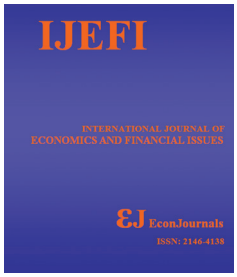

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The Effect of Credit and Market Risk on Bank Performance: Evidence from Turkey

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ABSTRACT

There is a strong connection between bank performance and economic growth. Therefore, understanding on the effects of credit and market risk on bank performance could contribute to the better functioning of the banking system. This study investigates the effects of credit and market risk, i.e., interest rate and foreign exchange (*FX*) rate risk, on the bank performance for the Turkish banking sector in a time-varying framework employing the generalized autoregressive conditional heteroscedastic approach for the 18.01.2002-30.10.2015 period by using weekly data. The results suggest two main findings: (i) Credit risk has a negative and FX rate has a positive effect, but interest rate has insignificant effect on banking sector profitability, (ii) credit and market risk have a positive and significant effect on conditional bank stock return volatility.

Keywords: Bank Lending Channel, Bank Performance, Credit Risk, Interest Rate Risk, Currency Risk
JEL Classifications: C32, E43, E44

1. INTRODUCTION

Bank performance is vital in order to achieve sustainable economic growth especially in emerging countries like Turkey, where the banking sector loans to gross domestic product ratio is over 70% and banks serve as the main financing source for corporations due to shallow financial markets. Therefore, the efficiency of credit channel plays a significant role to provide uninterrupted and low cost of funding for corporations. However, banks deal with different types of risks such as credit risk, market risk and operational risk when meeting their intermediation function. Therefore, better understanding on the effects of these risks on bank performance could contribute to the better functioning of the banking sector.

In the history of Turkish Banking System, the 1990s were identified as the years of a high volatile environment because of 1994 currency, 1999 economic, and 2001 financial crises. The 90s could be characterized by high government debt, sudden-stop problems and determining exchange rates by the Central Bank of Turkey with fixed-rate, which in turn created devaluation problems in the crisis period. Banks were increasingly investing in government bonds as well as taking huge currency mismatches and interest rate risk in these years. Credit channel could not function well because of high government demand on money market. Finally, eleven banks were transferred to the savings deposit insurance fund (SDIF) during the 1994-1999 period and 10 banks were transferred to the SDIF because of the negative effects of 2001 financial crisis. On the other hand, the operating losses of publicly-financed banks were indemnified, their capital structures were consolidated and their operations were restructured (BRSA, 2009). Eventually, Turkey took significant lessons from the crisis, especially after the 2001 financial crisis and proceeded to enact new laws and regulations concerning the banking sector.

Turkish banking sector started a strong and relatively healthy growth period after the 2001 crisis and became one of the least affected banking sectors in the world from the 2008 global crisis. After the establishment of Banking Regulation and Supervision Agency (BRSA)[1], banks defined their risk management procedures

1 BRSA was established in June 1999 according to Banks Act Nr. 4389 and began to operate in August 2000. Before BRSA, the regulation and supervision of banking system had a fragmented structure. The Under secretariat of treasury was responsible for issuing banking regulations, carrying out on-site supervision and enforcement, Central Bank of Turkey was responsible for off-site supervision and SDIF gave insurance to saving deposits.

and have taken necessary precautions in order to avoid risks, in compliance with Basel accords[2]. The minimum capital adequacy ratio (CAR)[3] in Turkey was determined as 12%, which was over the 8% international target set by BRSA. As of September 2015, the banking sector CAR ratio was 14.65% and the share of credit, market and operational risk in risk weighted assets were about 90%, 3% and 7% respectively. Today, the Turkish banking sector is the second largest banking system in Emerging Europe after Russia, with an asset size of USD 795 billion as of December 2014. There are 49 banks in total, 32 of them being deposit, 13 development and investment and 4 of them participation banks.

Credit risk is the most important risk exposure for banks due to strong connection with bank profitability and economic growth. For banks, a proper investment decision means the greatest return on investment at the lowest credit risk. Each loan without repayment decreases banks' profit and equity, which in turn may result in bank failure if the bank cannot pay off its liabilities. The effects of credit risk on output have been mostly examined in the literature in terms of the bank lending channel, one of the non-neoclassical monetary transmission channels (Boivin et al., 2010). There is a growing literature on the importance of credit risk for monetary policy, especially after the 2008 global financial crisis (Ciccarelli et al., 2010; Hempell and Kok, 2010; Gilchrist et al., 2009; Gilchrist and Mojon, 2014). Most of the studies focusing on the effect of the credit risk on bank performance employed time series or panel data and used the monthly data since the credit risk variable is observed monthly. Generally, return on assets and return on equity are used as bank performance indicators and diffusion indexes, stress tests, default spreads, expected default frequencies, loan loss provisions, loss given default, and non-performing loans are used as credit risk indicators in these papers. The inverse relationship between bank performance and credit risk emerges as one of the main findings of the studies (Bourke, 1989; Molyneux and Thornton, 1992; Demirguc and Huizinga, 1999; Abreu and Mendes, 2002; Goddard et al., 2004; Naceur and Goaied, 2001; 2005; and Pasiouras and Kosmidou, 2007; Mileris, 2012; Romanova, 2012).

Market risk is the risk of losses in liquid portfolio arising from the movements in market prices and consisting of interest rate, currency, equity and commodity risks. Interest rate and currency risk are the main parts of the market risk in the Turkish banking sector. As I mentioned before, the share of market risk in risk-weighted assets are only about 3% as of September 2015, but market risk exposure is more volatile than credit risk exposure due to rapid changes in market conditions. After the 2001 financial crisis, the economic structure of Turkey has shifted to a new paradigm. The Central Bank of the Republic of Turkey (CBRT) has become independent, passed to a floating foreign exchange (*FX*) rate regime from fixed *FX* rate regime and adopted inflation targeting at the beginning of 2002. To achieve low inflation target under the new monetary policy, the CBRT uses the short term interest rates as an instrument of monetary policy instead of *FX* rates. While inflation decreased from over 30% to under 10% from 2002 to 2004, public debt and spending rates have improved significantly because of tight fiscal policy and strong economic growth. As a result, loans to assets ratio in the Turkish banking sector has Risen from 23% in December 2002 to 62% in September 2015. On the other hand, *FX* liabilities to total liabilities ratio has fluctuated between 25% and 40% during the period of 2002-2015. So the sensitivity of balance sheet to changes in *FX* rate is high in Turkey. Interest rate is also another important risk exposure for Turkish banking sector when considering the average duration for deposits is very short, i.e., around 3 months and deposits to liabilities ratio is 53% as of September 2015.

The existing literature offers little consensus regarding the effects of changes in interest rates on bank performance. If banks borrow short-term and lend long-term, and if their interest rates are not fully flexible, banks will be exposed to repricing and yield curve risk[4]. In such a case, the negative relationship between short-term interest rates and bank profitability has mostly been offered by the literature (Lloyd and Shick, 1977; Flannery, 1981; 1983; and Flannery and James, 1984; Hancock, 1985; Den Haan et al., 2007; Kasman et al., 2011). On the other hand, banks generally can protect their balance sheet against interest rate changes using risk techniques. Banks may hedge their interest rate risk exposure through using interest rate derivatives (Flannery, 1981; Gorton and Rosen, 1995; Purnanandam, 2007). Moreover, banks may change the size and composition of non-interest income/expense in response to movements in interest rates. However, such changes in risk mitigation techniques are open to discussion due to their own risks (Smith et al., 2003; Stiroh, 2004; Stiroh and Rumble, 2006; and Lepetit et al., 2008). On the other hand, Demirguc and Huizinga (1999) found a positive relationship with interest rates and profits, particularly in emerging market economies and Albertazzi and Gambacorta (2009) concluded that short-term interest rates have no significant impact on income margins for a group of OECD countries.

The fluctuations in the *FX* rates can affect the bank profits directly by changing the value of net foreign currency position. If a bank has a long position, the increase in *FX* rate, i.e., loss in local currency value, results in a gain for a bank. However, especially for developing countries such as Turkey, the changing value of local currency has important effects on inflation, import and export and interest rates. Similar to interest rate risk, banks might mitigate the foreign currency exposure by using different hedging techniques. Most of the studies on the effect of *FX* rates on bank performance have no clear conclusion; results are sensitive in regards to country, period or methodology. Aharony et al. (1985) and Grammatikos et al. (1986) concluded that the effect of the *FX* rate risk on bank stock returns is statistically significant because banks have imperfectly hedged their foreign currency positions. Chamberlain et al. (1997) found that the exchange rate sensitivity of the stock returns of US banks was stronger than that of Japanese banks. Moreover, several studies have examined the effect of both

2 It is provided with legal amendments, "Regulation on Bank's Internal Control and Risk Management Systems" published in Official Gazette, issue no. 24312, on 8 February 2001.

3 CAR, also called capital to risk (weighted) assets ratio, is a ratio of a bank's capital to its risk and is formulated as following: CAR = Equity/risk weighted assets (credit risk + market risk + operational risk).

4 See for more information BIS, 2004.

Table 1: Descriptive statistics

Variable	Mean	Maximum	Minimum	SD	Skewness	Kurtosis	Jarque-Bera	ADF
Bank index	0.2468	36.555	−20.586	5.3131	0.2923	6.8403	450.18*	−27.755*
A	−0.3542	21.706	−23.211	5.8106	−0.0088	4.6267	78.954*	−28.982*
B	−0.3992	20.022	−31.365	6.1483	−0.1716	4.7467	94.539*	−28.792*
C	−0.2329	25.757	−42.845	6.0033	−0.4083	7.8188	712.65*	−27.282*
D	0.1213	54.935	−44.183	6.8393	0.0628	12.689	2801.1*	−16.524*
Industrial	0.2669	15.005	−16.278	3.0218	−0.8649	6.7344	505.33*	−22.068*
Interest	−0.0685	2.9700	−3.89	0.5452	−1.6962	14.575	4340.6*	−8.753*
Commercial	−0.0713	8.0500	−16.39	1.9029	−1.7165	18.307	7331.6*	−6.288*
Spread	1.9275	9.8900	−12.68	2.6677	−1.3237	7.2540	749.01*	−2.935**
Basket	0.1165	9.0825	−6.5566	1.4655	0.8891	7.0044	572.74*	−19.838*

*Indicates the significance level at 1%, **ındicates the significance level at 5%. ADF: Augmented Dickey-Fuller, SD: Standard deviation

interest rate and exchange rate changes on financial sector returns (for example, Choi et al., 1992; Wetmore and Brick, 1994; Choi and Elysiani, 1997; Koch and Saporoschenko, 2001; and Joseph, 2003). Some other studies focusing on the joint interaction of credit, interest and *FX* rate risks are Madura and Zarruk (1995), Adjaoud and Rahman (1996), Prasad and Rajan (1995), Choi et al. (1998), Tai (2000), Atindéhou and Gueyie (2001) and Rahman (2010).

As can be seen above, there is vast literature on the effects of credit and market risk on banking performance for developed countries. Few studies focus on emerging countries, such as Turkey. Kasman et al. (2011), for instance, investigated the effects of interest rate and *FX* rate changes on Turkish banks' stock returns using the ordinary least squares and generalized autoregressive conditional heteroscedastic (GARCH) estimation models. The results suggest that changes in interest rate and *FX* rate have a negative and significant effect on the conditional bank stock return. Moreover, bank stock return sensitivities are found to be stronger for market return than interest rates and exchange rates, implying that market return plays an important role in determining the dynamics of conditional return of bank stocks. The results further indicate that interest rate and exchange rate volatility are the major determinants of the conditional bank stock return volatility. This paper follows the Kasman et al. (2011) and reinvestigates the same question with some extensions, namely the addition of credit risk besides interest and *FX* rate risk, use of different variables for interest rate such as 3 months deposits interest rate, commercial loan interest rate and spread, and selection of the different time period based on monetary policy in Turkey.

The remainder of the paper is organized as follows. Section 2 discusses the data, Section 3 explains the methodology, Section 4 presents the empirical results and section 5 focuses on some different measurements of interest rate as a robustness check. The paper ends with some brief concluding remarks.

2. DATA

I employed weekly data beginning on 18 January 2002 and ending on 30 October 2015 with 716 observations. The return of the bank index, industrial index and bank stocks[5] listed on Istanbul stock exchange (ISE) are calculated as $r_t = 100^* (\ln p_t - \ln p_{t-1})$. Where p_t is the stock price at time t and p_{t-1} is the stock price at time $t-1$. The return of bank index and bank stocks indicates the performance of banking sector and banks respectively, and the industrial index, which consists of the stocks of industrial companies traded in the ISE, indicates the credit risk. The banks consider low credit risk when the return of the industrial companies is high. The high stock return for industrial companies means high profit for companies and sends good signals to banks about the financial condition of companies[6].

The market risk consists of interest rate risk and *FX* rate risk. Interest rate and *FX* rate data are gathered from the CBRT electronic data delivery system weekly. 3 months deposit interest rate[7] is used for understanding the effect of changes in interest rate and interest rate risk on bank performance since the average duration of deposits is around 3 months in Turkey and deposits are the main financing sources for banks. Furthermore, commercial loan interest rate and spread, the difference between, 3 months deposit interest rate and commercial loan interest rate is taken as other proxies for interest rate. The first differences of 3 months deposit and commercial loan interest rate are used to provide stationary condition $\Delta i_t = i_t - i_{t-1}$, and spread variable is already stationary in level. The *FX* rate is based on a simple basket of equally weighted two major currencies, the US dollar and the Euro. The continuously-compounded returns for the *FX* rate are computed the same as stock returns.

The descriptive statistics of the variables is presented in Table 1. The return distribution is negatively skewed for all variables except for bank index and basket. Negative skewness means an asymmetrical distribution with a long tail to the left, or to put it differently, big losses in the crisis periods. All data have big kurtosis values indicating a leptokurtic distribution which is more peaked around the mean than a Gaussian distribution. As expected, the normality has been rejected at 1% significance level by Jargue-Bera tests. Augmented Dickey-Fuller statistics indicates that all data have proven stationary condition by rejecting the unit root at 1% and 5% significance levels.

5 The selection of banks is depending on data period and asset size of the banks, selected ones are the major banks in Turkish banking system and marked as A, B, C, D banks.

6 Kasman et al. (2011) use the return of ISE 100 index as market risk, which reflects economy-wide factors. In this study, the return of industrial index is preferred to use because it is a narrower index to focus on the relationship between bank performance and corporation performance and excludes the effects of banks on overall ISE 100 index.

7 Weighted average interest rates of the banking sector are calculated by weighting each bank's weighted and compounded average interest rates relating to its weekly amounts.

3. METHODOLOGY

I follow the same modeling methodology by Kasman et al. (2011), with some extensions. They use the return of the Istanbul stock price index 100 as market risk, but I use the return of industrial index as credit risk as I explained in the data section. Instead of using the 2 years Turkish government bond, the 3 months deposit interest rate is used in this paper due to its strong relationship with liabilities as explained in the data section. While the data is daily and starts from 1999 and finishes in 2009 in Kasman et al. (2011); I use the period of 2002-2015 and exclude before 2002 because of the different monetary policy framework whose details are provided in the introduction section. Moreover, weekly data are employed as interest rate data are gathered only on a weekly basis.

Kasman et al. (2011) employed the GARCH (1, 1) model to understand the effect of changes in interest rate and *FX* rate on bank return. Instead of market risk, the credit risk variable is used in the model and it is estimated following the GARCH (1, 1) model[8]:

$$r_t = \gamma_0 + \gamma_1 CR_t + \gamma_2 INT_t + \gamma_3 FX_t + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \quad (2)$$

The mean Equation given in (1) is written as a function of exogenous variables with an error term. Where r_t is the return of bank index or bank stocks, CR_t is the credit risk defined as the return of the industrial stocks at time *t*. INT_t refers to the first difference of the 3 months deposit interest rate at time *t*, FX_t stands for the return of the basket *FX* rate, and ε_t is the error term which is normally distributed with zero mean and a variance of σ_t^2. The sensitivity of banking sector or bank performance at time *t* to the credit risk, interest rate and *FX* rate are measured by the parameters γ_1, γ_2, and γ_3, respectively. The conditional variance σ_t^2 is given by Equation (2), and is ω is the time-invariant component of risk. Furthermore, α is the ARCH parameter, which indicates the news about volatility from the previous period and measured as the lag of the squared residual from the mean equation, and β is the GARCH parameter, which is measured as the last period's forecast variance.

The second model focuses on the effect of credit, interest and *FX* rate risk on the bank index and bank stock returns volatility. The model is specified as follows:

$$r_t = \gamma_0 + \varepsilon_t \quad (3)$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \phi_1 CR_t + \phi_2 INT_t^2 + \phi_3 FX_t^2 \quad (4)$$

The return of the bank index or bank stocks r_t is written as a function of the constant term and an error term. The variance model given in Equation (4) is the traditional GARCH (1, 1) model, plus credit risk, interest rate risk measured as INT_t^2 and the *FX* rate measured as FX_t^2. The return of the industrial index is used as credit risk indicator as did in Equation (1) without square function due to the first degree relationship between return and risk.

4. EMPIRICAL EVIDENCE

The estimated coefficients from the mean given in Equation (1) and variance equation given in (2) are presented in Table 2. The results indicate that the return of industrial index γ_1 has a positive and significant relation with the return of the bank index and bank stocks. Hence, greater credit risk means lower profitability for banks and banking sector. This main finding is in line with the literature (Bourke, 1989; Molyneux and Thornton, 1992; Demirguc and Huizinga, 1999, Abreu and Mendes, 2002; Goddard et al., 2004; Naceur and Goaied, 2001; 2005; and Pasiouras and Kosmidou, 2007; Mileris, 2012; Romanova, 2012). While the returns of bank index and D Bank are affected the most, C Bank is the least affected bank by credit risk.

The response of conditional return to changes in interest rates is negative but insignificant for some cases. The effect of changes in 3 months deposit interest rate, γ_2, is negative but insignificant for bank index and D bank, and negative and significant for A bank, B bank and C bank. In the overall banking sector and D bank may hedge their interest risk exposure through the use of interest rate derivatives (Flannery, 1981; Gorton and Rosen, 1995; Purnanandam, 2007) or change the size and composition of non-interest income/expense. On the other hand, A bank, B bank and C bank have been affected by interest rates negatively, which is consistent with the main expectation in the literature (Lloyd and Shick, 1977; Flannery, 1981; 1983; and Flannery and James, 1984; Hancock, 1985; Den Haan et al., 2007; Kasman et al., 2011). An increase in 3 months deposit interest rate may make the cost of funding higher than before for banks and may affect the value of securities portfolio negatively. As a result, net interest margin and profit decreases. C bank is the most sensitive bank to the changes in interest rate.

The profitability of banking sector and all other banks has been affected by the increase of the *FX* rate positively, except for A Bank. The coefficient γ_3 is negative and insignificant for A bank (Table 2). The increase in *FX* rate and weaker local currency, may affect bank profitability in a positive way if a bank has a long position. For instance, the net foreign currency position is generally positive when facing a hike in *FX* rate, such as banking sector, B bank, C bank and D bank. On the other hand, insignificant result for A bank may be interpreted as a balanced *FX* position in general and successful *FX* risk management. The returns of bank index and D bank are the most sensitive to the changes in *FX* rate as the same with credit risk; however, the bank index and D bank are insensitive to the interest rate changes.

In contrast with the finding from this study, Kasman et al. (2011) found the negative and significant effect for bank index, A bank, B bank and insignificant coefficients for nine banks. This opposite effect may be explained by the difference of net currency position and the exchange rate policy between these two studies. The banking sector had large, short position till

8 Each return series have own dummy variables, which is identified over ±30% returns, in the mean equation such as Equations (1) and (3).

Table 2: Estimates of the mean model given in Equation 1 and variance Equation given in 2

Variable	γ_0	γ_1	γ_2	γ_3	ω	α	β
Bank index	−0.0562	1.0417*	−0.1288	0.4133*	1.1509**	0.0935*	0.8405*
	(0.1514)	(0.0585)	(0.2990)	(0.1294)	(0.5270)	(0.0278)	(0.0484)
A bank	−0.4773*	0.2168*	−0.8075**	−0.0070	0.7450**	0.0466*	0.9287*
	(0.2033)	(0.0814)	(0.3993)	(0.1597)	(0.3827)	(0.0123)	(0.0196)
B bank	−0.6013*	0.2728*	−0.6874***	0.2916***	0.7899***	0.0643*	0.9119*
	(0.2075)	(0.0829)	(0.4010)	(0.1567)	(0.4903)	(0.0177)	(0.0248)
C bank	−0.3992**	0.1494***	−1.0301**	0.2712***	0.4564	0.0534*	0.9314*
	(0.2005)	(0.0895)	(0.4580)	(0.1546)	(0.2970)	(0.0129)	(0.0174)
D bank	−0.1733	1.1090*	−0.3568	0.4074*	1.2507*	0.1814*	0.7974*
	(0.1827)	(0.0678)	(0.4275)	(0.1471)	(0.3675)	(0.0272)	(0.0218)

Numbers in parenthesis indicate the standard errors. *indicates the significance level at 1%, **indicates the significance level at 5%, ***indicates the significance level at 10%

December 2002, and generally small and long position after that time[9]. The increase in *FX* rate resulted in big losses for the banks which aimed at having large short positions before 2003. In addition to this, the behavior of *FX* rates was different before and after February 2001 due to different *FX* rate policies as explained in the introduction section.

The conditional σ_t^2 variance follows the process described in Equation (2) and determined by the time-invariant component of risk ω, ARCH parameter α and GARCH parameter β. Both the ARCH parameters and GARCH parameters are significant, satisfy the non-negativity condition, and the sum of the α and β parameters is less than one to secure the covariance stationary for the conditional variance for all cases. The GARCH parameters, the past behaviour of the variance σ_t^2, are stronger than the ARCH parameters, past squared error terms ε_{t-1}^2. In other words, the volatility of each stock return and bank index return are more sensitive to own lagged values than the news from the previous period. The sum of the ARCH and GARCH parameters are close to one, which indicates that shocks have highly persistent effects on bank and index return, and the effect of shocks on conditional volatility decays at a slower rate.

Table 3 reports the estimated coefficients given in Equation (2) and (4) to improve our understanding of the effect of credit, interest and *FX* rate risk on bank return volatility. After the inclusion of credit, interest and *FX* rate risk into the variance equation, the variance of the bank index or bank stock returns are sensitive to the GARCH parameter for all cases but sensitive to the ARCH parameter for only A bank with 10% significance level.

Credit risk φ_1 has a significant effect on bank index and bank returns volatility for all cases, except B bank, which is still negative but insignificant. A decrease in credit risk, i.e., an increase in profitability of industrial sector, leads to less volatility for banking sector, A bank, C bank and D bank. On the other hand, when considering the mean equation in Table 2, a decrease in credit risk also supports the profitability of banking sector and banks. To put it in another way, less credit risk means stronger and more stable growth for banks and vice versa. The effect of credit risk on the return volatility is stronger for C bank than other banks and bank index.

The interest rate risk φ_2 has a statistically significant and positive effect on the volatility of bank profitability for all cases, which indicates that an increase in volatility of the 3 months interest rate rises up the volatility in bank returns. These findings on the effect of interest rate on average bank returns and volatility of bank returns are in accordance with Kasman et al. (2011). Moreover, the interest rate risk is explicitly the leading risk type affecting the volatility of returns among the credit and *FX* rate risk when the size of coefficients is compared.

The effect of *FX* risk on bank return volatility φ_3 is significant and positive for all cases, except for D bank, whose impact on bank return volatility is positive but insignificant. A possible explanation of the positive relationship between currency risk and bank return volatility is that Turkish banks may not hedge their *FX* risk exposure well by using financial instruments known as derivatives, the two most common of which are options and futures.

5. DIFFERENT PROXIES FOR INTEREST RATE

As a robustness check, the alternative measures of interest rate have been used to see how the results are sensitive to the measurement. The estimates of the coefficients from the Equation (1) and (2) are reestimated with the new proxies, commercial loan interest rate and spread, and the results are presented in Tables 4 and 5. As shown in Table 4, the interest rate variable γ_2 is insignificant for all cases after the inclusion of the commercial interest rate. The coefficient of the interest rate is negative and significant for A bank, B bank and C bank and negative but insignificant for bank index and D bank as the first case (Table 2), where the interest rate is used as 3 months deposit interest rate. This result may be expected when considering the different roles of the commercial and deposit rates into the banks' balance sheet. While 3 months deposit interest rate is related with the cost of funding for banks, the commercial loan rate depends mostly on the deposit interest rate and related with the

9 The net foreign exchange position for banking sector is −13,2 billion USD in 1999, −17,3 billion USD in 2000, −8,7 billion USD in 2001 and −5,3 billion USD in 2002; on the contrary, 0,150 billion USD in 2003, −0,074 billion in 2004, −0,086 billion USD in 2005, 0,198 billion in 2006, 0,204 billion USD in 2007, −0,93 billion USD in 2008, 0,605 billion USD in 2009, −0,813 billion in 2010, 0,602 billion USD in 2011, 3,9 billion USD in 2012, −1,2 billion USD in 2012 and −6,0 billion in 2014. See The Banks Association of Turkey Statistics for additional data.

Table 3: Estimates of the mean model given in Equation 3 and variance Equation given in 4

Variables	γ_0	ω	α	β	φ_1	φ_2	φ_3
Bank index	0.5475*	4.9309*	0.0396	0.6978*	−1.0561*	2.2149***	0.6476**
	(0.1895)	(1.2683)	(0.0289)	(0.0724)	(0.3231)	(1.2187)	(0.3245)
A bank	−0.2901	2.7944*	0.0334***	0.8459*	−0.4974**	1.4754***	0.3875**
	(0.2029)	(1.0857)	(0.0183)	(0.0532)	(0.2444)	(0.8375)	(0.1972)
B bank	−0.4018**	5.1068*	0.0394	0.7484*	−0.5311	3.7552***	0.6559**
	(0.2073)	(2.1237)	(0.0293)	(0.0893)	(0.3610)	(2.0297)	(0.3197)
C bank	−0.2175	18.502*	0.0103	0.3884*	−2.1955*	3.0242***	0.6319***
	(0.2184)	(3.9518)	(0.0191)	(0.1288)	(0.5023)	(1.7318)	(0.3823)
D bank	0.3495	3.5527*	0.0344	0.8046*	−0.7278*	12.553*	0.1493
	(0.2208)	(1.0528)	(0.0223)	(0.0512)	(0.2751)	(4.9301)	(0.2482)

Numbers in parenthesis indicate the standard errors. *Indicates the significance level at 1%, **indicates the significance level at 5%, ***indicates the significance level at 10%

Table 4: Estimates of the mean model given in Equation 1 and variance Equation given in 2 by the commercial interest rate instead of 3 months deposit rate

Variables	γ_0	γ_1	γ_2	γ_3	ω	α	β
Bank index	−0.0484	1.0442*	0.0051	0.4156*	1.0521**	0.0914*	0.8477*
	(0.1506)	(0.0576)	(0.0933)	(0.1304)	(0.4777)	(0.0261)	(0.0443)
A bank	−0.4344**	0.2274*	0.0693	−0.0121	0.7316**	0.0447*	0.9306*
	(0.2015)	(0.0816)	(0.1426)	(0.1648)	(0.3305)	(0.0112)	(0.0163)
B bank	−0.5784*	0.2781*	0.0631	0.2712***	0.9099***	0.0663*	0.9062*
	(0.2078)	(0.0829)	(0.1277)	(0.1601)	(0.5197)	(0.0183)	(0.0259)
C bank	−0.3623***	0.1621***	−0.0240	0.2503	0.4763***	0.0539*	0.9299*
	(0.2004)	(0.0886)	(0.1228)	(0.1589)	(0.2911)	(0.0127)	(0.0168)
D bank	−0.1468	1.1032*	0.0778	0.3884*	1.3395*	0.1783*	0.7958*
	(0.1843)	(0.0686)	(0.1267)	(0.1501)	(0.3873)	(0.0287)	(0.0247)

Numbers in parenthesis indicate the standard errors. *Indicates the significance level at 1%, **indicates the significance level at 5%, ***indicates the significance level at 10%

Table 5: Estimates of the mean model given in Equation 1 and variance Equation given in 2 by the spread instead of the 3 months deposit rate

Variables	γ_0	γ_1	γ_2	γ_3	ω	α	β
Bank index	−0.2898	1.0360*	0.1137***	0.3975*	1.0774**	0.0956*	0.8429*
	(0.1901)	(0.0574)	(0.0605)	(0.1293)	(0.4983)	(0.0280)	(0.0464)
A bank	−0.4169	0.2293*	−0.0099	−0.0132	0.7087**	0.0445*	0.9320*
	(0.2667)	(0.0807)	(0.0848)	(0.1598)	(0.3445)	(0.0117)	(0.0176)
B bank	−0.4894***	0.2811*	−0.0343	0.2759***	0.7611***	0.0621*	0.9149*
	(0.2646)	(0.0818)	(0.0798)	(0.1584)	(0.4616)	(0.0168)	(0.0231)
C bank	−0.2139	0.1649**	−0.0606	0.2552***	0.4539	0.0535*	0.9313*
	(0.2457)	(0.0871)	(0.0757)	(0.1557)	(0.2947)	(0.0130)	(0.0176)
D bank	−0.3145	1.1028*	0.0641	0.3878*	1.3162*	0.1855*	0.7922*
	(0.2646)	(0.0696)	(0.0877)	(0.1477)	(0.3722)	(0.0286)	(0.0236)

Numbers in parenthesis indicate the standard errors. *Indicates the significance level at 1%, **indicates the significance level at 5%, ***indicates the significance level at 10%

return of assets. When the fact that the average duration of loans are longer than deposits in Turkey is considered, it may be expected that the banks have been more sensitive to changes in deposit interest rates than the commercial loan rates. On the other hand, there is no significant change on the effect of credit and *FX* rate on bank return when the two results are compared. The only considerable change is evident in C bank because the *FX* rate coefficient for C bank γ_3 turns to insignificant in this new definition.

The results are very similar with the previous one when using spread as a proxy for interest rate, except for the fact that the interest rate coefficient of bank index γ_2 is significant and positive at the 10% significance level (Table 5). The spread indicates the basic profit for loans; therefore, an increase in spread leads to an increase in banking sector profitability. The first effect of the rising in deposit rate is less spread for banking sector. Hence, the inverse relationship between deposit rate and spread is expected, which explains the reason of significant but different sign coefficient for bank index. On the other hand, the spread coefficients for individual banks are insignificant, which may indicate better management for interest risk exposure in respond to changes in spread at the bank level.

6. CONCLUSION

There is a strong connection between bank performance and sustainable economic growth. Therefore, better understanding on

the effects of credit and market risk on bank performance could contribute to the better functioning of the banking system and help to understand the effects of monetary policy on it. Following the same modeling methodology by Kasman et al. (2011), this study provides strong empirical evidence on the effects of credit and market risk, which consist of interest rate and *FX* rate risk, on the bank performance for the Turkish Banking sector for the period of 18.01.2002-30.10.2015 by using weekly data. Unlike to Kasman et al. (2011), credit risk variable has added besides interest and and *FX* rate risk into the model, different variables for interest rate such as 3 months deposits interest rate, commercial loan interest rate and spread has used and different time period based on monetary policy has chosen. The paper has two main findings. (i) Credit risk and *FX* rate have a positive and significant effect, but interest rate has insignificant effect on banking sector profitability, (ii) Credit and market risk have a positive and significant effect on the conditional bank stock return volatility.

Credit risk, measured as return of industrial index, has a strong negative relationship with bank performance, measured as the return of bank index and bank stocks, i.e., A bank, B bank, C bank and D bank. This effect is also valid under the alternative measures of interest rate. Credit risk is the most influential risk exposure on the bank profitability for the Turkish banking sector but it changes at the bank level, that is some banks may effected by changes in interest rate or *FX* rate more than others. Credit risk also has significant negative effect on return volatility. Therefore less credit risk means high profit with less volatility for banks, in other words, less credit risk means stronger and stable growth for banks and vice versa.

The effect of interest rate on bank profitability is not clear as literature suggested. The effect is insignificant for bank index and D bank but negative and significant for all other banks, i.e., A bank, B bank and C bank at 10% level. On the other hand, the effect is insignificant for all cases when the commercial interest rate instead of 3 months - Deposit rate is used, and only significant for bank index at 10% level when the spread, which is defined as difference of these two rates is considered. However, interest rate risk has a significant and positive effect on return volatility for banking sector and every bank.

The *FX* rate and *FX* rate risk have a positive and significant effect on return[10] and return volatility[11] respectively. This finding supports the imperfect hedging in banking sector against the fluctuations in *FX* rate. The inference about the effects of credit and interest rate risk on bank returns is mainly in line with the Kasman et al. (2011), except for the effect of *FX* rate on return. In contrast, Kasman et al. (2011) finds a negative and significant effect for bank index, A bank, B bank and insignificant coefficients for nine banks. This result is consistent with the theoretical explanation when the fact that the Turkish banking system had a large short position till the end of 2002 and generally small and long position after that time, and adopted different *FX* regimes before and after February 2001, is taken into account.

10 Insignificant for A bank.
11 Insignificant for D bank.

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