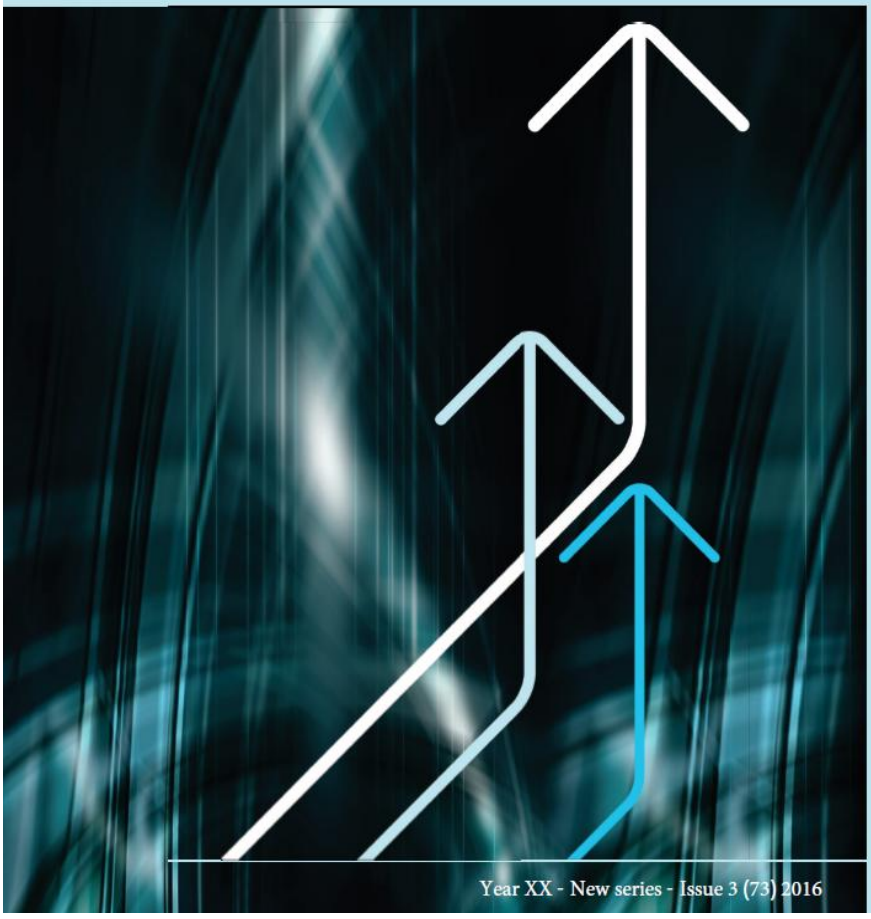
Romanian Academy
"Costin C. Kiriţescu" National Institute for Economic Research
"Victor Slăvescu" Centre for Financial and Monetary Research

# Financial Studies



Year XX - New series - Issue 3 (73) 2016

“VICTOR SLĂVESCU” CENTRE FOR FINANCIAL
AND MONETARY RESEARCH

---

# FINANCIAL STUDIES

ROMANIAN ACADEMY
"COSTIN C. KIRIȚESCU" NATIONAL INSTITUTE FOR ECONOMIC RESEARCH
"VICTOR SLĂVESCU" CENTRE FOR FINANCIAL AND MONETARY RESEARCH

# FINANCIAL STUDIES

**Year XX – New series – Issue 3 (73)/2016**

**ROMANIAN ACADEMY**
**"COSTIN C. KIRIȚESCU" NATIONAL INSTITUTE FOR ECONOMIC RESEARCH**
**"VICTOR SLĂVESCU" CENTRE FOR FINANCIAL AND MONETARY RESEARCH**

**Quarterly journal of financial and monetary studies**

**Issue3/2016 (73,Year XX)**

**ISSN 2066 - 6071**
**ISSN-L 2066 - 6071**

# CONTENTS

# DOES ECONOMIC CRISIS AFFECT THE DEMAND FOR MONEY: EVIDENCE FROM CROATIA?

**Tonći SVILOKOS, PhD***

**Abstract**

The purpose of this paper is to examine whether there are significantly different characteristics of the demand for money in Croatia in the period before and during the recession. The paper applies error correction model (ECM) and autoregressive distributed lag (ARDL) approach, estimating model 1 for the period of growth, and model 2 for the period of recession. Structural stability of these models was tested by cumulative sum and cumulative sum of square tests. Comparing the results of the models, the substantial changes in the function of the demand for money has been detected. Namely, the research shows that variables: interest rates (IR), real effective exchange rate (REER) and inflation (CPI) are significant in model 1, while the variable industrial production (IP) is not significant. In model 2 only industrial production (IP) and inflation (CPI) have been found to be statistically significant with the adequate sign.

**Keywords**: money demand, economic crisis, error correct model, autoregressive distributed lag, Croatia

**JEL Classification:** E41, G01

## 1. Introduction

Understanding the issues about money demand is a prerequisite for conducting adequate monetary policy. This is why the determinants of money demand have been extensively studied by both policy makers in the central banks, as well as academic researchers. The focus of interest is often directed toward questions which variables should be included in money demand function and which monetary aggregate best describes money demand. Another very important question that should be thoroughly investigated is whether the relationship between the chosen variables and the demand for money under various conditions is persistent. It could be

* *Assistant Professor, University of Dubrovnik, Croatia.*

expected that during the recession money demand changes its characteristics. The goal of this paper is to investigate if this is the case for Croatia.

Namely, at the end of 2008 Croatia has entered into the long-lasting deep recession with very high negative GDP growth rates (-8.6% in 2009q1, -8.2% in 2009q2, etc.). Although Croatia in 2nd and 3rd quarter of 2011 recorded two positive GDP growth rates (0.2% and 0.4%, respectively), unfortunately that was not the sign of the end of the recession, because after that followed numerous quarters with negative growth rates. However, it seems that in the 4th quarter of 2014 the recession has finally ended, but according to currently available data this conclusion cannot be confirmed.

In the second half of 2008, the monetary authority noted that Croatia has entered the recession, and that is why they adjusted their monetary policy. Croatian central bank - Croatian national bank (CNB) made a series of Decisions among which the most important were these: The first Decision was announced in October 2008. That was Decision to cease the Decision of the marginal reserve requirement in order to increase the foreign currency liquidity of banks. After that, in November of the same year, the reserve requirement rate was reduced from 17% to 14% which released 8.4 billion Kuna into liquidity. In February 2010 this rate was further reduced to 13%, which freed up another 2.9 billion Kuna for financing the government and HBOR programs for encouraging bank credit activity. In January, and then again in February 2009 the CNB decided to reduce the rate of minimum coverage of foreign currency liabilities by foreign currency claims, first from 28.5% to 25% (in January) and then from 25% to 20% (in February), which gave the banking system access to a total of 18.25 billion Kuna. In March 2011 the Governor of the CNB decided on an additional easing of the rates of minimum coverage of foreign currency liabilities by foreign currency claims from 20% to 17%, which meant for bankers 6.3 billion Kuna of newly available funds. However, such growth of monetary aggregates, unfortunately, had no significant impact on economic growth (Svilokos, 2012).

Reasons for that could be because the determinants of money demand in a period of recession have changed. Namely, because of rising unemployment and fear of job loss, households demand for loans stagnated. Money demand from enterprises in periods of the recession was also lower because of lack of good investment projects

and overall pessimistic expectations. In the same time, because of higher credit risk and country risk, banks increased the interest rates. Furthermore, because direct foreign investments and loans from abroad significantly dropped with the beginning of the recession, that contributed to the depreciation of domestic currency. The negative changes in the real effective exchange rate (REER) in the highly euroized economy such as Croatia could also have significant negative impact on money demand. Croatian consistent practice to use relatively stable foreign currencies in order to protect against currency risk means that in times of crisis the demand for domestic currency will decrease, and at the same time the demand for foreign currencies, primarily for the Euro and Dollar, will increase.

Because of all of the above, the focus of interest of this paper is to the changes in money demand determinants in Croatia. The goal of the research is to find out whether there are significant differences in these determinants before and after Croatia entered the recession. For conducting this research there are relatively short time series span (131 monthly observations for periods of expansion, and 76 monthly observations for period of recession), so the suitable approach is to employ Autoregressive Distributed Lag (ARDL) bound testing procedure based on an unrestricted error correction model proposed by Pesaran et. al. (2001). The ARDL model is a more reliable method to determine the cointegration relation in small samples (Ghatak and Siddiki, 2001) than standard Johansen co-integration technique that requires large data samples for validity.

The remainder of the paper is structured as follows: after the Introduction part, Section 2 provides the short literature review of numerous papers related to the topic of money demand stability in periods of financial crisis and money demand in Croatia. Section 3 gives the description of methodology, theoretical framework and data. In Section 4 the main results of this research are presented followed by a conclusion in Section 5.

## 2. Literature review

Money demand stability during the financial crisis and under other conditions has been a very popular research topic. There are many papers of which the recent work of Dreger and Wolters (2011), Kapounek (2011), Atkins (2005), Slavova (2003) and Carstensen (2006) should be emphasised.

Dreger and Wolters (2011) explored the stability of the relation between money demand for M3 and inflation in the euro area by including the period of the financial crisis. Their results indicated that the equilibrium evolution of M3 was still in line with money demand. They concluded that the hypothesis of weak exogeneity should be rejected for real money balances and inflation, and find out that real income, real asset prices, and the term structure did not respond to deviations from the long-run equilibria.

Kapounek (2011) focused on monetary policy implementation and money demand in the euro area during the financial crisis. His empirical analysis showed money demand function instability during the financial crisis. The instability was described by a decrease in credit money creation and money velocity changes.

Atkins (2005) estimated the money demand function for Jamaica using a Structural cointegrating VAR in order to find out whether the Jamaican financial crisis compromised the stability of money demand. The author determined the adequate stability of money demand despite the serious financial crisis of the 1990's.

Slavova (2003) estimated the demand for narrow and broad money in Bulgaria over three distinct sub-periods: the period of high, variable, but not systematically accelerating inflation; the near-hyperinflationary period; and the period of stabilization. Her results confirmed that the functional econometric relationship among the variables of interest has changed. Over the first sub-period, the long-run demand for real M1 and M2 balances was affected significantly by the deposit rate and the price level. For the hyperinflationary period, author tested a Cagan-style demand for money specification and found strong evidence that the demand for both M1 and M2 was determined solely by inflation. The results for the last sub-period were indicative of a more "normally behaved" demand for money function for both M1 and M2. Both the wage rate and the Treasury Bill rate have been found as significant determinants of the demand for real M1 and M2 balances.

The article of Carstensen (2006) analysed the question whether money demand in the Euro area underwent a structural change in the end of 2001 when M3 money growth started to considerably overshoot the reference value set by the European Central Bank. It has been concluded that conventional specifications of money demand have in fact become unstable, whereas

specifications that were augmented with equity returns and volatility remained stable.

Money demand determinants for Croatia have been previously studied by Anušić (1994), Babić (2000), Erjavec and Cota (2001), Payne (2002), Hsing (2007), Škrabić and Tomić-Plazibat (2009).

Anušić (1994) in his paper established econometric estimation of money demand function in Croatia for the period from January 1991 to November 1993. He concluded that the main determinants of the money demand during the period of hyperinflation were inflation, real economic activity and lagged real money, whereas interest rate did not have a significant influence on money demand. Later Babić (2000) re-examined money demand providing empirical evidence that the demand for the real monetary aggregates was a stable function of a few explanatory variables: the variable of economic activity, the opportunity cost variable and the variables of partial adjustment. The best variable of economic activity for the M0, M1 and M1a turned out to be the real monthly GDP. The best opportunity cost variable for the M0, M1 and M1a turned out to be the weighted average interest rate on the commercial banks' demand deposits in Kuna.

Erjavec and Cota (2001) analysed period from October 1994 to August 2000 and found that output was a dominant positive factor, and had a negative significant interest rate. These estimates that were based upon VEC model confirmed that money-price relationship has disappeared in the post-stabilization period.

Payne (2002) conducted the post stabilisation estimates of money demand in Croatia by estimating error correction model and bounds testing approach. He discovered that industrial production was statistically insignificant for both the Ma and M1a money demand specifications, and that interest rates, inflation and the real effective exchange rate had a negative and statistically significant impact.

Hsing (2007) investigated the impacts of currency depreciation, the foreign interest rate and functional forms on Croatia's money demand function. He concluded that the demand for real M1 in Croatia was positively influenced by real output and negatively associated with the deposit rate, the kuna/euro exchange rate, the euro interest rate, and the expected inflation rate. The results for the demand for real M2 were similar. Furthermore, he noticed that for the real M1 or M2 demand, the capital mobility effect was greater than the cost of borrowing effect, and for real M1 demand, the substitution effect was greater than the wealth effect. His

results also indicated that the depreciation of the Kuna would raise output.

Škrabić and Tomić-Plazibat (2009) analysed real money demand within multivariate time-series framework. The estimated long-run money demand function indicated the slow speed of adjustment of removing the disequilibrium. Additionally, their empirical results provided the evidence that in Croatia real industrial production and exchange rate explained most variations of money demand in the long-run, while interest rate was significant only in short-run.

### 3. Methodology, theoretical framework and data

Autoregressive Distributed Lag (ARDL) model recently became recognised as a very usable tool for testing the presence of long-run relationships between economic time-series. ARDL model was firstly introduced by Pesaran et al. (2001) in order to incorporate I(0) and I(1) variables in the same estimation process. If analysed variables are stationary in levels (I(0)), then standard OLS approach is appropriate. If all variables are I(1), and if they are not cointegrated, in this case, the standard OLS can be estimated using the first differences of each series. If all variables are I(1), and econometric tests (e.g. Johansen cointegration technique; Johansen, (1988)) also strongly support the thesis that they are cointegrated, than two types of models are recommended: (a) A standard OLS regression model applied to the levels of variables that will describe the long-run relationship between them; Or (b) an error-correction model (ECM), that will show the short-run dynamics.

In practice, the things are usually more complicated than this. Sometimes the research has to be conducted based on variables of which some may be stationary (the unit root tests are inconclusive), some may be I (1), and there is also the possibility of cointegration among some of the I(1) variables (the Johansen test is inconclusive). Also, there could be a problem of availability of only the small sample sizes. In these situations using the ARDL model could be the solution. The advantages of ARDL over conventional cointegration testing is that: (a) in small samples the ARDL model is more statistically significant approach that can be used to determine the cointegration relation than conventional techniques (Ghatak and Siddiki 2001); (b) the ARDL approach does not require any assumption as to whether the time series are I(1) and/or I(0). This means that pre-testing problems associated with standard cointegration, which requires that

the variables should be classified into I(1) or I(0) can be avoided (Pessaran et al, 2001); (c) using ARDL approach we can avoid the decisions about the number of endogenous and exogenous variables to be included, how to treat the deterministic elements, and the decisions about the order of VAR and the optimal number of lag (Pesaran and Smith, 1998).

ARDL form of the regression model is

$$\phi\ L,p\ y_t = \sum_{i=1}^{k} \beta_i\ L,q_i\ x_{i,t} + \delta' w_t + u_t \quad (1)$$

where: $\phi\ L,p\ = 1 - \phi_1 L - \phi_2 L^2 - \cdots - \phi_p L^p$,

and $\beta_i\ L,q_i\ = 1 - \beta_{i,1} L - \beta_{i,2} L^2 - \cdots - \beta_{i,q_i} L^{q_i}$, *i=1, 2,…, k.*

In equation (1) $y_t$ is the dependent variable, $x_{i,t}$ is *i* dependent variables, L is a lag operator, and $W_t$ is S×1 vector of deterministic variables. The long-run elasticity can be estimated by (Wilson and Chaudhri, 2004):

$$\Theta_i = \frac{\beta_{i,0} + \beta_{i,1} + \cdots + \beta_{q,i}}{1 - \phi_1 - \phi_2 - \cdots - \phi_p},\ \forall i = 1, 2, \ldots, k \quad (2)$$

The long-run cointegration relationship can be presented with equation (3)

$$y_t - \Theta_0 - \Theta_1 x_{1,t} - \Theta_2 x_{2,t} - \cdots - \Theta_k x_{k,t} = \varepsilon_t,\ \forall t = 1, 2, \ldots, n \quad (3)$$

where:

$$\Theta_0 = \frac{\beta_0}{1 - \phi_1 - \phi_2 - \cdots - \phi_p} \quad (4)$$

The Error correction model of ARDL can be obtained by rewriting the equation (1) in terms of the lagged levels and first difference of $y_t$, $x_{1,t}$, $x_{2,t}$,…, $x_{k,t}$ and $w_t$ (Pahlavani et.al., 2005):

$$\Delta y_t = -\phi\ 1,p\ EC_{t-1} + \sum_{i=1}^{k} \beta_{i,0}\Delta x_{1,t} + \delta'\Delta w_t - \sum_{j=1}^{p-1} \varphi^* y_{t-j} - \sum_{i=1}^{k}\sum_{j=1}^{q-1} \beta_{i,j}{}^*\Delta x_{i,t-1} + u_t \quad (5)$$

In equation (5) error correction term is defined with (6):

$$EC_t = y_t - \sum_{i=1}^{k} \Theta_i x_{i,t} - \Psi' w_t \quad (6)$$

In equation (5) and (6) ϕ*, δ' and $\beta_{i,j}$* are the coefficients which are related to short-run dynamics of the models' convergence to equilibrium, and Φ(1, $p$) is the speed of adjustment.

In order to setup ARDL model for money demand determination first we have to choose the variables for the model. In previous studies of money demand for Croatia the researchers used monetary aggregate M0 (Babić, 2000), M1 or M1a (Anušić, 1994; Babić, 2000; Erjavec and Cota, 2001; Payne, 2002; Hsing, 2007; Škrabić and Tomić-Plazibat, 2009) as a dependent variable that describes money demand. Explanatory variables that were used in previously mentioned papers are: real GDP (Anušić, 1994; Babić, 2000; Erjavec and Cota, 2001; Hsing, 2007), industrial production index (Anušić, 1994; Payne, 2002; Škrabić and Tomić-Plazibat, 2009), nominal effective exchange rate (Anušić, 1994), real effective exchange rate (Payne, 2002), Kuna/Euro exchange rate (Hsing, 2007; Škrabić and Tomić-Plazibat, 2009), retail consumer price index (Erjavec and Cota, 2001; Payne, 2002; Hsing, 2007; Škrabić and Tomić-Plazibat, 2009), nominal interest rates on short-term deposits in foreign currency (Babić, 2000), foreign interest rate (Hsing, 2007), and nominal interest rates on short-term deposits in Kuna (in all previously mentioned papers).

This selection of variables is based on economic theory. The quantity theory of money developed by the classical economists in the nineteenth and early twentieth century suggests that the demand for money is purely a function of income. They argue that interest rates do not influence the demand for money (Fisher, 2006; Marshall, 1923; Pigou, 1917).

Later Keynes (1936) abandoned the classical view and developed his theory of the demand for money, which he called the liquidity preference theory that emphasized the importance of interest rates. He argues that real money balances are positively related to

real income and negatively related to interest rates. This Keynes's conclusion that the demand for money is related not only to income but also to interest rates is a major departure from Fisher's views on money demand, in which interest rates have no effect on the demand for money. Further development of the Keynesian approach (Baumol, 1952; Tobin 1956) strived to give a more precise explanation of Keynes' transactions, the precautionary and speculative motive for money demand.

In 1956 Friedman (1956) developed a theory of the demand for money in which he stated that the demand for money must be influenced by the same factors that influence the demand for any asset. That is why it should be a function of the resources available to individuals (their wealth) and the expected returns on other assets relative to the expected return on money. Friedman expressed his formulation of the demand for money as follows (Mishkin, 2010):

$$\frac{M^d}{P} = f\ \ Y_p,\ r_b - r_m,\ r_e - r_m,\ \pi^e - r_m \qquad (7)$$

$$\qquad\qquad +\quad -\quad -\quad -$$

In equation (7) $\frac{M^d}{P}$ is demand for real money balances, $Y_p$ is the present value of expected future income, $r_m$ is expected return on money, $r_b$ is expected return on bonds, $r_e$ is expected return on equity, and finally, $\pi^e$ is expected inflation rate. The signs below the equation (7) indicate whether the demand for money is positively or negatively related to the terms above.

In this paper the methodology and variable selection is based on work of Payne (2002) that was followed very strictly, but in contrast to that research, this paper offers two models of money demand, one for prerecession period, and one model for recession period, in order to find out whether there are significant differences in money demand determinants before and after Croatia, has entered into the phase of recession. Additionally, this research was conducted on the extended time period (from June 1994 to April 2015).

According to this, the explanatory variables of following models are:

- **Industrial production index (IP) that is used as a proxy of the level of income**. Income increase tends to be associated with the increases in the demand for currency to conduct transactions, so it should have a positive sign in subsequent models. The data resource for this variable is Croatian Bureau of Statistics;

- **Nominal interest rates on short-term deposits in Kuna (IR)**. Lower interest rates reduce the opportunity cost of holding currency and so make it relatively more attractive. It is expected that this variable has a negative sign in subsequent models. The data resource for this variable is Croatian National Bank;

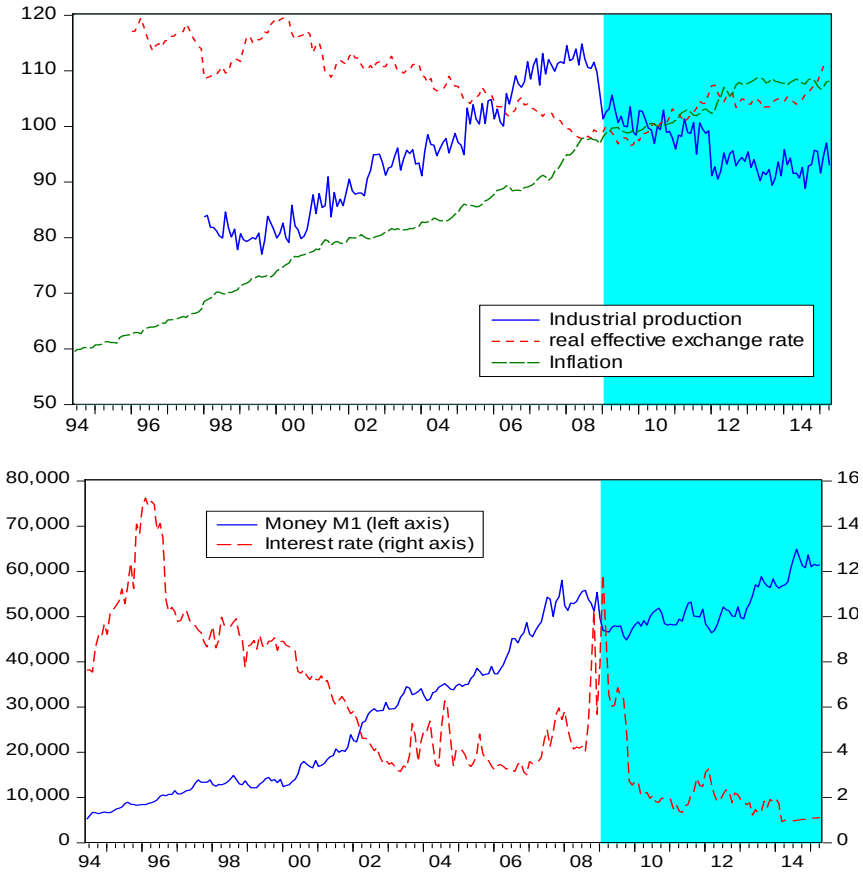
- **Real effective interest rate (REER)**. Namely, the exchange rate could be an important determinant of the demand for money in a small highly euroized economy. If the domestic currency depreciates and there are also general expectations of further depreciation, this could trigger the substitution of domestic currency with a foreign one, and vice-versa. This is why models include (REER) defined as the ratio of the Croatian Kuna relative to foreign currencies. The increase in REER means depreciation of Kuna, and therefore, this variable should have a negative sign. The data resource for this variable is Croatian National Bank;

- **Consumer price index (CPI) as a proxy for inflation**. Inflation should have a negative impact on money demand because it also represents the opportunity cost of holding money. This means that theory predicts the negative sign for this variable. The data resource for this variable is Croatian Bureau of Statistics.

Figure 1 shows the movement of chosen variables in levels for the period from June 1994 to April 2015. Shaded area represents the period of recession in Croatia.

**Figure 1**

**Movement of Industrial production, Real effective exchange rate, Inflation, Money M1, Interest rates**




### 4. Empirical results

Following Pesaran et al. (2001) and Bahmani-Oskooee (2004), the error correction representation of the ARDL model is:

$$\Delta L\_M_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1,i} \Delta L\_M_{t-i} + \sum_{i=1}^{n} \alpha_{2,i} \Delta L\_IP_{t-i} + \sum_{i=1}^{n} \alpha_{3,i} \Delta L\_IR_{t-i} + \sum_{i=1}^{n} \alpha_{4,i} \Delta L\_REER_{t-i} + \sum_{i=1}^{n} \alpha_{5,i} \Delta L\_CPI_{t-i} + \delta_1 L\_M_{t-1} + \delta_2 L\_IP_{t-1} + \delta_3 L\_IR_{t-1} + \delta_4 L\_REER_{t-1} + \delta_5 L\_CPI_{t-1} \quad (8)$$

In equation (8) Δ is the first-difference operator, and L_ denotes the natural logarithm. All variables represent monthly values that are seasonally adjusted. Money demand (M) is presented by money aggregate M1. Other variables (Industrial production (IP), Interest rates (IP), Real effective exchange rate (REER) and Inflation (CPI)) were explained and discussed previously.

The parameters $\delta_j$, j=1,…,5 are the long-run multipliers, while the parameters $\alpha_{i,j}$, i=1…n, j=1,…,5 are the short-run dynamic coefficients of the underlying ARDL model. First we need to estimate (8) to conduct the usual F-statistic for testing the null hypothesis (of no cointegration) defined by H0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$. The calculated F-statistic is compared with the critical value proposed by Pesaran et al. (2001) which are calculated for different regressors under the condition of an intercept and/or a trend. According to Bahmani-Oskooee (2004), these critical values include an upper and a lower bound, covering all possible classifications of the variable into I(1), I(0) or even fractionally integrated. If the F-statistic is above an upper bound, the null hypothesis of no long-run relationship can be rejected. If the computed F-statistic is below the lower bound, then the null hypothesis cannot be rejected. However, if it falls in between the lower and upper critical values, the result is inconclusive.

Based on the results of Akaike information criterion and Schwarz (Bayes) criterion (SC) and taking the care not to over-select the number of lags and paying the attention to the significance of the coefficients in the model, one lag was chosen for the model (8).

The Wald test coefficient restrictions, i.e. H0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$, was conducted using whole sample, and for each period separately. The results of F tests are presented in Table 1.

**Table 1**

**Wald test coefficient restrictions**

| Period | F-statistic | Critical value 5% | | Critical value 10% | |
|---|---|---|---|---|---|
| Whole sample | 4.296** | 2.62 | 3.79 | 2.26 | 3.35 |
| 1994m6-2008m12 | 3.572* | 2.62 | 3.79 | 2.26 | 3.35 |
| 2009m1-2015m4 (recession) | 4.112** | 2.62 | 3.79 | 2.26 | 3.35 |

*Notes: Critical values were obtained from Table CI(iii) Case III: unrestricted intercept and no trend for k=5 (Pesaran et al. 2001, p 300); * - denotes significance at the 10% level; ** - denotes significance at the 5% level*
*Source: Authors' calculation*

The results show that the hypothesis of no long-run relationship can be rejected regardless if the test has been conducted for the pre-recession period, or for the recession period, or if it has been conducted using whole available data, with the significance level of 10%. Based on 5% significance level, this conclusion stands only for a test of the whole sample, and for the recession period. For the pre-recession period, according to Pesaran et al. (2001) the result test is inconclusive (F statistic falls between the lower and upper critical value).

Based on the obtained results it can be concluded that there is the long-run relationship between the variables. This is according to the results of Payne (2001) and this means that we can proceed to the next step of the estimation process.

Two parsimonious ARDL-ECM models for two separate sample periods are set up with lag selection based on the Akaike information criterion (AIC) and Swartz criterion (SC). The estimation results are presented in Table 2:

Model 1 for sample period from 1994m6 to 2008m12

$$\Delta L\_M_t = \beta_0 + \beta_1 \Delta L\_IP_t + \beta_2 \Delta L\_IR_t + \beta_3 \Delta L\_IR_{t-1} + \beta_4 \Delta L\_REER_t + \beta_5 \Delta L\_CPI_t + \beta_6 EC_{t-1} + e_t \quad (9)$$

Model 2 for sample period from 2009m1 to 2015m4

$$\Delta L\_M_t = \beta_0 + \beta_1 \Delta L\_IP_t + \beta_2 \Delta L\_IP_{t-1} + + \beta_3 \Delta L\_IR_t + \beta_4 \Delta L\_REER_t + \beta_5 \Delta L\_CPI_t + \beta_6 EC_{t-1} + e_t \quad (10)$$

**Table 2**

**Error correction models for period from June 1994 to December 2008 (Model 1) and for period from January 2009 to April 2015 (Model 2)**

| Variable | Model 1 (1994m6-2008m12) Dependent variable ΔL_M | Model 2 (2009m1-2015m4) Dependent variable ΔL_M |
|---|---|---|
| C | 0.010749*** (4.204749) | 0.005677** (2.085527) |
| $\Delta(L\_IP)_t$ | -0.017485 (-0.231463) | 0.214059** (2.287853) |
| $\Delta(L\_IP)_{t-1}$ | | 0.162529* (1.741397) |
| $\Delta(L\_IR)_t$ | -0.047271** (-2.566837) | -0.010584 (-0.714458) |
| $\Delta(L\_IR)_{t-1}$ | -0.041300** (-1.996941) | |
| $\Delta(L\_REER)_t$ | -0.883990*** (-3.033984) | -0.598140 (-1.576784) |
| $\Delta(L\_CPI)_t$ | -0.382107* (-0.656333) | -1.615434** (-2.209771) |
| $EC_{t-1}$ | -0.084377*** (-2.957999) | -0.119272*** (-2.843108) |
| Observations | 131 | 76 |
| Adjusted R-squared | 0.2532 | 0.3547 |
| Serial correlation LM test (lag 2) | F=0,135; Prob. F(2,67)=0,874 | F=0,149; Prob. F(2,122)=0,700 |
| Heteroskedasticity test: White | F=0,516; Prob. F(27,103)=0,975 | F=1,003; Prob. F(27,48)=0,4834 |

*Notes: * denotes significance at the level of 10%; ** denotes significance at the level of 5%; *** denotes significance at the level of 1%; t statistics are in parentheses*
*Source: Authors' calculation*

For these models, several validity tests were conducted. Serial correlation LM test suggests that we cannot reject the null of no

serial correlation. White's heteroskedasticity test (White, 1980) tests a null hypothesis of no heteroskedasticity against heteroskedasticity of unknown general form. The test results suggest that we cannot reject the null hypothesis. In order to test whether these models have stability, the CUSUM and CUSUM of squares were performed.

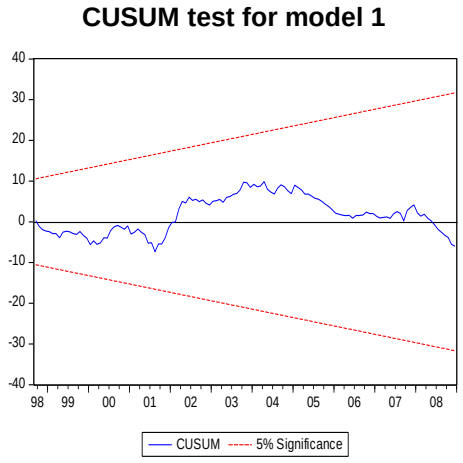
The CUSUM test (Brown, et al., 1975) is based on the cumulative sum of the recursive residuals. This option plots the cumulative sum together with the 5% critical lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. The CUSUM test is based on the statistic:

$$W_t = \sum_{r=k+1}^{t} \frac{w_r}{s} \tag{11}$$

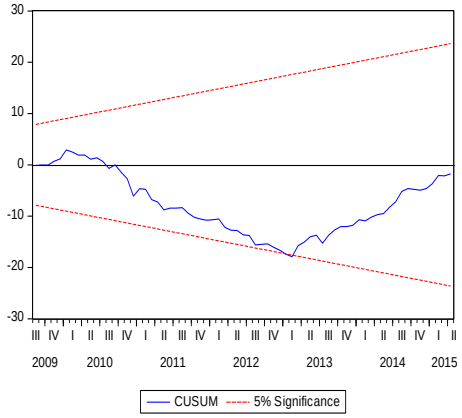
for t=k+1,…,T, where *w* is the recursive residual, and *s* is the standard deviation of the recursive residuals $w_t$. If the β vector remains constant from period to period, $E(W_t)=0$, but if β changes, $W_t$ will tend to diverge from the zero mean value line. The significance of any departure from the zero line is assessed by reference to a pair of 5% significance lines, the distance between which increases with t. Movement of outside the critical lines is suggestive of coefficient instability. The CUSUM test results are given below:

**Figure 2**

**CUSUM tests**



**CUSUM test for model 2**




*Source: Authors' calculation*

The CUSUM test for model 1 clearly indicates stability in the equation during the whole sample period, while the CUSUM test for model 2 shows adequate stability in the equation. This test reveals stability during the whole sample period except for 2013M02.

The CUSUM of squares test (Brown, et.al, 1975) is based on the test statistic:

$$S_t = \frac{\sum_{r=k+1}^{t} w_r^2}{\sum_{r=k+1}^{T} w_r^2} \tag{12}$$

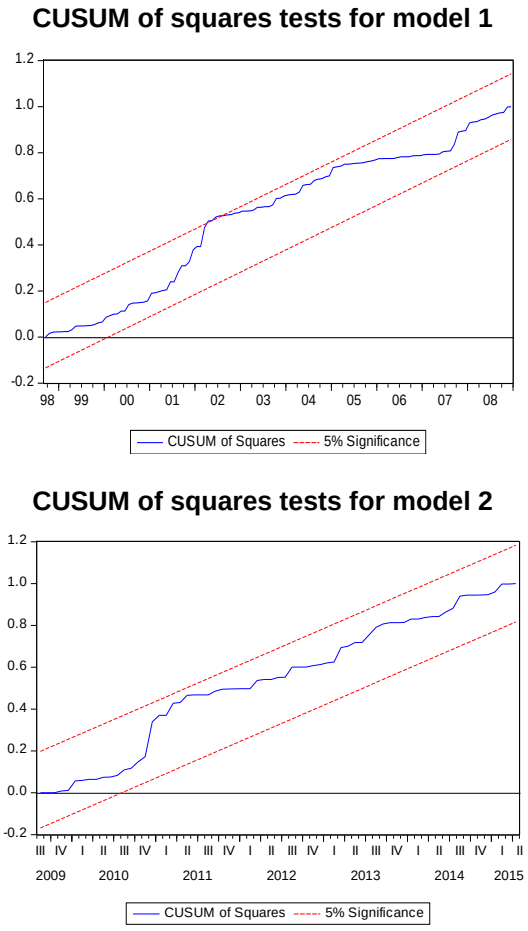
The expected value of $S_t$ under the hypothesis of parameter constancy is:

$$E\ S_t\ = \frac{t-k}{T-k} \tag{13}$$

which goes from zero at t=k to unity at t=T. The significance of the departure of S from its expected value is assessed by reference to a pair of parallel straight lines around the expected value. The CUSUM of squares test provides a plot of $S_t$ against t, and the pair of 5 percent critical lines. As with the CUSUM test, movement outside the critical lines is suggestive of the parameter or variance instability. Now follows the results of CUSUM of squares test for both models:

**Figure 3**

**CUSUM of squares tests**




*Source: Authors' calculation*

The cumulative sum of squares for model 1 is generally within the 5% significance lines, except for short period 2002m4-2002m6 suggesting that the residual variance is relatively stable. The cumulative sum of squares for model 2 indicates the residual variance stability for a whole sample period. After these tests, we can draw a general conclusion that the both models are stable and statistically adequate.

The empirical results show that the variable IP in model 1 has a negative sign which is not according to the theoretical expectations. However, in this model this variable is not statistically significant. In model 2, IP variable has a positive sign, and it is significant (at 5% level) as well as its lag 1 (at 10% level). A positive sign means that a higher level of economic activity increases the level of demand for money.

Variable IR has a negative sign in both models, and it is significant in model 1 with a significance level of 5%, while in the model 2 it has been shown as not significant. The negative sign is according to the theory because interest rate could be considered as an opportunity cost of holding money. During financial crisis, it seems that the public holds this cost as no more important.

Regarding the REER, the negative sign of this variable is in line with theoretical expectations with a significance level of 1% in the first model, and in the second model this variable is not significant. The result of model 1 is in line with Payne (2002), and the result of model 2 suggests that the statistical linkages between REER and money demand for the period of crises were broken.

In both models the CPI variable is significant (at 1% level) and has a negative sign, which means that a higher level of inflation has a negative impact on the demand for money. This is also consistent with the theory.

Finally, residual EC has a negative sign and is highly significant in both models indicating the existence of a long-run relationship. This variable also presents the speed of adjustment to long-run equilibrium. The whole system comes back to long-run equilibrium at the speed of 8.44% within one month in the period from 1994m4 to 2008m12 and in the period from 2009m1 to 2015m4 the whole system comes back to long-run equilibrium at the speed of 11.93% within one month.

If we compare the results of model 1 with the results that are presented in Payne (2002), the similarity of the signs and the significance of the parameters can be noticed. However, if we compare the results of model 1 with the results of model 2 it can be concluded that there is a substantial difference in the determinants of money demand in a period of recession compared with the period of growth. In the interval before the recession, IP is not a significant determinant of demand for money, and in the interval of the recession it becomes significant. Variables such as interest rate and real

effective exchange rate ceased to be statistically significant in a period of recession. These results could be useful for monetary authorities in a process of decision making because their policies should take into the consideration the changes in the determinants of money demand under the various conditions.

## 5. Conclusions

This study provides additional evidence of changes in money demand function as a consequence of different economic circumstances. There are many papers that try to capture this phenomenon (Dreger and Wolters (2011), Kapounek (2011), Atkins (2005), Slavova (2003) and Carstensen (2006), etc.), but none of them were conducted in the case of Croatia. Unfortunately, since January 2009 Croatia has experienced a long lasting period of recession, but exactly that made it very suitable for this research. Money demand determinants for Croatia have been previously studied by Anušić (1994), Babić (2000), Erjavec and Cota (2001), Payne (2002), Hsing (2007), Škrabić and Tomić-Plazibat (2009), and all of these researches were conducted using the pre-recession data.

The goal of this paper was to establish two models, one model for a period of growth (1994m6-2008m12) and one model for a period of recession (2009m1-2015m4) in order to compare the results of the first model with the results of previous researches, and to compare the models between them. This paper was based on error correction model (ECM) and autoregressive distributed lag (ARDL) methodology proposed by Pesaran et al. (2001), while the variables selection was based on work of Payne (2002). The chosen methodology has advantages over conventional cointegration testing because it is more statistically significant in small samples, it can be applied whether the regressors are I(1) and/or I(0), and the decision about the number of endogenous and exogenous variables that are to be included, how to treat the deterministic elements, and the decision about the optimal number of lag is not so crucial.

The bounds testing reveal that there is the long-run relationship among the chosen variables. Furthermore, variables interest rates (IP), real effective exchange rate (REER) and inflation (CPI) have the same sign as the theory suggests, and they are significant in model 1. Variable industrial production (IP) in model 1 is not significant which is in line with results presented in Payne (2002). In model 2 only industrial production (IP) and inflation (CPI) have

been found statistically significant with the adequate sign. In both models, the constant term (C), as well as error correction term (EC) have been also found significant. The whole system comes back to long-run equilibrium at the speed of 8.44% within one month in the period from 1994m4 to 2008m12, and in the period from 2009m1 to 2015m4 the whole system comes back to long-run equilibrium at the speed of 11.93% within one month.

The comparison of the results of model 1 with the results of model 2 reveals the substantial differences in the determinants of money demand. There may be areas for further research. Using the same data sets based on different methodology or different variables, other models could be estimated. The additional comparison of the empirical results could be useful in order to draw the stronger scientific conclusions about the money demand determination under different economic circumstances.

## References

1. Anušić, Z. (1994). "The Determinants of Money Demand in Croatia and Simulation of the Post-Stabilization Period". *Croatian Economic Survey*, No. 2, 1994, pp. 85-120.
2. Atkins, F. (2005). "Financial crises and money demand in Jamaica". *London: Birkbeck College, University of London* Working Paper. September 2005, ISSN 1745-8587, pp. 1-21.
3. Babić, A. (2000). "The monthly Transaction Money Demand in Croatia". Working paper, *Croatian National Bank*, 2000, pp. 1-46.
4. Bahmani-Oskooee, M., & Ng, R. W. (2002). "Long-run demand for money in Hong Kong: an application of the ARDL model". *International journal of business and economics*, 1(2), pp. 147-155.
5. Baumol, W. J. (1952). "The transactions demand for cash: An inventory theoretic approach". *The Quarterly Journal of Economics*, pp. 545-556.
6. Brown, R. L., J. Durbin, and J. M. Evans (1975). "Techniques for Testing the Constancy of Regression Relationships Over Time". *Journal of the Royal Statistical Society*, Series B, 37, pp. 149–192.

7. Carstensen, K. (2006). “Stock market downswing and the stability of European Monetary Union money demand”. *Journal of Business and Economic Statistics* 24, pp. 395–402.
8. Dreger, C., & Wolters, J. (2011). “Money and inflation in the euro area during the financial crisis”. European University Viadrina Frankfurt (Oder), Department of Business Administration and Economics, Discussion Paper No. 300, June 2011, ISSN 1860 0921, pp. 1-38
9. Erjavec, N., Cota, B. (2001). “The stability of money demand in Croatia in post stabilization period, Ekonomski pregled”. 52(9-10), pp. 1149-1172.
10. Fisher, I. (2006). “The Purchasing Power of Money: Its' Determination And Relation to Credit Interest And Crises”. Cosimo, Inc.
11. Friedman, M. (1956). “The Quantity Theory of Money: A Restatement”. *Studies in the Quantity Theory of Money*. Univeristy of Chicago Press, pp. 3-21.
12. Ghatak, S., & Siddiki, J. U. (2001). “The use of the ARDL approach in estimating virtual exchange rates in India”. *Journal of Applied statistics*, *28*(5), pp. 573-583
13. Hsing, Y. (2007). “Impacts of Currency Depreciation, the Foreign Interest Rate and Functional Forms on Croatia’s Money Demand Function”. *International Research Journal of Finance and Economics,* Issue 8, pp. 7-15.
14. Johansen, S. (1988). “Statistical Analysis of Cointegration Vectors”. *Journal of Economic Dynamics and Control*, 12, pp. 231-254
15. Kapounek, S. (2014). “Monetary policy implementation and money demand instability during the financial crisis”. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, *59*(7), pp. 177-186.
16. Keynes, J., M., (2006). “The General Theory of Employment, Interest and Money”. *Atlantic Publishers & Dist*.
17. Krznar, I. (2011). “Identifikacija razdoblja recesija i ekspanzija u Hrvatskoj”. *Istraživanja I-32*, *Hrvatska Narodna Banka*, ISSN 1332-1900, pp 1-20.
18. Marshall, A. (1923). “Money, credit & commerce”. AM Kelley, Bookseller.

19. Mishkin, F., S. (2010). “The Economics of Money, Banking & Financial Markets”. 9. edition, Addison-Wesley, New York, Boston
20. Pahlavani, M., Wilson, E., & Worthington, A. C. (2005). “Trade-GDP nexus in Iran: An application of the autoregressive distributed lag (ARDL) model”. *Faculty of Commerce-Papers*, 144.
21. Pesaran, M. H., & Smith, R. P. (1998). “Structural analysis of cointegrating VARs”. *Journal of Economic Surveys*, *12*(5), pp. 471-505.
22. Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). “Bounds testing approaches to the analysis of level relationships”. *Journal of applied econometrics*, *16*(3), pp. 289-326.
23. Pigou, A. C. (1917). “The value of money”. *The Quarterly Journal of Economics*, pp. 38-65.
24. Skrabic, B., & Tomic-Plazibat, N. (2009). “Evidence of the long-run equilibrium between money demand determinants in Croatia”. *International Journal of Human and Social Sciences*, 4(16), pp. 1177-1181.
25. Slavova, S. (2003). “Money demand during hyperinflation and stabilization: Bulgaria, 1991-2000”. *Applied Economics*, *35*(11), pp. 1303-1316.
26. Svilokos, T. (2012). “Determinants of Croatian Money Supply, 1st International M-sphere conference for Multidisciplinarity in Science and Business”. *Book of Proceedings*, part 2, ISBN: 978-953-7930-00-4, pp 549.-561.
27. Tobin, J. (1956). “The interest-elasticity of transactions demand for cash”. *The Review of Economics and Statistics*, pp. 241-247.
29. Wilson, E. J., & Chaudhri, D. P. (2004). “A perspective on food policies evolution and poverty in the Indian Republic (1950-2001)”. presented in *33rd conference of Economics*, University of Sydney, 27-30 September, 2004.

# MEASURING FINANCIAL SYSTEMIC STRESS IN ROMANIA: A COMPOSITE INDICATOR APPROACH[1]

**Ágnes NAGY, PhD** [*]
**Annamária DÉZSI-BENYOVSZKI, PhD****
**Imre SZÉKELY, PhD*****

**Abstract**

The authorities and financial supervisors recognized, following the financial and economic crises, that the process of identification of systemic risks should receive more attention. The aim of this paper is to construct a financial systemic stress indicator which aims to predict which financial stress tends to depress the real economy in Romania. We obtained the composite indicator with the aggregation of five market-specific subindices created from individual financial stress measures (foreign exchange market, bond market, equity market, money market and banking sector). The systemic nature of stress is captured by the time-varying correlations between market segments. This indicator represents a real-time measure of systemic risk and quantify stress in the Romanian financial system. The results show that the financial systemic stress index is able to provide a periodization of crises.

**Keywords**: financial system, systemic risk, financial crisis, composite indicator, emerging economy

---

[1] *This paper is an extended version of the communication presented at The International Conference "Financial Perspective and Challenges 2016", 16 June, organized by "Victor Slăvescu" Centre for Financial and Monetary Research, Bucharest.*

[*] *Associate Professor, Babeş-Bolyai University of Cluj-Napoca, Faculty of Economics and Business Administration, e-mail address: agnes.nagy@econ.ubbcluj.ro*

** *Associate Professor, Babeş-Bolyai University of Cluj-Napoca, Faculty of Economics and Business Administration, e-mail address: annamaria.benyovszki@econ.ubbcluj.ro*

*** *Assistant Lecturer Babeş-Bolyai University of Cluj-Napoca, Faculty of Economics and Business Administration, e-mail address: imre.szekely@econ.ubbcluj.ro*

**JEL Classification**: G01, G10, G20, E44

## 1. Introduction

The recent financial and economic crisis revealed considerable gaps in the theoretical and empirical frameworks for identifying, analysing, monitoring and controlling systemic risk in the financial system (Holló et al., 2012). The motivation behind studying financial stress is its impact on the real economy and the social costs that it entails (Louzis and Vouldis, 2012).

The European Central Bank defines financial stability as a condition in which the financial system – intermediaries, markets and market infrastructures – can withstand shocks without major disruption in financial intermediation and in the general supply of financial services (ECB, 2015). The definition of National Bank of Romania is quite similar, the financial stability is seen as the financial system's capability to withstand systemic shocks in the long run without triggering major disturbances, to efficiently allocate resources across the economy, and to effectively identify and manage risks (NBR, 2006).

In this paper we construct a composite indicator of financial stress for Romania. This kind of indicator represents a measure of systemic risk and tries to quantify and summarize the stress in the financial system in a single statistic (Cambón and Estévez, 2016). The stress index permits the real time monitoring of the stress level in the whole financial system, also help to delineate historical episodes of financial crises. The composite financial stress indicators can also be used to measure the impact of policy measures directed towards mitigating systemic stress (Holló et al., 2012).

The rest of this paper is organized as follows. Section 2 provides the conceptual framework of financial systemic stress, in Section 3 we explain how to select financial variables as financial stress indicators and how to construct a composite financial stress indicator. Section 4 presents our empirical results. Section 5 summarizes the paper with some concluding remarks.

## 2. Literature review

The relevance of systemic risk was highlighted by the economic and financial crisis starting in mid-2007 (Cambón and Estévez, 2016). This paper develops a systemic stress indicator for the Romanian financial system. The identification and prediction of

the state of the financial system is an important practical issue for policy design (Louzis and Vouldis, 2012). Systemic risk is the risk of an extensive financial instability that causes the disfunctioning of a financial system to the point where economic growth and welfare suffer materially (ECB, 2009).

Many authors have considered various indicators for measuring uncertainty or stress in financial markets. According to Louzis and Vouldis (2012) financial stress is a situation in which one or more segments of the market show the signs associated with financial stress, namely increasing uncertainty and asymmetry of information. The main concern in constructing financial stress indicators is that the indicators should be able to serve as an early warning indicator for slowdowns in the real economy (Islami and Kurz-Kim, 2013). The development of stress indicators for particular segments of the market and their aggregation into a composite index of systemic stress provides insights into the propagation channels of specific events (Louzis and Vouldis, 2012).

In order to measure systemic risk across the Romanian financial system, we consider the foreign exchange market, bond market, money market, equity market and banking sector as good representations of different segments of the financial system.

Currency risk is an important component of financial stress for transition economies. The large movements in foreign exchange markets are particularly relevant for those institutions heavily dependent on non-domestic liabilities and also for those with a high exposure to non-domestic assets (Cambón and Estévez, 2016). On the other hand, foreign exchange rates can move driven by investors' expectations related to increased sovereign yield spreads or wider interest rate spreads (Eichler et al., 2009).

Movements in the government bond market are related to sovereign risk and concern about solvency and liquidity conditions in the corporate bond market. They can also be a consequence of an increase in the uncertainty or the risk aversion of investors (Cambón and Estévez, 2016). The CDS spread is an indicator for default risk and can be transformed into market implied probabilities of default, given the recovery rate and time to maturity and under the assumption of risk neutrality of the investor (Islami and Kurz-Kim, 2013). The interaction between the financial and fiscal stress has intensified during and after the Global Financial Crisis (Magkonis and Tsopanakis, 2016).

The money market is a primary source of liquidity for the financial sector. Inclusion of money market variables enhances the index's ability to identify the financial stress (Louzis and Vouldis, 2012).

The contribution of stock market volatility to the real economy has become negligible (Beetsma and Giuliodori, 2012). Stock market crashes constitute one of the primary forms of financial crises (Reinhart and Rogoff, 2009). The inclusion of equity market data is needed in order to capture the stress related to the stock market. The conditional variance of stock market returns is essential for calculating measures of risk (Cevik et al., 2013). A large number of studies employ GARCH models to forecast volatility in the stock market.

The soundness of banking system is important for financial stability and a large number of studies consider riskiness of the banking sector in measuring financial stress (Cevik et al., 2013). Financial intermediaries play a major role in the correct functioning of the financial system. High increases in stress conditions for these institutions can be spread across the financial system and potentially have a strong negative impact on the real economy (Cambón and Estévez, 2016).

In the literature related to the development of stress indicators have emphasized on the selection of variables which is driven primarily by the need to reflect stress conditions in all dimensions related to the functioning of the financial system (Louzis and Vouldis, 2012). The studies have used market data (e.g. Cardarelli et al., 2011; Hollo et al., 2012; Zigraiova and Jakubik, 2015), balance sheet data (e.g. Morales and Estrada, 2010) or mixed market and balance sheet data (e.g. Hanschel and Monnin, 2005; Louzis and Vouldis, 2012). Most of the studies have utilized market data.

The adopted methodology in this paper is to construct composite indices for sets of variables and then aggregate them into a systemic stress indicator. The aggregation schemes vary in the literature. According to Louzis and Vouldis (2012) it can be classified into variance-equal weight method and portfolio theory based aggregation schemes. The mostly used variance-equal weight methods are: the average of standardized variables (e.g. Bordo et al., 2001; Cardarelli et al., 2011), principal component analysis (e.g. Hakkio and Keeton, 2009; Cevik et al., 2013), logit models (e.g. Nelson and Perli, 2007). The portfolio theory based aggregation takes

into account the correlation structure of stress indicators (e.g. Holló et al., 2012; Louzis and Vouldis, 2012; Cambón and Estévez, 2016).

The validation approach, followed most frequently in the literature, has been used to compare the derived index with known events of intensified financial stress (e.g. Hanschel and Monnin, 2005; Hakkio and Keeton, 2009; Cardarelli et al., 2011; Louzis and Vouldis, 2012).

### 3. Methodology and data

The composite indicator comprises the five most important segments of an economy's financial system: foreign exchange market, bond market, money market, equities market and the banking sector. Each of these segments will be presented as a subindex of the composite indicator. The systemic nature of stress is captured by the correlations between stress components. The systemic risk is higher when the correlation between the stress indicators increases.

The choice of the variables is of crucial importance for the construction of financial stress indices. We select the financial variables used for constructing financial stability indices in the literature, such as in Holló et al. (2012), Louzis and Vouldis (2012), Islami and Kurz-Kim (2013), Babecký et al. (2013), Zigraiova and Jakubik (2015), Cambón and Estévez (2016).

The financial variables are daily time series covering the period between 1st March 2008 and 25th August 2015 (1,897 observations). High frequency stress indices depict in a more precise way the level of stress.

Each subindex include a few stress indicators, which capture one or more of the typical symptoms of financial stress. The set of variables used in the construction of the financial systemic stress index include market data. In what follows, the stress indicators and the data source is presented, organized by the representative market segment.

Foreign exchange market:

- daily close bid-ask spread calculated from firm quotations (EUR/RON spot foreign exchange market). Source: Reuters.
- daily change in mid close price calculated from firm quotations (EUR/RON spot foreign exchange market). Source: NBR interactive database.
- daily volatility of average daily EUR/RON spot exchange rates: we estimated the daily volatility of the EUR/RON spot

exchange rates with generalized autoregressive conditional heteroscedasticity (GARCH) model.

Government securities market:

- 5Y Romanian CDS spread. Source: Bloomberg.
- Transactions in government securities in the interbank secondary market (number and turnover): leu and euro denominated debt securities. Source: NBR interactive database.

Money market:

- daily volatility of the overnight ROBOR rate: we estimated the daily volatility of the overnight ROBOR rate with generalized autoregressive conditional heteroscedasticity (GARCH) model. Source: NBR interactive database.
- daily change of the overnight ROBOR rate. Source: NBR interactive database.

Equity market:

- BET index (source: Bloomberg): We use the CMAX transformation of the Bucharest Stock Exchange Trading Index (BET) to identify periods of sharp declines in Romanian stock market. The CMAX in defined as:

$$CMAX_t = \frac{BET_t}{\max\left\{BET \in \left(BET_{t-j} \middle| j = \overline{1,90}\right)\right\}}, \quad (1)$$

where $BET_t$ is the Bucharest Stock Exchange Trading Index at day *t*.

- Volatility of the returns from the BET index: we estimated the daily volatility of the returns from the BET index with generalized autoregressive conditional heteroscedasticity (GARCH) model. Source: Bloomberg.

Banking sector:

- conditional value at risk (CoVaR) for the financial institutions listed in the BSE: time series estimated with quantile regression. For more details see Adrian and Brunnermeier (2008). CoVaR measures the Value at Risk (VaR) of the financial system conditional on an institution being in distress.

The first step towards the computation of the financial systemic stress index is the construction of subindices that correspond to each of the five sets of variables. The aggregation starts with putting the individual stress indicators on a common scale. The standardized indicators are then usually aggregated into a

composite indicator. Similar to Holló et al. (2012), we transform the stress indicators based on their empirical cumulative distribution function (CDF).

A particular data set of a stress indicator $x_t$ is denoted as $x = (x_1, x_2, \ldots, x_n)$ with *n* the total number of observations in the sample. The ordered sample is denoted $(x_{(1)}, x_{(2)}, \ldots, x_{(n)})$, where $x_{(1)} \leq x_{(2)} \leq \cdots \leq x_{(n)}$ and $(r)$ referred to as the ranking number assigned to a particular realisation of $x_t$. The transformed stress indicators $z_t$ are computed from the stress indicators $x_t$ on the basis of the empirical cumulative distribution function $F_n(x_t)$ as follows:

$$z_t = F_n(x_t) = \begin{cases} \frac{r}{n} \; for \; x_{(r)} \leq x_t < x_{(r+1)} & r = \overline{1, n-1} \\ 1 \; for \; x_t \geq x_{(n)} \end{cases} \quad \text{for } t = \overline{1, n}. \qquad (2)$$

The transformation thus projects stress indicators into variables which are unit-free and measured on an ordinal scale with range (0, 1].

The stress factors of each market category (i = 1, 2, … 5) are finally aggregated into their respective subindex by taking their arithmetic average:

$$s_{i,t} = \frac{\sum_{j=1}^{n_i} z_{i,j,t}}{n_i}, \qquad (3)$$

where $n_i$ is the number of stress indicators of subindex *i*. This implies that each of the stress factors is given equal weight in the subindex.

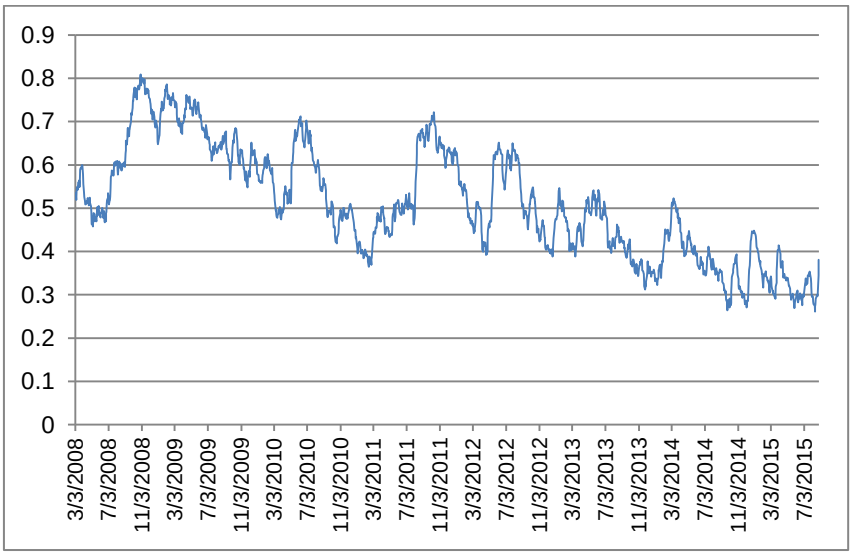
The next step is the aggregation of the five subindices into a simple indicator to measure the systemic stress. The subindices are aggregated into the composite indicator using Exponential Weighted Moving Average (EWMA) method, modelling time-varying cross-correlations with lambda=0,94.

## 4. Results

The quantile transformations of stress indicators are presented in appendix. In Fig. 1 we present the composite stress indicator estimated with exponential weighted moving average (EWMA) model.

**Figure 1**

**Composite stress indicator for Romania**




*Source: Own estimations in R.*

Based on calculated composite stress indicator in case of Romania we have identified the following stressful periods:

- September 2008 – May 2009 (with a maximum value in October 2008): Romania was affected by the global financial turmoil took place after the bankruptcy of Lehman Brothers (in September 2008). This external effect was intensified by internal vulnerabilities coming from previous fiscal indiscipline. The IMF Stand-By Arrangement (in May 2009), and the Vienna Agreement (in March 2009 enforced in May 2009) has played a significant role in moderating the utmost financial stress that we have identified.
- May 2010 – July 2010: Overlaps external and internal factors. In this period peaked the first round of the Greek sovereign debt crises increasing financial risks in emerging Eastern European

countries. In this context, the postponement of Romanian fiscal adjustment that had been during 2009 and on the beginning of 2010 was untenable. In July 2010 the implementation in a suitable extent of fiscal correction measures grounded a lower financial systemic risk.

- August 2011 – November 2011: The increased values of the indicator are due to increased financial instability in the euro area associated with sovereign risk crisis, worsen banking sector prospects and weaken macroeconomic activities. The launching of the Two-pack in the end of November 2011 and the entering in force of the Six-pack in the beginning of December 2011 have started to restore the confidence in Europe with favourable effect on Romanian financial stability.
- May 2012 – August 2012: Financial stability was affected by the renewed European pressures associated with a significant deterioration of internal political conditions. The political instability started with the interruption of the governance installed three month before and continued with the presidential impeachment attempt. This process was ended up in the end of August when the European financial conditions improved.

During 2013-2015, the composite indicator decreased signalling the improvement of the financial stability conditions. We have not identified any major stressful period. The indicator's slight and sporadic increase is not persistent, its value is not so high like formerly and quickly jumps back to the lower values.

## 5. Conclusions

The global financial crisis of 2007–2009 highlighted the importance of financial stress and their implications for real economic activity. There are few studies in the literature focused on former socialist economies in Eastern Europe. In this study we constructed a financial systemic stress index for Romania. Romania is an emerging market economy with relatively less experience dealing with (managing) financial crises. Accurate recognition of the systematic nature of stress is important in order to provide proper policy guidance with respect to financial crises identification.

The financial stress index developed in this paper incorporates foreign exchange market, government bond market, equity market, money market and banking sector. Each subindex include a few stress indicators, which capture one or more of the typical symptoms of financial stress. The variables used for the

construction of the composite stress indicator include market data. The aggregation starts with putting the individual stress indicators on a common scale. Similar to Holló et al. (2012), we transform the stress indicators based on their empirical cumulative distribution function (CDF). Lastly, the subindices are aggregated into the composite indicator using Exponential Weighted Moving Average (EWMA) method. It was found that the stress index is sensible to the financial crisis events.

Further research could be conducted to develop financial stress index for Romania using portfolio theory for the aggregation of the subindices, as well as to estimate the impact of financial stress on the real economy. The range of analysed countries could be extended to other Eastern European countries, which provides an opportunity to identify common stressful periods, in particular case the same source of these stresses.

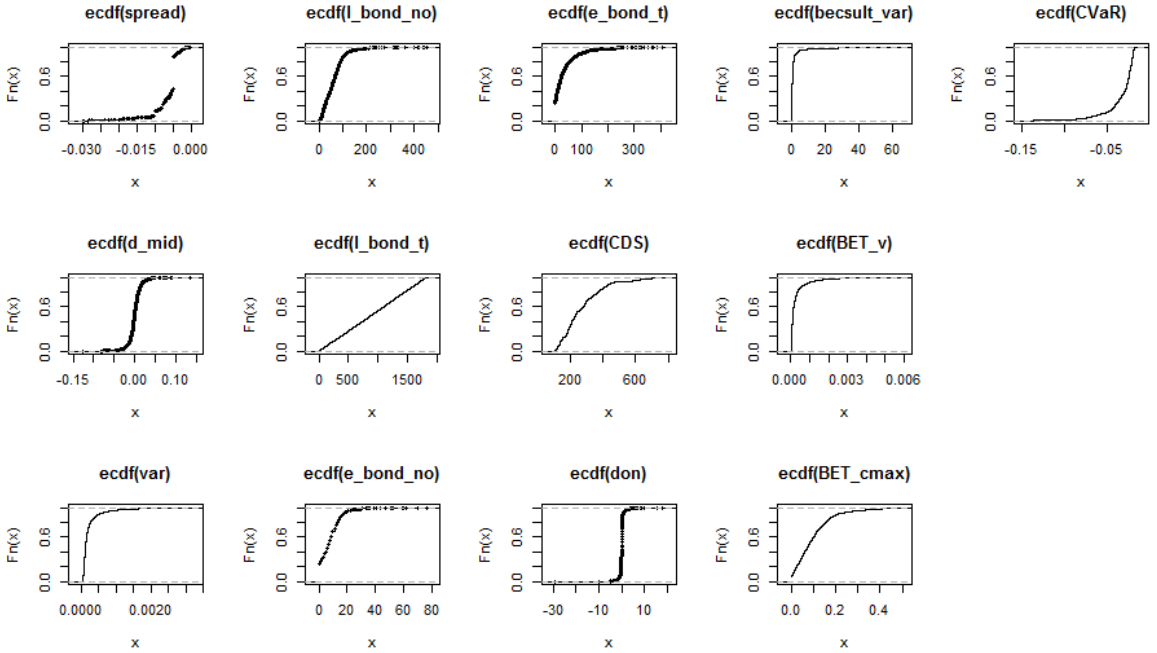
## References

1. Adrian, T., Brunnermeier, M. K. (2008). "CoVaR". *Federal Reserve Bank of New York Staff Reports,* 348.
2. Babecký, J., Havránek, T., Matěju, J., Rusnák, M., Šmídková, K., Vašíček, B. (2013). “Leading Indicators of Crisis Incidence: Evidence from Developed Countries”. *Journal of International Money and Finance*, 35, pp. 1–19.
3. Beetsma, R., Giuliodori, M. (2012). “The changing macroeconomic response to stock market volatility shocks”. *Journal of Macroeconomics*, 34, pp. 281–293.
4. Bordo, M., Dueker, M., Wheelock, D. (2001). “Aggregate price shocks and financial stability: a historical analysis”. *Federal Reserve Bank of St. Louis Working Paper*, 2000-005B.
5. Cambón, I., Estévez, L. (2016). “A Spanish Financial Market Stress Index (FMSI)”. *The Spanish Review of Financial Economics,* 14, pp. 23-41.
6. Caldarelli, R., Elekdag, S. A., Lall, S. (2011). “Financial Stress and Economic Contractions”. *Journal of Financial Stability*, 7, pp. 78-97.
7. Cevik, E. I., Dibooglu, S., Kutan, A. M. (2013), “Measuring financial stress in transition economies”. *Journal of Financial Stability,* 9, pp. 597– 611.

8. ECB (2009). “The concept of systemic risk”. *ECB Financial Stability Review*, December 2009.
9. ECB (2015). “ECB Financial Stability Review”. November 2015.
10. Eichler, S., Karmann, A., Maltritz, D. (2009). “The ADR shadow exchange rate as an early warning indicator for currency crises”. *Journal of Banking and Finance*, 33, pp. 1983–1995.
11. Hakkio, S.C., Keeton, W.R. (2009). “Financial stress: what is it, how can it be measured, and why does it matter?”. *Federal Reserve Bank of Kansas City Economic Review*, *Second Quarter*, pp. 5–50.
12. Hanschel, E., Monnin, P. (2005). “Measuring and forecasting stress in the banking sector: evidence from Switzerland”. *BIS Working Paper,* No 22.
13. Holló, D., Kremer, M., Lo Duca, M. (2012). “CISS – A Composit Indicator of Systemic Stress in the Financial System”. *European Central Bank Working Paper Series, p.* 1426.
14. Islami, M., Kurz-Kim, J.-R. (2013). ”A single composite financial stress indicator and its real impact in the euro area”. *Bundesbank Discussion Paper*, p. 31.
15. Louzis, D. P., Vouldis, A. T. (2012). “A methodology for constructing a financial systemic stress index: An application to Greece”. *Economic Modelling,* 29, pp. 1228–1241.
16. Magkonis, G., Tsopanakis, A. (2016). “The financial and fiscal stress interconnectedness: The case of G5 economies”. *International Review of Financial Analysis*, 46, pp. 62–69.
17. Morales, M.A., Estrada, D. (2010). “A Financial Stability Index for Columbia”. *Annals of Finance*, 6, pp. 555–581.
18. NBR (2006). “*Financial Stability Report*”
19. Nelson, W.R., Perli, R. (2007). “Selected indicators of financial stability”. *Irving Fisher Committee's Bulletin on Central Bank Statistics*, 23, pp. 92–105.
20. Reinhart, C.M., Rogoff, K.S. (2009). “This Time is Different”. Princeton University Press, Oxford.
21. Zigraiova, D., Jakubik, P. (2015). “Systemic event prediction by an aggregate early warning system: An application to the Czech Republi”. *Economic Systems,* 39, pp. 553–576.

**APPENDIX**

## Quantile transformation of stress indicators




*Note: ecdf denotes the empirical cumulative distribution calculated from the entire sample of available data. spread – daily close bid-ask spread calculated from firm quotations (EUR/RON spot foreign exchange market); d_mid - daily change in mid close price calculated from firm quotations (EUR/RON spot foreign exchange market); var - daily volatility of average daily EUR/RON spot exchange rates; l_bond_no – number of transaction in leu denominated government securities in the interbank secondary market; l_bond_t - turnover of transaction in leu denominated government securities in the interbank secondary market; e_bond_no – number of transaction in euro denominated government securities in the interbank secondary market; e_bond_t - turnover of transaction in euro denominated government securities in the interbank secondary market; CDS – 5Y Romanian CDS spread; don - daily change of the overnight ROBOR rate; becsult_var - daily volatility of the overnight ROBOR rate; BET_v - volatility of the returns from the BET index; BET_cmax - CMAX transformation of the BET index; CVaR - conditional value at risk (CoVaR) for the financial institutions listed in the BSE.*

*Source: Own estimations in R.*

# THE IMPACT OF CORPORATE GOVERNANCE ON CASH HOLDINGS: A COMPARATIVE STUDY OF THE MANUFACTURING AND SERVICE INDUSTRY

**Asad KHAN, PhD Candidate**[*]
**Memoona BIBI**[**]
**Sarfaraz TANVEER, PhD Candidate**[***]

**Abstract**

In this study, a comparative analysis of manufacturing and services industry is conducted to test the relationship between corporate governance and cash holdings of non-financial listed firms in Pakistan. Several proxies for corporate governance were used, such as the institutional ownership, directors' ownership, ownership concentration, board size and board independence. To avoid omitted-variable bias in explaining cash holdings of these firms, seven control variables were also included namely growth, dividend, size, leverage, capital expenditures, net-working capital and cash flows. The study reveal that for manufacturing firms the growth is found to be positively related with cash holdings, while size of firm, leverage and networking capital are negatively related with the cash holdings. On the other side, for servicing firms, board independence and dividend are directly related to cash holdings while leverage and net-working capital are negatively related to cash holdings by these firms. However, most of the proxies are found to be insignificant, which is an indication of weak corporate governance in Pakistan in determining the cash holding decision.

**Keywords:** Board of Directors, Ownership Structure, Ownership Concentration, Non-financial firms, Karachi Stock Exchange

[*]*Lecturer, Department of Management Sciences, University of Haripur. Pakistan. asadkhan@uoh.edu.pk*
[**]*Research Scholar, Department of Management Sciences, University of Haripur, Pakistan. memoona.bibi.4346@gmail.com*
[***]*Assistant Professor, Department of Management Sciences. University of Haripur. Pakistan. sarfaraz.tanveer@uoh.edu.pk*

**JEL Classification:** G29, G38, O16

## 1. Introduction

Holding adequate cash is one the most important art adopted by modern organization to provide operational liquidity and also to capitalize on good investment opportunities. Cash holding is "the cash in hand or readily available for investment in physical assets and to distribute to investors" (Shah, 2012). Generally, firms hold cash for various motives such as to meet operational needs of the business or unanticipated cash demands that require additional amount to be kept for a firm's safety (Damodaran, 2005). However it is noticed that the motives for holding cash in Manufacturing Sector differ from Services Sector. This is because of the idiosyncratic factors which are peculiar to individual firms such as research and development (R & D) intensity, organizational expenditure rate, etc. affect cash ratio differently in these sectors (Sánchez & Yurdagul, 2013). Typically it is seen that firms in the Services Sector are more inclined to maintain cash reserves for the purpose of research and development whereas firms in the Manufacturing Sector may require cash mainly for operational and capital expenditures such as acquiring new machinery or replacement of an asset. Therefore, to fulfil these firms' specific requirements, availability of sufficient cash is very important for every going concern but still several costs and benefits are also associated with holding cash. According to Opler, Pinkowitz, Stulz and Williamson (1999), the cost of holding liquid assets includes the lower rate of return of these assets because of a liquidity premium and possibly, tax disadvantages. Yet, there are two main benefits from holding liquid assets. First, the firm saves transaction costs to raise funds and does not have to liquidate assets to make payments. Second, the firm can use the liquid assets to finance its activities and investments if other sources of funding are not available or are excessively costly. Keeping these costs and benefits in view, firms are required to maintain an optimal level of cash.

Masood and Shah (2014) believed that good corporate governance by firms is essential in order to maintain an optimal level of cash. Corporate governance in simple words can be defined as "the system through which businesses are directed and controlled" (Isaksson, 1999). According to the ASX corporate governance council (2014), corporate governance describes "the framework of rules, relationships, systems and processes within and by which authority is

exercised and controlled within corporations." Whereas, La Porta, Lopez-de-Silanes, Shleifer and Vishny (2000) stated that "corporate governance is a set of mechanisms through which outside investors protect themselves against expropriation by the insiders". They further explained "the insiders" as both managers and dominating shareholders of firms.

One of the major advantages of corporate governance is its role in coping with the agency problem which is the conflict of interests between the manager and shareholders. This is due to the reason that management with weak corporate governance can exploit excessive cash holdings for their personal benefits by investing in negative NPV projects (Ammann, Oesch & Schmid, 2010). Resultantly firms in the countries where shareholders' protection is weak and excess cash is mismanaged by managers, potential investors feel reluctant to invest more. In Pakistan, the trend of corporate governance is scratching the surface as the Code of Corporate Governance was formed in 2002. Therefore, most of the studies conducted in Pakistan address corporate governance and cash holdings separately. However, Masood and Shah (2014) studied the impact of corporate governance on cash holdings of non-financial firms listed on KSE. In the present study, a comparative examination of the non-financial firm in the Manufacturing and Services Sector will be conducted to investigate the likely impact of corporate governance on cash holdings since the reasons for holding cash between these two sectors differ from each other.

This study will primarily shade lights on association of corporate governance and cash holding. It will also help firms in determining that how managerial ownership and board structure can alter the ways of corporate governance and thereby moving a step ahead in improving economic performance of the country. Similarly, by highlighting the effect of growth, size, dividend payments, investment opportunities, liquidity and profitability on cash holdings of non-financial firms, this research will enable the firms in manufacturing and services sector of Pakistan to cope up with agency problems by maintaining an optimal level of cash. The main objective of study is to identify the relationship among corporate governance proxies and various control variables (i.e. growth, size, dividend, investment opportunities, liquidity and profitability) on cash holding decision of the KSE listed firms in the manufacturing and services industry of Pakistan.

The remaining paper is organized as follow: Comprehensive discussion about the previous literature is documented in section 2. Section 3 cover the methodology, and empirical results is discussed in section 4. The section 5 of study is about the conclusions.

## 2. Literature Review

The three most important motives for holding cash is, transaction motives to meet daily operations, precautionary motives for contingencies and third is speculative motives (Keynes, 1936). Cash holding is important because it provides corporations with liquidity; that is, corporations are able to pay off their obligations on time even if bad times hit. Gill and Shah (2012) emphasized that in order to grow sales and profits, a corporation needs to build up cash reserves by ensuring that the timing of cash movements should create an overall positive cash flow situation. Likewise, Cossin and Hricko (2004) described that appropriate cash holdings allow for optimal timing of an investment and hence, avoid the under pricing issue. Therefore, cash is considered as an essential ingredient that enables a business to survive and prosper.

According to tradeoff theory, firms set their optimal level of cash holdings by weighting the marginal costs and marginal benefits of holding cash (Afza & Adnan, 2007). The principal benefit of holding cash is that it constitutes a safety buffer which allows firms to avoid the costs of raising external funds or liquidating existing assets and thus, helps firms to finance their growth opportunities (Levasseur, 1979; Myers & Majluf, 1984). Cash holdings also include reduction in the likelihood of financial distress and pursuance of the investment policy when financial constraints are met (Ferreira & Vilela, 2004). The major cost associated with cash holdings is manager's ability to maximize the shareholder's wealth. If manager fails to serve shareholders interests, the increase in assets under their control will increase their managerial discretion, which will result in agency cost of managerial discretion (Saddour, 2006). Agency problems between shareholders and managers over payout policies remained a reason of conflict, especially for a firm with high cash flow (Byrd, 2010). The extra cash may result in unwise future investments such as ambitious acquisitions (Lang, Stulz & Walkling, 1991). Thus, increase in free cash flow is associated with increase in agency conflicts (Masood & Shah, 2014).

### 2.1. Link between Corporate Governance and Cash Holdings

In a study conducted by Chen (2008) examined the impact of corporate governance on cash holdings by analyzing 1,500 American firms from 2000 to 2004 on the basis of different investment opportunities. He divided these firms into "old economy" such as manufacturers of durable and non-durable products and "listed new economy" firms such as telecommunications, computer, software, Internet and networking industries. The *listed new economy* were maintaining large amount of cash for investment and research and development purposes. This was supported by the reason that, these firms were adopting good governance practices for shareholder's protection that built investors' confidence to hold more cash. Furthermore, the results of this study highlighted important proxies for corporate governance that in old economy firms the higher managerial ownership will reduce cash holdings. Similarly, Masood and Shah (2014) identified another proxy for corporate governance is the board of directors that plays its role in monitoring and confirming the accuracy of information released to shareholders. They suggested that by increasing board independence, agency problem can be coped up as it reduces managerial control. Chen (2008) further showed that higher board independence increases cash holdings in listed new economy firms. It was justified on the grounds that presence of independent board ensures that the cash is invested by the company in an appropriate manner.

Literature shows that the internal corporate governance mechanism is based on **ownership structure** (Pouraghajan, Pourali & Akbari, 2015). Keeping in view a firm's authority, profit generation and performance, ownership structure is considered as an important factor (Barbosa & Louri, 2002). By considering its significance in corporate governance, researchers have used different dimensions of ownership structure as per their topic under investigation such as Masood and Shah (2014) mentioned three dimensions namely director's ownership, institutional ownership and ownership concentration. While in another study by Almudehki and Zeitun (2012) four different dimensions of ownership concentration are observed namely board ownership, concentrated ownership, foreign ownership, and institutional ownership. A study by Khamis, Hamdan and Elali (2015) documented the relation of ownership structure and firm's performance. After controlling cash holding variables, they found that

ownership concentration has a negative effect with statistical significance firm's performance while institutional ownership has a positive effect on company performance. Managerial ownership has an insignificant effect on company performance, however it was found that managerial ownership has a positive effect on performance only in the case of declining ownership concentration.

By studying publically listed Singaporean firms Kusnadi (2003) examined the impact of non-management blockholder ownership (Non-executive directors holding more than 5% of a firm's stakes) and board size on cash holdings. A significant positive relationship between board size and cash holdings was established, while an inverse relation between non-management blockholder ownership and cash holdings was observed. He concluded that firms having large board and small non-management blockholder ownership have poor corporate governance and therefore hold more cash. It is believed that small boards are more effective in monitoring the CEO's work whereas large boards emphasize more on "Politeness and Courtesy", and believe in CEO discretionary powers (Jensen, 1993). Another study by Lee and Lee (2009) has documented the association between cash holdings, board structure and management ownership structure by using a sample of five Asian countries (Malaysia, Philippines, Indonesia, Singapore and Thailand). They found that strong board i.e. smaller in size, separate CEO and higher independence has a negative relation with cash holding. However, if managerial ownership is increased to a higher level, it will increase their entrenchment and cash holding of the firms will increase.

In contrast to management ownership and boards of directors, institutional investors have become increasingly focused to use their influence on managers to work for the shareholder's interests by using their ownership rights (Cornett, Marcus, Saunders & Tehranian, 2007). Likewise, pension funds and mutual funds are considered as important sources of a firm's monitoring and hence, help in reducing agency costs (Crutchley, Jensen, Jahera & Raymond, 1999). Similarly Harford, Mansi and Maxwell (2008) studied the corporate governance and cash holding behaviour of US firms and found that weaker corporate governance leads to smaller cash holding. While examining the impact of institutional ownership on cash holdings of firms listed on Tehran Stock Exchange (TSE) Ramezani (2011) found that cash holdings of a firm can be reduced by increasing the percentage of ownership held by biggest shareholders of that firm.

Another important proxy of corporate governance is the ownership concentration (Masood & Shah, 2014). In this regard, Shleifer and Vishny (1997) provided a benchmark that "ownership is concentrated when one or several investors in the firm have 10 or 20 percent of equities". Anderson and Hamadi (2009) examined the impact of large powerful shareholders on cash holdings of Belgian firms. They observed a positive association between the level of liquid assets and ownership concentration in general and strong positive association for family firms in particular. This is because family firms face difficulties in diversifying their wealth effectively because of their risk aversive nature. In contrast, Ferreira and Vilela (2004) investigated the determinants of cash holdings in EMU countries and found that firms in countries where shareholders protection is strong and ownership is more concentrated hold less cash than others. Another study by Xingquan and Jie (2007) documented different results from the previous mentioned studies while examining the cash holding behaviour of the publically listed Chinese firms. They showed that ownership concentration, independent directors and leadership structure have no effect on cash holdings while management ownership has a positive effect on corporate cash holdings. This is due to the reason that corporate governance mechanism is not up to the mark in Chinese firms, hence, less monitoring and control leads to increase in agency conflicts (Ping et al. 2011).

It is evident that cash holding is affected by governance mechanism of firms. If shareholders protection is weak, managers have more control and results in agency conflicts (Masood & Shah, 2014). Dittmar, Mahrt-Smith and Servaes (2003) provided strong evidence by considering agency conflicts as an important determinant of corporate cash holding. They worked on a sample taken from 45 countries and found that cash holding in countries where shareholders protection is weak is almost doubled compared to countries with strong shareholders protection. In an another important study regarding corporate governance and value of cash holdings, Dittmar and Mahrt-Smith (2007) argued that the firms having poor corporate governance results in significant value reduction due to excess cash holdings, because of poorly selected investments. Similarly, Kalcheva & Lins (2007) examined the impact of expected managerial agency problems on cash holdings of firms from 31 countries and concluded that when external country-level shareholder protection is weak, controlling managers have an incentive to hold

more cash for personal benefits, which results in firm's underperformance. Daher (2010) also documented agency problem and its impact on corporate governance by taking 60,000 UK firms from 1994 to 2005. He found that higher the ownership concentration, lesser will be the agency problems and ultimately cash holdings level will be reduced.

### 2.2. Firm-Specific Characteristics Effecting Cash Holdings

Apart from corporate governance proxies, certain firm-specific characteristics related to cash holdings are also noteworthy which might affect the relationship of corporate governance and cash holdings (Kusnadi, 2006; Chen, 2008; Ammann et al. 2010; Masood & Shah, 2014). Researchers have identified several factors that might explain variations in corporate cash holdings i.e. Size, growth, leverage, dividend payouts, capital expenditures, net working capital, cash flow and profitability (Opler et al. (1999); Chen, 2008; Ammann et al. 2010; Ogundipe, Ogundipe, & Ajao, 2012; Masood & Shah, 2014).

Hofmann (2006) examined the determinants of corporate cash holdings of non-financial firms and proposed that the firm's growth opportunities, cash flows variability, leverage, dividend payments, and availability of liquid asset substitutes were the main determinants of corporate cash holdings in New Zealand. Gill and Shah (2010) investigated several factors that determine cash holdings and documented that cash flow, net working capital, leverage, firm size and board size significantly affect cash holdings of Canadian firms. Similarly, in 15 European countries Flipse (2012) concluded that firm specific characteristics are primarily responsible for increase in cash holdings such as increase in Research and Development (R&D) intensity, decrease in net working capital and in case of riskier cash flows. Moreover, in absence of high level of investor's protection, self-interested managers are more likely to spend excess cash on personal ambitions. Likewise, some other determinants of cash holdings are also highlighted by different researchers which are discussed as under:

#### Growth Opportunities

Firms having more growth opportunities may want to raise capital either through debt or by issuing securities. If a firm is highly leveraged then cost of issuing new bonds and shares will be high (Islam, 2012). Therefore, following pecking order theory, the cost of

cash holding would be less expensive in such a case. According to Saddour (2006) growing firms maintain more cash than mature firms, while it will decrease with an increase in trade credit and research and development in case of mature firms. Kim, Kim, and Woods (2011) examined publically traded restaurant and found that those restaurant which have greater investment opportunities for growth hold more cash than others. Whereas, large restaurant with high capital expenditures and dividend payout ratio hold less cash, which also confirms precautionary and transaction motive of cash holding by restaurant. Similarly, Castiglionesi (2012) while documenting the prominent cash holding determinants of US industrial firms showed that the firms hold more cash when quality investment opportunities are available. Furthermore, he concluded that firms that have better access to capital markets and more substitutes available for cash tend to hold less cash.

**Dividend**

In a corporate world dividends are a sign of maturity, stability and access to capital markets (Sher, 2014). Dividend paying firms can suspend dividend payment to avoid expensive financing from external sources, and thus expected to hold less cash (Kafayat, Rehman & Farooq, 2014). In case where shareholders protection is weak, firm value can be increased if controlling managers pay dividends (Kalcheva & Lins, 2007). Similarly Ammann et al. (2010) also viewed that high dividend payout ratio can also safeguard the firms with poor corporate governance from poorly selected investments. In contrast a study in emerging market by Mitton (2004) holds the view that, the firms with stronger corporate governance had higher dividend payouts. At the same time negative relationship was established between dividend payouts and growth opportunities. Similarly, Rao (2015) found that dividend payments are positively associated with cash holdings suggesting inclination of Indian firms to hold more cash for the purpose of paying dividends.

**Size of Firm**

Generally smaller firms have limited access to external financing both in capital market as well as form financial institutions therefore need to hold cash for future investment and operations needs (Carrascal, 2010). Moreover, the cash holding for smaller firms is more strongly linked with cash flows variation. Similar observation were documented by Wai (2013) and found that the association

between corporate governance and holdings is dependent on size of the firm. This study showed that small firms with effective corporate governance intend to hold more cash. Hence, all these findings are in line with the studies conducted by Jensen (1986) and Soku (2011) that smaller firms hold more cash than larger firms.

**Leverage**

A study conducted by Guney, Ozkan and Ozkan (2007) examined the cash holding behaviour of firms from five countries namely France, Germany, Japan, the UK and the US and found a positive (precautionary effect) association between leverage and cash holding because as leverage increases firms are likely to accumulate larger cash reserves to minimize the risk of financial distress and costly bankruptcy. Additionally, they showed that the impact of leverage on cash holdings is partly dependent upon country-specific characteristics such as the degree of creditor protection, shareholder protection, and ownership concentration. Uyar and Kuzey (2014) analysed the factors which explain the level of corporate cash holdings of Turkish non-financial listed firms over the period 1997 to 2011. The results of the study revealed that the degree of tangibility of assets, financial debt ratio and leverage have negative and significant impact on the cash level. Similarly, Faulkender (2004) analyzed small US firms and confirmed that, these firms hold more cash with an increase in financial leverage.

**Capital Expenditures**

According to Sher (2014) capital expenditure remained an important control variable to assess the effects of different variables on cash holding, but its association with cash holding varied as either positive or negative, which also signify the active or passive behaviour of the firm. Bates, Kahle and Stulz (2009) suggested that if an increase in capital expenditures creates assets that can be used as collateral for debt, then these capital expenditures can result in an increase in debt capacity and therefore lead to less cash holdings of a firm. Further, Riddick and Whited (2009) argues that, “a productivity shock that increases investment can lead firms to temporarily invest more and save less cash, which would lead to a lower level of cash. At the same time, capital expenditures could proxy for financial distress costs and/or investment opportunities, in which case they would be positively related to cash”. On these grounds, a positive relationship between capital expenditure is confirmed by Azmat

(2011) while a negative relationship between these variables is proved by Kim et al. (2011); Kafayat et al. (2014); Masood and Shah (2014) and Rao (2015).

**Cash flows and Cash Flow Volatility**

Volatility in cash flows is another determinant of cash holding that arises when future expected payments are not regularly received and cost of financial distress goes up. Therefore, by following Trade off theory such firms hold more cash and a positive relation is expected between cash flow volatility and cash holdings (Islam, 2012). Increase in operational income (cash flow) is positively associated with corporate cash holding (Couderc, 2005). According to Sher (2014) the increase in cash holding of Japanese non financial firms is a result of increase in corporate profitability and uncertainty. Han and Qiu (2007) empirically examined the precautionary motive of holding cash in terms of cash flow volatility of publicly traded U.S firms. They found that financially constrained firms are sensitive to cash flow volatility. This is because the cash flow risk is not fully diversifiable, and precautionary motive promotes these firms to increase cash holdings to overcome such cash flow volatility. These findings are in line with the study conducted by Almeida, Campello and Weisbach (2004).

McVanel and Perevalov (2008) shed light on the financial constraints and cash holding behaviour of Canadian firms from 1990 to 2006. They concluded that higher level cash holding is significantly correlated with Canadian firms having smaller size, more cash flow volatility, less available cash substitutes, higher expenditures on Research and development and being faced by financial distress. Similarly a strong positive relationship was established by Rao (2015) among cash holdings and cash flow, dividend payments, net debt and equity issuance by Indian firms while a strong negative association was observed among cash holdings and net working capital, leverage, capital expenditure, and research and development (R&D) expenditure.

### 2.3. Theoretical Framework

The dependent variable for the study is cash holdings, which is the variable of primary interest. In order to make an attempt to explain the variance in this dependent variable, this study has extracted three sets of independent variables from the previous literature. Out of these three sets, the first two sets are consisted of

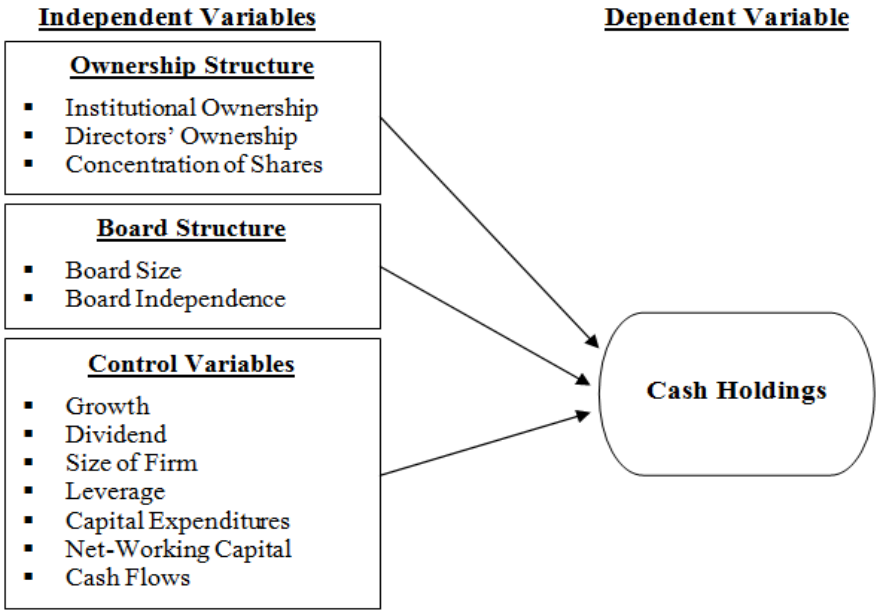
proxies of corporate governance i.e. Ownership structure and Board structure, whereas the third set is comprised of a number of control variables for reducing omitted-variable bias.

### 2.3.1. Schematic Diagram

The schematic diagram demonstrating the link between independent and dependent variables i.e. corporate governance proxies, a set of control variables and cash holdings respectively, is shown below.

**Figure 1**

**Schematic Diagram**




*Source: Masood and Shah (2014)*

## 3. Research Methodology

This section discusses the description of the variables and their measurement criteria along with sample and statistical model selected for the study.

### 3.1. Description and Measurement of Variables

This section discusses the description of the variables and their measurement criteria along with the statistical model selected for the study. Variables as defined by previous studies (Opler et al., 1999; Dittmar et al., 2003; Kusnadi, 2003; Saddour, 2006; Harford et al., 2008; Masood & Shah, 2014) are discussed as follows. Cash holdings (CASH) of the firms is the dependent variable for this study The independent variables include different proxies for corporate governance and a set of control variables. Detail explanation is given in Table 1.

**Table 1**

**List and Measurement of Variables**

| Variables | Names of Variables | Measured By |
|---|---|---|
| **Dependent Variable** | | |
| | Cash Holdings (CASH) | A ratio of cash and cash equivalents to net assets. Net Assets are Total Assets less cash and cash equivalents |
| **Independent Variables** | | |
| Ownership Structure | Institutional Ownership (INST) | It is the shares held by the Institutional Investors divided by Total Number of Shares. |
| | Directors Ownership (DIRC) | It is the shares held by the directors divided by the total number of shares. |
| | Concentration (CON) | It is the log of the number of shareholders. |
| Board Struture | Board Size (BOARD) | The number of directors on the board. |
| | Board Independence (BIG) | The shares held by the 5 largest shareholders of the firm divided by total number of shares. |
| **Control Variables** | | |
| | Growth (GROWTH) | It is the geometric mean of the percentage increase in the total assets. |
| | Dividend (DIVDUM) | Dividend is a dummy variable. The firms that pay dividend =1 and those not paying dividend =0 |
| | Size of firm (LOGSIZE) | The log of total assets. |

| | | |
|---|---|---|
| | Leverage (LEVE) | It is the ratio of total liabilities to total assets. |
| | Capital Expenditure (CAPEX) | It is the percentage increase in the gross fixed assets. |
| | Net working Capital (NW_CASH) | The ratio of Current assets minus cash minus current liabilities to total assets is the networking capital. |
| | Cash flows (CASHFLOWS) | It is the ratio of addition net income and depreciation to total assets. |

### 3.2. Sample and Sources of Data

A sample of 80 non-financial listed firms for the period 2010 to 2014 is drawn from the target population which is comprised of data obtained from 50 non-financial firms of manufacturing industry (with a total of 250 observations) and 30 non-financial firms of services industry (with a total of 150 observations). The rationale behind excluding financial firms from present study is that their capital structure and profits are different from non-financial firms listed on KSE (Kusnadi, 2003; Shah, 2011; Masood & Shah, 2014). The sources of the data used in the study are the annual reports of the listed firms.

### 3.3. Statistical Model

A statistical model for this study is designed to quantitatively examine the impact of corporate governance on cash holdings of firms which incorporates all of the aforementioned variables to derive some meaningful results. This model is shown as below.

$$Cash\ Holdings_{i,t} = \alpha + \beta_1\ (Ownership\ Structure)_{i,t} + \beta_2\ (Board\ Structure)_{i,t} + \beta_3 (Control\ Variables)_{i,t} + \varepsilon_{i,t}$$

In the above model the cash holdings of the firm "i" at time "t" is the dependent variable and the independent variables are the ownership structure, the board structure and a set of control variables where "ε" is the error term. "α" is the intercept which shows cash holdings of firm "i" at time t = 0, whereas $\beta_1$, $\beta_2$ and $\beta_3$ is the slope of independent variables i.e. ownership structure, board structure and control variables respectively.

To test the relationship between corporate governance and cash holdings regression technique is used in the study. Panel data analysis is used in the present study because it contains both time-series and cross-sectional features. Panel data is also helpful in controlling unobserved heterogeneity i.e. one instance in where a

correlation between observable variable and unobservable variable is expected (Masood & Shah, 2014). Putting differently, it allows controlling for omitted (unobserved or mis-measured) variables. Another motivation for using this technique is that it increases sample size and involves more variability.

## 4. Results and Analysis

In this section, a detailed analysis is conducted for finding the impact of corporate governance on cash holdings of non-financial firms in the manufacturing and services industry of Pakistan. Starting from descriptive analysis and then OLS regression is applied on both non-financial firms in the manufacturing and services industry. To select the best model between fixed and random effect regression models, Hausman test is used. The results in Table 3B in Appendix of Hausman test derived from the data of non-financial manufacturing firms shows that fixed effect regression model is more appropriate model (P-value is 0.0178 which is less than 0.05). Similarly Table 4B in Appendix presents the results for Hausman test for non-financial servicing firms. The P-value is 0.6633 which is far greater than 0.05 showing that the null hypothesis will be accepted i.e. random effect is a good model.

### 4.1. Descriptive Statistics

The Table 2 highlights the summary statistics of sampled 50 non-financial listed firms, these firms containing name of variables in the first column followed by mean, median, mode, standard deviation, sample variance and minimum and maximum value.

These results show that on average, non-financial firms in manufacturing industry hold 5.35% cash and cash equivalents *(CASH).* Institutional investors *(INST)* hold 17.53% shares and directors *(DIRC)* have 43.35% shares out of the total share of firms. Similarly the concentration of shares *(CON)* and board size *(BOARD)* is 7.76% and 8.24% respectively. However, shares held by five largest shareholders in the manufacturing industry *(BIG)* is 69.19% on average whereas, growth *(GROWTH),* dividends *(DIVDUM),* leverage *(LEVE),* capital expenditures *(CAPEX),* net-working capital *(NW_CASH)* and cash flows *(CASHFLOWS)* are 9.29%, 58.80%, 54.28%, 7.22%, 3.41% and 12.31% respectively.

**Table 2**

**Descriptive Statistics of Firms in the Manufacturing Industry**

| Variables | Mean | Median | Mode | Standard Deviation | Sample Variance | Min | Max |
|---|---|---|---|---|---|---|---|
| CASH | 0.0535 | 0.0141 | 0.0029 | 0.1356 | 0.0184 | 0.0001 | 1.6566 |
| INST | 0.1753 | 0.1114 | 0.0002 | 0.1921 | 0.0369 | 0.0002 | 0.8696 |
| DIRC | 0.4335 | 0.0667 | 0.0000 | 3.8780 | 15.0391 | 0.0000 | 61.3800 |
| CON | 7.7637 | 7.5600 | 7.1900 | 1.0141 | 1.0283 | 5.5900 | 10.5600 |
| BOARD | 8.2440 | 8.0000 | 7.0000 | 1.4341 | 2.0567 | 6.0000 | 13.0000 |
| BIG | 0.6919 | 0.7219 | 0.8010 | 0.1758 | 0.0309 | 0.0562 | 0.9782 |
| GROWTH | 0.0929 | 0.0715 | 0.0987 | 0.1102 | 0.0121 | -0.1585 | 0.6780 |
| DIVDUM | 0.5880 | 1.0000 | 1.0000 | 0.4932 | 0.2432 | 0.0000 | 1.0000 |
| LOGSIZE | 15.2747 | 15.3850 | 15.3700 | 1.5212 | 2.3140 | 10.0900 | 18.5600 |
| LEVE | 0.5428 | 0.5495 | 0.7090 | 0.2563 | 0.0657 | 0.0060 | 1.9620 |
| CAPEX | 0.0722 | 0.0345 | 0.0000 | 0.1652 | 0.0273 | -0.8371 | 0.8891 |
| NW_CASH | 0.0341 | 0.0240 | 0.0116 | 0.2252 | 0.0507 | -0.7169 | 0.9862 |
| CASHFLOWS | 0.1231 | 0.0747 | 0.0778 | 0.6334 | 0.4012 | -0.7777 | 9.9463 |

**Table 3**

**Descriptive Statistics of Firms in the Services Industry**

| Variables | Mean | Median | Mode | Standard Deviation | Sample Variance | Min | Max |
|---|---|---|---|---|---|---|---|
| *CASH* | 0.1027 | 0.0525 | 0.0016 | 0.1413 | 0.0200 | 0.0001 | 0.8642 |
| *INST* | 0.2431 | 0.1577 | 0.1004 | 0.2211 | 0.0489 | 0.0056 | 0.9700 |
| *DIRC* | 0.1043 | 0.0010 | 0.0000 | 0.1704 | 0.0290 | 0.0000 | 0.5590 |
| *CON* | 8.0955 | 7.9750 | 6.6700 | 1.3246 | 1.7545 | 5.0110 | 10.9690 |
| *BOARD* | 8.6600 | 8.0000 | 7.0000 | 2.0360 | 4.1454 | 5.0000 | 15.0000 |
| *BIG* | 0.6825 | 0.7332 | 0.5772 | 0.1914 | 0.0366 | 0.3210 | 0.9777 |
| *GROWTH* | 0.1376 | 0.0954 | 0.0000 | 0.2368 | 0.0561 | -0.1660 | 1.4704 |
| *DIVDUM* | 0.6200 | 1.0000 | 1.0000 | 0.4870 | 0.2372 | 0.0000 | 1.0000 |
| *LOGSIZE* | 16.1787 | 16.1450 | 15.9300 | 1.6074 | 2.5837 | 12.9000 | 19.4900 |
| *LEVE* | 0.6041 | 0.5040 | 0.4260 | 0.4003 | 0.1602 | 0.0590 | 2.1110 |
| *CAPEX* | 0.1002 | 0.0397 | 0.0000 | 0.3284 | 0.1079 | -0.8289 | 2.2875 |
| *NW_CASH* | -0.0312 | 0.0297 | 0.0000 | 0.3471 | 0.1205 | -1.1684 | 0.5746 |
| *CASHFLOWS* | 0.0580 | 0.0862 | 0.0488 | 0.1456 | 0.0212 | -0.9486 | 0.4369 |

Similarly, Table 3 presents the descriptive statistics of a sample of 30 non-financial listed firms in the services industry. These results show that on average, non-financial firms in services industry hold 10.27% cash and cash equivalents *(CASH).* Institutional investors *(INST)* hold 24.31% shares and directors *(DIRC)* have 10.43% shares out of the total share of firms.

### 4.2. Simple Ordinary Least-Square Regression Model

The empirical results of simple ordinary least square method are shown in Table 4. These results are obtained by taking an overall sample of 80 non-financial firms of manufacturing and services industry of Pakistan along with embedding a dummy variable (DUM) is equal to "1" for non-financial manufacturing firms and "0" otherwise. The dependent variable is cash holding (CASH). In the first column, list of variables is shown whereas beta coefficients are shown in the second column, followed by standard error, t-statistics and probability value in the third, fourth and fifth column respectively. The overall significance or validity of the model is good as value of F-statistics is 7.08, which is greater than 4 showing that the model is a good fit with the P-value of 0.000. R-square value is 0.1926 showing that 19.26% variations in the dependent variable are explained by the independent variables.

Table 4 shows that concentration of shares *(CON),* number of shares held by five largest shareholders *(BIG)* and dividend *(DIVDUM)* are significantly and positively related whereas leverage *(LEVE)* and net-working capital *(NW_CASH)* are significantly and negatively related to cash holdings of non-financial listed firms in the manufacturing and services industry of Pakistan. Similarly, the *(DUM)* variable is also significant which indicates that the cash holdings pattern of manufacturing firms differs from the servicing firms based on differences in their operational needs and R & D expenditures. However, the institutional ownership *(INST)* and growth *(GROWTH)* are found to be positively related to cash holdings but insignificant. In contrast, the directors' ownership *(DIRC),* board size (BOARD), size of firm (LOGSIZE), capital expenditure (CAPEX) and cash flows (CASHFLOWS) are observed as negatively related to cash holdings but insignificant in context of non-financial firms of manufacturing and services of Pakistan.

**Table 4**

**Results of Simple OLS Regression**

Dependent Variable: *CASH*
Method: Least Squares Regression
Sample: 80
Included observations: 400

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| *C* | 0.018382 | 0.086303 | 0.212994 | 0.8314 |
| *INST* | 0.019493 | 0.033979 | 0.573691 | 0.5665 |
| *DIRC* | -0.002294 | 0.002124 | -1.079674 | 0.2810 |
| *CONC* | 0.014392 | 0.007092 | 2.029188 | 0.0431 |
| *BOARD* | -0.007461 | 0.004576 | -1.630682 | 0.1038 |
| *BIG* | 0.203086 | 0.036718 | 5.531024 | 0.0000 |
| *GROWTH* | 0.005432 | 0.041464 | 0.131006 | 0.8958 |
| *DIVDUM* | 0.060375 | 0.015284 | 3.950173 | 0.0001 |
| *LOGSIZE* | -0.005556 | 0.004987 | -1.114050 | 0.2660 |
| *LEVE* | -0.099653 | 0.031379 | -3.175764 | 0.0016 |
| *CAPEX* | -0.011715 | 0.027011 | -0.433711 | 0.6647 |
| *NW_CASH* | -0.092368 | 0.040195 | -2.298026 | 0.0221 |
| *CASHFLOWS* | -0.008539 | 0.012895 | -0.662248 | 0.5082 |
| *DUM* | -0.050074 | 0.014156 | -3.537395 | 0.0005 |
| R-squared | 0.192651 | | | |
| Adjusted R-squared | 0.165461 | | | |
| S.E. of regression | 0.127579 | | | |
| F-statistic | 7.085251 | | | |
| Prob (F-statistic) | 0.000000 | | | |

### 4.3. Fixed Effect Regression Model for Non-Financial Manufacturing Firms

The resulted shown in Table 5 elaborate the results of fixed effect regression model for non-financial firms in manufacturing industry of Pakistan. The significance level of 5% is used in this regression model. A total of 250 observations from 50 non-financial manufacturing firms are included in the panel from 2010 to 2014. Balanced panel is used because data is collected for the same variables in the same time period. Results of the fixed effect regression model indicate that this model fits the data as the value of F-statistics is 4.897, which is greater than 4. Coefficient of determination i.e. the value of R-square is 0.6137 showing that

61.37% variation in the dependent variable *(CASH)* is due to independent variables included in the study.

The institutional ownership *(INST)* is the first proxy included in the study for corporate governance mechanism. Results show that institutional shareholding *(INST)* is positively related with cash holdings *(CASH)* but insignificant. With an increase in institutional ownership *(INST)* by one unit, cash holding of non-financial manufacturing firms will increase by 0.0346 units. These results are in line with the previous studies conducted by Harford et al. (2008); Masood and Shah (2014); Ullah, Saeed and Zeb (2014) who found a positive association between cash holdings and institutional shareholdings. This shows that in a country like Pakistan, where corporate governance is weak, inside owners hold more cash and outside investors cannot force them to pay dividends. Another reason for this insignificant positive relationship might be that some firms maintain large cash for stable dividend payments to these institutional investors. But in Pakistani manufacturing firms, high institutional shareholdings do not cause firms to increase in their total payouts as indicated by Afza and Mirza (2011) because institutional investors such as banks, joint-stock companies and financial institutions have different preferences towards dividends. Such as insurance companies demands more dividend, so firms in which insurance companies hold more shares are likely to hold more cash for dividend payments. In contrast, NIT and Modarbah companies might have less proportion of shares in these companies so cannot significantly influence cash holdings for dividend payments.

**Table 5**

**Fixed Effect Regression Results for Manufacturing Firms**

Dependent Variable: CASH
Method: Panel Least Squares
Sample: 2010-2014
Periods included: 5
Cross-sections included: 50
Total panel (balanced) observations: 250

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| *INST* | 0.034613 | 0.063752 | 0.542934 | 0.5878 |
| *DIRC* | -0.000244 | 0.001787 | -0.136450 | 0.8916 |
| *CONC* | -0.093017 | 0.067241 | -1.383335 | 0.1682 |
| *BOARD* | -0.014397 | 0.013535 | -1.063711 | 0.2888 |

| | | | | |
|---|---|---|---|---|
| *BIG* | 0.042210 | 0.103607 | 0.407405 | 0.6842 |
| *GROWTH* | 0.305667 | 0.121940 | 2.506707 | 0.0130 |
| *DIVDUM* | 0.035491 | 0.022241 | 1.595784 | 0.1122 |
| *LOG_SIZE* | -0.106291 | 0.034644 | -3.068096 | 0.0025 |
| *LEVE* | -0.268183 | 0.075064 | -3.572700 | 0.0004 |
| *CAPEX* | -0.046975 | 0.048329 | -0.971981 | 0.3323 |
| *NW_CASH* | -0.308952 | 0.086248 | -3.582146 | 0.0004 |
| *CASH_FLOWS* | -0.005420 | 0.010745 | -0.504451 | 0.6145 |

| Effects Specification | | | |
|---|---|---|---|
| Cross-section fixed (dummy variables) | | | |
| R-squared | 0.613749 | Mean dependent var | 0.053474 |
| Adjusted R-squared | 0.488423 | S.D. dependent var | 0.135618 |
| S.E. of regression | 0.097000 | | |
| F-statistic | 4.897215 | | |
| Prob (F-statistic) | 0.000000 | | |

Directors' ownership *(DIRC)* is another proxy for corporate governance. The relationship between directors' ownership *(DIRC)* and cash holdings *(CASH)* of non-financial manufacturing firms is negative but highly insignificant. This result is consistent with previous literature i.e. increase in managerial ownership will reduce cash holdings (Chen, 2008; Zia-ul-Hannan and Asghar, 2013; Masood & Shah, 2014; Ullah, Saeed & Zeb, 2014). However, the insignificance of this result is an indication of weak corporate governance in Pakistan.

The concentration of shares *(CON)* with the coefficient of -0.093 is negatively and insignificantly related to cash holdings *(CASH)* of non-financial firms in manufacturing industry. This result is supported by the study of Anjum and Malik (2013) and Daher (2010) showing that high ownership concentration leads to less cash holdings in order to avoid agency conflicts. However, due to weak legal system, such increase in concentration of shares does not contribute to increase in monitoring and control over managers in terms of cash manipulation, hence the relationship is insignificant.

Similarly, the coefficient of board size *(BOARD)* is negative i.e. -0.0143 but again insignificant. Studies conducted by Harford et al. (2008) and Masood and Shah (2014) support the finding of this study that board members are responsible in effective monitoring and

control of the activities of manager and thereby contributing to less cash holdings. But being insignificant in case of non-financial firms in manufacturing industry, these results indicate that corporate governance is not effective in Pakistan and directors do not play their role well in determining cash level of these firms in manufacturing industry (Razzaq & Naeem-Ullah, 2014).

Board independence *(BIG)* with coefficient 0.0422 showed a positive but insignificant relationship with cash holdings of manufacturing firms. Dittmar et al. (2003) supports this result as increase in ownership percentage by five largest shareholders of firm leads to an increase in cash holdings for investment in profitable projects. However, in a country like Pakistan where shareholders protection is weak, presence of block holders on the board does not ensure their ability to effectively monitor that whether such increase in cash holdings will ultimately be invested in profitable projects by managers or not. Therefore, the relation comes out to be insignificant for non-financial manufacturing firms.

The variable growth *(GROWTH)* has a positive and significant relationship with cash holdings of firms in the manufacturing industry. The coefficient of growth *(GROWTH)* is positive i.e. 0.3056 indicating that one unit increase in growth *(GROWTH)* will cause an increase in cash holdings *(CASH)* of firms in manufacturing industry by 0.3056 units. The results show that growing firms in the manufacturing industry hold more cash with them as compared to mature firms. These results are consistent with study conducted by Saddour (2006), Kim et al. (2011) and Castiglionesi (2012). However, the results are inconsistent with the findings of Masood and Shah (2014) which showed a positive but insignificant relationship between growth and cash holdings of Pakistani firms.

The study shows a positive and insignificant relationship of dividend payments *(DIVDUM)* and cash holdings with a coefficient of 0.0354 indicating that manufacturing firms in Pakistan do not hold cash for dividend payments. Though, the positive relationship between dividend payments and cash holdings is consistent with the study conducted by Ammann et al. (2010) and Masood and Shah (2014) showing that dividend payments minimizes the possibility of cash to be invested in negative-NPV projects but the insignificance of this relationship indicates that weak shareholders protection in Pakistan does not guarantee these dividend to be paid on consistent basis.

Size of firm *(LOGSIZE)* showed a negative and significant relationship with cash holdings of firms in manufacturing industry. With a coefficient of -0.1062, the results indicate that an increase in size of firm *(LOGSIZE)* by one unit will cause a decrease in cash holdings of firms by 0.1062 units. This finding is consistent with the work of Jensen (1986), Dittmar et al. (2003), Carrascal (2010), Soku (2011) and Wai (2013) that smaller firms hold more cash than the larger firms. This is because larger firms have better access to capital markets (Carrascal, 2010), well diversified with less chances of bankruptcy and economies of scale in issuing new securities (Drobetz & Grüninger, 2007). However, these results are inconsistent with the study of Afza and Adnan (2011), Azmat (2011) and (Islam, 2012).

Similarly, the relationship of variable leverage *(LEVE)* is found to be negatively significant with the cash holdings of non-financial manufacturing firms. With a coefficient of -0.2681, the results indicate that an increase in leverage *(LEVE)* by one unit will cause a decrease in cash holdings of firms by 0.2681units. This result is consistent with the study of Afza and Adnan (2011), Zia-ul-Hannan and Asghar (2013), Masood and Shah (2014) and Uyar & Kuzey (2014). Firms in manufacturing industry with higher debt have less cash with them as cost of debt servicing rises with an increase in leverage. Also, debt can be used as a substitute for cash (Shah, 2011). However, these results are found to be inconsistent with Guney et al. (2007) and Oplers et al. (1999) who found a positive relationship between leverage and cash holdings.

Net-working capital *(NW_CASH)* is negatively and significantly related with cash holdings of firms in manufacturing industry. Results showed that an increase in net-working capital *(NW_CASH)* by one unit will bring a decrease in cash holdings of these firms by 0.3089. The results are consistent with Basheer (2014), Masood and Shah (2014) who showed that "the net-working capital is the close substitute of cash for firms." These findings are contrary to the studies by Aslam (2013), Zia-ul-Hannan and Asghar (2013), Kafayat et al. (2014) who found a positive relationship between these variables.

The results of the fixed effect regression model also showed that the relationship of capital expenditures *(CAPEX)* and cash flows *(CASHFLOWS)* is negative but insignificant with cash holdings for manufacturing firms in Pakistan. These results show that increase in investment opportunities and profitability do not affect cash holdings of manufacturing firms.

### 4.4. Random Effect Regression Model for Non-Financial Firms in the Services Industry

The results of random effect regression model for non-financial firms in services industry of Pakistan are presented in Table 6. Similarly, the results of fixed effects are shown in Table 2B, in the Appendix.

The significance level of 5% is used in this regression model. A total of 150 observations from 30 non-financial servicing firms are included in the panel from 2010 to 2014. Balanced panel is used because data is collected for the same variables in the same time period. Independent variables are shown in the first column. Results indicate that this model fits the data as the value of F-statistics is 4.255, which is greater than 4. Coefficient of determination i.e. the value of R-square is 0.3649 showing that 36.49% variation in the dependent variable *(CASH)* is due to independent variables included in the study.

Those independent variables which have significant impact on cash holdings of firms in services industry are discussed first, followed by other variables having insignificant but opposite effect on cash holdings in comparison with firms in the manufacturing industry.

Board independence *(BIG)* showed a significantly positive relationship with the cash holdings of firms, with a coefficient of 0.0406 indicating that one unit increase in board independence *(BIG)* will cause an increase in cash holdings *(CASH)* of firms in services industry by 0.0406 units. With an increase in the percentage of shares held by five big shareholders of the firm, the cash holding will rise because such share holders will have more influencing power on manager to hoard more cash (Masood & Shah, 2014). The finding is also consistent with the study conducted by Chen (2008) that since firms in telecommunications, computer, software, Internet and networking industries where the investment opportunities are relatively high as compared to manufacturing firms of durable and non-durable products with limited investment opportunities available therefore such firms hold more cash. Same is the case of firms in services industry of Pakistan where presence of big shareholders on board ensures that cash is invested in appropriate manner for investment in R & D and other profitable projects, so increase in cash holdings occurs in services industry. This result is inconsistent with the study of Kusnadi (2003) who found a negative relationship between board independence and cash holdings.

**Table 6**

**Random Effect Regression Results for Servicing Firms**

Dependent Variable: CASH
Method: Panel Regression (Cross-section random effects)
Sample: 2010-2014
Periods included: 5
Cross-sections included: 30
Total panel (balanced) observations: 150

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| *INST* | 0.116764 | 0.081612 | 1.430711 | 0.1548 |
| *DIRC* | 0.040682 | 0.103627 | 0.392582 | 0.6952 |
| *CONC* | 0.005146 | 0.017025 | 0.302252 | 0.7629 |
| *BOARD* | -0.001481 | 0.009826 | -0.150744 | 0.8804 |
| *BIG* | 0.321882 | 0.112400 | 2.863730 | 0.0048 |
| *GROWTH* | 0.055059 | 0.051256 | 1.074193 | 0.2846 |
| *DIVDUM* | 0.065356 | 0.026165 | 2.497793 | 0.0137 |
| *LOG_SIZE* | -0.004790 | 0.015320 | -0.312683 | 0.7550 |
| *LEVE* | -0.188866 | 0.059629 | -3.167355 | 0.0019 |
| *CAPEX* | -0.003901 | 0.021265 | -0.183421 | 0.8547 |
| *NW_CASH* | -0.229187 | 0.067519 | -3.394403 | 0.0009 |
| *CASHFLOWS* | -0.072591 | 0.076807 | -0.945110 | 0.3463 |

| | | | |
|---|---|---|---|
| R-squared | 0.364970 | Mean dependent var | 0.029360 |
| Adjusted R-squared | 0.101828 | S.D. dependent var | 0.081574 |
| S.E. of regression | 0.077739 | | |
| F-statistic | 4.255492 | | |
| Prob (F-statistic) | 0.012302 | | |

The study shows a positive and significant relationship of dividend payments *(DIVDUM)* and cash holdings with a coefficient of 0.0653 indicating that servicing firms in Pakistan hold cash for dividend payments. The same result between these variables was observed by Rao (2015) while examining Indian listed firms. Likewise, this positive relationship between dividend payments and cash holdings is consistent with the study conducted by Ammann et al. (2010) and Masood and Shah (2014) showing that dividend payments minimizes the possibility of cash to be invested in negative-NPV projects. Similarly, since most of the corporate governance proxies in this study are found to be insignificant showing weak corporate

governance in the services industry, Ammann et al. (2010) suggests that the firms in such industries can still be able to make profit from cash holding by maintaining high dividend payouts even if the corporate governance is poor.

The relationship of variable leverage *(LEVE)* is found to be negatively significant with the cash holdings of non-financial servicing firms. With a coefficient of -0.1994, the results indicate that an increase in leverage *(LEVE)* by one unit will cause a decrease in cash holdings of firms by 0.1994units. This result is same for firms in both of the manufacturing and services industry of Pakistan but the magnitude of this relationship is slightly higher for the firms in manufacturing industry i.e. 0.2681 showing that the increase in level of debt causes a greater decrease in cash holding level of manufacturing firms than the servicing firms.

Similarly, net-working capital *(NW_CASH)* is negatively and significantly related with cash holdings of firms in services industry. Results showed that an increase in net-working capital *(NW_CASH)* by one unit will bring a decrease in cash holdings of these firms by 0.2291. A similar result was also observed in the manufacturing industry but the impact of networking capital on cash holdings of manufacturing firms is high as compared to servicing firms which indicates that the manufacturing firms rely more on use of networking capital as a substitute of cash than firms in the services industry of Pakistan.

In case of directors' ownership *(DIRC)* in servicing firms, an opposite but insignificant is observed as compared to manufacturing firms. The relationship between directors' ownership *(DIRC)* and cash holdings *(CASH)* of non-financial servicing firms is positive but insignificant. The coefficient of directors' ownership *(DIRC)* is 0.0406 showing that an increase in directors' ownership *(DIRC)* by one unit, cash holding of non-financial servicing firms will increase by 0.0406 units. The positive nature of this relationship is consistent with Morck, Shleifer and Vishny's (1988), Lee and Lee (2009), Ping et al. (2011) which indicates that due to weak corporate governance, directors do not play their role well and are involved in more cash holdings in services industry.

Similarly, the relationship of concentration of shares *(CON)* is positively and insignificantly related to cash holdings *(CASH)* of non-financial firms in services industry. The coefficient of concentration of shares *(CON)* is 0.0051 showing that an increase in concentration of

shares *(CON)* by one unit, cash holding of non-financial servicing firms will increase by 0.0051 units. La Porta et al. (2000) and Masood and Shah (2014) explained the positivity of such relationship as the founders of firms existing in a weak legal environment try to hold more cash in order to avail profitable investment opportunities. But this impact is insignificant in context of servicing firms of Pakistan.

However, some variables in the present study (as discussed in the previous section in detail) are found to have the same insignificant impact on cash holdings of firms in the services industry as observed in the manufacturing industry. These variables include institutional ownership *(INST)*, board size *(BOARD)*, capital expenditure *(CAPEX)* and cash flows *(CASHFLOWS).*

## 5. Conclusions

The main findings of the study reveal that the cash holding pattern of firms in the services sector differs significantly from the manufacturing sector due to differences in their operational needs and R & D investments. Generally servicing firms hold more cash as compared to manufacturing firms. Moreover, in case of manufacturing firms, the growth is found to be positively related with cash holdings while size of firm, leverage and networking capital are negatively related with the cash holdings. On the other side, for servicing firms, board independence and dividend are directly related to cash holdings while leverage and net-working capital are negatively related to cash holdings by these firms. However, most of the corporate governance proxies are found to be insignificant, which is an indication of weak corporate governance in Pakistan in determining the cash holding decision of firms in manufacturing and services industry.

The findings of this study suggest that in manufacturing industry the impact of institutional ownership is positive but insignificant which implies due to weak corporate governance in Pakistan. Inside owners hold more cash and outside investors cannot force them to pay dividends. Additionally, institutional preferences towards dividend are also different which ultimately affects their ability to influence cash holding decision of these firms. The relationship of directors' ownership, concentration of shares and board size with cash holdings is negative and insignificant which indicates that increase in number of shares held by directors, ownership concentration and number of directors on board respectively, do not

contribute to increase in monitoring and control over managerial activities in terms of cash manipulation in manufacturing firms. This further confirms the existence of weak governance mechanism in manufacturing industry. Moreover, the board independence is positively but insignificantly related with cash holdings of manufacturing firms which suggests that although an increase in the percentage of ownership held by five biggest shareholders of a firm leads to an increase in cash holdings for availing profitable investment opportunities. As the investment opportunities are limited and shareholders protection is weak, the board independence in such a situation does not guarantee the manger's investments in profitable projects.

In manufacturing industry, the growth of firms is positively and significantly related with cash holdings indicating that growing firms hold more cash with them. In contrast, the relationship of firm's size with cash holdings is significantly negative, suggesting that small manufacturing firms hold more cash with them because of limited access to capital markets than the large firms in manufacturing industry. Likewise, leverage and net-working capital are negatively related with cash holdings implying that debt and net-working capital can be used as a substitute for cash in manufacturing firms. However, the relationship of dividend, capital expenditure and cash flows is insignificant in case of cash holdings of manufacturing firms suggesting that these firms do not hold cash for dividend payments and increase in investment opportunities and profitability do not affect cash holdings.

For services industry, the present study reveals that the relationship of board independence is significantly positive with cash holdings, suggesting that the increase in percentage of shares held by five biggest shareholders of a firm will increase cash holdings because such shareholders will be having more influential power on managers to hoard cash as more investment opportunities are available in services industry as compared to manufacturing industry. Also the presence of independent board in such firms ensures that excess cash would be invested in appropriate manner on R & D and other profitable projects which ultimately build investors' confidence for large cash holdings in servicing firms in Pakistan. The impact of other corporate governance proxies' i.e. institutional ownership, directors' ownership and ownership concentration on cash holdings of firms is insignificant for the services industry. After examining the

impact of control variables on cash holdings of servicing firms, the study concludes a direct relationship between dividend payments and cash holdings of these firms. This shows that servicing firms hold cash for dividend payments. In contrast, the relationship of cash holdings with leverage and net-working capital of firms in services industry is same as that of manufacturing industry i.e. significantly negative. However, the impact of these two factors was higher on cash holdings of the manufacturing firms than the servicing firms.

Under the guidance of above findings firms in the manufacturing industry can improve their governance practices to strengthen the investors' confidence by ensuring an effective utilization of excess cash holdings. Moreover, by active role of the directors and vigilant oversight of manager, the excess cash can be utilized in profitable projects. With better access to capital markets firms in manufacturing sector especially with low borrowing should hold less cash. However, firms in the services industry, in addition to enhancing board of directors' role can utilize influential power of the biggest shareholders for maintaining optimal cash level.

The major limitation was the time-constraint and excess to data. More improved results can be obtained by increasing sample size for an extended time period. Moreover, firm which do not disclose consistent annual reports and data regarding some important variables such as institutional ownership and directors' ownership are also excluded from study, but can be incorporated by use of primary data. Analyzing the impact of corporate governance on cash holdings of firms offering financial services can be a worthwhile research. Similarly, impact of other corporate governance proxies such as foreign ownership on cash holdings can also be examined in context of Pakistani firms. Moreover, cross country analysis among the developing countries and the developed countries can also be a considerable dimension for future research.

## References

1. Afza, T., and Adnan, S.M. (2007). "Determinants of corporate cash holdings: A case study of Pakistan". *Proceedings of Singapore Economic Review Conference (SERC)* 2007, August 01-04, Organized by Singapore Economics Review and the University of Manchester (Brooks World Poverty Institute), Singapore pp. 164-165. [Online] Retrieved from:

https://editorialexpress.com/cgibin/conference/download.cgi?db_name=SERC2007&paper_id=166.
2. Afza, T., and Mirza, H. H. (2011). "Institutional shareholdings and corporate dividend policy in Pakistan". *African Journal of Business Management*, *5*(22), pp. 8941-8951.
3. Almeida, H., Campello, M., and Weisbach, M. S. (2004). "The cash flow sensitivity of cash". *The Journal of Finance*, *59*(4), pp. 1777-1804.
4. Almudehki, N., and Zeitun, R. (2012). "Ownership Structure and Corporate Performance: Evidence from Qatar". *Available at SSRN 2154289*.
5. Ammann, M., Oesch, D., and Schmid, M. M. (2010). "Cash holdings and corporate governance around the world". *Journal of Empirical Finance, forthcoming*.
6. Anderson, R. W., and Hamadi, M. (2009). "Large powerful shareholders and cash holding". (Discussion Paper), [Online] Retrieved from: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1433886
7. Azmat, Q. (2011). "Corporate Cash Holdings: A Growth and Mature Firm Perspective in Pakistani Context". 3rd International SAICON Conference. [Online] Retrieved from: http://saicon2011.ciitlahore.edu.pk/Economics/11-1220%20qurat%20ul%20ann.pdf.
8. Barbosa, N. and Louri, H. (2002). "On The Determinants of Multinationals' Ownership Preferences: Evidence from Greece and Portugal". *International Journal of Industrial Economics, Vol. 20*(1), pp. 493–515.
9. Basheer, M. F. (2014). "Impact of Corporate Governance on Corporate Cash Holdings: An empirical study of firms in manufacturing industry of Pakistan". *International Journal of Innovation and Applied Studies, 7* (4), pp. 1371-1383.
10. Bates, T. W., Kahle, K. M., and Stulz, R. M. (2009). "Why do US firms hold so much more cash than they used to?". *The Journal of Finance*, *64*(5), pp. 1985-2021.
11. Byrd, J. W. (2010). "Financial policies and the agency costs of free cash flow: evidence from the oil industry". Available at *SSRN 1664654*.
12. Carrascal, C. M. (2010). "Cash holdings, firm size and access to external finance: evidence for the Euro Area". *Documentos de trabajo del Banco de España*, (34), pp. 9-26.

13. Castiglionesi, S. R. D. F. (2012). "What Determines Cash Holding of A Firm? Evidence from Euro-Zone Listed Firms". [Online] Retrieved from: http://arno.uvt.nl/show.cgi?fid=127364.
14. Chen, R. (2008). "Corporate Governance and Cash Holdings: Listed New Economy versus Old Economy Firms". *Corporate Governance: An International Review*, *16* (5), pp. 430–442.
15. CIA World Factbook (2015), "List of Countries by GDP sector composition, Statistics Times". [Online] Retrieved from: http://statisticstimes.com/economy/countries-by-gdp-sector-composition.php.
16. Claessens, S., Djankov, S., and Lang, L. H. (2000). "The separation of ownership and control in East Asian corporations". *Journal of financial Economics*, *58*(1), pp. 81-112.
17. Cornett, M. M., Marcus, A. J., Saunders, A., and Tehranian, H. (2007). "The impact of institutional ownership on corporate operating performance". *Journal of Banking & Finance*, *31*(6), pp. 1771-1794.
18. Cossin, D., and Hricko, T. (2004). "The Benefits of Holding Cash: A Real Options Approach". *Managerial Finance*, 30(5), 29-43, [Online] Retrieved from: http://dx.doi.org/10.1108/03074350410769056.
19. Couderc, N. (2005). "Corporate cash holdings: financial determinants and consequences". [Online] Retrieved from: http://www.univ-orleans.fr/deg/GDRecomofi/Activ/couderc_strasbg05.pdf.
20. Crutchley, C. E., Jensen, M. R., Jahera, J. S., and Raymond, J. E. (1999). "Agency problems and the simultaneity of financial decision making: The role of institutional ownership". *International review of financial analysis*, *8*(2), pp. 177-197.
21. Daher, M. (2010). "The determinants of cash holding in UK public and private firms". [Online] Retrieved from: http://www.professionsfinancieres.com/docs/2011104904_25--the-determinants-of-cash-holdings.pdf.
22. Damodaran, A. (2005). "Dealing with cash, cross holdings and other non-operating assets: Approaches and implications". *Cross Holdings and Other Non-Operating Assets: Approaches and Implications* (September 30, 2005).
23. Dittmar, A., Mahrt- Smith, J. and Servaes, H. (2003). "International Corporate Governance and Corporate Cash

Holding". *Journal of Financial and Quantitative Analysis* 38(1), pp. 111-133.
24. Dittmar, A., and Mahrt-Smith, J. (2007). "Corporate governance and the value of cash holdings". *Journal of Financial Economics*, *83*(3), pp. 599-634.
25. Drobetz, W., and Grüninger, M. C. (2007). "Corporate cash holdings: Evidence from Switzerland". *Financial Markets and Portfolio Management*, 21(3), pp. 293-324.
26. Faulkender, M. W. (2004): "Cash Holdings among Small Businesses". *Working Paper*.
27. Ferreira, M.A., & Vilela, A.S. (2004). "Why do firms hold cash? Evidence from EMU countries". *European Financial Management,* 10(2), pp. 295-319, http://dx.doi.org/10.1111/j.1354-7798.2004.00251.x.
28. Flipse, A. P. (2012). "Determinants of Corporate Cash Holdings". [Online] Retrieved from: http://arno.uvt.nl/show.cgi?fid=122512.
29. Gao, H., Harford, J., & Li, K. (2012). "Determinants of corporate cash policy: A comparison of public and private firms". [Online]. Available at SSRN 1722123.
30. Gill, A., and Shah, C. (2012). "Determinants of corporate cash holdings: Evidence from Canada". *International Journal of Economics and Finance*, *4*(1), p.70.
31. Greene, W. H. (2003). "Econometric analysis (fifth edition)". *United States of America: Pearson Education*, Inc.
32. Guney, Y., Ozkan, A., and Ozkan, N. (2007). "International evidence on the non-linear impact of leverage on corporate cash holdings". *Journal of Multinational financial management*, *17*(1), pp. 45-60.
33. Gupta, A., Gupta, S. L., and Hothi, B. S. (2011). "Corporate Governance in India". *Global Journal of Management and Business Research*, *11*(5).
34. Habib, A. and Amin, A. (2006). "Determinants of Corporate Cash Holdings in Bangladesh. An EmpiricalEvaluation". *Journal of Business Studies*, 27(1) (June), pp. 165-185.
35. Han, S., and Qiu, J. (2007). "Corporate precautionary cash holdings". *Journal of Corporate Finance*, *13*(1), pp. 43-57.
36. Harford, J., Mansi, S. A., and Maxwell, W. F. (2008). "Corporate governance and firm cash holdings in the US". *Journal of Financial Economics*, *87*(3), pp. 535-555.

37. Hofmann, C. (2006). “Why New Zealand Companies hold cash: An empirical Analysis” (Unpublished Thesis).
38. Isaksson, M. (1999). “Investment, Financing and Corporate Governance: The Role and Structure of Corporate Governance Arrangements in OECD Countries”. *In Seminar on Corporate Governance in the Baltics,* pp. 21-22.
39. Islam, S. (2012). “Manufacturing Firms' Cash Holding Determinants: Evidence from Bangladesh”. *International Journal of Business and Management*, *7*(6), p. 172.
40. Jensen, M. C. (1986). “Agency cost of free cash flow, corporate finance and takeovers”. *American Economic Review 76*, pp. 323-329.
41. Jensen, M. (1993). “The modern industrial revolution, exit, and the failure of internal control systems”. *Journal of Finance 48*, pp. 831–880.
42. Kafayat, A., Rehman, K. U., and Farooq, M. (2014). “Factors Effecting Corporate Cash Holding of Non-Financial Firms in Pakistan”. *Acta Universitatis Danubius. Œconomica*, *10*(3).
43. Kalcheva, I., and Lins, K. V. (2007). “International evidence on cash holdings and expected managerial agency problems”. *Review of Financial Studies*, *20*(4), pp. 1087-1112.
44. Keynes, J. M. (1936). “The General Theory of Employment, Interest and Money”. *London: McMillan*.
45. Khamis, R., Hamdan, A. M., and Elali, W. (2015). “The Relationship between Ownership Structure Dimensions and Corporate Performance: Evidence from Bahrain”. *Australasian Accounting, Business and Finance Journal*, *9*(4), pp. 38-56.
46. Kim, J., Kim, H., and Woods, D. (2011). “Determinants of corporate cash-holding levels: An empirical examination of the restaurant industry”. *International Journal of Hospitality management,* 30(3), pp. 568-574, http://dx.doi.org/10.1016/j.ijhm.2010.10.004.
47. Kusnadi, Y. (2003). “Corporate Cash Holdings, Board Structure, and Ownership Concentration: Evidence from Singapore”. (*Working Paper). Hong Kong University of Science and Technology, 2003*.
48. La Porta, R., Lopez-De-Silanes, F., Shleifer, A., and Vishny, R. (2000), “Investor protection and corporate governance”. *Journal of Financial Economics, 58*, pp. 3–27.

49. Lang, L.H.P., Stulz, R.M., and Walkling, R.A. (1991). “A test of the free cash flow hypothesis: the case of bidder returns”. *Journal of Financial Economics* 29, pp. 315–336.
50. Lee, K. W. and Lee, C. F. (2009). “Cash Holdings, Corporate Governance Structure and Firm Valuation”. *Review of Pacific Basin Financial Markets and Policies, 12*(03), pp. 475-508.
51. Levasseur, M. (1979). “Gestion de trésorerie”. *Economica*.
52. Masood, A., and Shah, A. (2014). “Corporate Governance and Cash Holdings in Listed Non Financial Firms of Pakistan”. *Business Review*, *9*(2), pp. 48-72.
53. Mitton, T. (2004). “Corporate governance and dividend policy in emerging markets”. *Emerging Markets Review, Vol.05*, pp. 409-426.
54. McVanel, D., and Perevalov, N. (2008). “Financial constraints and the cash-holding behaviour of Canadian firms (No. 2008-16)”. *Bank of Canada (Discussion Paper).*
55. Myers, S.C. and Majluf, N.S. (1984). “Corporate financing and investment decisions when firms have information that investors do not have”. *Journal of Financial Economics*, 13, pp. 187-221.
56. Naqvi, S. A. A., and Ikram, A. (2004). “Group Affiliation, Firm Performance, and Corporate Governance in Pakistan: Evidence from the Textile Sector”. In *LUMSSEC Conference on ‘Corporate Governance in Pakistan: Regulation, Supervision, and Performance’. Lahore: Lahore University of Management Sciences, May*, pp. 29-30.
57. Ogundipe, L. O., Ogundipe, S. E., and Ajao, S. K. (2012). “Cash holding and firm characteristics: Evidence from Nigerian emerging market”. *Journal of Business Economics and Finance*, *1*(2), pp. 45-58.
58. Opler, T., Pinkowitz, L., Stulz, R., and Williamson, R. (1999). “The determinants and implications of corporate cash holdings”. *Journal of financial economics,* 52(1), pp. 3-46, http://dx.doi.org/10.1016/S0304-405X(99)00003-3.
59. Pakistan Economic Survey (2015). “Pakistan Economic Survey 2014-15”. Retrieved from: Government of Pakistan, Ministry of Finance website: http://www.finance.gov.pk/survey_1415.html.
60. Paskelian, O. G., Bell, S., and Nguyen, C. V. (2010). “Corporate governance and cash holdings: A comparative analysis of Chinese and Indian firms”. *The International Journal of Business and Finance Research*, *4*(4), pp. 59-73.

61. Ping, T., Chang-qing, S., and Li, S. (2011). "Empirical research on the interactive relationship between cash holdings and corporate performance of listed companies in China". In *Management Science and Engineering (ICMSE), 2011 International Conference on*, pp. 938-949. IEEE.
62. Pouraghajan, A. A., Pourali, M.R., and Akbari, L. (2015), "Relationship between Ownership Structure and Corporate Cash Holdings in Iran". *Applied mathematics in Engineering, Management and Technology, 3*(1), pp. 771-778.
63. Ramezani, H. (2011). "Effect of institutional ownership in determining the level of cash holdings in companies listed in TSE". s.l.: s.n.
64. Rao, K. V. (2015). "The Determinants and Value Of Cash Holdings: Evidence From Listed Firms In India". *(Doctoral Dissertation, Indian Institute Of Management Indore).*
65. Saddour, K. (2006). "The determinants and the value of cash holdings: Evidence from French firms". *CEREG*, pp. 1-33. [Online] Retrieved from: http://www.dauphine.fr/cereg/cahiers_rech/cereg200606.pdf.
66. Sánchez, J. M., and Yurdagul, E. (2013). "Why are US firms holding so much cash? An exploration of cross-sectional variation". *Federal Reserve Bank of St. Louis Review*, *95*(4), pp. 293-325.
67. Shah, A. (2011). "The corporate cash holdings: Determinants and implications". *African Journal of Business Management*, *5*(34), pp. 12939-12950.
68. Sher, G. (2014). "Cashing in for Growth: Corporate Cash Holdings as an Opportunity for Investment in Japan" (No. 14-221). (Working Paper), *International Monetary Fund*.
69. Shleifer, A., and R. W. Vishny (1997): "A survey of corporate governance". *Journal of Finance*, *52* (2), pp. 737-783.
70. Soku, B. (2011). "Financial Flexibility and Capital Structure Decision". [Online] Retrieved from: http://ssrn.com/abstract=1108850
71. Tsai, C. C. (2012). "Cash holdings and corporate governance in business group affiliated firms". In *International Conference on Economics Marketing and Management*, *Vol. 28*, pp. 83-86.
72. Uyar, A., & Kuzey, C. (2014). "Determinants of corporate cash holdings: evidence from the emerging market of Turkey". *Applied Economics*, *46*(9), pp. 1035-1048.

73. Valipour, H. et al. (2012). “Corporate Governance and Cash Holdings Policies: Evidence from Iran”. *American Journal of Scientific Research 44*, pp. 153-162.
74. Varma, J. R. (1997). “Corporate governance in India: disciplining the dominant shareholder”. *IIMB Management Review*, *9*(4), pp. 5-18.
75. Wai, W. Y. (2013). “The Effect of Corporate Governance on Cash Holdings: Evidence from Hong Kong”. *(Doctoral dissertation, Hong Kong Baptist University Hong Kong).*
76. World Bank Report (2015). “An Overview of Pakistan Economy. Retrieved from: the World Bank”. *Working for a World Free of Poverty* website: http://www.worldbank.org/en/country/pakistan/overview.
77. Xingquan, Y., and Jie, S. (2007). “A Positive Study on the Determinants of Corporate Cash Holdings: The Empirical Evidence from Listed Companies of China [J]”. *Nankai Business Review*, *6*, pp. 47-54.
78. Zia-ul-Hannan, R., and Asghar, M. N. (2013). “Impact of Corporate Governance on Corporate Cash Holding: Evidence from Non-Financial Firms in Pakistan”. *Journal of Business and Management*, 8(1), pp. 122-125. [Online], Retrieved from: http://iosrjournals.org/iosr-jbm/papers/Vol8-issue1/Q81122125.pdf.

**APPENDIX A**

**Table 1A**

**Classification of Services Sector in Pakistan**

| | |
|---|---|
| **I. <u>Distributive Services</u>**<br>• ***Transport, Storage and Communications*** | ▪ Railways<br>▪ Water Transport<br>▪ Air Transport<br>▪ Pipeline Transport<br>▪ Road Transport<br>▪ Mechanized<br>▪ Non- Mechanized<br>▪ Communications<br>▪ Storage<br>▪ Water Transport |
| • ***Wholesale, Retail Trade and Hotels and Restaurants*** | ▪ Wholesale and Retail Trade including Imports<br>▪ Purchase and Sale Agents and Brokers<br>▪ Auctioning |
| **II. <u>Producer Services</u>**<br>• ***Financial Institution*** | ▪ State Bank of Pakistan<br>▪ Commercial Bank<br>▪ Other Financial Intermediaries<br>▪ Insurance Corporations and Pension Funds |
| **III. <u>Personal Services</u>**<br>• ***Entertainment and Recreation Services***<br>• ***Ownership and Dwelling*** | |
| **IV. <u>Social Services</u>**<br>• ***Public Administration and Defense***<br>• ***Social Community and Private Services*** | ▪ Education<br>▪ Medical and Health Services Other Household and Community Services |

*Source: Economic Survey of Pakistan (2015)*

**Table 2A**

**Non-Financial Manufacturing Firms**

| Manufacturing Sector | Number of Firms | Percentage (%) |
|---|---|---|
| Automobile assembler | 2 | 4.00 |
| Automobile parts and accessories | 2 | 4.00 |
| Cable & electrical goods | 2 | 4.00 |
| Cement | 8 | 16.00 |
| Chemical | 9 | 18.00 |
| Engineering | 6 | 12.00 |
| Fertilizers | 3 | 6.00 |
| Food & personal care products | 8 | 16.00 |
| Glass and ceramics | 2 | 4.00 |
| Paper and board | 3 | 6.00 |
| Sugar and allied industries | 5 | 10.00 |
| **Total** | **50** | **100** |

**Table 3A**

**Non-Financial Firms Servicing Firms**

| Services Sector | Number of Firms | Percentage (%) |
|---|---|---|
| Power generation and distribution | 6 | 20.00 |
| Technology and communication | 5 | 16.67 |
| Industrial transportation | 2 | 6.67 |
| Media | 2 | 6.67 |
| Pharmaceuticals and bio-tech | 9 | 30.00 |
| Travel and leisure | 2 | 6.67 |
| Oil and gas marketing companies | 4 | 13.32 |
| **Total** | **30** | **100** |

**APPENDIX B**

**Table 1B**

**Random Effect Regression Results for Manufacturing Firms**

| Dependent Variable: CASH | | | | |
|---|---|---|---|---|
| Method: Panel Regression (Cross-section random effects) | | | | |
| Sample: 2010-2014 | | | | |
| Periods included: 5 | | | | |
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| *INST* | 0.0129 | 0.0511 | 0.2539 | 0.7997 |
| *DIRC* | -0.0009 | 0.0018 | -0.5039 | 0.6148 |
| *CONC* | 0.0158 | 0.0152 | 1.0402 | 0.2993 |
| *BOARD* | -0.0118 | 0.0089 | -1.3305 | 0.1846 |
| *BIG* | 0.1468 | 0.0651 | 2.2566 | 0.0249 |
| *GROWTH* | 0.0851 | 0.0945 | 0.9012 | 0.3684 |
| *DIVDUM* | 0.0537 | 0.0196 | 2.7389 | 0.0066 |
| *LOG_SIZE* | -0.0085 | 0.0097 | -0.8779 | 0.3809 |
| *LEVE* | -0.1214 | 0.0539 | -2.2525 | 0.0252 |
| *CAPEX* | -0.0462 | 0.0458 | -1.0099 | 0.3136 |
| *NW_CASH* | -0.1828 | 0.0666 | -2.7467 | 0.0065 |
| *CASH_FLOWS* | -0.0063 | 0.0106 | -0.5973 | 0.5509 |
| **Effects Specification** | | | | |
| R-squared | 0.0918 | Mean dependent var | | 0.0243 |
| Adjusted R-squared | 0.0459 | S.D. dependent var | | 0.1019 |
| F-statistic | 1.9962 | | | |
| Prob(F-statistic) | 0.0253 | | | |

**Table 2B**

**Fixed Effect Regression Results for Servicing Firms**

| Dependent Variable: CASH | | | | |
|---|---|---|---|---|
| Method: Panel Regression (Cross-section random effects) | | | | |
| Sample: 2010-2014 | | | | |
| Periods included: 5 | | | | |
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| *INST* | 0.0129 | 0.0511 | 0.2539 | 0.7997 |
| *DIRC* | -0.0009 | 0.0018 | -0.5039 | 0.6148 |
| *CONC* | 0.0158 | 0.0152 | 1.0402 | 0.2993 |
| *BOARD* | -0.0118 | 0.0089 | -1.3305 | 0.1846 |

| | | | | |
|---|---|---|---|---|
| *BIG* | 0.1468 | 0.0651 | 2.2566 | 0.0249 |
| *GROWTH* | 0.0851 | 0.0945 | 0.9012 | 0.3684 |
| *DIVDUM* | 0.0537 | 0.0196 | 2.7389 | 0.0066 |
| *LOG_SIZE* | -0.0085 | 0.0097 | -0.8779 | 0.3809 |
| *LEVE* | -0.1214 | 0.0539 | -2.2525 | 0.0252 |
| *CAPEX* | -0.0462 | 0.0458 | -1.0099 | 0.3136 |
| *NW_CASH* | -0.1828 | 0.0666 | -2.7467 | 0.0065 |
| *CASH_FLOWS* | -0.0063 | 0.0106 | -0.5973 | 0.5509 |
| **Effects Specification** | | | | |
| R-squared | 0.0918 | Mean dependent var | | 0.0243 |
| Adjusted R-squared | 0.0459 | S.D. dependent var | | 0.1019 |
| F-statistic | 1.9962 | | | |
| Prob(F-statistic) | 0.0253 | | | |

**Table 3B**

**Hausman Test for Manufacturing Firms**

| **Test Summary** | **Chi-Sq. Statistic** | **Chi-Sq. d.f.** | **Prob.** |
|---|---|---|---|
| **Cross-section random** | 24.426450 | 12 | 0.0178 |

**Cross-section random effects test comparisons**:

| **Variable** | **Fixed** | **Random** | **Var(Diff.)** | **Prob.** |
|---|---|---|---|---|
| *INST* | 0.03461 | 0.012970 | 0.001456 | 0.5706 |
| *DIRC* | -0.00024 | -0.000881 | 0.000000 | 0.0886 |
| *CONC* | -0.09302 | 0.015784 | 0.004291 | 0.0967 |
| *BOARD* | -0.01439 | -0.011766 | 0.000105 | 0.7973 |
| *BIG* | 0.04221 | 0.146817 | 0.006501 | 0.1945 |
| *GROWTH* | 0.30567 | 0.085118 | 0.005948 | 0.0042 |
| *DIVDUM* | 0.03549 | 0.053669 | 0.000111 | 0.0840 |
| *LOG_SIZE* | -0.10629 | -0.008467 | 0.001107 | 0.0033 |
| *LEVE* | -0.26818 | -0.121361 | 0.002732 | 0.0050 |
| *CAPEX* | -0.04698 | -0.046246 | 0.000239 | 0.9624 |
| *NW_CASH* | -0.30895 | -0.182838 | 0.003007 | 0.0215 |
| *CASH_FLOWS* | -0.00542 | -0.006300 | 0.000004 | 0.6678 |

**Table 4B**

**Hausman Test for Non-Financial Servicing Firms**

| **Test Summary** | **Chi-Sq. Statistic** | **Chi-Sq. d.f.** | **Prob.** |
|---|---|---|---|
| **Cross-section random** | 9.459238 | 12 | 0.6633 |
| **Cross-section random effects test comparisons**: | | | |
| **Variable** | **Fixed** | **Random** | **Var(Diff.)** | **Prob.** |
| *INST* | 0.190077 | 0.116764 | 0.008003 | 0.4125 |
| *DIRC* | 0.007125 | 0.040682 | 0.009267 | 0.7274 |
| *CONC* | 0.023971 | 0.005146 | 0.000314 | 0.2878 |
| *BOARD* | 0.003818 | 0.001481 | 0.000093 | 0.8087 |
| *BIG* | 0.386772 | 0.321882 | 0.027173 | 0.6938 |
| *GROWTH* | 0.029574 | 0.055059 | 0.000873 | 0.3885 |
| *DIVDUM* | 0.053828 | 0.065356 | 0.000146 | 0.3407 |
| *LOG_SIZE* | 0.027455 | -0.004790 | 0.000832 | 0.2635 |
| *LEVE* | -0.199471 | -0.188866 | 0.001584 | 0.7899 |
| *CAPEX* | -0.010169 | -0.003901 | 0.000022 | 0.1782 |
| *NW_CASH* | -0.258097 | -0.229187 | 0.000860 | 0.3242 |
| *CASH_FLOWS* | -0.107720 | -0.072591 | 0.000888 | 0.2385 |

# FRACTIONAL COINTEGRATION ANALYSIS OF STOCK MARKET AND EXCHANGE RATES: THE CASE OF TURKEY[1]

**Deniz ERER, PhD Candidate**[*]
**Elif ERER, PhD Candidate**[**]
**Tuna Can GÜLEÇ, PhD Candidate**[***]

**Abstract**

The fluctuations and responses between the exchange rate and the stock market has been a topic of interest for both policy makers and market participants for a long time. The aim of the study is to examine so-called relationship using fractional cointegration analysis. For this purpose, we utilized from Borsa İstanbul and daily exchange rates USD/TRY and EUR/TRY for period 2002:01–2015:04 to determine this relationship. Fractional cointegration analysis indicates presence of an equilibrium in the long term in series and fractional integrated errors show persistent characteristics which indicate long memory. Therefore instead of using classical cointegration we have decided using Geweke and Porter-Hudak fractional cointegration for more accurate results. Results indicate that there is a significant positive cointegration between exchange rates and stock prices in Turkish market Borsa İstanbul. This study contributes to literature by analyzing the phenomenon under long memory conditions in Borsa Istanbul.

**Keywords:** Financial Markets, Fractional Integration, Fractional Cointegration

**JEL Classification:** G1, A1, C22, C32

---

[1] *This article is the revised and extended version of the paper presented in International Congress on Economics and Business (ICEB'2015), in Macedonia, on June 10-12, 2015.*

[*] *Ege Üniversitesi Sosyal Bilimler Enstitüsü, İktisat Anabilim Dalı, denizerer@hotmail.com*

[**] *Ege Üniversitesi Sosyal Bilimler Enstitüsü, İktisat Anabilim Dalı, elif_erer_@hotmail.com*

[***] *Celal Bayar Üniversitesi, SBE, Muhasebe ve Finans Anabilim Dalı, tunacan.gulec@cbu.edu.tr*

## 1. Introduction

Stock market and exchange rate interaction is a crucial factor in determining foreign currency policies and regulating the stock market prices, even though a substantial quantity of studies analyze this relationship, there is not a commonly accepted theory that command the majority of literature. As explained by Kim (2003: pp. 304), the relationship between exchange rate and stock market is of importance owing to the fact that they have a vital effect on the development of a country's economy. Besides, this relationship is followed by investors in respect of forecasting the future trends. The interaction of these two financial variables become especially fundamental when evaluating the 1997 Asian crisis. During this crisis, both stock prices and exchange rate went down. In other words, decrease in stock prices was replied with a volatile decrease in exchange rates. In the recent years, this relationship has gained importance on account of developing international diversification, cross-market return correlations, gradual abolishment of capital inflow barriers and more flexible exchange rate arrangements in emerging and transition countries (Agrawal, Srivastav and Srivastava, 2010: pp. 64). In addition, these markets are immediately influenced by changes in economic policy due to being sensitive parts of financial markets. So, this relationship is of interest to investigators (Mishra, 2004: 210). However, there is no theoretical and empirical consensus regarding the presence and the way of the relationship between exchange rates and stock returns (Nieh and Lee, 2001, pp. 477-478).

The relationship between exchange rates and stock prices is mainly investigated under "classical approach" and "portfolio balanced approach" in literature. The two widely recognized approaches have emerged significant in the literature on this subject which conflict with each other, one being the classical economic theory that suggests flow oriented models, claiming that movements in exchange rate is a leading factor in stock price movements. As for the other view, Bronson (1977) has emphasized the portfolio balance approach. The approaches differ in the way they explain the direction of the relationship. According to the classical approach, changes in exchange rate have an impact on stock prices by affecting international competitive structure and balance of trade. The causality goes from exchange rates to stock prices as stated by Dornbusch and Fischer in 1980 (pp. 962). Increasing world trade and growing

capital movements bring about that exchange rates become one of the main factors which affect profitability and equity prices (Kim, 2003: pp. 304). Additionally, the movements in exchange rates affect the future cash flows of the firms, their competitive capacity in international market, their sales (Yau and Nieh, 2006: pp. 537). Exchange rate fluctuations cause change for firms' foreign operations. In this respect, the value of firms' foreign operations has a bearing on stock prices. As a consequence of currency appreciation, imported inputs become more expensive while exported goods become cheaper. This case enhances economic value, profitability of firms and also their stock returns (Aggarwal, 1981). Therefore it is suggested in classical theory that the direction of relationship is positive.

In portfolio balance approach, investors diversify their portfolio with various equities. Exchange rate balances supply and demand for domestic and foreign financial equities. Increasing domestic stock prices attract investors to invest in domestic equity shares and lead to capital inflow. As a result of this capital inflow, the demand for domestic currency rises. This situation creates a downward pressure in exchange rates. According to this approach, there is an inverse relationship between exchange rates and stock prices. The causality goes from stock prices to exchange rates. An increase in stock prices causes an increase in stock market prices and bring about a raise in aggregate welfare affecting domestic interest rate, thus the exchange rate falls while demand for domestic currency goes up (Branson, 1983; Dornbusch and Fischer, 1980).

The aim of this study is to investigate the relationship between US/TL exchange rate and BIST 100 stock prices. For this purpose, Geweke and Porter-Hudak fractional cointegration test considering long memory is used. This study contributes to literature by analyzing the phenomenon under long memory conditions in Borsa Istanbul.

## 2. Literature review

In the literature, there are a large number of studies examining the relationship between the stock market and exchange rate. Some of these studies show that so-called relation is valid while other studies state that there is no such relation.

Solnik (1987) examined the connection between US dollar and Canada, France, Germany, Japan, Netherlands, Switzerland, U.K., and U.S.A. stock markets via multivariate regression. Rahman

ve Uddin (2008) investigated the relationship between US dollar, Euro, Japanese yen, pound sterling and monthly values of Dhaka Stock Exchange General Index with Johansen cointegration and Granger causality test. Rahman and Jashim (2009) considerate this relationship for Pakistan, India and Bangladesh and used Engle-Granger procedure. Zia and Rahman (2011) used Engle-Granger cointegration to analyze the relationship between US dollar and monthly Karachi Stock Exchange 100 Index in Pakistan. None of these studies were able to reveal a significant relationship between the between stock prices and exchange rates.

Nieh and Lee (2001) analyzed the short and long run relationship between exchange rates and stock prices in G-7 countries through Engle-Granger and Johansen maximum likelihood test and vector error correction model. Their study did not find any long-run relationship between the two variables while finding a positive relationship in the short run within G7 countries. Naeem and Rasheed (2002) studied the dynamic relationship between exchange rate and stock markets in Asian countries using Johansen and Juselius bivariate cointegration tests and vector error correction model together. As a conclusion, even though short-run relationship between exchange rates and stock prices is not found for all of the countries, there is bi-directional long-run relationship for Bangladesh and Sri-Lanka contrary to Pakistan and India.

Aggarwal (1981) analyzed the relationship between US dollar and US stock market prices with OLS. Phylaktis and Ravazzolo (2005) considered the relationship among Taiwan and Japanese stock prices, and New Taiwan Dollar/Yen exchange rate via bivariate, trivariate cointegration test and multivariate Granger causality test for pacific Basin countries. These studies show that there is a positive relationship between these two financial variables. Yau and Nieh (2009) researched the connection between New Taiwan and Japanese exchange rates and Taiwan and Japanese stock markets by using threshold error correction model. The results of the study show that there is positive long-run relationship in contrast to short-run relationship.

Soenen and Hennigar (1988) studied the connection between exchange rate and stock prices for US. Erbaykal and Okuyan (2007) examined this relationship in terms of portfolio approach for emerging markets by using Granger causality method. These studies show that there is negative relationship between two financial variables.

Some studies support portfolio balance approach. Kasman (2003) indicated that causality relationship exists from exchange rate to stock prices in terms of causality. Aydemir and Demirhan (2009) found that there is bidirectional relationship between exchange rate and stock market indices. Köse, Doğanay and Karabacak (2010) took into account five currencies, which are US dollar, Euro, Japanese Yen, Pound Sterling and Swiss Franc, and used Granger causality test to test this relationship. The result of the analysis indicates unidirectional causality from stock prices to exchange rates and negative relationship between two financial variables. Rjoub (2012) examined the dynamic relationship between the Turkish stock prices and exchange rate and US stock prices with vector autoregressive model. Study finds bidirectional relationship between exchange rate and stock price as well as the negative effects exchange rate has on Turkish stock prices. Kaya et. al. (2013) analyzed the stock prices and macroeconomic variables by using OLS. According to the result of this study, there exists negative relationship between these variables.

As for the studies that support the classical approach. Altıntaş and Tombak (2011) tested the connection between exchange rate and stock prices with VAR and Granger causality methods. In conclusion, it is revealed that there is a positive relationship between these variables. Kıran (2009) used data ranging from 1990-1994 and 2001-2008 and used bound test developed by Pesaran, Shin and Smith and Toda Yamamoto causality test. For 1990-1994 period, he has found that there is a positive long-run relationship. Sevüktekin and Nargeleçekenler (2007) used Engle-Granger test, Johansen co integration test and Phillips-Oulliaris test to analyze the connection between two variables. Although bidirectional relationship exists in long-run, there is no causality relationship in short-run. However, positive relationship between exchange rate and stock price is somewhat observed.

## 3. Methodology

Fractional integration process was initially discussed by Granger and Joyeux (1980) and Hosking (1981). Granger-Joyeux (1980) and Hosking (1981) said that integrated degree concerning time series always cannot be integer in contrast to traditional unit root tests, integrated degree can only have decimal value and thus fractional structure should be preferred. Fractional integrated

processes have long memory and long-run dependence as defined by Hurst (1957) and Mandelbrot (1968). Fractional integrated processes $[1-L^d]$ is described with fractional difference operator. Here, L is lag operator $L^k x_k = x_{t-k}$.. Lag operator is written again by using binomial series as below :

$$[1-L]^d = 1 - dL - \cdots - \frac{\Gamma(\mathrm{k}-\mathrm{d})}{\Gamma\ \mathrm{k}+1\ \Gamma(-\mathrm{d})} L^k + 0(L^{k+1}) \quad (1)$$

This operator is used to define fractional integrated process. If $1-L\ ^d x_t = u_t,\ x_t, t = 1, \ldots, n$ process follows autoregressive fractional integrated mean process (ARFIMA). Where $u_t$ exhibits ARMA(p,q). $\varphi_p\ L\ u_t = \theta_q\ L\ \varepsilon_t, \varepsilon_t$ has a white noise structure with zero mean and $\sigma_\varepsilon^2$ variance. $u_t$ is stationary and satisfies the reversible conditions (Diebolt ve Guiraud, 2005: pp. 828; Xu, Liu, Nie, 2006: pp. 485). Fractional differenced processes are efficient to model long run permanence (Hosking, 1981: pp. 167).

In fractional unit root analysis, the calculated d value is tested to be bigger than 1. Null hypothesis is $H_0$: d<1 (series is stationary) while alternative hypothesis is $H_1$: d>1 (series is not stationary). The critical values regarded t value to be compared ae taken from Sephton's article named "Fractional Cointegration: Monte Carlo Estimates of Critical Values, With an Application" (Hepaktan, 2009: pp. 47-48).

**Table 1**

**Memory Characteristic Related to Series According to d Parameter**

| Range | Memory Feature |
|---|---|
| $-0.5 < d < 0$ | The series has short memory and permanent effect isn't observed |
| $0 < d < 0.5$ | The series has long memory and is stationary |
| $d = 0$ | The series has short memory and is stationary |
| $0.5 \leq d < 1$ | The series isn't covariance stationary, but it turns back its mean and has finite impulse-response weights |
| $d \geq 1$ | The series isn't stationary and doesn't turn back its mean |

$x_t$ refers to fractional cointegration, if

$$\alpha \in IR^a, a \neq 0,\ \alpha' x_t \sim I(d)\ 0 < d < 1 \quad (2)$$

$d$ refers to long memory parameter and is written as $x_t \sim FCI\ d$ (Dittmann, 2000: pp. 3).

The main characteristic of this test is that fractional difference parameter (d) depends on slope of spectral density function around angular frequency=0. Geweke, Porter and Hudak suggested to take first difference of the series to guarantee stationary and reversibility.

$$\ln\ I\ w_j\ = \theta + \lambda \ln\ 4sin^2\ \frac{w_j}{2}\ + v_j;\quad j = 1, \dots, J \tag{3}$$

Where, is constant, indicates Fourier frequency. . J is increasing function of T, and T shows number of observation. . is periodogram concerned with the time series at frequence. For sample series with T observations, is calculated as below:

$$I\ w_j\ = \frac{1}{2\pi} \sum_{k=-T+1}^{T-1} \gamma_J e^{-iw_j k}, i^2 = -1 \tag{4}$$

$$I\ w_j\ = \frac{1}{2\pi}(\gamma_0 + 2 \sum_{k=1}^{T-1} \gamma_k \cos(w_j k)) \tag{5}$$

Where, is j. order sample autocovariance,

$$\gamma_J = \begin{matrix} T^{-1} \sum_{t=j+1}^{T} y_t - y\ \ y_{t-j} - y\ ,\ j = 0,1,2, \dots, T-1 \\ \gamma_{-J}, \qquad j = -1, -2, \dots, -T+1 \end{matrix} \tag{6}$$

The presence of fractional integrated degree can be tested by investigating statistical significance of d parameter (Cooray and Felmingham, 2008: 50; Geweke and Porter, 1993). The hypothesis used in GPH cointegration test is as follows:

$H_0 = \gamma_{GPH} = 0$

$H_1 = \gamma_{GPH} \neq 0 H_1 = \gamma_{GPH} < 0$

Because the values of error terms cannot be observed directly and they are obtained by minimizing the variance of error term in cointegration equation, t critical values are biased toward the

presence of cointegration at the hypothesis tests. Critical values are generated with Monte Carlo simulation so as to prevent this situation.

### 4. Data and Emprical Results

In order to analyze the cointegration relationship between exchange rate and stock prices in Turkish stock market, monthly data including Dollar, Euro and BIST 100 closing prices are used. Monthly data are taken from TCMB statistical database for period 2002:01 - 2015:04. The variables used in the study are as following:

**Table 2**

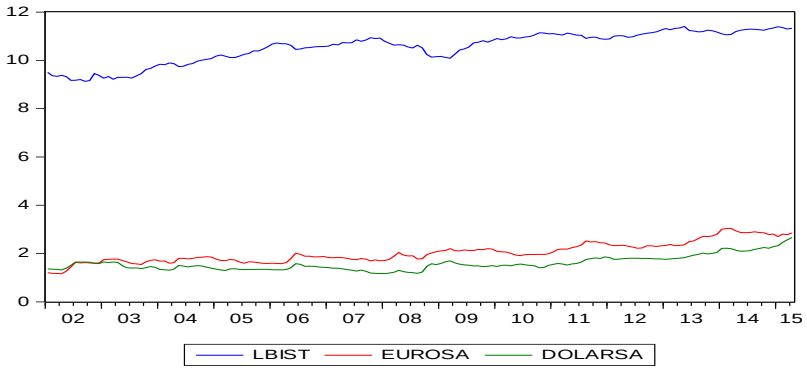
**The Variables Used In The Study**

| Variables | Definition |
|---|---|
| Lbist | Log of Borsa Istanbul Stock Exchange closing prices |
| Dollarsa | TL/US exchange rate (Seasonality Eliminated) |
| Eurosa | TL/Euro exchange rate (Seasonality Eliminated) |

In first stage of the analysis, dollar and Euro exchange rates are rendered pure from seasonality by adjustment via moving average method. The time-line graph concerning the financial variables is presented in Figure 1. According to Figure 1, these financial variables act parallel with each other. Also, the effects of 2008-2009 global financial crisis on dollar, Euro and BIST 100 index are clearly observable.

**Figure 1**

**The Time-Line Graph**



In seconds stage, we apply ADF, KPSS and Phillps-Perron unit root tests to these series to detect the presence of cointegration relationship between exchange rate and stock prices. The results are shown in Table 3.

**Table 3**

**The Results of Unit Root Tests for I(0) and I(1)**

| | ***ADF-Dickey Fuller*** | ***Philips-Perron*** | ***KPSS*** |
|---|---|---|---|
| **I(0)** | | | |
| ***lbist*** | -2.147437 | -2.126455 | 0.202751*** |
| ***dollarsa*** | -1.706085 | -0.420654 | 0.337742*** |
| ***eurosa*** | -0.950594 | -0.959521 | 1.433374*** |
| **I(1)** | | | |
| ***Δlbist*** | -10.41243*** | -10.39730*** | 0.045924 |
| ***Δdollarsa*** | -8.488923*** | -8.195854*** | 0.061976 |
| ***Δeurosa*** | -9.428702*** | -9.194538*** | 0.044632 |

*Note: *, ** and *** represent %1, %5 and %10 significance level.*

As demonstrated in Table 3, all series are seen to be stationary at I(1) level. As long as series have long memory properties, traditional unit root tests lead to the biased results in favor of the presence of unit root. Therefore, fractional unit root tests are applied to series. Presence of fractional stationarity in all series is tested with quasi parametric GPH method. The results are as shown Table 4. In Table 4, λ values and d values regarding λ can be found.

**Table 4**

**GPH Fractional Unit Root Test**

| **Critical Values** | **λ** | **Asymptotic Standard Deviation** | **Dollarsa** | |
|---|---|---|---|---|
| | | | **D** | $H_0: t_d = 0$<br>$H_1: t_d < 0$ |
| 2.306 | 0.40 | 0.3787 | 1.06054*** | 2.8001 |
| 2.228 | 0.45 | 0.3021 | 0.861618*** | 2.8523 |
| 2.160 | 0.50 | 0.2214 | 0.751405*** | 3.3938 |
| 2.120 | 0.55 | 0.159 | 0.665292*** | 4.1843 |
| 2.080 | 0.60 | 0.09287 | 0.790384*** | 5.4324 |

| Critical Values | λ | Asymptotic Standard Deviation | Eurosa D | $H_0: t_d = 0$ $H_1: t_d < 0$ |
|---|---|---|---|---|
| 2.306 | 0.40 | 0.168 | 0.820317*** | 4.8838 |
| 2.228 | 0.45 | 0.1566 | 0.872364*** | 5.5702 |
| 2.160 | 0.50 | 0.1116 | 0.868169*** | 7.7768 |
| 2.120 | 0.55 | 0.08349 | 0.858435*** | 10.2819 |
| 2.080 | 0.60 | 0.06157 | 0.831854*** | 13.5110 |
| **Critical Values** | **λ** | **Asymptotic Standard Deviation** | **Lbist D** | $H_0: t_d = 0$ $H_1: t_d < 0$ |
| 2.306 | 0.40 | 0.2491 | 1.03126*** | 4.1407 |
| 2.228 | 0.45 | 0.1861 | 1.02181*** | 5.4911 |
| 2.160 | 0.50 | 0.133 | .980012*** | 7.3661 |
| 2.120 | 0.55 | 0.1016 | 1.07413*** | 10.5711 |
| 2.080 | 0.60 | 0.07862 | 1.07413*** | 13.7083 |

*Note: it shows t table values for %5 critical value. *, ** and *** represent %1, %5 and %10 significance level.*

As seen in Table 4, null hypothesis claiming that d values concerning dollarsa, eurosa and lbist variables are equal to zero, is rejected at %5 significance level. So, dollarsa, eurosa and lbist variables are understood to have long memory and not being covariance stationary. Besides, dollarsa and eurosa don't turn back to mean in contrast to lbist. These results are similiar to ADF, Phillips Perron and KPSS tests.

Equation (7) is estimated to test cointegration relationship between stock prices and dollar, it is tested whether the residuals from this equation are stationary with GPH test.

$$lbist = \beta_0 + \beta_1 dollarsa + e_t \quad (7)$$
$$lbist = 8.950197 + 1.001478\ dollarsa + e_t$$
(0.0000) (0.0000)

Secondly, equation (8) is estimated to test cointegration relationship between stock prices and eurosa, and then it is tested whether the residuals from this equation are stationary with GPH test.

$$lbist = \beta_0 + \beta_1 eurosa + e_t \quad (8)$$
$$lbist = 8.232649 + 1.135323\ eurosa + e_t$$
(0.0000) (0.0000)

Cointegration relationship between stock prices and both exchange rates (dollar and euro) is investigated with GPH cointegration test. Fractional cointegration shows the long-run relationship among economic variables. The results concerning GPH cointegration test are indicated in Table 5. It is inferred from Table 5 that there is cointegration relationship between stock prices and both exchange rates.

**Table 5**

**GPH Fractional Cointegration Test**

| Critical Values | λ | Asympt. Standard Deviation | Dollar-Residuals | | Asympt. Standard Deviation | Euro-Residuals | |
|---|---|---|---|---|---|---|---|
| | | | d | $H_0: t_d=0$ $H_0: t_d<0$ | | D | $H_0: t_d=0$ $H_0: t_d<0$ |
| -2.79 | 0.40 | 0.236 | 0.889558 | 3.7688 | 0.2495 | .519733 | 2.0833 |
| -2.86 | 0.45 | 0.3089 | 1.20428 | 3.8985 | 0.3743 | 1.11998 | 2.9924 |
| -2.87 | 0.50 | 0.2182 | 1.11282 | 5.1002 | 0.2687 | 1.14784 | 4.2726 |
| -2.86 | 0.55 | 0.1648 | 1.14973 | 6.9749 | 0.2038 | .966588 | 4.7421 |
| -2.83 | 0.60 | 0.1478 | 1.21937 | 8.2524 | 0.158 | .99132 | 6.2725 |

*Note: Critical values for %5 significance level are taken from Sephton (2002).*

After finding out long-run relationship between stock prices and exchange rates, the direction of so-called relationship is examined via Granger Causality. The results is showed in Table 6.

**Table 6**

**The Results of Granger Causality**

| Null Hypothesis | Chi-square | Decision |
|---|---|---|
| lbist is not Granger causality of dollarsa | 3.627173 | Not rejection |
| dollarsa is not Granger causality of lbist | 4.480363* | Rejection |
| lbist is not Granger causality of eurosa | 1.272599 | Not rejection |
| eurosa is not Granger causality of lbist | 3.172032* | Rejection |

*Note: *, ** and *** represent %1, %5 and %10 significance level.*

As seen in Table 6, dollarsa and eurosa is Granger Casuality of lbist. In other words, direction of so-called relationship is from

exchange rates to stock market prices. This situation represents that classical approach is valid in Turkish financial market.

## 5. Conclusions

The results of the analysis indicates that there is a cointegration relationship between stock prices and exchange rates. In respect of the nature of relationship, a positive relationship between exchanges rate and stock prices is detected. The direction of the relationship supports the classical approach and therefore it can be gathered that the causality of the relationship is from exchange rates to stock prices. Therefore using these results as baseline for Turkish market, it can be argued that the classical approach is valid in case of Turkish financial market. These results are aligned with the studies made by Sevüktekin and Nargeleçekenler (2007), Kıran (2009), Altıntaş and Tombak (2011) in the literature. It is hoped that these results will aid the policy makers to design their decision making processes concerning the relationship between the financial markets and exchange rates.

## References

1. Aggarwal, R. (1981) “Exchange Rates and Stock Prices: A Study of the US Capital Markets Under Floating Exchange Rates”. *Akron Business and Economic Review*, 12, pp. 7-12.
2. Agrawal, G.; Srivastav, A. K. and Srivastava, A. (2010) “A Study of Exchange Rates Movements and Stock Market Volatility”. *International Journal of Business and Management*, 5(12), pp.63-73.
3. Altıntaş, H. and Tombak, F. (2011), “Türkiye’de Hisse Senedi Fiyatları ve Makroekonomik Değişkenler Arasındaki İlişkinin Ekonometrik Analizi: 1987-2008”. *Paper presented at EconAnadolu 2011: Anadolu International Conference in Economics II*.
4. Aydemir, O. and Demirhan, E. (2009) “The Relationship Between Stock Prices and Exchange Rates Evidence From Turkey”. *International Research Journal of Finance and Economics*, 23, pp. 207-215.
5. Branson, W. H. (1983) “Macroeconomic Determinants of Real Exchange Rate Risk, In R. J. Herring Managing Foreign Exchange Risk”. *Cambridge University Press*.

6. Cooray, A. and Felmingham, B. (2008) "Are Australia's Savings and Investment Fractionally Cointegrated?". *International Journal of Applied Economics*, 5(1), pp. 48-53.
7. Diebolt, C. and Guiraud, V. (2005) "A Note On Long Memory Time Series". *Quality & Quantity*, vol: 39(6), pp. 827-836.
8. Dittmann, I. (2000) "Error Correction Models for Fractionally Cointegrated Time Series". *Econstor working paper series*. 2.
9. Dornbusch, R. and Fischer, S. (1980) "Exchange Rates and the Current Account". *American Economic Review,* 70 (5), pp. 960-971.
10. Erbaykal, E. and Okuyan, H. A. (2007) "The Relationship Between Stock Prices and Exchange Rates: An Empirical Study on Emerging Markets". *L. BRSA Banking and Financial Markets,* 7(1), pp. 77-89.
11. Granger, C. W. and Joyeux, R. (1980). "An Introduction to Long-Memory Time Series Models and Fractional Differencing". *Time Series Analysis*, 1, pp. 15-29.
12. Hepaktan, E. (2009) "Türkiye'nin Marshall-Lerner Koşuluna İlişkin Parçalı Eşbütünleşme Analizi". *Yönetim ve Ekonomi*, 16(1), pp. 40-57.
13. Hosking, J. R. M. (1981). "Fractional Differencing". *Biometria*, 68(1), pp. 165-176.
14. Kasman, S. (2003). "The Relationship Between Exchange Rate and Stock Prices: A Causality Analysis". Dokuz Eylül University *The Journal of Graduate School of Social Sciences*, 5(2), pp. 70-79.
15. Kaya, V.; Çömlekçi, İ.; Kara, O. (2013). "Hisse Senedi Getirilerini Etkileyen Makroekonomik Değişkenler 2002-2012 Türkiye Örneği". Dumlupınar University *The Journal of Graduate School of Social Sciences*, 35, pp.167-176.
16. Kıran, B. (2009). "Türkiye'de Döviz Kuru ve Hisse Senedi Fiyatlarının Sınır Test Analizi". *İktisat İşletme ve Finans*, 24 (275), pp. 66-88.
17. Kim, K. (2003). "Dollar Exchange Rate and Stock Market Price: Evidence From Multivariate Cointegration and Error Correction Model". *Review of Financial Economics*, 12, pp. 301-313.
18. Köse, Y.; Doğanay, M. and Karabacak, H. (2010). "On The Causality Between Stock Prices and Exchange Rates:

Evidence From Turkish Financial Market". *Problems and Perspectives in Management*, 8(1), pp. 127-135.

19. Mishra, A. K. (2004). "Stock Market and Foreign Exchange Market in India: Are They Related?". *South Asia Economic Journal*, 5(2), pp. 209-232.
20. Nieh, C. and Lee, C. (2001). "Dynamic Relationship Between Stock Prices and Exchange Rates for G-7 Countried". *The Quarterly Review of Economic and Finance*, 41, pp. 477-490.
21. Phylaktis, K. and Ravazzolo, F. (2005). "Stock Prices and Exchange Rates Dynamics". *Journal International Money and Finance*, 24(7), pp. 1031-1053.
22. Rahman, L. and Uddin, J. (2008). "Relationship Between Stock Prices and Exchange Rates: Evidence From Bangladesh". *International Journal of Business and Management,* 3(9), pp. 52-57.
23. Rahman, L. and Uddin, J. (2009). "Dynamic Relationship Between Stock Prices and Exchange Rates: Evidence From Three South Asian Countries". *International Business Research,* 2(2), pp. 167-174.
24. Rjoub, H. (2012). "Stock Prices and Exchange Rates Dynamics: Evidence From Emerging Markets". *Afracan Journal of Business Management,* 6(13), pp. 4728-4733.
25. Sephton, P. S. (2002). "Fractional Cointegration: Monte Carlo Estimates of Critical Values, With an Application". *Applied Financial Economics*, 12, pp. 331-335.
26. Sevüktekin, M. and Nargeleçekenler, M. (2007). "Türkiye'de İMKB ve Döviz Kuru Arasındaki Dinamik İlişkinin Belirlenmesi". Paper presented at 8. *International Econometrics and Statistics Conference 2007.*
27. Soenen, L. and Hennigar, E. (1988). "An Analsis of Exchange Rates and Stock Prices: The US Experience (1980-1986)". *Akron Business Economic Review,* 19(4), pp. 7-16.
28. Solnik, B. (1987). "Using Financial Prices to Test Exchange Rate Models: A Note". *Journal of Finance,* 42, pp. 141-149.
29. Xu, Lixia; Liu, Cihua; Nie, Gaogin (2006). "Bayesian Estimation and the Application of Long Memory Stochastic Volatility Models. Science Direct". *Statistical Methodology*, 3, pp. 483-489.

30. Yau, H. Y. and Nieh, C. C. (2006). “Interelationship Among Stock Prices of Taiwan and Japan and NTD/Yen Exchange Rate”. *Journal of Asian Economics,* 17, pp. 535-552.
31. Yau, H. Y. and Nieh, C. C. (2009). “Testing for Cointegration with Threshold Effect Between Stock Prices and Exchange Rates in Japan and Taiwan”. *Japan and World Economy*, 21(3), pp. 292-300.
32. Zia, Qazi Z. And Rahman, Zahid (2011). “The Causality Between Stock Market and Foreign Exchange Market of Pakistan”. *Interdisciplinary Journal of Contemporary Research Business*, 3(5), pp. 906-919.

# THE IMPACT OF THE DOMESTIC AND FOREIGN MACROECONOMIC NEWS ANNOUNCEMENTS ON THE TURKISH STOCK MARKET[1]

**Ibrahim Yasar GOK, PhD**[*]
**Sefa TOPUZ, MSc Student**[**]

**Abstract**

This study investigates the impacts of the US and domestic macroeconomic news announcements on the Turkish stock market volatility. We analyze the GARCH volatilities behaviour of Borsa Istanbul (BIST) 100 stock index around announcement and non-announcement days. We test 13 US and 8 Turkish macroeconomic news announcements and used daily data for the period 01.04.2010-12.31.2015. We find that both US and Turkish GDP news announcements and also US new residential sales have significant impacts by increasing the volatility, which indicates the increasing uncertainty in these news announcements days. On the other hand, the total US and total domestic macroeconomic news effects do not have significant impacts on the BIST 100 volatility. Since the world stock markets integration can be investigated with respect to the macroeconomic news announcements of developed markets, our results indicate that Turkish stock market is less integrated and suggest portfolio diversification opportunities for international investors regarding Turkish stock market.

**Keywords:** US macroeconomic news, Turkish macroeconomic news, Turkish stock market, volatility, stock market integration, GARCH

**JEL Classification:** G14, G15

[1] *This study was supported by Suleyman Demirel University Scientific Research Projects Coordination Unit (Project No: 4404-YL1-15).*
[*] *Assistant Professor, Department of Banking and Finance, Suleyman Demirel University, Isparta, Turkey. Corresponding author. E-mail: ibrahimgok@sdu.edu.tr*
[**] *Research Assistant, Department of International Trade, Gazi University, Ankara, Turkey*

## 1. Introduction

The reactions of the stock markets to the macroeconomic news announcements of the developed markets are an important research interest especially to understand the formation of prices. Efficient market hypothesis states that prices fully reflect all available information at any instant time. According to this hypothesis, only the unexpected component of news announcements should have an impact on stock prices, because the expected component of announcements should already be incorporated in prices (Pearce and Roley, 1985). Although efficient market hypothesis suggests that the prices should fully reflect all available information about underlying fundamentals instantaneously, a feeling for the relation between economic fundamentals and asset prices is that they may be somewhat disconnected (Andersen et al., 2007). For instance, Flannery and Protopapadakis (2002) argue that the hypothesis of the influence of the macroeconomic news on the stock markets is intuitively appealing but has little empirical evidence, and Birz and Lott (2011) note that it is hard to find empirical evidence for the relationship between stock prices and real sector news announcements according to the related literature. Also, the reactions of the stock markets volatility to the macroeconomic news announcements can be either increasing or decreasing. Kim (2003) state that the volatility increase because of the mixed interpretation of the news, and decrease because the news announcements can lower the market uncertainty.

Analyzing the reactions of the global stock markets to the macroeconomic news announcements of the developed markets helps to determine the stock markets integration process. Nikkinen et al. (2006) investigate the effects of the US macroeconomic new announcements on 35 stock markets in six regions, and find that G7 countries, developed European countries other G7s and emerging and developed Asian countries are highly integrated with respect to US macroeconomic news announcements. They also document that Latin American markets and some emerging markets like Slovakia, Russia etc. are not affected significantly by US macroeconomic news announcements indicating the portfolio diversification opportunities regarding the segmented markets. Büttner et al. (2012) examine the effects of the US and Euro Area (EA) macroeconomic news announcements on the financial markets of Czech Republic,

Hungary, and Poland. They report that there are significant US and EU news announcements effects on these markets even though the reactions of the markets differentiate. They also demonstrate that there is a slightly increasing impact of EU news comparing to the US news over time, which indicates the process of the European integration.

Among previous studies regarding the impacts of the macroeconomic news announcements on the stock markets, Kim (2003) examines the effects of the US and Japanese macroeconomic news announcements on Hong Kong, Australia, and Singapore markets and it is documented that the announcements have a significant effect on the first and second moments of returns. Kim et al. (2004) investigate the effects of US macroeconomic news announcements on US FX, bond and stock markets, and find that reactions of the markets to the government releasing act of information are not significant, but their "news" contents have a significant impact on the markets. They discover that the consumer and producer price indices play an important role on the US stock market. They also report mixed impacts of the announcements on the volatility of the markets, while some of them increase and the others decrease the volatility. Brenner et al. (2009) study the impact of the US macroeconomic news announcements on the volatility and comovement of US stock, treasury, and corporate bond markets, and find that the price formation process of these markets and the interaction between them are affected by the economic fundamentals. However, they document that the reactions of the markets to the macroeconomic news surprises differentiate. Birz and Lott (2011) investigate the effects of real economic news on US stock markets, and argue that these relationship has a weak empirical evidence in the literature. They use a different approach, the newspaper stories as their measure of news and first time, to their knowledge, it is evidenced that US GDP news affects the US stock market. Harju and Hussein (2011) investigate the effects of the US market on the major European stock markets, and find that the US stock market opening have a significant impact on the volatility level of European markets and also major US macroeconomic news affect both return and volatility of European markets immediately after their releasing. Nguyen and Ngo (2014) study the impacts of the US macroeconomic news announcements on twelve developed and emerging Asian markets. They find that there is a strong relationship between US

macroeconomic news announcements and Asian stock markets return and volatility, and the impacts of the announcements on the emerging markets are more prominent than the developed markets. They also document that the US labor news has a greater impact than other news.

There are also some studies investigating the impacts of the macroeconomic news announcements on the Turkish stock market[2]. Önder and Şimga-Mugan (2006) investigate the effects of the political and economic news on the Argentina and Turkey stock markets in the context of domestic and global effects. They show that domestic political and global economic news have a significant impact on Turkish stock market volatility. In addition, they report that Turkish stock market trading volume significantly reacts to the world political news and country-related world economic news. Ehrmann and Fratzscher (2009) examine the effects of the US monetary shocks to the fifty stock markets around the world, and find that Turkish stock market do not respond significantly to US monetary shocks. Gümüş et al. (2011) investigate the effects of four US and seven Turkish macroeconomic news on BIST 100 index for 2002-2010 period. They find that only the domestic macroeconomic news have an impact on the volatility of the market. Cakan et al. (2014) study the impacts of the US unemployment rate and inflation news announcements on twelve emerging markets including Turkey in the light of positive and negative surprises. They evidence that good news of US unemployment rate significantly decreases the Turkish stock market volatility, which indicates that an unexpected decreasing in unemployment rate make Turkish stock market less risky. Solakoglu and Demir (2014) examine the effects of the public information arrival on Turkish stock market during the crisis period. They classify economic news as real economy and inflation/money news, and also classify them by the origin as Turkish, US, and EA news. They find

[2] *The effects of the developed markets on the emerging markets can be classified as spillover and macroeconomic news effects (Hanousek and Kočenda, 2011). In terms of return and volatility spillover between developed markets and Turkey, Gök and Kalaycı (2013) evidence that US and Turkish stock markets are not cointegrated and there is one way return and volatility spillover from US stock markets to the Turkish stock market. Also, Demirgil and Gök (2014) find that developed European stock markets affect both return and volatility of Turkish stock market and the comovement of Turkish and European stock markets is very low though it is significant.*

that US real economy news and European/Turkish real economy and inflation news have a significant impact on return volatility of BIST 100 index. But, they note that the influence of the expected component of some European and Turkish news on the volatility is inconsistent with the efficient market hypothesis. Fedorova et al. (2014) study the impacts of the EA macroeconomic news announcements on some emerging markets including Turkey. They find that consumer price index and unemloyment news of EA have significant impacts on Turkish stock market.

This study examines the impacts of the US and Turkish macroeconomic news announcements on the Borsa Istanbul stock market volatility. The daily data for the period 01.04.2010-12.31.2015 is used and thirteen US and eight Turkish macroeconomic news announcements are included in the study. Following Nikkinen et al. (2006) we investigate the GARCH volatilities behaviour around announcement and non-announcement days. The major contribution of this study to the literature is that it has the largest macroeconomic news data set to examine the effects of the US macroeconomic news announcements.

The remainder of this paper is organized as follows: Section II presents the data and methodology, Section III discusses the empirical findings, and Section IV concludes the paper.

## 2. The Data and Methodology

In this study, the impacts of the Turkish and US macroeconomic news announcements on BIST 100 index is empirically investigated. BIST 100 is a capitalization-weighted index. It is the major stock index for Turkey. The data is used for the period 01.04.2010-12.31.2015, which consists 1510 trading days. We include thirteen US and eight Turkish macroeconomic news announcements in the study. The details of the macroeconomic news announcements are presented in Table 1. We analyze 8.30 am and 10.00 am EST (GMT-5) US macroeconomic news announcements. Because there is seven hours time difference between Turkey and US (EST), the time is 3.30 pm in Turkey for the 8.30 am US news announcements and 5.00 pm in Turkey for 10.00 am US news announcements[3]. Since Borsa Istanbul trading session ends[4] at 5.40

[3] *The time difference between Turkey and US (EST) can reduce to six hours for a short period, because daylight saving time practices may differ for both countries.*

pm, it is possible to detect the effects the US news announcements[5] on Borsa Istanbul in the announcement days.

**Table 1**

**Macroeconomic News Announcements Included in the Study**

| | Macroeconomic News | Announcement | | Distribution of Release Days Across Weekdays | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Time | Mon | Tue | Wed | Thu | Fri | Total |
| TURKEY | Gross Domestic Product | *Quarterly* | 10.00 am | 8 | 6 | 5 | 4 | 1 | 24 |
| | Foreign Trade Statistics | *Monthly* | 10.00 am | 8 | 11 | 8 | 13 | 32 | 72 |
| | Labor Force Statistics | *Monthly* | 10.00 am | 30 | 12 | 11 | 12 | 13 | 78 |
| | Industrial Production Index | *Monthly* | 10.00 am | 30 | 12 | 8 | 8 | 14 | 72 |
| | Consumer Price Index | *Monthly* | 10.00 am | 30 | 11 | 10 | 11 | 10 | 72 |
| | Business Tendency Survey and and Real Sector Confidence Index | *Monthly* | 02.30 pm [1)] | 32 | 11 | 10 | 7 | 12 | 72 |
| | Consumer Confidence Index | *Monthly* | 10.00 am | 23 | 9 | 11 | 19 | 11 | 73 |
| | House Sale Statistics | *Monthly* | 10.00 am | 9 | 4 | 6 | 11 | 10 | 40 |
| US | Gross Domestic Product | *Monthly* | 08.30 am | 0 | 6 | 9 | 29 | 23 | 67 |
| | Consumer Price Index | *Monthly* | 08.30 am | 0 | 16 | 14 | 19 | 20 | 69 |
| | Producer Price Index | *Monthly* | 08.30 am | 0 | 11 | 21 | 19 | 19 | 70 |
| | Durable Goods Manufacturers' Shipments, Inventories and Orders | *Monthly* | 08.30 am | 3 | 14 | 27 | 16 | 8 | 68 |
| | New Residential Construction | *Monthly* | 08.30 am | 0 | 28 | 23 | 12 | 5 | 68 |
| | International Trade in Goods and Services | *Monthly* | 08.30 am | 0 | 15 | 15 | 26 | 14 | 70 |
| | Personal Income And Outlays | *Monthly* | 08.30 am | 22 | 4 | 5 | 7 | 27 | 65 |
| | Nonfarm Payroll Employment | *Monthly* | 08.30 am | 0 | 1 | 0 | 3 | 67 | 71 |
| | Sales For Retail And Food Services | *Monthly* | 08.30 am | 6 | 18 | 14 | 15 | 17 | 70 |
| | Manufacturing and Trade Inventories and Sales | *Monthly* | 10.00 am | 6 | 18 | 14 | 14 | 17 | 69 |
| | Manufacturers' Shipments, Inventories and Orders | *Monthly* | 10.00 am | 8 | 19 | 12 | 20 | 10 | 69 |
| | New Residential Sales | *Monthly* | 10.00 am | 9 | 16 | 24 | 7 | 9 | 65 |
| | Construction Spending | *Monthly* | 10.00 am | 27 | 14 | 10 | 7 | 8 | 66 |
| **Total** | | | | 251 | 256 | 257 | 279 | 347 | 1390 |

*[1)] Before 2011, the release time was 04.30 pm*

To examine the effects of Turkish and US macroeconomic news on BIST 100 index volatility, we follow Nikkinen et al. (2006) and investigate the GARCH volatilities behaviour around announcement and non-announcement days for 21 news announcements.

Daily return series is calculated by using $r = \ln(\frac{P_t}{P_{t-1}})$, where $P_t$ is index closing value of day *t*, and $P_{t-1}$ is the closing value of day *t-1*. To obtain the GARCH volatilities, the GARCH (1,1) model as in equations (1) and (2) are estimated.

[4] *The trading session was ending at 5.30 pm till 07.16.2012.*

[5] *Federal open market committee news announcement of US is not included in the study, because it is released after the trading hours of Borsa Istanbul.*

$$r_t = \mu + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = a_0 + a_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (2)$$

After getting the GARCH volatility series, to examine the news effects on volatility behaviour, log difference of the volatility series ($log\sigma_t^2 - log\sigma_{t-1}^2$) is taken[6] as a dependent variable. Then, OLS regression is estimated including the macroeconomic news announcements as independent variables in form of dummy variable, which takes the value "1" on announcement days and "0" on non-announcement days.

### 3. Empirical Findings

Descriptive statistics of the return series is reported in Table 2. The ADF test result of the return series shows that it is level stationary.

**Table 2**

**Descriptive Statistics of Return Series**

| | **Return** |
|---|---|
| **Panel A** | |
| Mean | 0.000196 |
| Median | 0.000881 |
| Maximum | 0.068952 |
| Minimum | -0.110638 |
| Std. Dev. | 0.014947 |
| Skewness | -0.515223 |
| Kurtosis | 6.823342 |
| Jarque-Bera | 985.8652 |
| Panel B | |
| ADF Test (Level) | -39.97728** |

*Note: ** indicates significance at the 5% level. Critical values for ADF test are -2.566496, -1.941034, -1.616558 for 1%, 5%, and 10% levels, respectively.*

OLS regression results are reported in Table 3. It is seen that only three macroeconomic news announcements have statistically significant impacts out of 21 announcements. These are Turkish GDP

[6] *Nikkinen et al. (2006) derived the* $log(\sigma_{t+1}^2) - log(\sigma_t^2)$ *series.*

and US GDP news announcements and also US new residential sales. But the impact of the US new residential sales is less significant than the other two announcements. These findings are in line with the findings of Solakoglu and Demir (2014), who find that the US real economy news are more influential on BIST 100 index return volatility than US inflation news, although the data of their study consists the crisis period of 2008-2009. As we evidence that US nonfarm payroll employment news do not have a significant impact, this finding contradicts to Cakan et al. (2014), who find that US unemployment report has a significant impact on conditional volatility of BIST 100 index.

Turkish GDP, US GDP, and US new residential sales announcements increase the volatility of BIST 100 index. Hence, releasing these news increase the uncertainty in the announcement days. This finding contradicts to Nguyen and Ngo (2014), who find that US macroeconomic news reduce uncertainty in Asian markets. They interpret their findings as the US news can resolve the uncertainty about the health of US economy for market participants.

**Table 3**

**OLS Regression Results**

| Variable | Coefficient | t-Statistic |
|---|---|---|
| TR_GDP | 0.070307 | 2.256506** |
| TR_Business Tendancy Survey | -0.021919 | -1.159933 |
| TR_Labor Force Statistics | -0.007060 | -0.391927 |
| TR_House Sales | 0.015517 | 0.622760 |
| TR_Industrial Production Index | 0.003238 | 0.176297 |
| TR_Foreign Trade Statistics | -0.021143 | -1.078193 |
| TR_Consumer Price Index | -0.001337 | -0.069219 |
| TR_Consumer Confidence Index | 0.014822 | 0.810775 |
| US_ Dur. Goods Manufacturers' Ship., Inv. and Orders | 0.013267 | 0.661230 |
| US_ Manufacturers' Shipments, Inventories and Orders | 0.021002 | 1.075899 |
| US_GDP | 0.050626 | 2.599086*** |
| US_Construction Spending | -0.001397 | -0.070585 |
| US_Personal Income and Outlays | -0.013827 | -0.686053 |
| US_Int.Trade in Goods and Services | 0.020200 | 1.092101 |
| US_ Sales For Retail And Food Services | 0.139042 | 0.933219 |
| US_Nonfarm Payroll Employment | 0.012481 | 0.675720 |

| | | |
|---|---|---|
| US_Consumer Price Index | -0.001338 | -0.070550 |
| US_Producer Price Index | -0.009284 | -0.486256 |
| US_Manufacturing and Trade Inventories and Sales | -0.133328 | -0.888377 |
| US_New Residential Construction | 0.005906 | 0.309558 |
| US_New Residential Sales | 0.034565 | 1.691029* |
| C | -0.005963 | -1.057482 |

| | |
|---|---|
| R-squared | 0.014675 |
| Adjusted R-squared | 0.000750 |
| Durbin-Watson stat | 2.062677 |

*Note: *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates at the 10% level.*

In sum, because it is evidenced that only US GDP and new residential sale announcements have impacts on volatility out of 13 US news, and only Turkish GDP news announcement play a significant role out of 8 Turkish news, the effects of the domestic and US economic news on BIST 100 volatility are very limited. We also confirm this finding by analyzing the total domestic news effect and total US news effect on the volatility as shown in Table 4. It is seen that, although both total domestic and total US economic news announcements increase the volatility, their effects are not significant. These findings are in line with Gümüş et al. (2011), who find that US macroeconomic news do not have a significant impact on BIST 100 index volatility, and also partially consistent with Önder and Şimga-Mugan (2006), who find that domestic economic news does not play a significant role on BIST volatility even though the effect of the world economic news is significant.

The number of the statistically insignificant announcements indicate that as a developing market, the investors of the Turkish stock market's responses to the US macroeconomic news announcements are less identical comparing to the G7 markets, developed European markets other than G7's, and developed and emerging Asian markets as reported in Nikkinen et al. (2006). As a result, it is inferred that while developing and also some emerging markets are integrated, Turkish stock market is segmented with respect to the US news announcements. This result indicates the portfolio diversification opportunities for international investors regarding the Turkish stock market.

**Table 4**

**Total Effect of Domestic and US Economic News**

| Variable | Coefficient | t-Statistic |
|---|---|---|
| TR_ALL | 0.000999 | 0.120890 |
| US_ALL | 0.011368 | 1.476045 |
| C | -0.005250 | -0.908454 |
| R-squared | 0.001461 | |
| Adjusted R-squared | 0.000134 | |
| Durbin-Watson stat | 2.068506 | |

## 4. Conclusion

This study investigates the impacts of the US and domestic macroeconomic news announcements on the Turkish stock market. We analyze 13 US and 8 Turkish news announcements for the period 01.04.2010-12.31.2015. We include only 8.30 am and 10.00 am (EST) US news announcements in the study since their effects can be observed in the same day of announcements in Borsa Istanbul. We follow the approach of Nikkinen et al. (2006) and examined the Borsa Istanbul 100 stock index volatility behaviour around announcement and non-announcement days. We find that Turkish GDP and US GDP news announcements and also US new residential sales significantly affect the volatility on the announcement days. We document that these announcements increase the volatility, which indicates an increasing in the uncertainty following the release of these macroeconomic news. Despite the scarce evidence about the significant impacts of GDP announcements in the literature, our results provide evidence for their significance in Turkish stock market. This result is important for investors, analysts and academicians.

On the other hand, the number of insignificant news announcements for both US and Turkish news suggests that the impact of the news announcements are limited. This result is confirmed by also testing the total US and total domestic news announcement effects. Considering the integration of the developed and also some emerging stock markets with respect to the US news announcements as reported in Nikkinen et al. (2006), our results indicate that Turkish stock market is less integrated, which imply the

international portfolio diversification opportunities for investors regarding Turkish stock market.

But as pointed out by Wongswan (2006) and Gümüş et al. (2011) using low frequency data may be the cause of the weak evidence of the spillover effects of the news across international markets. Thus, using high frequency data may result different impacts of news in an intraday frame for further studies. Also, studying surprise components of news as positive and negative surprises will help to better understand the effects of the macroeconomic news announcements in an intraday frame.

## References

1. Andersen, T. G., Bollerslev, T., Diebold, F. X., Vega, C. (2007). "Real-Time Price Discovery in Global Stock, Bond and Foreign Exchange Markets". *Journal of International Economics*, 73(2), pp. 251-277.
2. Birz, G., Lott, J. R. (2011). "The Effect of Macroeconomic News on Stock Returns: New Evidence from Newspaper Coverage". *Journal of Banking & Finance*, 35(11), pp. 2791–2800.
3. Brenner, M., Pasquariello, P., Subrahmanyam, M. (2009). "On the Volatility and Comovement of U.S. Financial Markets around Macroeconomic NewsAnnouncements". *The Journal of Financial and Quantitative Analysis*, 44(6), pp. 1265-1289.
4. Büttner, D., Hayo, B., Neuenkirch, M. (2012). "The Impact of Foreign Macroeconomic News on Financial Markets in the Czech Republic, Hungary, and Poland". *Empirica*, 39(1), pp. 19–44.
5. Cakan, E., Doytch, N., Upadhyaya, K. P. (2014). "Does U.S. Macroeconomic News Make Emerging Financial Markets Riskier?". *Borsa İstanbul Review*, 20, pp. 1-7.
6. Demirgil, H., Gök, İ. Y. (2014). "Türkiye ve Başlıca AB Pay Piyasaları Arasında Asimetrik Volatilite Yayılımı". *Yönetim ve Ekonomi Araştırmaları Dergisi* (23), pp. 315-340.
7. Ehrmann, M., Fratzscher, M. (2009). "Global Financial Transmission of Monetary Policy Shocks". *Oxford Bulletin of Economics and Statistics*, 71(6), pp. 739–759.
8. Fedorova, E., Wallenius, L., Collan, M. (2014). "The Impact of Euro Area Macroeconomic Announcements on CIVETS Stock Markets". *Procedia Economics and Finance*, 15, pp. 27-37.

9. Flannery, M. J., Protopapadakis, A. A. (2002). “Macroeconomic Factors Do Influence Aggregate Stock Returns”. *The Review of Financial Studies*, 15(3), pp. 751-782.
10. Gök, İ. Y., Kalaycı, Ş. (2013). “Türkiye ve ABD Pay Piyasaları Arasında Getiri ve Volatilite Yayılımı: Çok Değişkenli GARCH Analizi ile Ampirik Bir Araştırma”. *Finans Politik & Ekonomik Yorumlar*, 50(584), pp. 39-58.
11. Gümüş, G. K., Yücel, A. T., Karaoğlan, D., Çelik, Ş. (2011). “The Impact of Domestic and Foreign Macroeconomic News on Stock Market Volatility: Istanbul Stock Exchange”. *Boğaziçi Journal*, 25(1), pp. 123-137.
12. Hanousek, J., Kočenda, E. (2011). “Foreign News and Spillovers in Emerging European Stock Markets”. *Review of International Economics*, 19(1), pp. 170–188.
13. Harju, K., Hussain, S. M. (2011). “Intraday Seasonalities and Macroeconomic News Announcements”. *European Financial Management*, 17(2), pp. 367-390.
14. Kim, S.-J. (2003). “The Spillover Effects of US and Japanese Public Information News in Advanced Asia-Pacific Stock Markets”. *Pacific-Basin Finance Journal*, 11(5), pp. 611-630.
15. Kim, S.-J., McKenzie, M. D., Faff, R. W. (2004). “Macroeconomic News Announcements and the Role of Expectations: Evidence for US Bond, Stock and Foreign Exchange Markets”. *Journal of Multinational Financial Management,* 14(3), pp. 217–232.
16. Nguyen, T., Ngo, C. (2014). “Impacts of the US macroeconomic news on Asian stock markets”. *The Journal of Risk Finance*, 15(2), pp. 149-179.
17. Nikkinen, J., Omran, M., Sahlström, P., Äijö, J. (2006). “Global Stock Market Reactions to Scheduled U.S. Macroeconomic News Announcements”. *Global Finance Journal*, 17(1), pp. 92-104.
18. Önder, Z., Şimga-Mugan, C. (2006). “How Do Political and Economic News Affect Emerging Markets? Evidence from Argentina and Turkey”. *Emerging Markets Finance and Trade*, 42(4), pp. 50-77.
19. Pearce, D. K., Roley, V. V. (1985). “Stock Prices and Economic News”. *The Journal of Business*, 58(1), pp. 49-67.
20. Solakoglu, M. N., Demir, N. (2014). “The Effect of News on Return Volatility and Volatility Persistence: The Turkish

Economy During Crisis". *Emerging Markets Finance and Trade*, 50(6), pp. 249-263.
21. Wongswan, J. (2006). "Transmission of Information across International Equity Markets". *The Review of Financial Studies*, 19(4), pp. 1157-1189.

**Financial Studies**

"Victor Slăvescu" Centre for Financial and Monetary Research
Casa Academiei 13, Calea 13 Septembrie, Building B, 5th floor
Bucharest, 050711, Romania
Phone: +40 21.318.24.19
Fax: +40 21.318.24.19
E-mail: s.vraciu@icfm.ro