The Exchange Rate Uncertainty On Foreign Trade: Evidence From Panel Cointegration Analysis For Turkey

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THE EXCHANGE RATE UNCERTAINTY ON FOREIGN TRADE: EVIDENCE FROM PANEL COINTEGRATION ANALYSIS FOR TURKEY

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Abstract

This study examines the impact of exchange rate uncertainty on bilateral trade between Turkey and 10 major trading partners, using FMOLS panel cointegration analysis and *recently developed Westerlund panel cointegration test with multiple structural break for the annual data between 1985 and 2011. Empirical results suggest that the exchange rate uncertainty is an important determinant of foreign trade behavior, the exchange rate uncertainty generally deteriorates Turkish exports to many countries with the exception of the France and Germany, the depreciation in Turkish Lira stimulates export and discourage import, and an increment in domestic income stimulates the household and firm's import demand. These findings will shed light in understanding the economic result of sudden increase and decrease in exchange rate.*

Keywords: FMOLS, Westerlund panel cointegration test, foreign trade, uncertainty, EGARCH,
JEL Classification: C33, F14, F31

1. Introduction

The impact of exchange rate and exchange rate uncertainty on foreign trade goes back to the 1970s. When Bretton woods system collapsed in the seventies, international monetary system changed from fixed exchange rate system to floating exchange rates. This new regime brings volatility in exchange markets. Although it is not clearly known whether exchange rate uncertainty has negative or positive effect on foreign trade, the effect of this new flexible regime on foreign trade has led to different arguments. One of these arguments says that the flexible rate could bring uncertainty and hurt exchange market, which may deteriorate international trade and investment between countries (Bahmani-Oskooee & Wang (2008, p.235). There are many studies

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supporting this argument. Authors support this argument also support the idea that there is a negative relationship between exchange rate uncertainty and foreign trade. The studies in this group is listed as follows: Akhtar and Hilton (1984), Brada and Mendez (1988), Assery and Peel (1991), Bini-Smaghi (1991), Hongwei and Zhu (2001), Köse et al. (2008), Bahmani-Oskooee and Wang (2008), Erdem et al. (2010) and Tunçsiper and Öksüzler (2012).

The second argument supports the idea that the exchange rate risk could be hedged through forward markets and leaves foreign trade unaffected.This means that there is no significant relationship between trade flows and exchange rate uncertainty. Studies in this group are as follows: Lastrapes and Koray (1990), McKenzie (1998), Lee (1999), Kasman (2003), Kasman and Ayhan (2006) and Ay et al. (2009).

In this study, we analyze the impact of exchange rate uncertainty on bilateral trade between Turkey and its 10 major trading partners using panel fully modified ordinary least square (FMOLS) analysis. The contribution of this paper is to test the panel cointegration relationship using a multiple structural break test, recently developed by Westerlund (2006). Observation period is 1985-2011. It is tested whether or not exchange rate volatility is a crucial determinant of long-term foreign trade behavior of Turkey. Empirical findings suggest that the exchange rate uncertainty generally affects Turkish exports negatively with the exception of its export to Germany and France. However, an increase in exchange rate uncertainty leads a statistically significant increment in import from Russia and Germany to Turkey. Moreover, the depreciation in Turkish Lira would stimulate export and discourage import; thereby the exchange rate elasticity of the import model would be greater than that of export model for trade between Turkey and its trade partners. Shortly, findings of the Panel FMOLS and bilateral cointegration tests indicate that the exchange rate uncertainty is an important determinant of Turkish trade.

The rest of the paper is organized as follows: In the section 2 methodology of the paper is introduced, in section 3 definitions and sources of the data are represented, in section 4 econometric findings are explained, and the paper is concluded with section 5.

2. Methodology

In this section, panel data set is briefly described and empirical results from the stationarity tests and cointegration tests of the export and import models proposed by Bahmani-Oskooee and Wang (2008) are reported. We finally, present some results on the Marshal-Lerner condition.

Conventional macroeconomic approach analyzes the effect of exchange rate on foreign trade within the framework of export and import demand elasticity. It is proved by Marshall-Lerner (ML) that the sum of export and import demand elasticity is bigger

than one, namely ML condition holds when $e_x + e_m > 1$. † Recently exchange uncertainty also becomes a crucial determinant of both import and export. Many studies modeled conventional import and export functions adding this uncertainty part to their studies. In this study we also take into account the exchange rate uncertainty using panel cointegration analysis for bilateral trade analysis.

The effect of exchange rate uncertainty on import and export (or on trade volume) is analyzed within the framework of Bahmani-Oskooee and Wang (2008). These authors augmented the conventional export and import models adding exchange rate fluctuations as follow:

$$LNEX_{i,t} = a_0 + a_1 LNYf_{i,t} + a_2 LNRER_{i,t} + a_3 UNRER_{i,t} + \mu_{i,t} \quad (1)$$

$$LNIM_{i,t} = b_0 + b_1 LNYd_{i,t} + b_2 LNRER_{i,t} + b_3 UNRER_{i,t} + \varepsilon_{i,t} \quad (2)$$

Where *i* and *t* stands for unit and time period, respectively and LN is the symbol of the natural logarithm. The definition of EX, Yf, Yd, RER and UNRER are reported below in detail in Table 1. In model (1) and (2) the expected sign of both a_1 and b_1 are positive, indicating that the economic growth of Turkey and its trade partners increases foreign trade between countries. It is also known that a real depreciation in local currency results is increment in export and decrement in import, so the expected signs of a_2 and b_2 is positive and negative, respectively. However, we have no definite evidence about the expected sign of a_3 and b_3. The effect of exchange rate uncertainty on foreign trade is mixed. It could be either positive or negative (Erdem et al., 2010: 539).

3. Data

In this study we examine the impact of exchange rate uncertainty on Turkey's commodity trade by estimating export and import models (mode 3 and model 4). For this purpose we employ a panel of annual data covering ten major trading partners of Turkey, namely Russia, Germany, China, United States (USA), Italy, France, Iran, Ukraine, United Kingdom (UK), United Arab Emirates (UAE) between 1985 and 2011. These countries cover nearly 52% of total Turkish export, and 57 % of total Turkish import (TurkStat, 2012) in 2012. Definition and sources of variables is presented in table 1. In this study following the study of Hansen and Lunde (2005), Kandilov (2008) and Erdem et al. (2010) we use Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model developed by Bollerslev (1986) model to characterize the exchange rate uncertainty. GARCH(1,1), the lag length 1 of a GARCH (p, q) procedure, allows us to model variance of exchange rates as time dependent.

† It is proved in appendix.

Table 1

Definition and source of variables

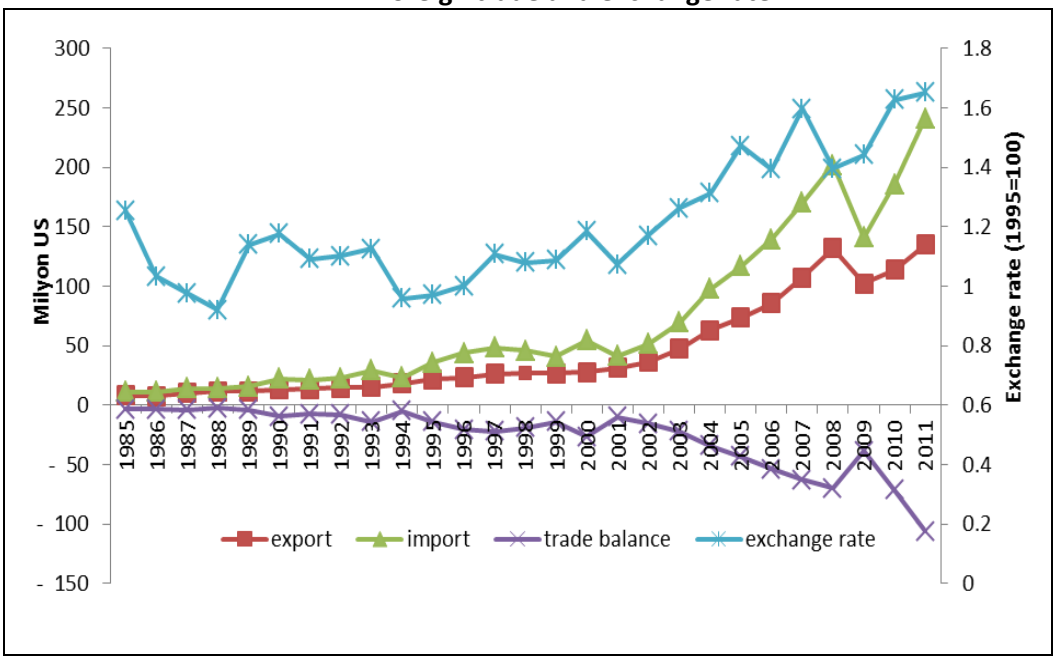
Variables	Definition	Sources
LNEX	Commodity export of Turkey in US dollars measured by the logarithm of trade values	TurkStat
LNIM	Commodity import of Turkey in US dollars measured by the logarithm of trade values	TurkStat
LNYS	Real income of Turkey's trading partners measured by the logarithm of GDP index (2000=100)	WBDI
LNY	Real income of Turkey measured by the logarithm of GDP index (2000=100)	WBDI
LNRER	The bilateral real exchange rate between turkey and its trading partners s measured as the logarithm of $(E_i.P_i^*)/P$, where P_i^* and P are consumer price index of partner country and Turkey, respectively, where E_i is the bilateral nominal exchange rate, calculated as Turkish Lira per unit of trading country's currency.	EVDS and IFS
UNRER	The exchange rate uncertainty measured for each country as the conditional variance of the bilateral exchange rates using EGARCH model proposed by Nelson (1991).	Writer's Calculation

Notes: An increase in E_i shows depreciation of Turkish Lira. WBDI: Worldbank Development Indicatior, TurkStat: Turkish Statistical Institute, EVDS: Electronic Data Distribution System of Central Bank of the Republic of Turkey, IFS: International Financial Statistics.

Figure 1 shows that the trade balance and the exchange rate series are moving in a modest range up to year 2001, mostly due to the pegged exchange rate implemented by the central bank between 1985 and 2001. After the February 2001 crisis in Turkey, free-floating exchange regime has been introduced and after this date the appreciation of Turkish Lira generally deteriorates trade balance during the period of 2001–2011 with the exception of the time period covering global financial crisis of 2008. As it is clearly seen from figure 1 exchange rate is more volatile than that of export and import, so the question is whether or not Turkish foreign trade volume is associated with exchange rate and exchange rate uncertainty (Erdem et al, 2010, p. 538). Besides, volatility of the exchange rate has a lagged effect on trade balance.

Figure 1

Foreign trade and exchange rate



Source: Author's calculation based on the data from TurkStat and Central Bank of the Republic

4. Empirical results

This section presents the empirical results of the study based on stationarity tests, cointegration tests and panel cointegration estimation.

4.1. Stationary tests

In this study to test the stationarity of the variables and determine integration level of variables, we employ three panel unit root tests: Levin, Lin and Chu (2002); Im, Pesaran and Shin (2003); Breitung (2000). The null hypothesis of three tests suggest unit root in panel series. Table 2 presents unit root test results. All tests suggest that variables are not clearly stationary at 99% confidence level. However all the variables except LNYS are found to be stationary when first differenced variables are considered. The first difference of LNYS is stationary only for Breitung test including intercept and trend: We reject the null hypothesis suggesting unit root in LNYS. Therefore, we conclude that all the variables are integrated at order of I(1).

Table 2

Panel unit root tests

Variables	LLC		IPS		Breitung
	Intercept	Intercept+ trend	Intercept	Intercept+ trend	Intercept+ trend
LNEX	2.100(0.982)	2.769(0.997)	2.410(0.992)	-0.050(0.479)	-1.005(0.157)
LMIM	3.488(0.998)	7.298(1.000)	-0.717(0.234)	3.432(0.999)	3.743(0.999)
LNYS	-5.004(0.000)	-3.451(0.000)	-0.642(0.261)	-0.531(0.297)	0.140(0.555)
LNY	-8.310(0.000)	13.859(1.000)	-2.933(0.000)	4.848(1.000)	6.554(0.000)
LNRER	-0.895(0.185)	-0.027(0.489)	-0.027(0.489)	-2.676(0.003)	-5.215(0.000)
Δ LNEX	-8.262(0.000)	-7.837(0.000)	7.902(0.000)	-5.642(0.000)	-4.889(0.000)
Δ LNIM	-10.996(0.00)	6.97(1.000)	-8.345(0.000)	-7.892(0.000)	1.350(0.937)
Δ LNYS	-3.314(0.000)	-1.451(0.073)	-2.998(0.001)	-1.777(0.037)	-4.999(0.000)
Δ LNY	0.909(0.818)	0.847(0.801)	0.377(0.647)	5.306(1.000)	7.128(0.000)
Δ LNRER	-18.952(0.00)	-17.374(0.00)	-16.495(0.00)	-14.662(0.00)	-10.478(0.00)

Notes: Δ shows first differences. The maximum lag length was assigned automatically based on Schwarz Bayesian. LLC and IPS show Im, Pesaran and Shin, and Levin, Lin and Chu statistics, respectively.

4.2. Cointegration tests

Long-term relationship between variables is analyzed by cointegration tests. Pedroni (1999) panel cointegration test are conducted to the variables to determine whether there is a long-term relationship between variables. Tests results are shown in table 4. Even though group rho statistics fail to reject the null hypothesis of no cointegraiton, the remaining five Pedroni tests strongly support the long-term cointegratin relationship between variables.

Table 4

Panel cointegration test

	Export: Model 1		Import: Model 2	
Statistics	Intercept	Intercept+Trend	Intercept	Intercept+Trend
Panel v-Statistic	3.680	2.279	2.891	0.441
Panel rho-Statistic	-2.156	-1.518	-2.757	-1.305
Panel PP-Statistic	-4.665	-5.218	-5.998	-5.533
Panel ADF-Statistic	-2.548	-1.347	-2.469	-1.229
Group rho-Statistic	3.680	-0.307	-1.641	-0.092
Group PP-Statistic	-2.156	-4.932	-6.497	-5.285
Group ADF-Statistic	-4.665	-0.602	-2.064	-0.470

Notes: The null hypothesis of all the statistics except panel v- suggests that there is no cointegration between variables. The null hypothesis of panel v- statistics suggests is rejection of the no cointegration. Test statistics are compared with the critical value at $k < -1.64$ for all tests, while panel v-statistics is compared with $k > 1.64$. Figures in the table are statistics.

We also conduct a second generation panel cointegration test with multiple structural break to take into account the effect of economic crises and recessions lived in 1994, 2001 and 2008, and the shift of exchange rate regimes in 2001 for Turkish Economy. The panel cointegration method recently developed by Westerlund (2006) is considering structural breaks in panel series. Westerlund panel cointegration tests are constructed taking into account cross- sectional dependence. Hence, Westerlund tests are superior to Pedroni tests. Westerlund and Edgerton (2007) panel bootstrap cointergation test approach considers cross-sectional dependence. The null hypothesis of cointegration in panel is tested against the alternative hypothesis proposing that there is no cointegration relationship in one or more individuals of the panel for Westerlund tests. The panel cointegration test result with multiple structural breaks is reported in table 4. It is clearly seen from table 4 that when we take into consideration the possible structural breaks, the null hypothesis of cointegration in panel is not rejected at least at the 10% level for both export and import model. The panel cointegration results without structural breaks (Pedroni (1999) and with structural break (Westerlund (2006) suggest that the deviation of Turkish commodity trade from equilibrium in short run is temporary, in long-term it converges to an equilibrium point. In another saying, table 4 provides clear empirical evidence for the existence of a statistically significance long-term relationship in both export and import models.

Table 4

Westerlund (2006) panel cointegration test with multiple structural breaks

Model	Test	Export Model	Import Model
Constant	Value	-2.890	18.110
	p-value*	0.998	0.090
	p-value**	1.000	0.101
Constant and trend	Value	-2.190	13.654
	p-value*	0.000	0.008
	p-value**	0.580	0.241

Notes: p-value* is asymptotic probability value and p-value** is bootstrapped probability value. Bootstrapped p-values are computed under the assumption that cross-section dependence is valid. The number of bootstrap replications is 1000.

Although we estimate cointegration test with structural break for both constant and constant and trend, in table 5 we only report structural break results of the model based on constant and trend for both export and import model to save space. Table 5 shows that three breaks are found for all countries but export model for UK. Hence, we stop estimating the maximum number of breaks for UK.

Table 5

Estimated breaks

Country	Export Model				Import Model			
	#	Break 1	Break 2	Break 3	#	Break 1	Break 2	Break 3
Russia	3	1993q2	1996q4	2005q3	3	1993q2	1998q1	2006q4
Germany	3	1997q1	1999q3	2006q3	3	1996q3	1999q1	2006q3
China	3	1993q2	1997q2	2006q3	3	1997q2	2000q4	2006q3
USA	3	1994q3	2000q3	2010q2	3	1994q4	2000q3	2010q2
Italy	3	1995q1	2003q2	2010q3	3	1994q2	2000q3	2008q3
France	3	1996q1	2004q4	2007q3	3	1995q2	1997q4	2005q1
Iran	3	1997q2	2004q4	2007q3	3	1997q2	2004q2	2006q4
Ukraine	3	1993q2	2000q3	2007q2	3	2000q1	2003q4	2010q4
UK	2	1993q3	1999q1	----------	3	1998q4	2005q2	2010q4
UAE	3	1993q3	2001q1	2008q3	3	1993q3	2000q4	2003q2

Notes: The maximum number of breaks in the cointegration test is three. The estimated breaks reported in this table are based on the model with both constant and trend. UAE, UK and USA are symbolized for United Arab Emirates, United Kingdom and United States of America, respectively.
shows the number of breaks.

4.3 Panel cointegration estimation

In this section the long-term parameters of the export and import model are estimated due to the validity of cointegration relationship between variables in long-term. Pedroni (2000) has proved that among three estimators, panel OLS, panel dynamic OLS and panel fully modified OLS, the best cointegration estimator is FMOLS for small samples. Following Pedroni (2000), this study also employs FMOLS method to find panel cointegration parameters. FMOLS results of export and import model are presented in table 6.The real exchange rate coefficients of the export model are significantly positive for Russia, Italy, France and Ukraine cases. However, for the export model the real exchange rate coefficients of the rest countries are not significant negatively or positively. For the import model, it is clearly seen from the table that Turkish import from China is negatively related to a depreciation of Turkish Lira against Chinese Renminbi. Besides, a depreciation of Turkish Lira against the currency of Germany, USA, Iran and UK negatively affect net export balance of Turkish foreign trade. On the other hand, for the import from Turkey to China and Italy, a depreciation of Turkish Lira against local currencies of these countries would discourage the imports. These results show that the depreciation in Turkish Lira would stimulate export and discourage import; thereby the exchange rate elasticity of the import model would be greater than that of export model for trade between Turkey and its trade partners. We conclude that the Marshall-Lerner (ML) condition indicating that the sum of exchange rate elasticity of export and import demand is bigger than one holds.

Table 6 also suggests that exchange rate uncertainty has statistically significant and negative coefficients for the export from Turkey to Russia, China, USA, Iran and Ukraine, but coefficient of uncertainty is statistically significant and positive only for Germany. This shows that the exchange rate uncertainty generally deteriorates

Turkish exports to many countries. Besides, an increase in exchange rate uncertainty leads a statistically significant increment in import from Russia and Germany to Turkey, and leads a statistically significant decrement in import from USA and Iran to Turkey.

Table 6: Panel FMOLS estimation results

Trade Partner of Turkey	Export model (1)			Import model (2)		
	LNYS	LNRER	UNRER	LNY	LNRER	UNRER
Russia	-3.77 (-15.35)	0.66 (8.44)	-1.05e+03 (-58.81)	0.58 (9.05)	0.37 (0.26)	402.65 (12.24)
Germany	-0.29 (-1.88)	-0.33 (-1.21)	12.12 (1.91)	0.58 (7.10)	6.66 (3.94)	1172.65 (28.12)
China	0.94 (5.17)	-0.84 (-1.29)	-24.26 (-3.35)	0.12 (1.98)	-2.33 (-1.95)	33.27 (1.09)
USA	-0.56 (-1.91)	0.45 (1.28)	-22.71 (-1.80)	0.55 (8.50)	5.57 (3.87)	-108.71 (-3.43)
Italy	0.71 (3.92)	1.55 (4.25)	-11.55 (-1.22)	0.24 (10.20)	0.55 (1.07)	-4.99 (-0.34)
France	-1.00 (-5.13)	1.55 (4.25)	1.12 (0.36)	0.25 (1.21)	-3.58 (-0.91)	4.81 (0.14)
Iran	0.42 (2.80)	-0.26 (-0.91)	-15.08 (-2.14)	0.24 (4.84)	2.73 (2.26)	-51.58 (-1.77)
Ukraine	0.57 (6.79)	0.35 (2.57)	-7.26 (-2.78)	0.23 (5.06)	1.44 (1.53)	-8.20 (-0.44)
UK	0.66 (8.44)	0.42 (0.79)	-12.38 (-1.43)	0.88 (5.56)	9.63 (2.23)	54.96 (0.73)
UAE	0.53 (0.44)	0.31 (0.29)	-1.31 (-0.44)	0.98 (2.26)	8.62 (1.25)	4.16 (1.19)
Panel	*0.66* *(8.44)*	*1.97* *(8.87)*	*-125.07* *(-23.09)*	*0.41* *(17.84)*	*2.34* *(4.20)*	*166.10* *(12.11)*

Note: Values inside parentheses are t-statistics.

Income of Turkish trade partners shown by LNYS in export model is statistically significant for all the countries with the exception of the United Kingdom. Income elasticity of export model is positive for UAE, UK, Ukraine, Iran, Italy, China, and negative for Russia, Germany, USA, and France cases. Domestic income shown by LNY in import model is also statistically significant for all cases with the exception of the France. Significant and positive coefficient of the domestic income suggest that an increment in domestic income stimulates the household and firm's the import demand from nine of the ten selected trade partners of the Turkey. Panel coefficients, shown below table 6, indicate that exchange rate uncertainty and foreign income are the long-term determinants of the Turkish export trade. If foreign income increases 1 % in export model, Turkish export will increase by 0.66%. Besides, in import model a 1 % increment of the domestic income leads to 0.41 % increment in import demand. Exchange rate uncertainty also has major impact on long-term foreign trade behavior of Turkey.

5. Conclusion

The aim of this study is to investigate the impact of exchange rate uncertainty on Turkish foreign trade (import and export) with its 10 major trading partners using recently developed panel cointegration analysis methods for the time period of 1985-2011. Panel FMOLS is used to find out long-term coefficients of the cointegration equations. Econometric analysis reveals three important results.

Firstly, the depreciation in Turkish Lira would stimulate export and discourage import; thereby the exchange rate elasticity of the import model would be greater than that of export model for trade between Turkey and its trade partners.

Secondly, the exchange rate uncertainty generally affects Turkish exports to many countries negatively with the exception of Germany and France. However, an increase in exchange rate uncertainty leads a statistically significant increment in import from Russia and Germany to Turkey.

Thirdly, an increment in domestic income stimulates the household and firm's the import demand from nine of the ten selected trade partners of the Turkey. If the foreign income increases 1 % in export model, Turkish export will increase by 0.66%, and also 1 % increment of the domestic income leads to 0.41 % increment in import demand.

Findings of the Panel FMOLS and bilateral cointegration tests imply that the exchange rate uncertainty is also an important determinant of long-term equation of Turkish foreign trade behavior, so we hope that research like this lead to the government and monetary authority in Turkey to reassess how sudden increase and decrease in exchange rates could negatively affect both export and import.

References

Akhtar, M.A. and Spence-Hilton, R. ,1984. Effects of Exchange Rate Uncertainty on German and US Trade, Quarterly Review, *Federal Reserve Bank of New York,* Spring, pp. 7–16.

Asseery, A. and Peel, D.A.,1991 .The Effects of Exchange Rate Volatility on Exports. *Economics Letters*, vol. 37, pp. 173–177.

Ay, A., Üçler, G and Koçak, İ. ,2009. Reel Döviz Kuru Dalgalanmalarının Dış Ticaret Üzerine Etkisinin Sınır Testi Yaklaşımı İle Analizi: 1996-2006 Türkiye Örneği. S*elçuk Üniversitesi İktisadi ve İdari Bilimler Fakültesi Sosyal ve Ekonomik Araştırmalar Dergisi*, 9 ,17 :51-67

Bahmani-Oskooee, M., Wang Y., ,2008. Impact of Exchange Rate Uncertainty on Commodity Trade Between the US and Australia. *Aust. Econ. Papers* 47, 235–258.

Bollerslev, Tim ,1986. Generalized Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics,* 31 ,3 : 307–327.

Brada, Josef C. and Mendez, Jose A. 1988. Exchange Rate Risk, Exchange Rate Regime and the Volume of International Trade, *KYKLOS*, vol. 41, pp. 263–280.

Breitung, J. ,2000 . The Local Power of Some Unit Root Tests for Panel Data. In: Baltagi, B.H. ,Ed. , Nonstationary Panels, Panel Cointegration and Dynamic Panels, *Advances in Econometrics* 15, pp. 161–177

Bini-Smaghi, L. 1991. Exchange Rate Variability and Trade: Why is it so Difficult to Find any Relationship, *Applied Economics*, vol. 23, pp. 927–936.

Erdem, E., Nazlioglu, S., and Erdem, C. ,2010 . Exchange Rate Uncertainty and Agricultural Trade: Panel Cointegration Analysis for Turkey. *Agricultural Economics, 41,6 , 537-543.*

Im, K.S., Pesaran, M.H., Shin, Y. ,2003.Testing for Unit Roots In Heterogeneous Panels. *J. Econometrics* 115, 53–74

Hongwei Du and Zhen Zhu 2001. The Effect of Exchange-rate Risk on Exports: Some Additional Empirical Evidence, *Journal of Economic Studies,* vol. 28, issue: 2, pp. 106–121

Kasman, A. ,2003 . Türkiye'de Reel Döviz Kuru Oynaklığı ve Bunun İhracat Üzerine Etkisi: Sektörel Bir Analiz. *Uludağ Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 22,2 , 169-186.

Kasman, S. and Ayhan, D. ,2006. Macroeconomic Volatility under Alternative Exchange Rate Regimes in Turkey*, Central Bank Review* 2006,6,2 :37-58

Köse, N., Ay, A., and Topallı, N. ,2008. Döviz Kuru Oynaklığının İhracata Etkisi: Türkiye Örneği ,1995-2008 . *Gazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 10,2 , 25-45.

Lastrapes, W.D. and Koray, F. 1990. Exchange Rate Volatility and US Multilateral Trade Flows, *Journal of Macroeconomics*, vol. 12, issue 3, pp. 341–362.

Levin, A., Lin, C., Chu, C.J. ,2002 . Unit Root Rests In Panel Data: Asymptotic and finite-sample properties. *J. Economet*. 108, 1– 24.

Lee, J. 1999, The Effect of Exchange Rate Volatility on Trade in Durables, *Review of International Economics,* vol. 7, issue 2, pp. 189–201.

McKenzie, M.D. 1998. The Impact of Exchange Rate Volatility on Australian Trade Flows, *Journal of International Financial Markets, Institutions and Money*, vol. 8, pp. 21–38.

Nelson, D.B., ,1991 , Conditional Heteroskedasticity in Asset Returns: A New Approach*, Econometrica,* 59, 347-370.

Pedroni, P., ,1999. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bull. Econ. Stat*. 61,Special Issue , 653–670.

Pedroni, P. ,2000. Fully Modified OLS for Heterogeneous Cointegrated Panels. In: Baltagi, B.H. ,Ed. , Nonstationary Panels, Panel Cointegration and Dynamic Panels, *Advances in Econometrics*, 15, pp. 93–130.

Tunçsiper, B. and Öksüzler, O. ,2012 . Döviz Kuru Riski Türkiyenin İhracatını Azaltır mı? Hata Doğrulama Yöntemi ile Bir Ampirik Değerlendirme. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, 2,3 , 1-13.

Westerlund, J., Edgerton, D.L. ,2007 . A Panel Bootstrap Cointegration Test. Economics Letters 97, 185–190.

Westerlund, J., 2006. Testing For Panel Cointegration with Multiple Structural Breaks. *Oxford Bulletin Economics and Statistics*. 68, 101–132.

Appendix

Proof of ML condition: Assume that net foreign trade is shown as

$$N_{EX} = EX - IMe$$

Where e denotes the price of one unit of foreign currency in terms of the domestic currency; *EX* and *IM* stands for export and import volume. Differentiating this equation with respect to e gives:

$$\frac{\partial N_{EX}}{\partial e} = \frac{\partial EX}{\partial e} - e\frac{\partial IM}{\partial e} - IM \ .$$

Dividing both sides by *EX* gives:

$$\frac{\partial N_{EX}}{\partial e}\frac{1}{EX} = \frac{\partial EX}{\partial e}\frac{1}{EX} - \frac{\partial IM}{\partial e}\frac{e}{EX} - \frac{IM}{EX}.$$

We know that the initial condition of the net foreign trade satisfies the equality of EX and IMe, namely $\mathrm{IMe} = \mathrm{EX}$. After making simplifications we get:

$$\frac{\partial N_{EX}}{\partial e}\frac{1}{EX} = \frac{\partial EX}{\partial e}\frac{1}{EX} - \frac{\partial IM}{\partial e}\frac{1}{IM} - \frac{1}{e}.$$

If we multiply this equation by e:

$$\frac{\partial N_{EX}}{\partial e}\frac{e}{EX} = \frac{\partial EX}{\partial e}\frac{e}{EX} - \frac{\partial IM}{\partial e}\frac{e}{IM} - 1.$$

Here $\frac{\partial EX}{\partial e}\frac{e}{EX}$ and $\frac{\partial IM}{\partial e}\frac{e}{IM}$ denotes elasticity of exports (e_{ex}) and elasticity of imports (e_{IM}) with respect to the exchange rate respectively. Hence, $\frac{\partial N_{EX}}{\partial e}\frac{e}{EX} = e_{EX} - e_{IM} - 1$. We know that the depreciation in local currency, namely a rise in e leads to a positive impact on net trade balance of the country. This means

that the left side of the last equation ($\frac{\partial N_{EX}}{\partial e}\frac{e}{EX}$) must be positive, then $e_{EX}-e_{IM}-1>0$ or $e_{EX}-e_{IM}>1$. It also could be written as follow: $e_{EX}+\left|e_{IM}\right|>1$.