should consider the effects of ERV when designing balance of payments policy. Exchange rate policy should not be used as a means for improving balance of payments because it may have adverse effects on exports when the latter are affected negatively and heavily by ERV, as is the case for the Ukrainian economy. Furthermore, a country relying heavily on exports should avoid exercising exchange rate policies in order to correct its international competiveness, as these policies may end up to an ERV that could, in turn, reduce substantially its export outflows. The latter is especially true in the case of increasing ERV that escalates its negative influence on exports.

Appendix: ARDL regression results (depended variable ΔX_t)

	ARDL order	Regressor, coefficient	F-statistic, LM test	Dynamic stability	Heteroskedasticity Test, F-statistic
1	2	3	4	5	6
Volatility measure 1	(5,2,0,4)	ln*V*1(–1)*: –6.402243 ln *GDP*(–1)*: 0.292963 ln *X*(–1)*: –0.386189 ln *P*(–1)*: –0.836112 Δ(ln(*X*(–1))): 0.277268 Δ(ln(*X*(–2)))*: 0.123380 Δ(ln(*X*(–3))): –0.119129 Δ(ln(*X*(–4)))*: 0.041010 Δ(ln(*X*(–5)))*: 0.027326 Δ(ln(*P*)) –1.083252 Δ(ln(*P*(–1))) 0.630890 Δ(ln(*P*(–2))) 0.218760 Δ(ln(*GDP*))**: 1.571965 Δ(*V*1)*: –0.586416 Δ(*V*1(–1))*: 5.128383 Δ(*V*1(–2))*: 4.072331 Δ(*V*1(–3))*: 4.888440 Δ(*V*1(–4))*: 3.445874	0.214144	yes	1.018882
Volatility measure 2		ln*V*2(–1)*: –0.696934 ln *GDP*(–1)*: 0.373833 ln*X*(–1)*: –0.442984 ln *P*(–1)*:			

1	2	3	4	5	6
	(3,2,2,4)	–0.849667 Δ(ln(*X*(–1))): 0.208069 Δ(ln(*X*(–2)))**: 0.149073 Δ(ln(*X*(–3))): –0.118286 Δ(ln(*P*)) –0.991660 Δ(ln(*P*(–1))) 0.706980** Δ(ln(*P*(–2)))* 0.173421 Δ(ln(*GDP*))*: 0.945799 Δ(ln(*GDP*(–1))*: –0.099951 Δ(ln(*GDP*(–2))*: 0.422141 Δ(*V*2): –0.166400 Δ(*V*2(–1))**: 0.465678 Δ(*V*2(–2))*: 0.209511 Δ(*V*2(–3))*: 0.318726 Δ(*V*2(–4))*: 0.301680	0.222596	Yes	1.434187

Notes: *X* represents the export values, *P* represents the ratio of the relative prices, ln*GDP* represents the logarithm of a weighted index composed of the sums of the world's countries *GDP*. *V*1 represents volatility measured as a moving average and *V*2 is volatility depicting values above and below 6% of the average value of the moving average. *V*1, *V*2 is the moving average plus an index of unexpected fluctuation. The single asterisk denotes up to 5% and the double asterisk denotes up to 10% level of statistical significance. The plot of the inverse roots of the AR polynomials for examining the dynamic stability of the model is presented in Figure 1.

References

Akhtar M., Hilton S.R., 1984, *Effects of exchange rate uncertainty on German and U.S. Trade*, Federal Reserve Bank of New York, Quarterly Review, vol. 9, pp. 7-16.

Arize A., 1996, *Real exchange rate volatility and trade flows: the experience of eight European economies,* International Review of Economics and Finance, vol. 5(2), pp. 187-205.

Arize A., 1999, *Foreign trade and exchange-rate risk in the G-7 countries: cointegration and error-correction models*, Review of Financial Economics, vol. 6(1), pp. 95-112.

Arize A., 1999, *The demand for LDC exports: Estimates from Singapore*, The International Trade Journal, vol. XIII (4), pp. 345-369.

Arize A., Osang T., Slottje D., 2000, *Exchange rate volatility and foreign Trade: Evidence from thirteen LDC's*', Journal Of Business and Economic Statistics, vol. 18(1), pp. 10-17.

Asseery A., Peel D., 1991, *The effects of exchange rate volatility on exports*, Economics Letters, vol. 37, pp. 173-177.

Awokuse T., Yuan Y., 2006, *The impact of exchange rate volatility on U.S. Poultry exports agribusiness,* vol. 22(2), pp. 233-245.

Bahmani-Oskooee M., Kovyryalova M., 2008, *The J-Curve: Evidence from industry trade data between U.S. and U.K.*, Economic Issues, vol. 13(1), pp. 25-44.

Bardsen G., 1989, *Estimation of long run coefficients in error correction models*, Oxford Bulletin of Economics and Statistics, vol. 51, no. 3, pp. 345-350.

Clark P., 1973, *Uncertainty, exchange rate risk, and the level of international trade,* Western Economic Journal, vol. 11, pp. 302-313.

De Grauwe P., 1988, *Exchange rate variability and the slowdown in growth of international trade,* Staff Papers − International Momentary Fund, vol. 35, pp. 63-83.

Devereux M.B., Lane P.R., 2003, *Understanding bilateral exchange rate volatility*, Journal of International Economics, vol. 60(1), pp. 109-132.

Dubas J.M., Lee B.-J., Mark N.C., 2005, *Effective exchange rate classifications and growth*, NBER Working Paper, no. 11272.

Efron B., Tibshirani R., 1998, *An Introduction to the Bootstrap*, Chapman & Hall, New York.

Égert B., Morales-Zumaquero A., 2008, *Exchange rate regimes, foreign exchange volatility, and export performance in Central and Eastern Europe: Just another blur project?*, Review of Development Economics, 12(3), pp. 577-593.

Eurostat 2015, *GDP and main components database*, http://ec.europa.eu/eurostat/web/national-accounts/data/main-tables.

Frankel J.A., 2003, *Experience of and lessons from exchange rate regime in emerging economies*, NBER Working Paper, no. 10032.

Gonzalez-Gomez M., Alvarez-Diaz, Otero-Giraldez M., 2011, *Modelling domestic tourism demand in Galicia using the ARDL approach*, Tourism and Management Studies, vol. 7, pp. 54-61.

Hall S., Hondroyiannis G., Swamy P., Tavlas G., Ulan M., 2010, *Exchange rate volatility and export performance: Do emerging market economies resemble industrial countries or other developing countries?*, Economic Modeling, vol. 27, pp. 1514-1521.

Hooper P., Kohlhagen S., 1978, *The effect of exchange rate uncertainty on the prices and volume of international trade,* Journal Of International Economics, vol. 8, pp. 483-511.

International Monetary Fund (IMF), 2015, *International Financial Statistics database*, http://www.econdata.com/databases/imf-and-other-international/ifs/.

Javed Z., Farooq M., 2009, *Economic Growth and exchange rate volatility in the case of Pakistan,* Pakistan Journal of Life and Social Sciences, vol. 7(2), pp. 112-118.

Johansen S., Juselius K., 1990, *Maximum likelihood estimation and inference on co-integration – with applications to the demand for money*, Oxford Bulletin of Economics and Statistics, vol. 52(2), pp. 169-210.

Kargbo J., 2006, *Exchange rate volatility and agricultural trade under policy reforms in South Africa*, Development southern Africa, 23(1), pp. 147-170.

Korhonena I., Wachtel P., 2006, *A note on exchange rate pass-through in CIS countries*, Research in International Business and Finance, 20(2), pp. 215-226.

Kroner K., Lastrapes W., 1993, *The impact of exchange rate volatility on international trade: reduced form of estimates using the GARCH-in-mean model*, Journal Of International Money And Finance, vol. 12, pp. 298-318.

McKenzie M., 1999, *The impact of exchange rate volatility on international trade flows,* Journal of Economic Surveys, vol. 13:(1), pp. 71-106.

Peree E., Steinherr A., 1989, *Exchange rate uncertainty and foreign trade, European* Economic Review, vol. 33, pp. 1241-1264.

Pesaran M.H., Shin Y., 1999, *An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis*, [in:] *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch- Centennial Symposium*, eds. S. Strom, P. Diamond, Cambridge University Press, Cambridge.

Pesaran M.H., Shin Y., Smith R.J., 2001, *Bounds testing approaches to the analysis of level relationships*, Journal of Applied Econometrics, vol. 16, no. 3, pp. 289-326.

Schnabl G., 2008, *Exchange rate volatility and growth in small open economies at the EMU periphery*, Economic Systems, vol. 32(1), pp. 70-91.

Serenis D., Tsounis N., 2012, *A new approach for measuring volatility of the exchange rate*, Procedia Economics and Finance, 1, pp. 374-382.

Serenis D., Tsounis N., 2015, *The effects of exchange rate volatility on sectoral exports. Evidence from Sweden, the U.K. and Germany*, International Journal of Computational Economics and Econometrics, 5(1), pp. 71-107.

Serenis D., Tsounis N., Serenis P., 2011, *Exchange rate volatility, and sectoral exports is there a relationship? New evidence from the E.U.*, Proceedings ICOAE2011, Perugia, 25-27 August.

Shehu A., Youtang Z., 2012, *Exchange rate volatility, trade flows and economic growth in a small economy,* International Review of Business Papers, vol. 8 (2), pp. 118-131.