THE RELATIONSHIP BETWEEN EXCHANGE RATE VOLATILITY AND ECONOMIC GROWTH: AN EXAMPLE OF TURKEY

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Abstract:
In the era of technology advancement and rapid globalization, the relationship between real exchange rate and economic growth has become one of the widely discussed topics in economics. The relationship helps in understanding the economic structure of a particular country and guides policy makers in economic decision making and assumption based planning. This paper not only empirically investigates the impact of exchange rate, but also it examines the impact of exchange rate volatility on the economic growth because country's growth is highly influenced by exchange rate volatility. In the study, after investigating the presence of unit root in the time series of GDP, inflation and real effective exchange rate, Engle-Granger cointegration approach is used to explore Turkey's economic growth and exchange rate volatility relationship, by using quarterly data for the period 1998:1-2014:4. The results provide evidence for the existence of both short and long term relationship between economic growth and real effective exchange rate.

JEL classification code: *C32*

Key words: Real exchange rate, Economic growth, Engle-Granger Cointegration Approach

1. INTRODUCTION

Exchange rate variations has been the focus of discussion in the economic literature. In a globalized world, where the exchange rate has a position of greatest importance, the relationship between exchange rate and economic growth of a country has been examined in numerous studies with a focus on exchange rate volatility. In the evaluation of previous literature, it has been observed that exchange rate volatility is associated with economic development and trade volume variations in the country. Similarly, this study aims to analyze the causal relationship between Turkey's exchange rate volatility and economic growth in three sections.

The paper is organized as follows. First section discusses exchange rate volatility, presents ARCH formulation in data analysis and explains Engle-Granger two-step approach. Second section explains the impact of exchange rate volatility on Turkey's economy, its economic growth and its foreign trade with the world. In the third section, three economic factors: GDP, inflation and real effective exchange rate, from 1998 to 2014, has been analyzed by two step Engle-Granger method. Subsequently, the relationship between exchange rate volatility and Turkey's economic growth has been investigated.

In this research, it is observed that the exchange rate volatility negatively impacts the economic growth in short-run. Conversely, inflation has a positive short term impact on the country's economic growth.Volatility (variability) is a statistical measure of the changes occurring in the price of any instrument (Butler, 1999). In another perspective, volatility is defined as a measure of expected changes in the prices of financial assets during a specific time period (Jorion, 2003). When volatility increases, risk increases. In addition to the volatility as a measure of risk, expectations regarding market volatility has been considered. There are certain effects of exchange rate volatility on the source of exchange rate risk, volume of foreign trade, and especially on the balance of payments.

For financial asset pricing during high risks in the financial markets, the significance of an appropriate and accurately defined risk estimation approach has been highlighted. Both variance and standard deviation of return distribution are generally accepted as risk measures in financial economics. Time variance is used as a measure for determining the risk premium, evaluation of risk reducing strategies, and especially for derivatives pricing. In a nutshell, volatility is a measure of uncertainty in expected returns of financial assets (Hull, 2014).

Companies that are involved in international trade, either through foreign investments or import/export of goods and services, face exchange rate and transaction risk that can have severe financial repercussions. Therefore, measuring and managing exchange rate risk holds great significance for reducing international firm's vulnerabilities from exchange rate movements. However, due to lack of technical infrastructure and skilled human resource, adequate exchange rate risk management techniques are not being implemented. Consequently, international businesses are more vulnerable to small changes in exchange rate. Exchange rate risk arises due to the actual and unexpected changes in foreign exchange rate in the market. Thus, key exchange rate risk factors cannot determine the future value of exchange rate.For that reason, future value of foreign currency estimation through various risk management techniques is the best way to avoid currency risk (Kayahan, 2007).

Volatility and volatility estimates are vital in financial markets because they play crucial role in asset and portfolio management by implementing and evaluating asset and derivative pricing models in addition to trading strategies (McMillan & Speight, 2004).

2. RESEARCH MODEL

2.1. Autoregressive Conditional Heteroskedasticity (ARCH) Model

In this section, we explains the original ARCH model as proposed by Engle (1982). Moreover, we focus on the properties of ARCH model which make it useful for volatility estimation of economic time series. One way of modeling observed volatility in time series is to define volatility related independent variable and forecast the future volatility using the variable. As opposed to traditional econometrics model, Engle proposed serially uncorrelated processes with constant condition variance but non-constant variance condition on the past. According to Engle, recent past provides information about next period forecasted variance.

Engle (1982) points out the dependence of conditional variance on past information, therefore suggested that conditional variance is a random variable. According to Engle, the estimation of $y_t$from conditional density function $f(y_t \mid y_{t-1})$shows the dependence of estimated current value onprevious data. Similarly, the variance of this current period forecast would be V $(y_t \mid y_{t-1})$ and thus it is a random variable.

A first order auto regressive structure is given below:

$$y_t = \gamma y_{t-1} + \epsilon_t$$

where ϵ_t is a white noise with variance σ^2. y_t has a conditional mean of γy_{t-1}while its unconditional mean is zero like traditional econometric assumptions. Moreover, the conditional variance is σ^2 while the unconditional variance is$\frac{\sigma_2}{1-\gamma^2}$. It is assumed that unconditional variance will remain constant as in the case of previous econometrics model, however the conditional variance will depend on the past values.

In a simple case: $y_t = \gamma y_{t-1}$ conditional variance is now$\sigma^2 y_{t-1}^2$. In this case the unconditional variance is either zero or infinity, therefore this formulation is not feasible. The problem is solved through slight generalization and the preferable model is given below:

$$y_t = \in_t h_t^{1/2}$$
$$h_t = a_0 + a_1 y_{t-1}^2$$
$$\sigma(\in_t) = 1$$

This is an autoregressive conditional heteroscedasticity (ARCH) model. By adding the assumption of normality and using conditional densities, the model can be expressed as:

$$y_t \mid \psi_{t-1} \sim N(0, h_1)$$
$$h_t = a_0 + a_1 y_{t-1}^2$$

The variance function h_t is expressed more generally below:

$$h_t = h(y_{t-1}, y_{t-2}, \ldots, y_{t-p}, \alpha)$$

where p denotes the order of ARCH process and α is a vector of unknown parameters.

2.2. Engle-Granger Two-Step Modelling Method (EGM)

After classification of variables according to integration of order zero, one or two etc.,we set up Engle-Granger two-step model to investigate the stationarity among different non-stationary variables, that is, cointegration. Engle-Granger model is one of the earliest cointegration tests that is not only intuitive but easy to apply.

2.2.1. First Step

The first step in Engle-Granger two-step procedure is the estimation of co-integrating regression.

$$y_{1t} = \alpha + \beta_1 x_{1t} + \beta_2 x_{2t} + \epsilon_t$$

where ϵ_t is a covariance stationary I(0) process In the above regression, we assume that dependent and all independent variables are I(1) and might be cointegrated to give stationary residuals. The stationary error

term can be expressed as:

$$\hat{\epsilon}_t = y_{1t} - \alpha - \beta_1 x_{1t} - \beta_2 x_{2t}$$

Engle-Granger two-step procedure assumes only one cointegration vector that is captured by cointegration regression (Sjo, 2008).However, when there are more than two variables, it is difficult to achieve the same order of integration. In such a case when there is more than one explanatory variables, care must be taken while applying Engle-Granger two-step procedure.It has been proved by the methodology developed by Charezma-Deadman (1992), cointegration relationship can be observed between the variables having different order of stationarity with different perspective.

In this regard, we have included two explanatory variables in our model.

$$y_t \sim I(0), x_{1t} \sim I(1), x_{2t} \sim I(1)$$

In such a case when independent variables have stationarity at first difference, and dependent variable is I(0) , linear combination of independent variables can be covariance stationary.

$$[(\beta x_{1t} + \beta x_{2t}) \sim I(0)]$$

Under these conditions, long term relationship can be observed between residuals and dependent variable $y_t \sim I(0)$.

Moreover, co-integration relationship can be searched, when more than two variables are included in the model andthe order of integration of dependent variable becomes larger than order of integration of any of the independent variables, as given below:

$$y_t \sim I(d), x_{1t} \sim I(d), x_{2t} \sim I(d-1)$$

If the order of integration of independent variables is greater than the order of integration of dependent variable, in order to determine the co-integration relationship between the variables at least order of integration of two explanatory variables must be equal or less than the order of integration of dependent variable.

$$y_t \sim I(1), x_{1t} \sim I(2), x_{2t} \sim I(2)$$

If the co-integration relationship is found between the independent variables, i.e. $[(\beta x_{1t} + \beta x_{2t}) \sim I(1)]$we can observe long term relation between error term and dependent variable (Yıldız 2013).

2.2.2. Second Step

The second step in Engle-Granger two-step approach is to test the covariance stationarity in the residual process of the first step's regression. For this reason, we use Augmented Dickey-Fuller (ADF) unit root test.

$$\Delta\widehat{\epsilon_t} = \alpha + \pi\widehat{\epsilon_{t-1}} + \sum_{i=1}^{k} \gamma_i \, \Delta\widehat{\epsilon_{t-i}} + \omega_t$$

where we test $H_0: \pi = 0$against$H_1: \pi < 0$.

In order to examine the stationarity of residuals, the critical values of DF and ADF tests are not used,instead Engle and Yoo (1987) critical values are used for 50, 100, 250 and 500 observations. We will consequently proceed to next step if the residuals are observed to be integrated of order I(0) in the unit root test.

2.2.3. Error Correction Model

An error correction model allows us to examine the short run relationship between dependent and independent variables. In this step, variables with same order of integration obtained from the estimation and estimated stationary residual terms are replaced in the error correction model as follows

$$\Delta y_t = \alpha_1 + \alpha_y(y_{t-1} - \beta_1 x_{t-1}) + \sum_{i=1}^{k} \alpha_{11}(i)\Delta y_{t-i} + \sum_{i=1}^{k} \alpha_{12}(i)\Delta x_{t-i} + \epsilon_{yt}$$

$$\Delta x_t = \alpha_2 + \alpha_x(y_{t-1} - \beta_1 x_{t-1}) + \sum_{i=1}^{k} \alpha_{21}(i)\Delta y_{t-i} + \sum_{i=1}^{k} \alpha_{22}(i)\Delta x_{t-i} + \epsilon_{yt}$$

As expressed in the second step equations, β is co-integration that comes from equations mentioned in the second steps, given by vector parameter. Accordingly, the lagged values of all the variables and error correction terms coming from regression are located on the right side of the equation.

$$\Delta y_t = \alpha_1 + \alpha_y \widehat{e_{t-1}} + \sum_{i=1}^{k} \alpha_{11}(i)\Delta y_{t-i} + \sum_{i=1}^{k} \alpha_{12}(i)\Delta x_{t-i} + \epsilon_{yt}$$

$$\Delta x_t = \alpha_2 + \alpha_x \widehat{e_{t-1}} + \sum_{i=1}^{k} \alpha_{21}(i)\Delta y_{t-i} + \sum_{i=1}^{k} \alpha_{22}(i)\Delta x_{t-i} + \epsilon_{yt}$$

This form of representation is an illustration of vector autoregressive(VAR) model. The coefficients of equations are obtained throughOLS regression (Engle and Granger: 1987).Termϵ_{yt}represents white noise process or error terms. In the above equations, short and long term relationships are shown together. Since all variables are stationary, they are predictable like in the case of traditional VAR model (Yıldız 2013).

3. LITERATURE REVİEW

In this section, we discuss the theoretical and empirical studies that explain the relationship of foreign trade and growth of a country with its inflation, exchange rate and exchange rate volatility.In these studies, the impact of exchange rate volatility on country's imports and exports has been analyzed in different exchange rate regimes. The literature reviewmostly includes the studies that deals with exports data or two way collectivetrade data, since enough studies that focus solely on the imports are not found. Moreover, the relationship between exchange rate volatility and economic growth of Turkey is widely discussed in the literature.

In one of the studies, the influence of exchange rate volatility on the real imports of the United Kingdom during the period of 1980 to 2003 from three different countries, i.e. Canada, Japan and New Zealand is investigated. The relationship between real imports and its determinants (including exchange rate volatility) is examined using Johansen multivariate cointegration approach and constrained error correction method. The study shows that unexpected changes in the exchange rate volatility positively affect the international trade flow as profits are affected by the changes in exchange rate. The increase in exchange rate volatility results in increased profit risk(Choudhry, 2005).

Hooy and Chong (2010) examine the impact of exchange rate volatility on the demand of exports in South Asian Association (South Asian Association for Regional Cooperation (SAARC)) countries, covering Bangladesh, India, Pakistan and Sri Lanka. In the study, conditional exchange rate volatility is modeledusing multivariate asymmetric CCC-GARCH model and bond testing approach was applied on the standard trade model framework. The results show that exports decisions of SAARC producers are influenced by foreign income, exchange rate and its volatility in long run. Real exchange rate volatility was found to have a significant and negative impact on the export demand of most of the SAARC countries. This implies that higher exchange rate fluctuation does not encourage intra-regional trade within SAARC region. It has been observed that there is significant and negative impact of real exchange rate volatility on the export demand in most of SAARC countries. In this case, it is implied that high exchange rate volatility discourages the intra-regional trade in SAARC region. In addition, it has been observed that foreign income has positive effect on real exports signifying that trade with in SAARC countries is dependent on countires' purchasing power. Nevertheless, as the negative effect of real exchange rate volatility is significant; especially for Bangladesh, India, and Pakistan,higher exchange rate volatility prevents the intra-region trade between

SAARC countries. As a result, critical role of exchange rate volatility should be considered while designing and implementation of trade policies(Hooy & Choong, 2010).

In a study by Aghion et al. (2006), the impact of real exchange rate volatility on productivity growth is empirically investigated. It is argued that the impact of volatility is significantly dependent on the level of financial development in a country. Therefore, instead of examining exchange rate volatility in isolation, level of financial development in a country and nature of macroeconomic shocks are incorporated in the research. The cross-country panel data validates the hypothesis that higher exchange rate fluctuations can inhibit growth in the countries with thin capital markets and where financial shocks mainly cause macroeconomic volatility. In this way, the study signifies the importance of financial development in the relationship between exchange rate and long-run growth (Aghion et al. 2006).

In a study that examines the effect of exchange rate fluctuations on the level and volatility of trade flow, it has been found that one standard deviation of exchange rate volatility results in 8.16% increase in trade volatility. The study contains industrially advanced and emerging countries; country pool includes: United States, United Kingdom, Austria, Denmark, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland, Canada, Japan, Finland, Portugal, Spain, Turkey, South Africa, Brazil, Mexico, Peru and South Korea. The country wise data has been is divided into three categories: industrially developed countries (Ind), newly industrialized (NIC) and the Eurozone (Ezone). Generally, it has been found for all of the countries that there is a strong relationship between exchange rate volatility and bilateral trade. The data of three groups has been examined and strong relationship between exchange rate volatility and trade in both industrially developed and newly industrialized countries could not be observed.However, significant relationship has been found between exchange rate volatility and trade volatility. In the study, exchange rate volatility positively affect the trade in industrially developed countries; while, negative effect of exchange rate volatility is observed in the case of newly industrialized countries. Consequently, it was suggested thatthere should be more focus on trade volatility rather than trade levels and exchange rate volatility (Baum and Caglayan 2009).

In another study, Engle-Granger method is used to examine Turkey's exchange rate volatility with its exports. Monthly data set, from 1990 to 2000, has been used in the study that is based on the sales in Turkey, United States and three different European Union countires. As a result, negative long term relationship has been found between exchange rate volatility and exports; particularly the relationship is more observable for the exports of Germany, France and United States of America. Moreover, short term negative relationship between exports and exchange rate volatility has also been observed. Significant relationships has also been observed for other countries (Vergil, 2007).

In another study, long term deterministic factors of Turkey's real exchange rate are examined. The study examines the long-term impact of real exchange rate on net foreign capital inflows, difference between the weighted average revenues of important foreign trade partners of Turkey, money supply, foreign trade balance and trade terms.(Şimşek, 2004).

Güvenek and Alptekin (2009) analyzed the autoregressive conditional heteroskedasticity of exchange rate index in their study and mentioned that analysis of series volatility is very important for consistency. In the study, growth and trend have been analyzed from financial liberation process 1980 to 2009. In order to predict and model the exchange rate volatility, the index volatility has been examined after bringing the real effective exchange rate index into the stationary state. Volatility has been observed in the series; after it has been brought into the state of stationarity by using various modelling techniques. Exchange rate projections were made by examining a new model derivedfrom volatility index, which leads to more realistic objectives in terms of macroeconomic plans. As a result, in order to achieve the expected return on capital movements, appropriate policies for foreign investors that facilitate investments in medium and long term have been

discussed. Moreover, in order to further encourage investors to create an essential and feasible environment for investments, the significance of risk minimization has been expressed (Güvenek and Alptekin, 2009).

Anotherresearch seeks to estimate Turkey's long term real exchange rate with the fundamental macroeconomic variables through cointegration methodology, by using ten years quarterly datasets between 2003 and 2013. As a result, it has been observed that movements in real effective exchange rate significantly explains the change in the ratio of public spending to GDP, ratio of imports and exports to total GDP and foreign trade level. Taking these results into consideration, the long term exchange rate uncertainty can be eliminated by taking precautionary measures in response to crisespredictions (Taş and Uysal, 2013).

The relationship of economic growth with exchange rate as well as inflation has been examined in many studies. Generally, it has been mentioned in the studies that there is positive relationship between inflation and economic growth of the countries. Moreover, the studies that found negative relation between inflation and growth have specified that inflation has negative effect on economic growth when inflation exceeds a certain threshold value. Barro (1995) conducted a research for 100 countries using inflation data from 1960 to 1990 to assess the impact of inflation on economic growth. In his research, he observed that the effect of inflation on investments and economic growth is negative in long term. At the end it has been states that high inflation has been observed during some years, however the effects of inflation were not as outstandingly high as been estimated. Precautions have been taken during research as the data comprise of inflation in different time period, so that the level of effect of inflation on different parameters can be clearly understood. It is concluded that the economic growth boosting factors should be focusedmore than the growth in inflation(Barro, 1995).

In another study carried out in 2005, inflation and economic growth of 80 countries have been examined between 1961 and 2000. While considering the full data set, the research consistently observed that high inflation is related with moderate gains in GDP growth, up to the threshold level of 15-18 percent inflation. Conversely, the outcomes are different when the full data is divided on the basis of countries' income levels. İn the case of OECD countries, no clear relationship between inflation and economic growth is estimated, however positive relationship has been found in middle and low income countries and positive relationship in low income countries is stronger than middle income countries. In a decade wise grouping of data, the results show that inflation and growthare highly correlated when macroeconomic policy is focused on demand management for growth stimulation. At the end, it is suggested that inflation-targeting policies are not justified as they are being held in middle and low income countries, i.e. to maintain inflation with in a band of 3-5%(Pollin and Zhu, 2005).

In another study, the inflation data between 1960 and 1998 of 140 countries has been used. It has been observed that there is 1-3% inflation in developed countries; however, in developing countires after passing 7-13% threshold level, inflation begins to adversely affect the growth of the country (Khan and Senhadji, 2001). A different study examining the relationship between inflation and economic growth of Turkey, ARDL model is used to analyze the data between January, 1988 and April, 2007. The study observesa negative relationship in both long term and short term between CPI based inflation and economic growth. Results obtained from the study support and highlight the fact that economic growth can be achieved without making compensations to maintain price stability (Karaçor, Özer, and Saraç, 2011).

Turhan(2007) examines the relation between inflation and economic growth of Turkey by using quarterly data from 1988 to 2005. In his study, the relationship between inflation and growth has been tested using Granger causality analysis. The research shows a unidirectional negative relationship between inflation and economic growth rates. In the period under review, it is observed that 10% increase in the inflation results in 2.5% decrease in the economic growth.

4. EMPIRICAL ANALYSIS

4.1. The Results of Empirical Analysis

According to unit root tests, all series (GDP (Gross Domestic Production), enf (inflation), reer (real effective exchange rate)are found to be integrated of order I(1). The results for the unit root test are provided in Table 1.

To reach exchange rate volatility value, appropriate model is determined by Box Jenkins model. AR, MA and ARMA processes are tested respectively and most appropriate process autoregressive model with four lags AR(4) has been selected. While examining the suitability of AR(4) model, autocorrelation between the residuals are not been found. Results can be viewed in the table2 and the econometric model is given below:

$$\Delta \log(reer) = \alpha + \beta_1 t + \beta_2 \Delta \log (reer)_{t-1} + \beta_3 \Delta \log (reer)_{t-2} + \beta_1 \Delta \log (reer)_{t-3} + \beta_1 \Delta \log (reer)_{t-4}$$

ARCH or GARCH model can be used if $E(\epsilon_t | \epsilon_{t-1}, \epsilon_{t-2}, \dots) = 0$, which means that erros are serially uncorrelated. However, the squared residuals can be expected to be serially correlated. We observed serial correlation between the squared error terms. The results can be seen in Appendix 2. Furthermore, the results obtained from ARCH tests, as given in table 3, demonstrate autocorrelation relationship between the squared residuals.

Following the results, we decided to use ARCH model. After applying the ARCH (1) model, we do not find any need to apply GARCH modelin order to reach the solution. In a variance equation, we observed that average variance value andparameter of ARCH coefficient are positive and significant, while at the same time the value of ARCH coefficient is less than one. Therefore, we concluded that implementation of GARCH model is not required. ARCH model is given below and its results are given in Table 4.

$$\Delta \log(reer) = \alpha + \beta_1 t + \beta_2 \Delta \log (reer)_{t-1} + \beta_3 \Delta \log (reer)_{t-2} + \beta_1 \Delta \log (reer)_{t-3} + \beta_1 \Delta \log (reer)_{t-4}$$

In this step, exchange rate volatility (ev)series is estimated. After estimating the series, Engle Granger two-step model is applied. In the first step of Engle-Granger model, the long-term relationship of gross domestic product with inflation, exchange rate and exchange rate volatility is estimated using least square estimator of linear regression. Results of the first step are provided in Table 5 and our econometric model is given below:

$$GDP_t = \alpha + \beta_1 \log(enf)_t + \beta_2 \log(\text{reer})_t + \beta_3 \text{ev}_t$$

In order to make a decision about the presence of long term cointegration between the series, it is required to examine the stationarity of residuals (rrr) obtained from above regression estimation. The ADF test statistic related to residuals comes out to be -4.18. As the test statistic does not exceeds the 10% Engle-Yoo (1987) critical value, -2.90, we reject the null hypothesis and claim that the residuals are stationary. Hence, we can proceed to the third step of our cointegration analysis.

After determining the long term relationship between the series, one period lagged stationary residual values are estimated using error correction model. The error correction model provides us information about the short term dynamics in the long term relationship between dependent and independent variables. Error term coefficient helps us to determine the rate at which the determinant variable returns to the long term equilibrium after a short term instability in independent variable. The positive coefficient shows the divergence of determinant variable from the equilibrium while negative coefficient shows convergence to equilibrium. In our study, we observed the divergence of dependent variable from short term and long term equilibrium. The econometric model of Engle-Granger regression is given below and the results are shown in Table 6.

$$\Delta GDP_t = \alpha + \beta_1 \Delta \log(enf)_t + \beta_2 \Delta \log(\text{reer})_t + \beta_3 \text{ev}_t + \beta_4 \text{rrr}_{t-1}$$

According to our estimated results coefficient rrr_{t-1} is statistical significant at 10%. In this situation, it means error correction mechanism is working between long term and short term variables. However, instability between long term and short term cannot be removed.

4.2 Research Findings

This study aims to examine the study of exchange rate volatility on Turkey's economic growth during the period of 1998-2014. Firstly, in this paper we examined the exchange rate volatility and two-stepEngle-Granger Model.

Lastly, the relationship between real exchange rate and economic growth has been closely examined. According to the important finding shown in our paper, the financial deficit of an emerging country is dependent on capital inflow and consequently global financial conditions. However, the positive financial conditions not only increase the capital inflow but also results in appreciation of country's currency. In case of negative global conditions, capital outflows, real value depreciation of country's currency and economic recession can be caused relatively independent to country's own macroeconomic dynamics. For this reason, to examine the country's exchange rate volatility, it is critical to understand the country's macroeconomic values.

In examining the relationship of inflation, exchange rate volatility and international trade with economic growth factors, the obtained results are different from the results mentioned in literature section. Generally, it has been observed that effect of exchange rate volatility on the country economic growth is negative, which leads to uncertain movements in foreign trade and disturbances in country's economic balance. It has been concluded that up to a certain threshold value, inflation has a positive effect on the economic growth of middle income countries and developing countries.

In this study, quarterly data for GDP, inflation and CPI based real effective exchange rate from 1998 to 2014 has been examined through Engle-Granger two stepmodel. It has been concluded that during this period, exchange rate volatility affects Turkey's economic growth in a long term and short term. In this context, an increase in Turkey's exchange volatility negatively affect the Turkey's economics growth, GDP, and CPI-based inflation. In addition, it has been seen in our analysis that inflation has a positive effect on the Turkey's economy in a short term. Moreover, it is observed in our study that increase in exchange rate and exchange rate volatility will have a negative effect on the growth of Turkey's economy in short and long term. According to Engle-Granger Model, both long term and short term independent variables have a significant long and short term effect on the dependent variable, i.e. economic growth, with 10% significant level.

With 10% significant level, error correction coefficient rrr_{t-1} is statistically significant but it is positive. This situation indicates the long term working relationship between the series. Looking at the short term coefficients, it has been observed that exchange rate and exchange rate volatility have negative effect while inflation has positive effect.Therefore, the increase in volatility will have a negative effect on such economies. Increase in CPI-based real effective exchange rate volatility negatively affect the economic growth of country in both short and long term.In this study, we conclude that exchange rate volatility has great significance in Turkey's economic development and growth.

5. CONCLUSION

New approaches have been discussed in our research to explain the influence of real effective exchange rate and the impact of exchange rate volatility to country's growth. These approaches simplify the examination and exploration of exchange rate volatility, consequently facilitating country's strategy decision making. Specifically for the developing countries, as most of them are dependent on foreign source, it has been

observed that the economy is deeply affected when the factors like exchange rate volatility become quite fragile. Exchange rate volatility negatively effects the capital movements (capital inflow and outflow), international trade, and other factors such as investment and production. Hence, modelling exchange rate volatility is vital for required, timely and accurate intervention. Particularly for the developing countries following export-led growth strategy, it is very important to eliminate a set of instability, such as exchange rate uncertainty, in order to eliminate deficit in balance of payments.

The general definition of volatility is that volatility is a statistical measure of the changes occurring in the price of an instrument. Exchange rate volatility is caused as a result of spontaneous and unexpected changes in exchange rate in the market. Thus, exchange rate risk reveals an important aspect that future value of exchange rate cannot be determined today. The best way to protect against currency risk is to examine the foreign currency future value with risk management techniques.

Turkey's economy was adversely affected by the global financial crisis in 2008-09. In the following years, during the recovery period, the economy remained fragile and vulnerable to external shocks. The current condition of Turkey's economy is a result of continued structured implementation of practices from 1980 until today. In recent years, with an increase in globalization, national capital, interest rate, foreign policies, economic growth, the saving and distribution mechanisms and the relationship between growth and current account deficit have become decisive factors for the future of Turkey's economy.For the economies with insufficient domestic savings, such as Turkey, disrupting current account deficit in balance of payments are compensated through foreign savings. Moreover, primary deficit is financedby imports and external financing (hot money).As mentioned in the empirical analysis, volatility in exchange rate negatively affects the Turkey's economy in short and long term; moreover, it has been mentioned that reduction in current account deficit is directly linked with exchange rate volatility.With the increase in exchange rate volatility, the foreign trade andmoney inflow decrease.

In another viewpoint, inflation rate play a critical role in the growth of Turkey's economy. It has been found in the literature research that within the certain threshold values sometimes inflation growth has positive effect and sometimes negative effect on the economy's growth. It has been observed in the empirical analysis that there is short term positive relationship between inflation and economic growth in Turkey's economy.According to this information, determined level of inflation target for the growth of turkey's economy (target set by the Central Bank of Turkey: 5%) must be reached and to improve the economy in both short and long term the targets should be revised and new plans must be devised.Firstly, actions should be taken for keeping the Turkey's economy alive, providing short term financing and increasing the inflow of hot money to the country. Since reduced exchange rate volatility play vital role in attracting foreign investors,reducing exchange rate volatility will be an important step to make the country attractive for foreign investors.

Making investments in accordance with the long term plans for economic growth improvement can be a solution to another big problem of Turkey's economy, i.e. unemployment. First, in order to ensure that new platform will provide employment, it is required to find out the connection between Turkey's investors and its capital flow. Currently, Turkey's investments are concentrated in construction industry that brings very short term gains. However, if the investment is increased in the manufacturing sector, the return will be much higher in the long term. As the sale of raw materials and finished product will increase, there will be an improvement in Turkey's profits; at the same time, employment opportunities will also increase in the country.

In this stage, the strategic position of Central Bank of Turkey (CBT) has been considered. Since 2001, CBT implemented framework of floating exchange rate policy which proved to be a stabilizing factor during periods of extreme movements in the foreign market; furthermore, its presence in the market is positively

perceived by the market players. In the CBT's policy framework, the implementation of effective interventions are required for current and future period directed inflation targeting, particularly for the avoidance of disruptive effects of exchange rate volatilityon price stability.

In conclusion, there is a positive impact of exchange rate volatility on the economic growth, moreover policy should be made for enhancing investment level in the country and reducing foreign dependency.

Table 1. The Results of ADF Statistics

Variables	ADF t statistics
Dlog(reer) (constant and trend)	-7.34418(1)
Dlog(enf)	-6.1587 (3)
DGDP	-9.368640 (1)

Note: The values in the parenthesis show that number of lags. Following are the respective critical values of variables at 5% significant level (-3.4804), (-1.9460), (-3.4815). All of the variable are I(1).

Table 2: The Results of AR (4) Model Regression

Dependent Variable: DLOGREER

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	0.011651	0.009954	1.170434	0.2468
@TREND	-0.000257	0.000258	-0.996105	0.3235
AR(1)	-0.005436	0.12947	-0.041983	0.9667
AR(2)	-0.283867	0.128156	-2.215004	0.0308
AR(3)	-0.182384	0.128607	-1.418146	0.1617
AR(4)	-0.248671	0.130719	-1.902334	0.0623

Table 3: The Results of ARCH Test

F-statistic	4.800581	Probability	0.032412
Obs*R-squared	4.589856	Probability	0.032162

Table 4: The Results of ARCH Test

Dependent Variable: DLOGREER

	Coefficient	Std. Error	z-Statistic	Prob
C	0.026766	0.006619	4.043549	0.0001
@TREND	-0.000555	0.000189	-2.934097	0.0033
AR(1)	-0.109663	0.130361	-0.841227	0.4002
AR(2)	-0.198112	0.11831	-1.67451	0.094
AR(3)	-0.280422	0.110614	-2.535141	0.0112
AR(4)	-0.334199	0.119361	-2.799905	0.0051
Variance Equation				
C	0.001422	0.000482	2.947101	0.0032
ARCH(1)	0.686351	0.300942	2.280672	0.0226

Table 5: The Results of Level of Series Regression

Dependent Variable: GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.20E-13	1.04E-13	4.980492	0.0000
LOGENF	1	6.09E-15	1.64E+14	0.0000
LOGREER	8.68E-14	1.16E-14	7.492488	0.0000
EV	9.77E-13	2.28E-13	4.27474	0.0001

Table 6: The Results of Engle-Granger Regression

Dependent Variable: DGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.47E-18	9.33E-19	5.860057	0.0000
DLOGENF	1	1.76E-17	5.68E+16	0.0000
DLOGREER	-1.77E-17	1.01E-17	-1.759208	0.0843
EV	-9.20E-16	1.53E-16	-6.02098	0.0000
RRR(-1)	0.000186	9.66E-05	1.9263	0.0594

APPENDIX

A.The Correlogram of Residuals of AR (4) Model

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	0.010	0.010	0.0062	
. | . |	. | . |	2	-0.049	-0.049	0.1632	
. | . |	. | . |	3	-0.054	-0.053	0.3571	
.*| . |	.*| . |	4	-0.069	-0.071	0.6849	
. | . |	. | . |	5	0.019	0.015	0.7111	0.399
**| . |	**| . |	6	-0.213	-0.226	3.9407	0.139
.*| . |	.*| . |	7	-0.087	-0.096	4.4883	0.213
. |*. |	. | . |	8	0.071	0.045	4.8634	0.302
. | . |	. | . |	9	0.026	-0.009	4.9125	0.427
. | . |	. | . |	10	0.056	0.019	5.1552	0.524
. | . |	. | . |	11	0.050	0.057	5.3534	0.617
. | . |	. | . |	12	0.033	0.004	5.4374	0.710
. | . |	.*| . |	13	-0.055	-0.091	5.6853	0.771
.*| . |	. | . |	14	-0.072	-0.044	6.1087	0.806
.*| . |	.*| . |	15	-0.088	-0.080	6.7669	0.818
. | . |	. | . |	16	0.003	0.000	6.7677	0.873
.*| . |	.*| . |	17	-0.108	-0.118	7.8022	0.856
. | . |	. | . |	18	0.004	-0.001	7.8038	0.899
. | . |	. | . |	19	0.011	-0.049	7.8157	0.931
. |*. |	. |*. |	20	0.172	0.133	10.615	0.833
. |*. |	. | . |	21	0.093	0.041	11.453	0.832
.*| . |	.*| . |	22	-0.181	-0.188	14.689	0.683
. |*. |	. |*. |	23	0.090	0.090	15.508	0.690
.*| . |	**| . |	24	-0.177	-0.209	18.772	0.537
.*| . |	.*| . |	25	-0.087	-0.096	19.581	0.548
. | . |	. | . |	26	-0.026	-0.006	19.657	0.604
. | . |	. | . |	27	-0.010	0.039	19.670	0.662
. | . |	.*| . |	28	0.006	-0.150	19.674	0.715

B. The Correlogram of Residuals Squared of AR (4) Model

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |** |	. |** |	1	0.273	0.273	4.8519	
. |*. |	. | . |	2	0.111	0.039	5.6623	
. |** |	. |** |	3	0.228	0.204	9.1574	
. | . |	.*| . |	4	0.051	-0.068	9.3385	
. |*. |	. |*. |	5	0.172	0.176	11.387	0.001
. |*. |	. | . |	6	0.163	0.037	13.281	0.001
.*| . |	**| . |	7	-0.149	-0.233	14.887	0.002
.*| . |	.*| . |	8	-0.109	-0.095	15.761	0.003
.*| . |	. | . |	9	-0.058	-0.042	16.010	0.007
.*| . |	. | . |	10	-0.077	0.013	16.467	0.011
. | . |	. | . |	11	0.031	0.062	16.543	0.021
. | . |	. | . |	12	-0.035	0.007	16.639	0.034
.*| . |	. | . |	13	-0.108	-0.010	17.580	0.040
.*| . |	. | . |	14	-0.062	-0.056	17.898	0.057
. |*. |	. |*. |	15	0.066	0.109	18.266	0.076
.*| . |	.*| . |	16	-0.081	-0.169	18.834	0.093
. | . |	. | . |	17	-0.022	0.020	18.875	0.127
. | . |	.*| . |	18	-0.054	-0.072	19.139	0.160
. | . |	. |*. |	19	-0.032	0.098	19.232	0.203
. | . |	. | . |	20	0.045	0.008	19.426	0.247
. | . |	. | . |	21	0.000	-0.013	19.426	0.305
.*| . |	. | . |	22	-0.066	-0.036	19.858	0.341
. | . |	. | . |	23	-0.044	-0.055	20.052	0.391
. | . |	. | . |	24	-0.012	0.022	20.067	0.454
. | . |	. | . |	25	-0.010	-0.036	20.078	0.516
. |*. |	. |*. |	26	0.094	0.115	21.057	0.517
. | . |	.*| . |	27	-0.038	-0.069	21.225	0.567
.*| . |	. | . |	28	-0.077	-0.020	21.910	0.585

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