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REVISITING THE RELATIONSHIP BETWEEN EXCHANGE RATES AND OUTPUT WITHIN SVAR BLANCHARD-QUAH FRAMEWORK: EMPIRICAL EVIDENCE FROM TURKEY, GERMANY AND RUSSIA

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ABSTRACT: *It seems important to determine the effects of exchange rate fluctuations on economic performance. In this study, we attempt to shed some light the relationship between industrial production difference and exchange rates using two Structural Vector Autoregression (SVAR) Blanchard-Quah models for the cases of Turkey and Germany and Turkey and Russia. Results from the impulse response functions (IRFs) and forecast error variance decompositions (FEVDs) of the two SVAR models emphasized that effects of nominal exchange rate on industrial production difference and real exchange rate are temporary. Nevertheless, macroeconomic policies of Turkey, Germany and Russia influencing nominal exchange rates should be examined seriously for explaining the variations in industrial production difference and exchange rates.*

Keywords: *exchange rates, industrial production, economic activity, SVAR model*

JEL Classification Codes: F31, F41, F43.

INTRODUCTION

In the wake of economic globalization phenomena, financial liberalization and economic integration have increased while volumes of foreign trade among countries and capital flows have also expanded. On the other hand, fluctuations in macroeconomic variables such as exchange rates, net exports, foreign reserves, monetary aggregates, price levels and output levels have ascended particularly in the severe crisis periods of new globalization era. Among all macroeconomic variables, effects of changes in nominal and real exchange rates on macroeconomic conditions have become important due to the integration of financial markets and acceleration of capital flows. The end of the Bretton Woods

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system has been strictly followed by the adoption of floating exchange rate system in major industrial economies and the other emerging countries over time. Since then, the issue of exchange rate fluctuations has given its impacts on price and aggregate output varying by degree of openness and/or price elasticity of demand. Economists have developed several explanations for the prominent factors of exchange rate fluctuations which have hindered the potential positive outcomes of efficient macroeconomic management strategies as one of the major determinants of aggregate demand and supply. Empirical studies accounting for the reasons of these fluctuations have generally been concentrated on two main approaches. First one suggests that real exchange rate fluctuations result from nominal shocks referring the variation in relative prices of traded goods across countries (Dornbusch, 1976; Krugman, 1990, 1993; Engel, 1993; Eichenbaum & Evans, 1993; Bayoumi & Eichengreen, 1994; Engel, 1999; Roger, 1999). In this vein, Clarida and Gali (1994) obtained similar results, exposing that monetary policy authority affects the real exchange rate by changing price level and nominal exchange rate via its policy instruments. The second insight from empirical researches emphasizes that real shocks, namely productivity-motivated surges, clarify the fluctuations in either real or nominal exchange rates (Balassa, 1964; Samuelson, 1964; Lastrapes, 1992; Inoue & Hamori, 2009).

The potential causes of exchange rate fluctuations also lead us to examine the theoretical basis of determination of exchange rates since fluctuations partly reflect deviations from the ground on which exchange rates are determined. One of the theories explaining the determination of real exchange rates is purchasing power parity (PPP) theory based on the presumption that a commodity should be sold at same price in various countries excluding transaction costs when measured in a common currency. In other words, a connection is assumed to be prevailing between exchange rate and price indexes of various countries. Exchange rates and changes in exchange rates are accepted as more volatile than relative price levels which accounts for the deviations from PPP as leading factor behind exchange rate movements (Stockman, 1980). Studies analyzing exchange rate fluctuations, have also concentrated on this issue revealing several empirical explanations.

As one of leading considerations explaining deviations from PPP condition is the Balassa-Samuelson effect. According to this effect, commodity prices are influenced by relative production costs which are determined by relative productiveness in the sectors producing traded and non-traded commodities. The impact of the tradable sector on the real exchange rate reveals that an increase in the productivity and competitiveness of the tradable sector with respect to foreign countries puts a downward pressure on the real exchange rates (Ricci & MacDonald, 2005). Thus, production process is likely to have a major role in exchange rate fluctuations. The other insight which accounts for deviations from PPP is the monetary approach developed by Mussa (1976), Frenkel (1976) and Bilson (1978, 1979) stating that while prices are sticky in the short run, the exchange rate returns to its equilibrium value and PPP holds as prices adjust in the long run. Diebold and Nason (1990) and Meese and Rose (1991) expressed the source of real exchange rate misalignment, suggesting that changes in nominal exchange rates are due to unobservable fundamentals or to non-fundamental factors such as speculative bubbles especially in short-run related to capital movements. In an effort to argue the consistency of PPP in the long run, Huizinga (1987), Huang (1990) and Abuaf and Jorion (1990) revealed that cumulative deviations from relative PPP tend to correct themselves in the long run. On the other hand, Roll (1979) and Adler and Lehman (1983) argued that deviations from relative PPP accumulated randomly over time and in turn in the long run relative PPP might also fail.

There can be found some other controversial theoretical and empirical arguments attending to major sources of deviations from PPP theory. However it is a stylized fact that rising economic and financial integration processes have stimulated the influence of changes in exchange rates on nominal and real macro economic variables. The widespread perception in open macroeconomics, namely Mundell-Fleming modeling, is that upward movement in the exchange rates, depreciation of domestic currency against foreign currency, increases the competitiveness of the country reducing domestically produced goods relative to foreign produced ones and stimulates exports and output growth (Dornbusch, 1976, 1989; Mendoza, 1991). Given the Marshall-Lerner condition is to hold, currency depreciation can stimulate aggregate demand thereby output level. However, expansionary effects of currency depreciation have been challenged by some other theoretical and empirical considerations suggesting that more expensive imported inputs associated with developing countries put a contractionary pressure on output growth increasing the cost of production and hereby inflation (Hirschman, 1949; Krugman, 1999; Goldfajn & Werlang, 2000). Another channel of currency depreciation to have reducing effect on income level is that income distribution diverges from wages to profits (Krugman & Taylor, 1978). As expected, currency appreciation has contractionary effects on output growth. At this point, effects of exchange rate volatility on the level of international trade should be considered since total production is influenced by the changes in foreign trade volume. In the literature, some studies such as Clark (1973), Baron (1976), Hooper & Kohlhagen (1978) and Broll (1994) reveal that higher exchange risk lowers the expected revenue from exports and therefore reduces the incentives to trade and naturally decreases domestic production. On the other hand, there also exist studies that fail to find a strong negative relation between exchange rate volatility and the volume of international trade. By using Vector Autoregressive (VAR) models, Koray and Lastrapes (1989) and Lastrapes and Koray (1990) expose that exchange rate volatility explains only a small part of the level of imports and exports. Similarly, with instrumental variables approach, Frankel and Wei (1993) argue that the effect of exchange rate volatility on trade is ignorable. In another empirical approach, Kandil and Mirzaie (2003) decompose the effects of changes in exchange rates into anticipated and unanticipated parts in a rational expectations framework for 33 developing countries pointing out that unanticipated currency fluctuations have an effect on aggregate demand mainly through exports and imports while anticipated changes in exchange rates have limited effect on output growth.

When analyzing the relationship between exchange rates and output, econometric models such as Structural Vector Autoregression (SVAR) and Structural Vector Error Correction (SVEC) allow for theoretical considerations to be incorporated into the estimation process. This study which investigates the relationship between differences in output levels and exchange rate fluctuations for both Turkey and Germany and Turkey and Russia in two separate models diverges from the previous ones in that we impose long-run restrictions attributable to economic theory within the methodology of SVAR Blanchard-Quah model pioneered by Blanchard-Quah (1989). Within this context, the aim of our study is to reveal the effects of variations in nominal exchange rate on output difference, bilateral real exchange rate and nominal exchange rate in future periods via impulse response functions (IRFs) and Forecast Error Variance Decomposition (FEVD) analysis based on the two SVAR Blanchard-Quah models.

In a plausible accordance with this aim, two SVAR Blanchard-Quah models are estimated for the period from January 2002 when Central Bank of Turkey (CBRT) began to implement inflation targeting policy in accordance with floating exchange rate regime to December 2010. As for the FEVD analysis, the log of the relative industrial production $y_t^{TURF} = (y_t^{TUR} - y_t^F)$, namely the difference between log of the industrial production of Turkey y_t^{TURF} and a foreign country y_t^F (Germany, or Russia), the log of the nominal exchange rates (ne_t^{TRYEUR} and ne_t^{TRYRUB}) defined in units of foreign country's currency (Currency of Germany (EUR) or Russian Ruble (RUB)) per unit of home currency (Turkish Lira (TRY)) and the log of the bilateral real exchange rate (re_t^{TURF}) between Turkey and foreign countries are used. In our study, bilateral real exchange between Turkey and foreign countries are computed as; $re_t^{TURF} = ne_t^{TRYF} + p_t^{TUR} - p_t^F$, where p_t^{TUR} denotes the logarithm of the price level in Turkey and p_t^F, is the logarithm of the price level in a foreign country. Accordingly, an increase in re_t^{TURF} denotes the appreciation of the Turkish Lira, whereas a decrease denotes the depreciation of Turkish Lira. All series included in the econometric analyze are sourced from OECD, except nominal exchange rates that are obtained using the databases of CBRT and Central Bank of Russia Federation (CBRF). Within this framework, the empirical analysis is conducted by using JMulTi software version.4.23.

The plan of the paper is as follows. Section 2, reviews briefly the Turkish case for exchange rate fluctuations and main effects of these movements given global economic developments. Section 3 introduces the theoretical and empirical methodology of the study. The empirical results and findings of the paper are discussed briefly in Section 4. Finally, we conclude and emphasize some issues for further research in Section 5.

2. THE CASE FOR TURKISH ECONOMY

With the greater integration of markets and implementation of financial and economic liberalization policies to varying degrees across countries, Turkey has undergone greater influence of international forces on its economic policy setting and macroeconomic variables. In this respect, the Turkish government announced its own National Program for the adoption of the Acquis Communautaire or the European Union (EU) Acquis on March 19, 2001 after being recognized as a candidate state at the Helsinki European Council. Subsequently, in an effort to harmonize its policy structures with that of the EU, Turkey chose its monetary policy, fiscal policy and exchange rate policy in accordance with the Maastricht criteria for adopting the EU's single currency, the Euro. This attempt coincidence with the wake of the February economic crisis in 2001 that led to the depreciation of the TRY by 21% in real terms, GDP contraction by 5,7, an increase in Public Sector Borrowing Requirement (PSO) and a high inflation rate as shown in Table 1.

Within the process of EU membership of Turkey, CBRT announced a new economic stabilization and structural change program at the beginning of 2002. With this new economic program, CBRT began to implement inflation targeting which constitutes the current monetary policy framework. Maintaining price stability was officially accepted as the major goal of CBRT which inclined to use short-term interest rates as the policy tool for this purpose. The economic program also included floating exchange rate regime since it is efficient under real shocks when there are no capital account restrictions. On this account, besides price stability, maintaining the control of domestic money supply and foreign currency reserves and stabilization of output has been among targets of monetary authority by the implementation of floating exchange rate regime. In accordance with these targets, the main principle of the floating exchange rate regime was that market conditions would determine exchange rates, so that CBRT could intervened exchange rates only in case of excess volatility.

Table 1: *Major Macroeconomic Indicators of Turkey*

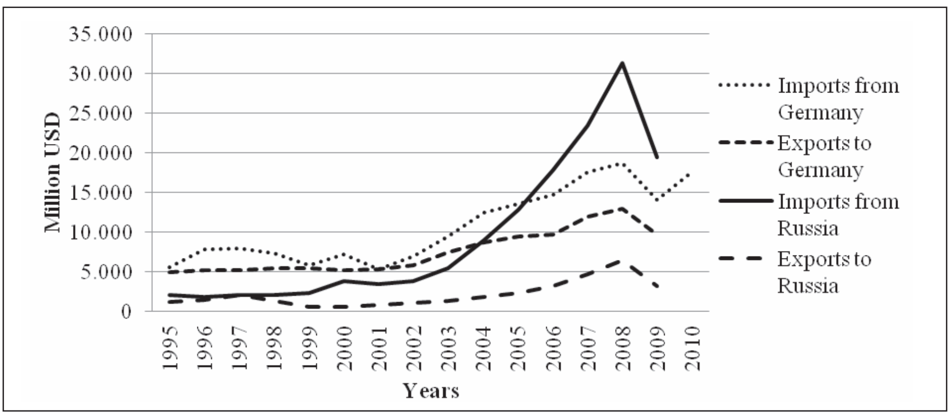
Years	GDP Growth (%)	Annual Inflation (%)	Public Sector Borrowing Requirement (PSBR)/GDP (%)	Real Effective Exchange Rate Index	Current Account Balance/GDP (%)
1995	7,19	89,11	3,7	103	-0,97
1996	7,01	80,41	6,5	102	-1,01
1997	7,53	85,67	5,8	116	-1,05
1998	3,09	84,64	7,1	121	0,71
1999	-3,37	64,87	11,7	127	-0,36
2000	6,77	54,92	8,9	148	-3,71
2001	-5,70	54,40	12,1	116	1,96
2002	6,16	44,96	10	125	-0,25
2003	5,27	21,60	7,3	141	-2,50
2004	9,36	8,60	3,6	143	-3,67
2005	8,40	8,18	-0,1	171	-4,59
2006	6,89	9,60	-1,9	160	-6,09
2007	4,67	8,76	0,1	190	-5,88
2008	0,66	10,44	1,6	169	-5,57
2009	-4,83	6,25	6,4	170	-2,20
2010	8,95	8,57	3,4	189	-6,51

Note: According to the real effective exchange rate computed by CBRT in relation to the base year 1995, an increase in the index denotes an appreciation of the Turkish Lira whereas a decrease denotes depreciation of Turkish Lira.

Source: Organization for Economic Co-operation and Development (OECD) and CBRT

As a natural consequence of strong aspiration of economic and financial liberalization policies and implementation of ambitious stabilization and structural change program, macroeconomic indicators of Turkish economy have gradually begun to give recovery signals after 2002 as recorded in Table 1. Particularly, fiscal dominance level and inflation rate fell gradually since the ratio of PSBR to GDP reached 3,4 % and annual inflation of consumer prices inflation was calculated as 8,6% in 2010. Besides, economic growth accelerated beginning from 2002, reaching the level of 4,6% on average between 2002 and 2010. In accordance with these moderate levels of major indicators, Turkey seems to achieve a significant competitive advantage since anti-inflation policies succeeded in this process. However, when real exchange rates are considered, Turkey seems to lose its competitive advantage due to appreciation of TRY. In this process as shown in Figure 1, foreign trade volume of Turkey increased with the rest of the world particularly with Turkey's two most important trade partners, Germany and Russia comprising the 20% of Turkey's foreign trade volume in 2010 as for CBRT data. Given export and import levels from these two countries, this increased trade volume seems to lead to current account balance deficit. In consequence, the share of current account balance deficit in GDP which was 6,51% in 2010 as shown in Table 1, has been an important risk factor increasing the vulnerability of Turkey's economy in addition to changes in international risk factors. Therefore, fluctuations in exchange rate of TRY may manifest itself in increased general price level in Turkey.

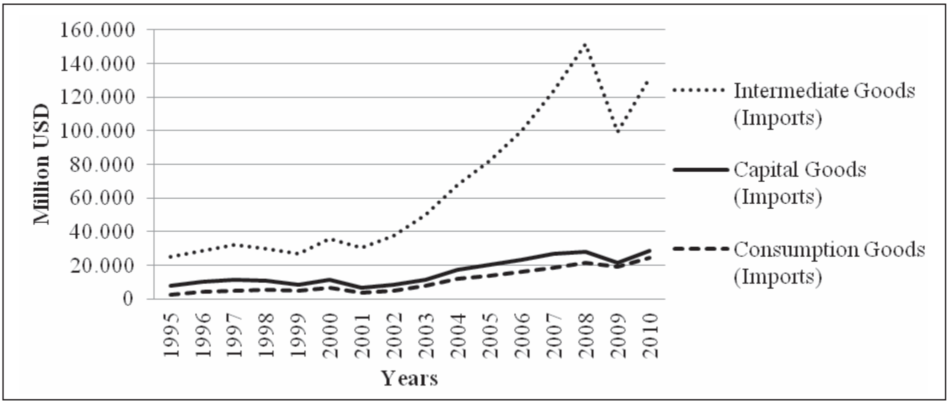
Figure 1: *Foreign Trade of Turkey with Germany and Russia*



Source: CBRT

Fluctuations of exchange rates have also had crucial role in production costs and therefore in Turkey's manufacturing sector since the total value of imported intermediate and capital goods have increased as shown in Figure 2. Given exchange rates has historically been one of the major signals for production decisions of Turkey, exchange rate movements are to be examined seriously in increasing economic and financial integration process.

Figure 2: *Foreign Trade of Turkey by Economic Categorization*



Source: CBRT

Since the value of currency affects macroeconomic variables such as foreign trade volume, price level etc. and the total production of a country is inevitably influenced. The majority of the recent studies among which Darvas (2001), Devereux and Engel (2002), Devereux and Yetman (2002), Campa and Goldberg (2002), Barhoumi (2005), Burstein et.al. (2005), Mumtaz et.al. (2006), Stulz (2007), Bussière and Peltonen (2008), de Bandt et.al. (2008), Shu et.al. (2008) and Auer and Chaney (2009) can be cited which focus to analyze the impacts of exchange rates on price level. On the other hand, effects of exchange rate fluctuations on output are accepted as so critically important that there exist considerable concentration on this issue. Kandil et al. (2007) survey the effects of exchange rates on real output, price level and real value of the components of aggregate demand in Turkey between 1980-2004 with Three Stage Least Squares (3SLS) model using instrumental variables. They attempted to decompose the effects of movements of exchange rates into anticipated and unanticipated components reaching the conclusion that unanticipated exchange rate fluctuations have a significant effect on both aggregate demand through exports, imports and demand for domestic currency and aggregate supply through the cost of imported inputs used in domestic production while anticipated changes have negative effects on real output level and inflation. Berument and Pasaogullari (2003) investigated the relationship between economic activity and real exchange rates for the period 1987-2001 using VAR framework. Their empirical results imply that exchange rate fluctuations have been significant determinant of output variability and also expose the negative relationship between exchange rates and output. Their analysis is primarily based on the negative effects of currency depreciation on economic performance particularly through its negative impacts on inflation expectations and on aggregate demand and supply. In accordance with these theoretical and empirical considerations, this study attempts to contribute to the existing literature using two SVAR Blanchard-Quah models for Turkey and its two major trade partners.

3. EMPIRICAL METHODOLOGY

3.1. Data

Stationary among variables is tested before the estimation procedure. Thus, we employ the most widely used test in the econometric literature namely the Augmented Dickey-Fuller (ADF) test. ADF test bases on the model below;

$$\Delta y_t = \phi y_{t-1} + \sum_{j=1}^{p-1} \alpha_j^* \Delta y_{t-j} + u_t \tag{2}$$

In the regression models above, Δy denotes first-differenced series $y_t - y_{t-1}$ and p is the number of lagged differences. ADF test statistic is based on the t-statistic of the coefficient ϕ from OLS estimation. $H_0 : \phi = 0$ versus $H_0 : \phi < 0$ is tested. Critical values of the test depend on the deterministic terms which have to be included. Therefore, different critical values are used when a constant or linear trend term is included in the test. If the null hypothesis is rejected, y_t is non-stationary whereas if the null hypothesis is accepted, y_t has a unit root and is stationary. In our study, we follow the Pantula principle proposed by Pantula (1989) which states that if a linear trend term is needed in the test for y_t, then only a constant term should be used for Δy's test. Similarly, if just a constant is necessary in the test for y_t, Δy's test is carried out with no deterministic term (Breitung et al., 2004:54-55).

Table 2: *Augmented Dickey-Fuller Test Results*

Variables	Augmented Dickey-Fuller Test Statistic	Deterministic Terms	Number of Lagged Differences
y_t^{TURGER}	-3,64	Constant, trend	1
y_t^{TURRUS}	-4,50	Constant	1
re_t^{TURGER}	-3,64	Constant, trend	0
re_t^{TURRUS}	-2,98	Constant	0
ne_t^{TURGER}	-3,85	Constant, trend	0
ne_t^{TURRUS}	-4,29	Constant, trend	1

Notes: %5 critical values for ADF test with constant and trend and constant are -3,41 and -2,86, respectively. Critical values are from Davidson and McKinnon (1993), Table 20.1, p. 708.

All series used in this study have a nonzero mean and also have a linear trend except y_t^{TURRUS} and re_t^{TURRUS} series. Therefore, ADF tests of y_t^{TURGER}, re_t^{TURGER}, ne_t^{TRYEUR} and ne_t^{TRYRUB} are carried out with constant and trend terms, whereas ADF test is applied to y_t^{TURRUS} and re_t^{TURRUS} series with only constant term. For carrying the ADF test, the number of lagged differences in the regressions allowing a maximum lag length (p) of 10 is set by the Akaike Information (AIC). As shown in Table 2, all series are stationary at least at the 5% level.

3.2 Svar model

The point of departure is a K -dimensional stationary VAR (p) process as indicated below;

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + CD_t + B_0 x_t + \ldots B_q x_{t-q} + u_t \tag{3}$$

Above, $y_t = (y_{1t},\ldots y_{kt})'$ is a $(K \times 1)$ vector of observable endogenous variables, D_t includes all deterministic variables such as a constant term, a linear trend term and dummy variables, $x_t = (x_{1t},\ldots, x_{Mt})'$ is a vector of M exogenous variables and $u_t = (u_{1t},\ldots, u_{Kt})$ is a K-dimensional unobservable zero-mean white noise that is, $E(u_t) = 0$ and has covariance matrix $E(\mu_t \mu_t') = \Sigma_u$. Finally, A_i, C and B_j parameter matrices (Lütkepohl, 2005:13).

Dynamic interactions between endogenous variables of a VAR(p) process are investigated by IRFs. In this respect, IRFs are estimated to trace out the responsiveness of dependent variables in the VAR to shocks to each of the variables for the following periods. Thus, if there are K variables in a system, a total of K^2 impulse responses could be generated (Brooks, 2008:299). In impulse response analysis, deterministic and exogenous variables are dropped from the system. If the process y_t is $I(0)$, VAR model impulse responses can be seen in moving average (MA) representation as shown below;

$$y_t = \Phi_0 u_t + \Phi_1 u_{t-1} + \Phi_2 u_{t-2} + \ldots, \tag{4}$$

where $(K \times K)$ identity matrix $(I_K) = \Phi_0$ and the Φ_S can be computed recursively as;

$$\Phi_S = \sum_{j=1}^{s} \Phi_{s-j} A_j, \qquad s = 1,2,\ldots, \tag{5}$$

The coefficients of this representation may reflect the responses to impulses hitting the system or the point estimates for the IRFs. The (i, j) th elements of the matrices Φ_S trace out the expected response of $y_{i,t+s}$ to a unit change in y_{jt} holding constant all past values of y_t. The change in y_{it}, given $\{y_{t-1}, y_{t-2},\ldots\}$, is measured by the innovation u_{it}. Therefore, the elements of Φ_S represent the impulse responses of the components of y_t with respect to the u_t innovations. Since the u_t's are 1-step ahead forecast errors, these impulse responses are called as forecast error impulse responses, whereas the accumulated effects of the impulses are obtained by adding up the Φ_S matrices (Breitung et al., 2007:166). The total long-run effects are given below;

$$\Phi = \sum_{s=0}^{\infty} \Phi_s = (I_k - A_1 - \ldots - A_p)^{-1} \tag{6}$$

On the other hand, the underlying shocks are not likely to occur in isolation if the components of u_t may be instantaneously correlated, that is, if Σ_u is not diagonal. At this point, a Cholesky decomposition of the covariance matrix Σ_u is used to orthogonalize the innovations of the VAR. Denoting by B a lower triangular matrix such that

$\sum_u = BB'$, the orthogonalized shocks that based on an one standard deviation shock, are given by $\varepsilon_t = B^{-1}u_t$ (JMulti Help System, 2008). In the stationary case, the form below is expressed;

$$y_t = \Psi_0 \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \ldots, \quad (7)$$

where $\Psi_i = \Phi_i B$ ($i = 0,1,2,\ldots$). Here $\Psi_0 = B$ is lower triangular. An ε or one standard deviation shock in the first variable may have an instantaneous effect on all the variables, whereas a shock in the second variable cannot have an instantaneous impact on y_{1t} but only on the other variables of the VAR model. Besides, different ordering of the variables in the vector y_t may produce different impulse responses. Accordingly, SVAR model has been developed JMulti Help System (2008).

For identifying the shocks in an impulse response analysis, SVAR model can be used. Within this context, restrictions are imposed on the matrices A and B in the SVAR model form as shown below;

$$Ay_t = A_1^* y_{t-1} + \ldots + A_p^* y_{t-p} + B\varepsilon_t \quad (8)$$

The residuals are represented as $B\varepsilon_t$. ε_t is a $(K \times 1)$ vector of structural shocks with covariance matrix $E\varepsilon_t\varepsilon_t) = \sum\varepsilon$, which is specified to be an identity matrix. In any case, structural shocks are instantaneously uncorrelated. SVAR model has three types, an A model where $B = I_K$, a B model where $A = I_K$ and a general AB model where restrictions can be placed on both matrices. For instance, the relation to the reduced form residuals is given by $Au_t = B\varepsilon_t$ in the AB-model. Therefore, a SVAR model's impulse responses can be obtained from process (7) with $\Psi_j = \Phi_j A^{-1}B$. If restrictions on the long-run effects are available, they may be placed on $\Psi = \Phi A^{-1}B$, Φ where is the matrix specified in (6). For instance, the restriction implying that some shocks do not have any long-run effects is achieved by setting the respective elements of the long-run impact matrix $\Psi = \Phi_0 + \Psi_1 + \ldots$ equal to zero (Breitung et al., 2007:167). Within this context, SVAR Blachard-Quah model proposed by Blanchard and Quah (1989) exposes the long-run effects of shocks by placing restrictions.

In Blanchard-Quah model $A = I_K$ and the matrix of long-run effects; $(I_K - A_1 - \ldots - A_p)^{-1}B$ is assumed to be lower-triangular. For instance, if a SVAR model contains three variables, the second residual has a zero long-run impact on the first variable, whereas the third residual cannot have a long-run impact on the first and second variable. Adjusting the order of variables may be necessary for ensuring that plausible restrictions are obtained. Estimation of Blanchard-Quah model is carried out by a Choleski decomposition of the matrix, $(I_K - \hat{A}_1 - \ldots - \hat{A}_p)^{-1}B\hat{\Sigma}_u(I_K - \hat{A}_1' - \ldots - \hat{A}_p')^{-1}$, where a hat indicates a reduced form estimate JMulti Help System (2008).

In addition to impulse response analysis, FEVDs are popular tools for interpreting VARs. Denoting the ij^{th} element of the orthogonalized impulse response coefficient matrix Ψ_n by $\varpi_{ij,n}$, the variance of the forecast error $y_{k,T+h} - y_{k,T+hT}$ is expressed as;

$$\sigma_k^2(h) = \sum_{n=0}^{h-1} (\varpi_{k1,n}^2 + \ldots + \varpi_{kK,n}^2) = \sum_{j=1}^{K} (\varpi_{kj,0}^2 + \ldots + \varpi_{kj,h-1}^2) \tag{9}$$

The term ($\varpi_{kj,0}^2 + \ldots + \varpi_{kj,h-1}^2$) is interpreted as the contribution of variable j to the h-step forecast error variance of variable k. Dividing the above terms by $\sigma_k^2(h)$, the percentage contribution of variable j to the h-step forecast error variance of variable k; $\varpi_{kj}(h) = (\varpi_{kj,0}^2 + \ldots + \varpi_{kj,h-1}^2) / \sigma_k^2(h)$ is obtained JMulti Help System (2008). Thereby, variance decompositions give the proportion of the movements in the dependent variables that are due to their own shocks versus shocks to the other variables. They determine how much of the h-step-ahead forecast error variance of a given variable is explained by exogenous shocks to the other variables (Brooks, 2008: 299-300).

4. EMPIRICAL RESULTS AND ANALYSES

In our study, SVAR Blanchard-Quah models are employed to analyze the relationship between industrial production difference, real bilateral exchange rate and nominal bilateral exchange rate for both Turkey and Germany and Turkey and Russia. Thus, two SVAR models for the time series vectors (y_t^{TURGER}, re_t^{TURGER}, ne_t^{TRYEUR})' and (y_t^{TURRUS}, re_t^{TURRUS}, ne_t^{TRYRUB})' are estimated depending on the same framework, VAR model with constant terms. Optimal lag lengths of the two VAR models are determined by using AIC, Hannan-Quinn Criteria (HQ) and Schwarz Criteria (SC). While SC suggests a lag length of 1, AIC and HQ suggest a lag length of 2 for both two VAR models. Thereby, it is implied that VAR(2) model is the most appropriate for the two SVAR Blanchard-Quah models. In order to identify the structural shocks of the SVAR models, long-run restrictions are imposed. For each two models, three restrictions are imposed assuming that nominal shock attributable to bilateral nominal exchange rate shock has no long-run effect on industrial production difference as well as on bilateral real exchange rate. It is also assumed that bilateral real exchange rate shock has no long-run effect on industrial production difference. Within this framework, SVAR models' IRFs are estimated to expose the dynamic behavior of the system and especially show the response of the industrial production difference and real and nominal bilateral exchange rates to a positive one standard deviation shock in nominal bilateral exchange rate for the next 36 months. In the impulse-response analysis, confidence intervals are implemented for reflecting the estimation variability of estimated impulse responses. Thereby, 95% Hall's Percentage Intervals are used and lower bands are shown in dashed lines in the figures[3]. Estimates of the IRFs of the two SVAR models are shown in Figure 3-8.

[3] See Hall (1992).

Figure 3: *Resp. of* y_t^{TURGER} *to* ne_t^{TRYEUR}

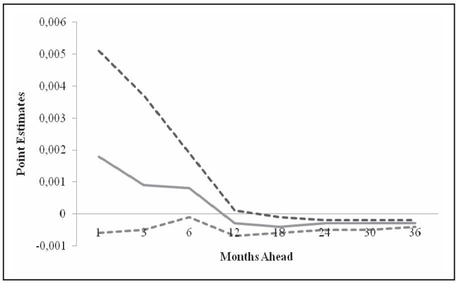


Figure 4: *Resp. of* y_t^{TURRUS} *to* ne_t^{TRYRUB}

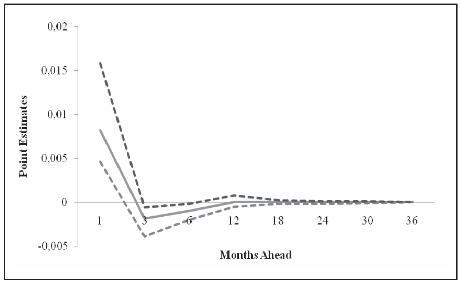


Figure 5: *Resp. of* re_t^{TURGER} *to* ne_t^{TRYEUR}

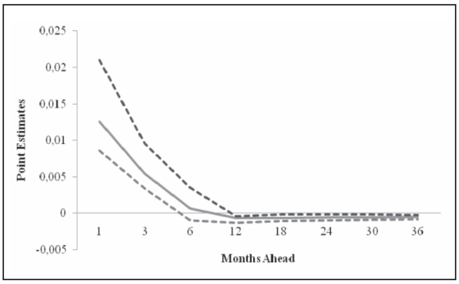


Figure 6: *Resp. of* re_t^{TURRUS} *to* ne_t^{TRYRUB}

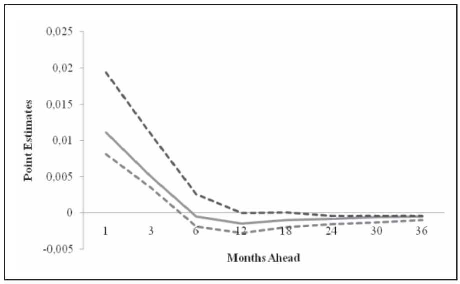


Figure 7: *Resp. of* ne_t^{TRYEUR} *to* ne_t^{TRYRUB}

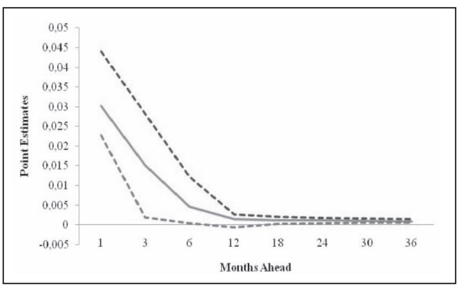
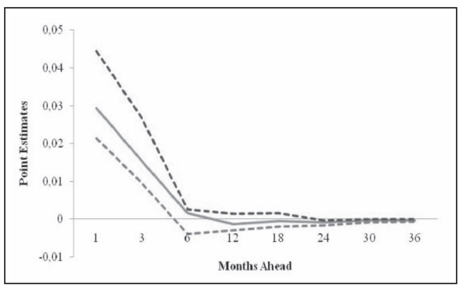


Figure 8: *Resp. of* ne_t^{TRYEUR} *to* ne_t^{TRYRUB}



Impulse response analysis points that after a positive one standard deviation shock in the nominal bilateral exchange rates (ne_t^{TRYEUR} and ne_t^{TRYRUB}), until the following 6 months, the real bilateral exchange rates (re_t^{TURGER} and re_t^{TURRUS}) exhibit an appreciation in real terms, whereas ne_t^{TRYEUR} and ne_t^{TRYRUB} appreciate in nominal terms. Thereby, it is indicated that the real bilateral exchange rates overshoot their long-run value immediately. These findings are in contrast to the popular one to three years delayed overshooting found in the earlier literature[4]. Similarly, it is shown that nominal exchange rates shocks have temporary effects on the industrial production differences. As consequence of the posi-

[4] See Eichenbaum & Evans (1993).

tive shocks in the nominal bilateral exchange rates (ne_t^{TRYEUR} and ne_t^{TRYRUB}) indicating the appreciation of the exchange rate of TRY against EUR and RUB in nominal terms, y_t^{TURGER} and y_t^{TURRUS} are affected positively to the 3rd and 12th month, respectively. Accordingly, it implied that exports of Turkey to Germany and Russia are promoted, whereas imports of Turkey from Germany and Russia is deteriorated since fluctuations of nominal exchange rates have also had major role in production costs of Turkey's manufacturing sector.

In addition to the IRFs, FEVDs are carried to show the degree of importance of nominal exchange rate for industrial production difference and real and nominal bilateral exchange rates in the following 36 months for both two cases. FEVD results of the two SVAR models are reflected in Table 3-5.

Table 3: *FEVD of the Industrial Production Differences*

	FEVD of y_t^{TURGER}			FEVD of y_t^{TURRUS}		
Forecast Horizon *h*	y_t^{TURGER}	re_t^{TURGER}	ne_t^{TRYEUR}	y_t^{TURRUS}	re_t^{TURRUS}	ne_t^{TURRUS}
1	0,13	0,39	0,48	0,65	0,05	0,30
3	0,14	0,38	0,48	0,65	0,09	0,26
6	0,15	0,38	0,47	0,64	0,09	0,27
12	0,18	0,37	0,45	0,64	0,09	0,27
18	0,20	0,36	0,44	0,64	0,09	0,27
24	0,21	0,36	0,43	0,64	0,09	0,27
30	0,22	0,35	0,43	0,64	0,09	0,27
36	0,23	0,35	0,42	0,64	0,09	0,27

Table 3 focuses on the results of the FEVD analysis for the industrial production differences. Table 3 indicates that y_t^{TURGER} accounts for nearly 25% of its variance up to the following 36 months. Up to 36 months, re_t^{TURGER} explains 35% of the variation in y_t^{TURGER}, whereas ne_t^{TRYEUR} account for 42% of the variance in y_t^{TURGER}. On the other hand, Table 3 shows that nearly 65% of the 36-step forecast error variance of y_t^{TURRUS} is explained by itself up to the following 36 months. Besides, re_t^{TURRUS} accounts for 9% of the 36-step forecast error variance of y_t^{TURRUS}, whereas net_t^{TRYRUB} explains nearly 27% of the variation in y_t^{TURRUS} up to 36 months. According to the FEVD analysis, it is exposed that causes of supply shocks affecting aggregate supply become major determinants of the industrial production differences. Thus, resource prices and changes in production technology in these countries may play an important role for explaining the industrial production differences. For both cases, findings of the FEVD analysis also stressed that dynamics of the foreign exchange markets changing nominal exchange rates seriously affect the industrial production differences. Thus, dynamics of the foreign exchange markets should be examined since several studies such as Najand et al., 1992; Fung & Patterson, 1999; Kearney & Patton, 2000; Speight & McMillan, 2001) concluded that volatility in exchange rates are closely linked across exchange rates. In addition to the dynamics of the foreign exchange rate markets, monetary and exchange rate policies of CBRT, European Central Bank (ECB) and CBRF and fiscal policy implementations in Turkey, Germany and Russia influencing price levels and nominal exchange rates should be considered since real exchange rate misalignment may hinder the real economic activity. This implication is in line with the outcome of a number of researches such as (Dornbusch, 1976, 1989; Mendoza, 1991; Hirschman, 1949; Krugman, 1999; Goldfajn & Werlang, 2000; Clark, 1973; Baron, 1976; Hooper & Kohlhagen, 1978 and Broll, 1994) concerning the response of output to movements in the real exchange rates.

Table 4: *FEVD of the Real Bilateral Exchange Rates*

	FEVD of re_t^{TURGER}			**FEVD of re_t^{TURRUS}**		
Forecast Horizon *h*	y_t^{TURGER}	re_t^{TURGER}	ne_t^{TRYEUR}	y_t^{TURRUS}	re_t^{TURRUS}	ne_t^{TRYRUB}
1	0,02	0,50	0,48	0,15	0,17	0,68
3	0,02	0,50	0,48	0,12	0,22	0,66
6	0,02	0,53	0,45	0,13	0,29	0,58
12	0,04	0,53	0,43	0,16	0,40	0,44
18	0,06	0,52	0,42	0,17	0,46	0,37
24	0,08	0,51	0,41	0,17	0,49	0,34
30	0,10	0,50	0,40	0,17	0,51	0,32
36	0,11	0,49	0,40	0,17	0,52	0,31

As shown in Table 4, re_t^{TURGER} has the highest explanatory power over the variation of itself, which explains nearly 50% of the 36-step forecast error variance, whereas ne_t^{TRYEUR} accounts for 40% of the variation in re_t^{TURGER}. Accordingly, FEVD results beckon that price levels of Turkey and Germany and nominal TRY/EUR exchange rate are the two major causes of the movements in bilateral real exchange rate between Turkey and Germany. Similarly, price levels of Turkey and Russia and nominal TRY/RUB exchange rate are also important factors for analyzing variation in bilateral real exchange rate between Turkey and Russia. According to Table 7, while 52% of the 36-step forecast error variance of re_t^{TURRUS} is explained by itself, ne_t^{TRYRUB} accounts for 31% of the variation in re_t^{TURRUS} up to the following 36 months. FEVD results imply that real exchange rate misalignment may arise from foreign exchange rate markets and inflation dynamics for both two cases. Thus, interactions between monetary and exchange rate policies in Turkey, Germany and Russia should be determined in open economy framework since monetary policy authority affects the real exchange rate by changing the price level and the nominal exchange rate via its policy instruments as Eichenbaum & Evans (1993) and Clarida and Gali (1994) noted. Besides, factors affecting relative production costs in the sectors producing traded and non-traded commodities should particularly be examined as Ricci & MacDonald (2005) suggested.

Table 5: *FEVD of the Nominal Bilateral Exchange Rates*

	FEVD of ne_t^{TRYEUR}			FEVD of ne_t^{TRYRUB}		
Forecast Horizon *h*	y_t^{TURGER}	re_t^{TURGER}	ne_t^{TRYEUR}	y_t^{TURRUS}	re_t^{TURRUS}	ne_t^{TRYRUB}
1	0,14	0,38	0,48	0,20	0,05	0,76
3	0,15	0,36	0,49	0,19	0,03	0,78
6	0,17	0,35	0,48	0,17	0,03	0,80
12	0,19	0,34	0,47	0,18	0,04	0,78
18	0,21	0,33	0,46	0,18	0,05	0,77
24	0,21	0,33	0,46	0,18	0,06	0,76
30	0,22	0,33	0,45	0,18	0,06	0,76
36	0,23	0,33	0,44	0,18	0,07	0,75

Table 5 exposes the results of the FEVD analysis for nominal exchange rates. Up to 36 months, 44% of the variation in ne_t^{TRYEUR} is accounted for itself, whereas re_t^{TURGER} explains 33% of the variation in ne_t^{TRYEUR}. According to these findings, fluctuations in nominal TRY/EUR exchange rate and bilateral real exchange rate between Turkey and Germany influence the movements in nominal TRY/EUR exchange rate seriously in future periods. Table 5 also shows the forecast error variance results for ne_t^{TRYRUB} up to 36 months. According to the analysis, ne_t^{TRYRUB} has the highest explanatory power which accounts for 75% over the variation in itself. These findings expose that causes of nominal TRY/RUB exchange rate changes are critically important. Thereby, it is emphasized that previous values of the nominal exchange rates should be considered as the most important factor for analyzing the fluctuations in nominal exchange rates. Within this context, dynamics of foreign exchange markets influencing the expectations relating to the nominal exchange rates should be examined in detail. Besides, nominal exchange rates depend on the expectations of macroeconomic variables since they act as an asset price as Frenkel and Mussa (1985) and Obstfeld and Rogoff (1996) stated. Thus, possible effects of macroeconomic policies in Turkey, Germany and Russia on nominal exchange rates should also be evaluated. On the other hand, FEVD analysis also reveals that price levels of Turkey, Germany and Russia and the industrial production differences are important factors of the nominal exchange rate fluctuations. Accordingly, determinants of the changes in aggregate demand and supply both in Turkey, Germany and Russia should also be explored for exposing the causes of the movements in the nominal exchange rates for the following years.

5. CONCLUSION

Economic globalization phenomena comprising of the globalization of production, markets, competition, and corporations and industries have been prevalent particularly over the last three decades. Accordingly, national economies have also been influenced seriously from each other leading to differences in macroeconomic conditions among countries. As a result of the integration of financial markets and the acceleration of capital flows due to economic globalization, interactions between exchange rates and macroeconomic variables have increased. Particularly, real and nominal exchange rate fluctuations and differentials of output growth across countries have become critically important for each other in this process Therefore, long-run relationship between industrial production difference, bilateral real exchange rate and nominal exchange rate are explored in our study via IRFs and FEVD analysis based on the estimated two SVAR models for Turkey and Germany and Turkey and Russia separately.

IRFs beckon that shocks in the nominal exchange rates have temporary effects on the industrial production differences. Thereby, it is revealed that exchange rates policies of central banks can not influence the real economic activity in long-run. Nevertheless, factors determining the nominal TRY/EUR and TRY/RUB exchange rates and price levels of Turkey, Germany and Russia may play a major role in determining the industrial production differences according to the results of FEVD analysis. Therefore, effects of the monetary, fiscal and exchange rate policies in Turkey, Germany and Russia on the real economic activity should also seriously be examined in open economy framework.

In our study, causes of the variation in bilateral real exchange rates between Turkey and its major trade partners, Germany and Russia and nominal exchange rates, TRY/EUR and TRY/RUB are also examined. IRFs emphasize that as a result of a positive shock in the nominal bilateral exchange rates, the real bilateral exchange rates overshoot their long-run value immediately, but the contribution of nominal exchange rates shocks to real exchange rate movements is temporary. On the other hand, FEVD analysis exposes that the nominal bilateral exchange rates may play a major role in determining real and nominal exchange bilateral rates. Thus, the dynamics of foreign exchange markets, monetary and exchange rate policies of the CBRT, ECB and CBRF and fiscal policy implementations in Turkey, Germany and Russia are critically important for analyzing the movements of bilateral real and nominal exchange rates. Within this context, interactions between monetary, fiscal and exchange rate policies in Turkey, Germany and Russia should be explored for further analysis on real and nominal exchange rate fluctuations. Furthermore, determinants of industrial production differences should be considered since cross-border movement of goods, services, technology and capital have rapidly increased in the process of economic integration between countries.

REFERENCES

Abuaf, N. & Jorion, P. (1990). Purchasing Power Parity in the Long Run. *Journal of Finance,* 45, 157-174.

Adler, M. & Lehmann, B. (1983). Deviations from Purchasing Power Parity in the Long- run. *Journal of Finance,* 38, 1471-1487.

Auer, R. & Chaney, T. (2009). Exchange Rate Pass-Through in a Competitive Model of Pricing-to-Market. *Journal of Money, Credit and Banking,* 41 (2), 151-175.

Balassa, B. (1964). The Purchasing Power Parity Doctrine: A Reappraisal. *Journal of Political Economy,* 72, 584–96.

Barhoumi, K. (2005). Long Run Exchange Rate Pass-Through into Import Prices in Developing Countries: An Homogeneous or Heterogeneous Phenomenon?. *Economics Bulletin,* 6(14), 1-12.

Baron, D. P. (1976). Fluctuating Exchange Rates and the Pricing of Exports. *Economic Inquiry,* 14 (3), 425–438.

Bayoumi, T. & Eichengreen, B. (1994). Macroeconomic Adjustment under Bretton Woods and the Post-Bretton-Woods Float: An Impulse-Response Analysis. *Economic Journal, Royal Economic Society,* 104 (425), 813-827.

Berument, H. & Pasaogullari, M. (2003). Effects of the Real Exchange Rate on Output and Inflation: Evidence from Turkey. *The Developing Economies,* 41(4), 401–435.

Bilson, J. F. O. (1978). The Monetary Approach to the Exchange Rate: Some Empirical Evidence. *IMF Staff Papers,* 25 (1), 48-75.

Bilson, J. F. O. (1979). Recent Developments in Monetary Models of Exchange Rate Determination. *IMF Staff Papers,* 26 (2), 201-223.

Blanchard, O. J. & Quah, D. (1989). The Dynamic Effects of Aggregate Demand and Supply Disturbances. *American Economic Review,* 79 (4), 655-73.

Breitung, J., Brüggemann, R. & Lütkepohl, H. (2007). Structural Vector Autoregressive Modeling and Impulse Responses. In Lütkepohl, H. & Kratzig, M. (Eds.), *Applied Time Series Econometrics* (pp. 159-195*).* New York: Cambridge University Press.

Broll, U. (1994). Foreign Production and Forward Markets. *Australian Economic Papers*, 62, 1–6.

Brooks, C. (2008). *Introductory Econometrics for Finance,* New York: Cambridge University Press.

Burstein, A., Eichenbaum, M. & Rebelo, S. (2005). Large Devaluations and the Real Exchange Rate. *Journal of Political Economy*, 113 (4), 742–784.

Bussière, M. & Peltonen, T. (2008). Exchange Rate Pass-through in the Global Economy - The Role of Emerging Market Economies. *European Central Bank Working Paper Series,* 951, 1-47.

Campa, J. M. & Goldberg, L. S. (2002). Exchange Rate Pass-Through into Import Prices: A Macro or Micro Phenomenon?. *NBER Working Papers,* 8934, 1-34.

Clarida, R. & Gali, J. (1994). Sources of Real Exchange Rate Fluctuations: How Important are Nominal Shocks?. *NBER Working Papers,* 4658, 1-84.

Clark, P. (1973). Uncertainty, Exchange Risk and the Level of International Trade. *Western Economic Journal,* 11 (3), 302–313.

Darvas, Z. (2001). Exchange Rate Pass-through and Real Exchange Rate in EU Candidate Countries. *Deutsche Bundesbank, Research Centre Discussion Paper Series,* 10, 1-76.

Davidson, R., & MacKinnon, J.G. (1993). *Estimation and Inference in Econometrics.* London: Oxford University Press.

De Bandt, O., Banerjee, A. & Kozluk, T. (2008). Measuring Long-run Exchange Rate Pass-through. *Economics — The Open-access, Open-assessment E-Journal*, 2 (6), 1-40.

Devereux, M. B. & Engel, C. (2002). Exchange Rate Pass-Through, Exchange Rate Volatility, and Exchange Rate Disconnect. *NBER Working Papers,* 8858, 1-43.

Devereux, M.B. & Yetman, J. (2002). Price Setting and Exhange Rate Pass-Through. *Hong Kong Institute for Monetary Research Working Papers,* 222002, 1-25.

Diebold, F. X. & Nason, J. A. (1990). Nonparametric Exchange Rate Prediction. *Journal of International Economics,* 28 (3/4), 315-332.

Dornbusch, R. (1976). Expectations and Exchange Rate Dynamics. *Journal of Political Economy*, 84, 1161-1176.

Dornbusch, R. (1989). Real Exchange Rates and Macroeconomics: A Selective Survey. *The Scandinavian Journal of Economics*, 91 (2), 401-432.

Eichenbaum, M. & Evans, C.L. (1993). Some Empirical Evidence on the Effects of Monetary Policy Shocks on Exchange Rates. *NBER Working Papers,* 4271, 1-47.

Engel, C. (1993). Real Exchange Rates and Relative Prices: An Empirical Investigation. *Journal of Monetary Economics*, 32, 35-50.

Engel, C. (1999). Accounting for U.S. Real Exchange Rate Changes. *Journal of Political Economy,* 107, 507–538.

Frenkel, J. A & Mussa, M. (1985), Assets Markets, Exchange Rates and the Balance of Payments, *NBER Working Papers,* 1287, 1-117.

Frankel, J. A. & Wei, S. J. (1993). Is There a Currency Bloc in the Pacific?. In Blundell-Wignall, Adrian (Ed.), *The Exchange Rate, International Trade and the Balance of Payments* (pp. 275-307). Australia: Reserve Bank of Australia.

Frenkel, J. A. (1976). A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence. *Scandinavian Journal of Economics*, 78, 200-224.

Fung, H-G. & Patterson, G. (1999). Volatility Linkage among Currency Futures Markets

During US Trading and Non-trading Periods. *Journal of Multinational Financial Management,* 9, 129-153.

Goldfajn, I. & Werlang, S. R. C. (2000). The Pass-through from Depreciation to Inflation: A Panel Study. *Banco Central do Brasil Working Paper Series*, 5, Brasília, 1-45.

Hall, P. (1992) *The Bootstrap and Edgeworth Expansion,* Springer. New York.

Hirschman, A. O. (1949). Devaluation and the trade balance: A Note. *Review of Economics and Statistics,* 31, 50-53.

Hooper, P. & Kohlhagen, S. W. (1978). The effect of Exchange Rate Uncertainty on the Prices and Volume of International Trade. *Journal of International Economics,* 8, 483-511.

Huang, R.D. (1990). Risk and Parity in Purchasing Power. *Journal of Money, Credit and Banking,* 22(3), 338-56.

Huizinga, J. (1987). An Empirical Investigation of the Long-run Behavior of Real Exchange Rates. *Carnegie-Rochester Conference Series on Public Policy*, 27, 149-214.

Inoue, T. & Hamori, S. (2009). What Explains Real and Nominal Exchange Rate Fluctuations? Evidence from SVAR Analysis for India. *Economics Bulletin*, 29 (4), 2803-2815.

JMulTi *(Time Series Analysis with Java) Econometric Software Help System,* Version.4.23.

Kandil, M. &http://www.sciencedirect.com/science/article/pii/S1062976902001461 - aff1 Mirzaie, A. I. (2003). The effects of Dollar Appreciation on Sectoral Labor Market Adjustments: Theory and evidence. *The Quarterly Review of Economics and Finance,* **43 (1)**, 89-117.

Kandil, M., Berument, H. & Dincer, N. N. (2007). The Effects of Exchange Rate Fluctuations on Economic Activity in Turkey. *Journal of Asian Economics,* 18, 466–489.

Kearney, C. & Patton, A. (2000). Multivariate GARCH Modeling of Exchange Rate Volatility Transmission in the European Monetary System. *Financial Review,* 35, 29-48.

Koray, F. & Lastrapes, W. D. (1989). Real Exchange Rate Volatility and U.S. Bilateral Trade: A VAR Approach. *Review of Economics and Statistics,* 71, 708-712.

Krugman, P. & Taylor, L. (1978). Contractionary Effects of Devaluation. *Journal of International Economics,* 8 (3), 445-456.

Krugman, P. (1990). Equilibrium Exchange Rates, In Branson, W.H., Frenkel, J.A. & Goldstein, M. (Eds.), *International Monetary Policy Coordination and Exchange Rate Fluctuations* (pp. 159-196). Chicago: University of Chicago Press.

Krugman, P. (1993). Recent Thinking About Exchange Rate Determination and Policy. In Blundell-Wignall, A. (Ed.), *The Exchange Rate, International Trade and the Balance of Payments* (pp. 6-22). Australia: Reserve Bank of Australia.

Krugman, P. (1999). Balance Sheets, the Transfer Problem, and Financial Crises. *International Tax and Public Finance,* 6, 459–472.

Lastrapes, W. D. & Koray, F. (1990). Exchange Rate Volatility and U.S. Multilateral Trade Flows. *Journal of Macroeconomics,* 12 (3), 341-362.

Lastrapes, W. D. (1992). Sources of Fluctuations in Real and Nominal Exchange Rates. *The Review of Economics and Statistics*, 74 (3), 530-539.

Lütkepohl, H. (2005). *New Introduction to Multiple Time Series Analysis,* Springer. Berlin.

Lütkepohl, H. (2007). Univariate Time Series Analysis. In Lütkepohl, H. & Kratzig, M. (Eds.), *Applied Time Series Econometrics* (pp. 8-84). New York: Cambridge University Press.

Meese, R. A. & Rose, A. K. (1991). An Empirical Assessment of Non-linearities in Models of Exchange Rate Determination. *Review of Economic Studies,* 58 (3), 603-19.

Mendoza, E. G. (1991). Capital Controls and the Gains from Trade in a Business Cycle Model of a Small Open Economy. *IMF Staff Papers,* 38 (3), 480-505.

Mumtaz, H., Oomen, O. & Wang, J. (2006). Exchange Rate Pass-Through into UK Import Prices. *Bank of England Working Paper,* 312, 1-25.

Mussa, M. (1986). Nominal Exchange Rate Regimes and the Behavior of Real Exchange Rates: Evidence and Implications. *Carnegie-Rochester Conference Series on Public Policy,* 25 (1), 117-214.

Najand, M., Rahman, H. & Yung, K. (1992). Inter-currency Transmission of Volatility in Foreign Exchange Futures. *Journal of Futures Markets,* 12, 609-620.

Obstfeld, M. & Rogoff, K. (1996). *Foundations of Open Economy Macroeconomics*, MIT Press. Cambridge.

Pantula, S. G. (1989). Testing For Unit Roots In Time Series Data. *Econometric Theory,* 5, 256-271.

Ricci, L. A. & MacDonald, R. (2005). PPP and the Balassa Samuelson Effect: The Role of the Distribution Sector. *IMF Working Paper,* 01/38, 1-40.

Rogers, J. H. (1999). Monetary Shocks and Real Exchange Rates. *Journal of International Economics*, 49 (2), 269-288.

Roll, R. (1979). Violations of Purchasing Power Parity and Their Implications for Efficient Commodity Markets. In Sarnat M. & Szego, G. (Eds.), *International Finance and Trade Vol.1* (pp. 133-179). Cambridge: Cambridge University Press.

Samuelson, P. A. (1964). Theoretical Notes on Trade Problems. *Review of Economics and Statistics,* 46, 145–54.

Shu, C., Su, X. & Chow, N. (2008). Exchange Rate Pass-through in Mainland China. *China Economic Issues*, 1/08, 1-16.

Speight, A. & McMillan, D. (2001) Volatility Spillovers in East European Black-market

Exchange rates. *Journal of International Money and Finance*, 20, 367-378.

Stockman, A. C. (1980). A Theory of Exchange Rate Determination. *Journal of Political Economy,* 88 (4), 673-698.

Stulz, J. (2007). Exchange Rate Pass-through in Switzerland: Evidence from Vector Autoregressions. *SNB Economic Studies,* 2007-4, 1-36.