

## The Effect of Exchange Rate Uncertainty on Agricultural Exports: A Study of Turkey

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### Abstract

*Using Turkish monthly data from 2003 to 2013, the short-term and long-term effects of the real income of foreign countries, and the relative price and uncertainty of the real exchange rate on Turkey's real agricultural export income were analysed using the Johansen co-integration method and the error correction model. The real exchange rate of uncertainty was obtained using the EGARCH model. The Johansen co-integration test showed a weak co-integration between variables in the long-term. The variable which affects agricultural exports in the long term is exchange rate uncertainty.*

**Key words:** Agriculture, Exports, Exchange rate, Price elasticity, Foreign trade



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### INTRODUCTION

The agriculture sector, which is different from other sectors in terms of its dependency on nature, has, in addition to its main task of increasing the supply of nutrition for the population, also has the responsibility for important tasks such as providing a labour force and raw materials, creating demand in these sectors, and contributing to economic growth. The influence of agriculture in the general economic structure is decreasing over time, as is the positive contribution of agriculture to the economic development of nations. Although the relative importance of the agriculture sector has been gradually decreasing as part of the economic development process, it continues in modern times to be one of the main foundations of socio-economic life in Turkey, just as it was in the past. In 2013 the agriculture sector represented 7.8% of gross domestic revenue, 11.68% of total exports, and 23.6% of the jobs in Turkey.

From the first years of the Turkish Republic to the 1960s, traditional agricultural products such as cotton, tobacco and dried fruits constituted 80% of Turkey's total exports. This rate was reduced to between 60-70% during the 1970s and, by the beginning of the 1980s the rate had diminished to its present level of 12%. The beginning of the 1980s was a milestone for Turkish exports, and both the quantity and the type of goods exported underwent a radical change. In 1980 agricultural products made up 57% of total exports, by 2000 they had reduced to 14%, and the latest figures from 2013 show they are now only 12% of total exports. The reason for the shift from agricultural to industrial exports is that the quantity of industrial products being exported has increased, while the quantity of agricultural products being exported has not increased in recent years.

After the downfall of fixed exchange-rates based on the Bretton Woods system, most countries, particularly the developed countries, abandoned fixed exchange rates and adopted a flexible exchange rate system instead. This change brought about significant fluctuations and uncertainty in exchange rates. This increase in exchange rate fluctuations, and its effect on trade balances, drew a great deal of attention to this subject, which in turn led policy-makers and researchers to examine the effect that these fluctuations were having on trading volume. As a result, it has become important to examine the effect of exchange rate fluctuations on trade both from the theoretical and empirical perspectives.

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No consensus exists on the effects of exchange rate fluctuations on foreign trade in the literature, but there is a consensus on the fact that exchange rate fluctuations have a positive/negative effect on foreign trade by increasing uncertainty and risk.

With this increase in uncertainty and risk caused by exchange rate fluctuations, entrepreneurs who are averse to risk will tend to transfer their activities to less risky areas, and this may affect foreign trade negatively (Hooper and Kohlhagen, 1978; Peree and Steinherr, 1989; Ozturk and Acaravci, 2002; Hatirli and Onder, 2010 and Sever, 2009). On the other hand, the theoretical model asserts that exchange rate fluctuations affect foreign trade positively, because it is accepted that any increase in risk offers the opportunity to make more profit. From this point of view, the increase in risk engendered by exchange rate fluctuations has a positive effect on foreign trade (Chowdhury, 1993; Kihangire, 2005; Fang and Miller, 2007; Vergil, 2002 and Saatcioglu and Karaca, 2004), and many research results support this view. As well as the studies which assert the positive/negative effect of exchange rate fluctuations on foreign trade in the literature, studies exist which demonstrate no relationship between exchange rate fluctuations and foreign trade (McKenzie, 1998; Aristotelous, 2001).

One of the main reasons for this disagreement over whether exchange rate fluctuations have an effect on foreign trade or not, and on which direction they will go, is that exchange rate fluctuations cannot reveal the differences between countries and sectors because of the use of aggregated data sets in most studies. Another important reason is that the profit differences between sectors also cause different reactions to exchange rate fluctuations. Sectors which have higher profits show less reaction to exchange rate fluctuations than sectors with lower profits since they can compensate for the exchange rate risk without decreasing exports. Moreover, the following factors have a significant effect on how companies react to changes in exchange rates: whether or not the companies are multinational, whether or not the companies have different activity areas, obstructions to international trade, and the risky actions of the companies involved (Hatirli and Onder, 2010).

In this study, the aim is to analyse the short-term and long-term effects of the real income of foreign countries, and to examine the effect of relative prices and uncertainty in the real exchange rate on Turkish real agricultural export income. This is done by using monthly data from the period 2003-2013 for the agriculture sector, which is one of the leading sectors for Turkey with its contribution to employment, exports and added value.

## LITERATURE REVIEW

In the studies of exchange rate uncertainty in Turkey, its general effect on exports was researched. Ozbay (1999) used three-monthly data for the 1988:II-1997:II period, and researched the relationship between exchange rate uncertainty and export income. In his study he ascertained that exchange rate uncertainty obtained with the GARCH model had a meaningful negative effect on exports.

Vergil (2002) researched the effect of real exchange rate uncertainty on trade movement between Turkey's three important trade partners from the European Union (Germany, France, Italy) and the USA. In the study, which uses monthly data for the 1990:01-2000:12 period, the real exchange rate uncertainty was calculated as a "moving average standard deviation". According to the results of co-integration and error correction analysis, it was ascertained that the result of Turkey's real export and exchange rate uncertainty had a significant and negative impact on the long-term relationship with Germany, France and the USA.

Doganlar (2002) researched the effect of exchange rate uncertainty on exports in Turkey, South Korea, Malaysia, Indonesia and Pakistan using three-monthly data for the 1980:I-1996:IV periods, and ascertained that there is a negative directional relationship between exchange rate fluctuations and real exports in these countries.

Ozturk and Acaravci (2002) analysed the effect of exchange rate uncertainty on Turkey's exports using monthly data for the 1989:01-2002:08 period within the co-integration model. According to the results of this study, it was ascertained that the increase in exchange rate fluctuations (exchange rate uncertainty) decreased the demand for exports.

Kasman (2003) researched the relationship between exchange rate uncertainty and export performance by using monthly data for the 1989–2002 period. According to the results of co-integration and error correction analysis, it was ascertained that exchange rate uncertainty is an important variable in the determination of the level of exports, and that exchange rate fluctuations negatively affected total exports in both the short and long term.

Saatcioglu and Karaca (2004) used monthly data for the 1981:III–2000:IV period to research the relationship between exports and exchange rate uncertainty using the co-integration method. According to the results of the analysis, it was ascertained that real exchange rate uncertainty affected exports in a negative direction. Moreover, the short term relationship between these two variables was examined using the error correction method, and a statistically significant relationship of 10% in a negative direction was ascertained.

In a rare study about agriculture, Demirel and Erdem (2004) used monthly data for the 1990–2001 period to research the effects of the real exchange rate, and real exchange rate uncertainty on the industrial, mining and agricultural sectors of Turkey in relation to the USA, Germany, England, France and Italy. The Engle-Granger co-integration and error correction analysis (Engle and Granger, 1987) was used, and showed that the effect of the real exchange rate uncertainty on exports is negative, especially for the mining and agricultural sectors.

Fidan (2006) researched the effects of the real exchange rate on agricultural exports and imports using the Granger Causality Test, the Vector Autoregressive (VAR) Model and the co-integration test to analyze yearly data for the 1970–2004 period. According to the results of an econometric analysis, there is a one-way causality from the real exchange rate to agricultural exports, and a one unit shock in the real exchange rate affecting agricultural exports in a positive way in the first five years. Moreover, the effect of the real exchange rate on exports is less in the short term than in the long term.

Kose et al. (2008) researched the effect of real exchange rate uncertainty on exports by means of the co-integration and error correction models by using monthly data for the 1995–2008 period. In this study, a simple standard deviation, which is frequently used in the literature, as well as a moving average standard deviation and conditional variance measures obtained by GARCH models were used to calculate real exchange rate uncertainty. According to the results of the econometric analysis, it was ascertained that real exchange rate uncertainty affects exports negatively in both the short term and the long term. Moreover, according to the results of variation discretisation of prediction error, it was ascertained that the variable with the most significant effect on exports is real exchange rate uncertainty.

## MATERIALS AND METHODS

In this study, the traditional export demand model, including exchange rate uncertainty as a result of a flexible exchange rate regime was used. The model was formed as shown below by using the model found in the work of Demirel and Erdem (2004), Fidan (2006) and Kose et al. (2008).

$$x = \vartheta_0 + \vartheta_1y + \vartheta_2p + \vartheta_3\text{exch\_vol} + u \quad (1)$$

“x” represents the nominal export income from agricultural and forestry products. “y” represents the industrial production index of 27 EU countries, which is used to express world demand conditions. “p” is the agricultural products international terms of trade index, used to express relative price change. “exch\_vol” represents exchange rate uncertainty. This variable was calculated by the EGARCH method, which is a variant of the GARCH model and common in the literature. “exch” represents the real exchange rate used to calculate exchange rate uncertainty.

The variables used in the study are monthly and cover the 2003–2013 period. For the exchange rate, 2003=100, based on the real effective exchange rate index, is used. This index is taken from the electronic data distribution system of the Central Bank. The real effective exchange rate index is calculated with reference to developing countries as defined by the Central Bank. The increase in the index represents the real value gain of TL. The data for the real effective exchange rate index used in this study are adjusted for seasonality by using the moving averages method.

The data related to agricultural exports were taken from the electronic data distribution system of the Central Bank expressed as one thousand US dollars. An examination of the real export data revealed a trend in escalation, and a seasonal change inclination which displayed increasing fluctuations in time close to this trend. Seasonal change inclination is suitable for multiplicative structures, so the moving averages method, within the framework of the multiplicative structure, is adjusted for seasonal variation in the time series. In the econometric analysis, the real exchange data without logarithm was used.

The industrial production index of EU countries (27 countries) with which Turkey has intensive exports is used as a real extraneous income indicator. Data adjusted for seasonal variation and taken from Eurostat database was obtained as a basic circuit index for 2005.

The terms of trade variable was used as a relative price. The data of this set was taken from the database of the Turkish Republic Statistical Institute.

Many different methods are used in the literature to model exchange rate uncertainty (Kose et al., 2008.). Although the most common method is the GARCH method, this process is unsuccessful in catching the asymmetry in variance structure, since it is defined as the function only of the size in the GARCH model, independent of signs of unconditional variance lag error terms. Nelson (1991) developed the exponential GARCH (EGARCH) model, in which conditional variance is modelled by taking the size and the sign of the lag error term into account, and by paying attention to the asymmetry in the uncertainty structure (Takaendesa et al., 2005; Choi et al., 2009; Agung, 2009). In the EGARCH model, the conditional variance equation is defined as;

$$\log(\sigma_t^2) = c + \alpha_1 \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma_1 + \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \log\beta_1 (\sigma_{t-1}^2) \quad (2)$$

(Takaendesa et al., 2005). In this model, the  $\gamma_1$  parameter is the leverage. If the sign of this coefficient is positive, this means the effect of positive way shock is higher than the effect of negative way shock. If the sign is negative, then the effect of negative shock is higher than the effect of positive shock. If the coefficient value is equal to zero, then the effect of positive and negative shock will be equal and positive, and negative way shocks will not make a change in the way of exchange rate uncertainty (Brandt and Jones, 2006).

The real exchange rate fluctuations examined in this study are presumed by OLS using AR models. Within this framework, AR models including different lag lengths are tried, and the following model is used in OLS according to the parameter significance criterion.

$$\text{exch}_t = \alpha_0 + \beta_1 \text{exch}_{t-1} + \beta_2 \text{exch}_{t-2} + \text{exch}_{t-3} \quad (3)$$

Whether the residual obtained from the OLS presumption includes autocorrelation or not is tested by the Breusch-Godfrey LM test (2.56), and whether it is suitable for the ARCH structure or not is tested by the ARCH-LM test (2.94) <sup>5</sup>. If there is a strong autocorrelation and a changed variance structure in the real exchange rate series, this means that exchange rate series is suitable for the ARCH model.

**Table 2: EGARCH Model Results**

| Variables           | Coefficient | Prob. |
|---------------------|-------------|-------|
| $\alpha_0$          | 116.87      | 0.00  |
| $\text{exch}_{t-1}$ | 1.27        | 0.00  |
| $\text{exch}_{t-2}$ | -0.43       | 0.00  |
| $\text{exch}_{t-3}$ | 0.14        | 0.00  |
| C                   | 2.45        | 0.00  |
| $\alpha_1$          | 0.89        | 0.00  |
| $\gamma_1$          | -0.31       | 0.00  |
| $\beta_1$           | -0.74       | 0.00  |

<sup>5</sup> Numbers in brackets are p-values.

When the presumption results are examined, it is seen that the  $\gamma_1$  parameter which shows asymmetry effect is negative and significant at high levels. This shows that negative shocks increase real exchange rate uncertainty more than positive shocks. Whether there is an ARCH effect in the model errors presumed by EGARCH or not is searched for with the ARCH-LM test (0.77)<sup>6</sup>, and the existence of autocorrelation in the series is searched for with the Breusch-Godfrey LM test (42.404). The autocorrelation can be identified, and the ARCH effect in the error series of the model presumed by EGARCH removed.

#### DESCRIPTION: EMPIRICAL FINDINGS UNIT ROOT TEST

In time series analysis, the data should be stationary. When the series are stationary, they will have too little information related to the past (Enders, 1995). Therefore, the stationary analysis of the variables will be done using the Developed Dickey and Fuller (ADF) unit root test.

**Table 4: ADF Unit Root Test Results**

| Variables | Level Value |                 | First Difference Value |                 |
|-----------|-------------|-----------------|------------------------|-----------------|
|           | Constant    | Constant /Trend | Constant               | Constant /Trend |
| X         | -1.76       | -2.30           | -12.98*                | -12.99*         |
| Y         | -2.83**     | -2.83           | -2.99*                 | -2.99           |
| P         | -2.14       | -2.42           | -11.31*                | -11.29*         |
| Exch.vol. | -7.67*      | -8.85*          | -8.84*                 | -8.77*          |
| * =1%     | -3.48       | -4.04           | -3.49                  | -4.04           |
| ** =5%    | -2.88       | -3.45           | -2.88                  | -3.45           |
| ***=10%   | -2.58       | -3.15           | -2.58                  | -3.15           |

Note. The number of leads and lags was determined by the AIC. \*, \*\* and \*\*\* denote statistical significance at the 1%, 5% and 10% level.

Depending on the results, the series are tested separately according to constant term and trend. In general, all the levels of the series are not constant, but it is seen that they become constant in the model including constant term where their first differences are taken. Depending on the results of the unit root tests, co-integration analyses are made to search for whether there is a long term relationship between variables or not.

#### CO-INTEGRATION TEST

The co-integration relationship is examined by using the multivariate co-integration analysis developed by Johansen and Juselius (1990). Co-integration is a test based on the linear combination of the nonstationary variables being stationary in the long term. The co-integration between the variables indicates a real long term relationship.

**Table 5: Johansen Co-integration Test Results**

| H <sub>0</sub> | H <sub>1</sub> | Eigenvalue | Trace Statistics | Critical Value | Max Eigenvalue Statistics | Critical Value |
|----------------|----------------|------------|------------------|----------------|---------------------------|----------------|
| r=0            | r=1            | 0.334      | 142.28*          | 54.07          | 116.39*                   | 28.58          |
| r≤1            | r=2            | 0.168      | 25.88            | 35.19          | 11.53                     | 22.29          |
| r≤2            | r=3            | 0.062      | 14.34            | 20.26          | 10.40                     | 15.89          |
| r≤3            | R=4            | 0.015      | 3.94             | 9.16           | 3.94                      | 9.16           |

Note. The number of leads and lags was determined by the AIC. The bandwidth was selected by Newey-West estimator using the Bartlett kernel. \*, \*\* and \*\*\* denote statistical significance at the 1%, 5% and 10% level.

<sup>6</sup> Numbers in brackets are p-values.

In the unrestricted VAR model, according to the Schwarz Information Criteria (SC), the time lag number is assumed to be 2, and autocorrelation in the error term and variable variation problem are not seen in this lag. According to the results of the co-integration test, a weak co-integration is seen between variables.

**Table 6: Normalized Co-integration Coefficient**

| X     | Y        | P        | Exch. Vol. | c        |             |
|-------|----------|----------|------------|----------|-------------|
| 1.000 | 0.0345   | -0.024   | -1.655     | -16.028  | Coefficient |
|       | (0.081)  | (0.019)  | (0.123)    | (8.307)  | St. Error   |
|       | [ 0.425] | [-1.238] | [ 13.463]  | [-1.929] | t. score    |

According to the long term relationship interpreted from the Normalized Co-integration Coefficient; while both the relative price change and exchange rate uncertainty coefficient have a significant and negative statistical effect on agricultural export income, world demand conditions have a significant and positive statistical effect on agricultural export income. This result is expected. It is seen that the variable which affects agricultural export most in the long term is exchange rate uncertainty, at -1.65. This means that 1 unit rise in real exchange rate uncertainty will produce a decrease of 1.6% in agricultural exports. The most significant result in terms of the aim of the researcher is that exchange rate uncertainty is negative and statistically significant. This shows that exchange rate uncertainty affects exports negatively during the base period.

#### ERROR CORRECTION MODEL

The causality relationship, and the relationship between variables are searched for using the “Error Correction Model”, since a long term relationship between series is identified. Granger (1988) stated that when a long term relationship between variables is identified, or in other words when they are co-integrated, the traditional Granger Causality test is not valid. In this case doing causality analyses among the series in the Error Correction Model framework will be more suitable. Moreover, the Engle-Granger co-integration and error correction analysis shows a vector error correction mechanism (VECM) which solves this short term alienation in this test approach (Engle and Granger, 1987).

$$\Delta x_t = c + \sum_{j=1}^m \alpha \Delta x_{t-1} + \sum_{i=1}^k \beta \Delta y_{t-i} + \sum_{i=1}^l \gamma \Delta p_{t-i} + \sum_{i=1}^n \vartheta \Delta exch\_vol_{t-i} + cointeq_{t-1} + \varepsilon_t \quad (4)$$

The variable (cointeq<sub>t-1</sub>) used in the Error Correction Mechanism is an error correction term gained from the results of co-integration regression, and is calculated as equation 5.

$$cointeq_{t-1} = x - \vartheta_0 - \vartheta_1 y - \vartheta_2 p - \vartheta_3 exch_{vol} \quad (5)$$

**Table 7: Error Correction Model Results**

| Variable                | Coefficient | Prob.      |
|-------------------------|-------------|------------|
| C                       | 0.017976    | 21.54585   |
| x <sub>t-1</sub>        | -0.469344   | 0.0000     |
| y <sub>t-1</sub>        | 0.016335    | 0.0377     |
| p <sub>t-1</sub>        | 0.000530    | -0.0829    |
| exch_vol <sub>t-1</sub> | 0.001385    | 0.0668     |
| cointeq <sub>t-1</sub>  | -0.065040   | 0.0724     |
| R <sup>2</sup> =0.28    | DW=2.34     | Prob.=0.00 |

According to the results of the Error Correction Model, there is a positive and statistically significant relationship between agricultural exports & exchange rate uncertainty, and world foreign demand in the short term, and there is a negative and statistically significant relationship between agricultural exports &

exchange rate uncertainty, and relative price change. In addition, that the alienation between the short term and the long term will be removed at a rate of 6.5% at the end of one month has also been identified.

## RESULTS AND DISCUSSION

In this study, through the use of 2003-2013 period monthly data for Turkey, an analysis has been made of the short-term and long-term effects of the real income of foreign countries, relative price and uncertainty in real exchange rate on Turkish real agricultural export income using the Johansen co-integration method and error correction model. In this study, real exchange rate uncertainty is obtained by using the EGARCH model, which is common in the literature.

According to the results of the Johansen co-integration test a weak co-integration between variables in the long term can be seen. It is also clear that while both relative price change and the exchange rate uncertainty coefficient have a significant and negative statistical effect on agricultural exports, world demand conditions have a significant and positive statistical effect on agricultural export. This result is expected when compared to previous results. It is seen that the variable which affects agricultural exports most in the long term is exchange rate uncertainty, with a value of -1.65. This means that 1 unit rise in real exchange rate uncertainty will result in a decrease of 1.6% in agricultural exports. According to the results of the Error Correction Model, there is a positive and statistically significant relationship between agricultural exports & exchange rate uncertainty and world foreign demand in the short term, and there is a negative and statistically significant relationship between agricultural export and exchange rate uncertainty and relative price change. In addition, the fact that the alienation between the short term and the long term will be removed at a rate of 6.5% at the end of one month has also been identified.

While there is a negative relationship between exchange rate uncertainty and agricultural export income in the long term, there is a positive relationship in the short term. This can be interpreted as follows: the relationship between exchange rate uncertainty and agricultural exports in the short term is temporary because of the fact that producers take high risks and tend to export as a result of sales opportunities decreasing on the domestic market. In the long term, this is in accordance with expectations.

## REFERENCES

- Agung, G. N. (2009). Time series data analysis using EViews. *Statistical Papers* 52(2): 437.
- Aristotelous, K. (2001). Exchange rate volatility, exchange rate regime and trade volume: Evidence from the UK-US export function (1889-1999). *Economics Letters* 2:87-94.
- Brandt, M.W. and Jones, C.S. (2006). Volatility Forecasting with Range-Based EGARCH Models. *American Statistical Association Journal of Business and Economic Statistics* 24(4):470-486.
- Choi, D.F.S., Fang V. and Fu, T.Y. (2009). Volatility Spillovers Between New Zealand Stock Market Returns and Exchange Rate Changes Before and After The 1997 Asian Financial Crisis. *Asian Journal of Finance & Accounting* 1(2):106-117.
- Chowdhury A.R. (1993). Does Exchange Rate Volatility Depress Trade Flows? Evidence From Error Correction Models. *Review of Economics and Statistics* 75:700-706.
- Demirel, B. and Erdem, C. (2004). The Impact of Exchange Rate Variability on Export: The Case of Turkey. *Journal of Economics Business and Finance* 19(223):116-127.
- Doganlar, M. (2002). Estimating The Impact of Exchange Rate Volatility on Export: Evidence From Asian Countries. *Applied Economics Letters* 9:859-863.
- Enders, W. (1995). Applied Econometric Time Series. U.S.A: John Wiley & Sons Inc.
- Engle, R. F. and Granger, C.W.J. (1987). Co-Integration and Error Correction: Representation, Estimation and Testing. *Econometrica* 55:251-276.
- EUROSTAT. <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/>.
- Fang, W. and Miller, S. (2007). Exchange Rate Depreciation and Exports: the Case of Singapore Revisited. *Applied Economics* 39(3):273-277.
- Fidan, H. (2006). Impact of The Real Effective Exchange Rate (Reer) On Turkish Agricultural Trade. *International Journal of Human and Social Sciences* 1(2):70-82.

- Granger, C.W.J. (1988). Some Recent Developments in A Concept of Causality. *Journal of Econometrics* 39: 199-211.
- Hatırlı, S.A. and Onder, K. (2010). An Investigation of Real Exchange Rate Volatility On Turkish Textile and Apparence Export. *Anadolu University Journal of Social Sciences* 10(2):41-54.
- Hooper, P. and Kohlhagen, S.W. (1978). The Effect of Exchange Rate Uncertainty on The Prices and Volume of the International Trade. *Journal of International Economics* 8:483-511.
- Johansen, S. and Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration-with Application to the Demand for Money. *Oxford Bulletin of Economics and Statistics* 52:169-210.
- Kasman, A. (2003). Real Exchange Rate Volatility and Its Effects On Export In Turkey: A Sectoral Analysis. *Uludag University Journal of Economy and Society* 22(2):169-186.
- Kihangire, D. (2005). The Effects of Exchange Rate Variability on Exports: Evidence From Uganda (1988-2001). *International Trade*, ESRC workshop No: 0505013.
- Kose, N., Ay, A. and Topalli, N. (2008). The Effect of Exchange Rate Volatility on Export: The Case of Turkey (1995-2008). *Gazi University Journal of Economy and Society* 10(2):25-45.
- McKenzie, M.D. (1998). The Impact of Exchange Rate Volatility on Australian Trade Flows. *Journal of International Financial Markets, Institutions and Money* 8:21-38.
- Nelson, D.B. (1991). Conditional Heteroskedasticity In Asset Returns: A New Approach. *Econometrica* 59:347-370.
- Ozbay, P. (1999). The Effect of Exchange Rate Uncertainty on Exports: A Case Study For Turkey. *Research Department of Central Bank of Turkey Discussion Paper No. 36*.
- Ozturk, I. and Acaravci, A. (2002). The Effects of Exchange Rate Volatility on the Turkish Export: An Empirical Investigation. *Review of Social, Economic and Business Studies* 2:197-206.
- Peree, E. and Steinherr, A. (1989). Exchange Rate Uncertainty and Foreign Trade. *European Economic Review* 33:1241-1264.
- Saatcioglu, C. and Karaca, O. (2004). The Impact of Exchange Rate Uncertainty on Exports: The Case of Turkey. *Dogus University Journal* 5(2):183-195.
- Sever, E. (2009). Uncertainty of Real Exchange Rate Effects on Trade Performance: The Case of Turkey. [\*Journal of Entrepreneurship and Development\* 2:105-134](#).
- Takaendesa, P., Tsheole, T. and Aziakpono, M. (2005). Real Exchange Rate Volatility and Its Effect on Trade Flows: New Evidence From South Africa. *The Biennial Conference of Economic Society of South Africa*, September 7-9, Durban.
- TCMB; Central Bank of Turkey, Electronic data delivery system, <http://evds.tcmb.gov.tr/yeni/cbt-uk.html>.
- Vergil, H. (2002). Exchange Rate Volatility In Turkey And Its Effect on Trade Flows. *Journal of Economic and Social Research* 4(1):83-99.