Day of the Week Effect on Turkish Foreign Exchange Market Volatility During the Global Financial Crisis

Ece Oral[1]
Central Bank of the Republic of Turkey, İstiklal Cad. No: 10, Ankara, Turkey, 06100

Abstract

Exchange rate activities have effects on capital flows and international trade that are crucial particularly for developing countries. The day of the week effect on exchange rates can also be very essential for portfolio managers and economists. Therefore, the day of the week effect should be examined carefully in order to understand the cause of the anomalies in the market. This paper evaluates the day of the week effect on the daily returns on US dollar and its volatility in the light of the global financial crisis 2008-2009.

Key Words: Exchange Rate; Volatility; Day of the week effect

1. Introduction

The properties of the daily exchange rate have important implications for economist and portfolio managers. The effects of exchange rate movements on international trade and capital flows can be vital, especially for developing economies. Moreover, understanding the day of the week effect on the exchange rate as well as on its variance could be important for portfolio managers when they construct their international assets portfolios.

There is broad literature on the day of the week effect on daily depreciation (McFarland et al, 1982; Hilliard and Tucker, 1992; and Cornett et al, 1995). Domodaran (1989) notes that bad news tends to be reported on Fridays and due to delayed release of the information, Mondays are associated with lower returns. Wang et al. (1997) find the Monday effect but only for the last 2 weeks of the month. Additionally, Foster and Vishwanathan (1990) claim that Mondays have more news to evaluate; therefore trade tends to be less intensive (Berument et al, 2007). Aydogan and Booth (2003) argue that the day of the week effect is present in the daily depreciation of the local currency in Turkey for the 1986-1994 period. Berument et al. (2007) extend the literature by allowing the conditional variance of the daily depreciation to change; showing that this change is possibly affected by the day of the week effect and by allowing this conditional variance to affect the exchange rate. They found that Thursdays are associated with higher and Mondays with lower depreciation rates compared to those of Wednesdays. Moreover, Mondays and Tuesdays are associated with higher volatility than Wednesdays. Parallel studies were made for the foreign equity markets by Berument and Kiymaz (2001), Kiymaz and Berument (2003).

[1] The views expressed in this paper are those of the author and do not necessarily correspond to the views of the Central Bank of the Republic of Turkey.

This paper assesses the day of the week effect on the daily returns on US dollar and its volatility in the light of the global financial crisis 2008-2009.

In the following section, the data and methodology are introduced. Section 3 discusses the empirical evidence and the last section provides the conclusions.

2. Data and Methodology

Daily data starting on April 1, 2002 and ending on March 20, 2012 is used. The depreciation of local currency against the USD is calculated as the growth rate of the TRY value of the USD.

$$\boldsymbol{R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100}$$

Where P_t is the Turkish lira value of the US dollar and R_t is the daily depreciation rate of the Turkish lira.

In order to model the exchange rate, the depreciation rate on 5 daily dummies to account for the day of the week effect is regressed. In order to account for the autocorrelation problem of errors, lagged values of the depreciation rates are included in the equation:

$$\boldsymbol{R_t = \propto_0 + \propto_1 M_t + \propto_2 T_t + \propto_3 TH_t + \propto_4 F_t + \sum_{i=1}^{n} \theta_i R_{t-i} + \varepsilon_t} \quad (1)$$

where M_t, T_t, TH_t and F_t are the dummy variables for Monday, Tuesday, Thursday and Friday at time t, and n is the lag order.

GARCH-in-Mean given in the equation below is used where the expected return on an asset is related to the expected asset risk:

$$\boldsymbol{R_t = \propto_0 + \propto_1 M_t + \propto_2 T_t + \propto_3 TH_t + \propto_4 F_t + \sum_{i=1}^{n} \theta_i R_{t-i} + \rho h_t + \varepsilon_t} \quad (2)$$

The estimated coefficient on the expected risk ($\hat{\boldsymbol{\rho}}$) is a measure of the risk-return tradeoff.

For the heteroscedasticity (error variances are not constant over time) problem, variances of errors are allowed to be time dependent where e_t ~(0, h_t^2). Then, exponential generalized autoregressive conditional heteroscedastic (EGARCH(1,1)) model is used for the conditional variance (Nelson, 1991):

$$\boldsymbol{logh_t^2 = \beta_0 + \varphi_1 logh_{t-1}^2 + \vartheta_1 \left|\frac{\varepsilon_{t-1}}{h_{t-1}}\right| + \delta \frac{\varepsilon_{t-1}}{h_{t-1}}} \quad (3)$$

The EGARCH specification has certain advantages. The conditional variance is in logarithmic form, which allows that h_t^2 can never be negative. It also allows the leverage effect. The presence of leverage effects can be tested by the hypothesis that $\delta=0$.

There are several studies in the literature which recommend the addition of exogenous variables in the ARCH specifications. For instance, Karolyi (1995) includes the volatility of foreign stock returns to explain the conditional variance of home country stock returns. Hsieh (1988) considers including the day of the week effect in volatility for various exchange rates. According to these studies, the conditional variability of depreciation is modeled by incorporating the day of the week effect into the volatility equation. In this way, the constant term of the conditional variance equation is allowed to vary for each day. Therefore, the model in (3) becomes:

$$\boldsymbol{logh_t^2 = \beta_0 + \varphi_1 logh_{t-1}^2 + \vartheta_1 \left|\frac{\varepsilon_{t-1}}{h_{t-1}}\right| + \delta\frac{\varepsilon_{t-1}}{h_{t-1}} + \beta_1 M_t + \beta_2 T_t + \beta_3 TH_t + \beta_4 F_t} \quad (4)$$

The depreciation of local currency for all days indicates heavy tailed distribution (Table 1). Therefore, Generalized Error Distribution(GED) is used to capture this pattern.

3. Empirical Evidence

First of all we examine the descriptive statistics of each day in order to search for any variation among days (Table 1). According to the mean values, it can be said that Tuesday is associated with the highest return whereas Monday & Friday are associated with the lowest return. Likewise, median values support this statement. In addition to this, the distributions of most days are skewed and heavy-tailed. The results of Table 1 make us consider about the existence of the day of the week effect.

Table 1: Descriptive Statistics

	All Days	***Monday***	***Tuesday***	***Wednesday***	***Thursday***	***Friday***
# obs.	2485	499	500	491	497	498
Mean	0.02	-0.02	0.07	0.06	0.00	-0.03
Median	-0.07	-0.14	-0.01	-0.03	-0.08	-0.05
Minimum	-11.25	-3.04	-3.85	-2.74	-2.55	-11.25
Maximum	7.29	5.65	4.23	4.37	7.29	6.07
Std.Dev.	0.92	0.89	0.96	0.80	0.93	0.99
Skewness	0.22	1.54	0.42	0.69	1.40	-2.18
Kurtosis	16.72	10.19	5.25	6.24	11.30	38.97

The global financial crisis is commonly believed to have begun in July 2007 with the credit crunch, when a loss of confidence by US investors in the value of sub-prime mortgages caused a liquidity crisis. By September 2008, the crisis had worsened as stock markets around the globe became highly volatile. The collapse of Lehman Brothers in September 2008 marked the beginning of a new phase in the global financial crisis. In order to capture the effect of crisis on our model we split the data into two periods such as Pre-global crisis (04.01.2002-08.29.2008) and Post global crisis (09.01.2008-03.20.2012) (Figure 1).

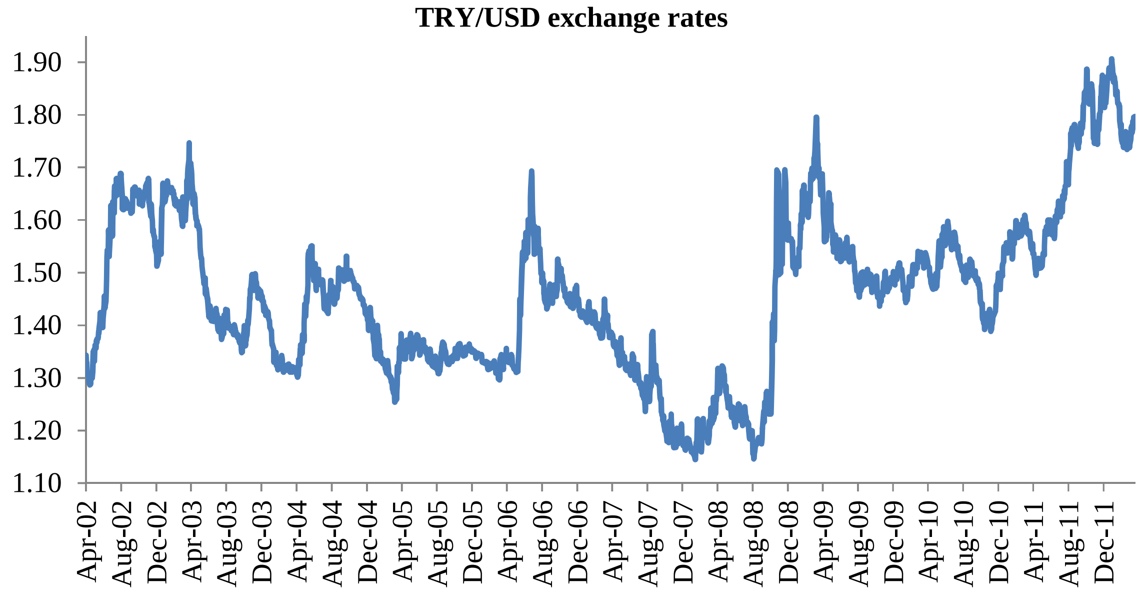

Figure 1: TRY against USD

Table 2 reports the estimates of the models in (2) and (4). The second and third columns report the estimates for Pre-Global Crisis period and Post-Global Crisis period respectively.

According to the results of the whole sample, the estimated coefficient for T_t is the highest and the lowest is for M_t. This suggests that the highest returns are observed for Tuesdays and the lowest returns for Mondays. The coefficient of Monday is statistically significant. This suggests that Mondays offer statistically significant higher return when compared to Wednesdays. Besides, the estimated coefficients for M_t, T_t, TH_t, and F_t are jointly statistically significant. This suggests that the day of the week effect is present. It is also found that return is affected by asset risk (risk-averse agents must be compensated to accept higher risk). Then, the estimates of the conditional variance model are examined. The estimated coefficients for all each day are jointly statistically significant that indicates the day of the week effect also exists in variance equation. The estimated coefficient for the leverage effect,δ, is positive and statistically significant. This implies that positive innovations are more destabilizing than negative innovations. The highest variances are observed on Tuesdays and the lowest variances on Mondays.

According to the results of the pre-crisis period, none of the coefficients of the week days are statistically significant in mean equation. However, the day of the week effect is present in the variance equation. Moreover, the highest variances belong on Tuesdays and the lowest variances on Fridays.

For the period after crisis, the estimated coefficients for M_t, T_t, TH_t, and F_t are jointly statistically significant in the mean equation. This suggests that the day of the week effect is present. Moreover, the coefficient of Monday and Thursday are statistically significant in the mean equation. The highest returns are observed for Tuesdays and the lowest returns for Thursdays. Nonetheless, the day of the week effect is not present in the variance equation after the crisis.

The estimated coefficient for the leverage effect is positive and statistically significant for both periods. It is also found that return is affected by asset risk and the estimated coefficient on the risk for post global crisis period is greater than the coefficient for the whole period. This effect is not statistically significant for pre-crisis period.

Table 2: Day of the Week Effect on the Turkish Foreign Exchange Market*:

	Full Sample	***Pre-Global Crisis***	***Post-Global Crisis***
Mean Equation			
$\propto_0$	-0.097 (0.032)	-0.111 (0.040)	-0.082 (0.321)
M_t	-0.089 (0.024)	-0.058 (0.210)	-0.133 (0.071)
T_t	0.017 (0.684)	0.030 (0.549)	-0.016 (0.825)
TH_t	-0.042 (0.273)	0.059 (0.202)	-0.236 (0.001)
F_t	-0.024 (0.545)	0.013 (0.777)	-0.071 (0.325)
R_{t-1}	0.040 (0.057)	0.020 (0.449)	0.034 (0.340)
R_{t-2}	-0.058 (0.005)	-0.072 (0.005)	-0.021 (0.548)
ρ	0.124 (0.038)	0.046 (0.522)	0.265 (0.012)
Variance Equation			
β_0	-0.585 (0.000)	-0.723 (0.000)	-0.354 (0.021)
φ_1	0.943 (0.000)	0.914 (0.000)	0.976 (0.000)
ϑ_1	0.289 (0.000)	0.352 (0.000)	0.206 (0.000)
δ	0.087 (0.000)	0.097 (0.001)	0.063 (0.004)
M_t	0.277 (0.038)	0.356 (0.032)	0.094 (0.686)
T_t	0.618 (0.000)	0.783 (0.000)	0.303 (0.250)
TH_t	0.472 (0.003)	0.609 (0.004)	0.223 (0.366)
F_t	0.293 (0.013)	0.262 (0.138)	0.274 (0.127)
Joint test for day effect in Mean	(0.094)	(0.163)	(0.008)
Joint test for day effect in Variance	(0.003)	(0.002)	(0.665)
ARCH-LM(5)	(0.903)	(0.853)	(0.875)
ARCH-LM(10)	(0.981)	(0.989)	(0.778)
ARCH-LM(40)	(0.081)	(0.999)	(0.852)
ARCH-LM(60)	(0.101)	(1.000)	(0.926)

*p-values are reported in parentheses.

4. Conclusion

This paper assesses the day of the week effect on foreign exchange rate changes and their volatility with an EGARCH specification. It also examines the changes in the pattern after the global crisis. Day of the week effect is found to exist in mean equation for the period of post global crisis while it exists in volatility specification for pre-global crisis period. The evidence presented in this paper suggests that Tuesdays offer statistically significant higher return when compared to Wednesdays for the whole sample and the post global crisis period. The highest variances are observed on Tuesdays and the lowest variances on Mondays for the whole period. Moreover, expected asset risk is found to have an effect on expected return after global crisis. As a final remark, there is positive leverage effect such as an increase in depreciation creates more volatility than a decrease for not only pre-global crisis period but also post global crisis period.

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