



The Effects of the Volatility Changes in Exchange Rates and Interest Rates from Historical Shocks on the Non-Performing Loans in Turkish Economy

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Abstract

Historical shocks (Lehman Brothers bankruptcy (15 September 2008), the FED's tapering decision (18 December 2013), the CBRT's interest rate decision (28 January 2013)) had significant impact on global and domestic financial markets, especially nonperforming loans (NPLs). In this context, main aim of this study is to analyze how volatility changes in exchange rates and interest rates triggered by these historical shocks affect consumer and industrial nonperforming loans in Turkish economy by using quantile regression techniques. The results showed that shocks that cause volatility changes in foreign exchange rates and interest rates have important effects on NPLs in the Turkish banking industry.

Key words: Volatility Changes, Historical Shocks, Nonperforming Loans, Turkish Economy

JEL Codes: E44, E58, G01, G21, G33,

1. Introduction

The 2007-2008 global financial crisis resulted from the bursting of the U.S. housing bubble had deep impacts on global and domestic markets. The bankruptcy of Lehman Brothers was one of the worst shocks of the financial crisis, leading to taking measures by the U.S. Federal Reserve (Fed) such as quantitative easing programs. On the other hand, the Fed announced reduction of its asset purchases on May 22, 2013 and December 18, 2013 named as Tapering 1 and 2, respectively in the paper. These historical shocks had important effects on the global and domestic markets.

The global financial crisis had also an important effect on Turkish economy through channels of international trade, financial flows and deterioration of credit allocation mechanism in the financial markets and the expectation of economic agents. Nonperforming loans in the Turkish banking sector were affected notably by the global crisis. Figure 1 shows the distribution of non-performing loans (NPLs) by sectors as a percentage of the total loans in the Turkish banking sector for the period 2008-2015, quarterly data. Non-performing loans in the consumer credits, credit cards and construction sectors significantly increased during the global financial crisis. Non-performing loans in business and manufacturing sectors were not affected by the years 2008-2009 but affected deeply especially after the FED's tapering decision (18 December 2013) and the CBRT's interest rate decision (28 January 2013).

In the literature studying the determinants of nonperforming loans mainly focus on the bank-specific indicators and country-specific macroeconomic variables. The originality of the paper is that it is aimed to analyze how volatility changes in exchange rates and interest rates triggered by historical shocks (Lehman Brothers bankruptcy (15 September 2008), the FED's tapering decision (18 December 2013), the CBRT's interest rate decision (28 January 2013)) affect consumer and industrial nonperforming loans in Turkish economy by using quantile regression techniques in the paper. It is crucial to understand the effects of the volatility changes in exchange rates and interest rates triggered by historical shocks on the financial stability when designing macro-prudential and fiscal policies.

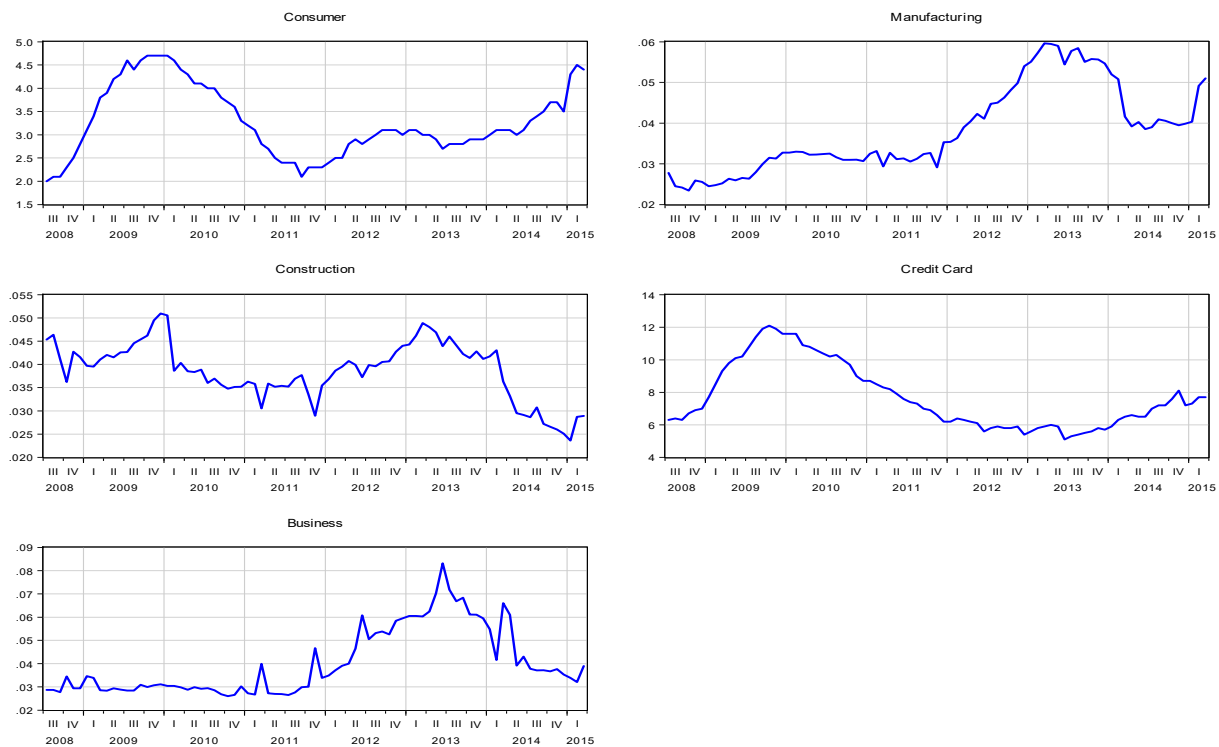


Figure 1. Distribution of non-performing loans (NPLs) by sectors as a percentage of total loans in the Turkish banking sector, Source: BRSA

2. Literature review

There is a close relationship between nonperforming loans and economic activity. Business cycles, banking crisis and financial stability are considered to be critical factors in explaining nonperforming loans (see Fisher (1933), King and Plosser (1984), Bernanke and Gertler (1989), Mishkin (1990), Kiyotaki and Moore (1997, 2012), Demirgüç-Kunt and Enrica (1998), Pesaran et al (2006), Kaminsky and Reinhart (1999), Beck et al. (2015)).

In the empirical literature, as determinants of nonperforming loans, it has been found that bank-specific and country-specific factors are the main determinants of nonperforming loans in the recent literature. Klein (2013) stated that “One group focuses on external events such as the overall macroeconomic conditions, which are likely to affect the borrowers’ capacity to repay their loans, while the second group, which looks more at the variability of NPLs across banks, attributes the level of non-performing loans to bank-level factors. Empirical evidence, however, finds support for both sets of factors.”

Table-1 shows the literature review on the determinants of non-performing loans. The literature on determinants of nonperforming loans in Turkish economy could be summarized briefly as follows:

Us (2016) finds that non-performing loans present persistence, which is more evident after the crisis, while other repressors have also persistent effects in the post-crisis period in the Turkish banking sector. Us (2016) also states that non-performing loans are mainly shaped by bank-specific variables before the crisis, whereas, after the crisis, non-performing loans are also driven by macroeconomic and policy-related variables. Commitment to price stability objective is indispensable for limiting non-performing loans and promoting financial stability.

Karahanoğlu and Ercan (2015) demonstrate granger causality from exchange rates USD/Turkish Lira, Euro/Turkish Lira, Industrial Production Index and Istanbul Stock Exchange Index to non-performing loans in Turkish economy for the period 2005M01- 2015M05.

Vatansever and Hepşen (2013) find that industrial production index, Istanbul Stock Exchange 100 Index, inefficiency ratio of all banks negatively affect NPL ratio while unemployment rate, return on equity and capital adequacy ratio positively affect NPL ratio in Turkish economy for the period 2007M01-2013M03.

Macit and Keçeli (2012) show that asset size, GDP growth and unemployment rate have significant effects on non-performing loan ratio of Turkish participation banks between 2005 and 2011.



Other studies on the determinants of nonperforming loans in Turkish economy such as Macit (2012), Yücememiş and Sözer (2011) and Karabulut and Bilgin (2007) report that nonperforming loans are affected by Net Loans/Assets (-), Ratio of Equity To Total Assets (+), Real Assets, TRY/USD Exchange Rate (+), Net Interest Margin (+), GDP (-), Industrial production index (-), Deposits (+), Foreign Borrowing (-).

The models explaining on determinants of nonperforming loans in other countries have reached different results because of the country-specific factors, periods analysed and methodology used (see Table-1). In particular, Greek economy has been affected by the global economic crisis notably. Konstantinos et al. (2016) state that nonperforming loans responses against impulse of the Public Debt, GDP, Unemployment, Credit Growth in the same direction in Greek economy. Dimitrios et al. (2016) find that NPL for mortgages, business and consumer loans are affected positively by the variables such as sovereign debt, bad management, too-big-to-fail, bad management II in Greek economy.

Table-1 Literature Review On The Determinants Of Non-Performing Loans (NPLs)

Author(s)	Period	Country / Region	Dependent Variable	Methodology / Results and Signs			
Us (2016)	2002Q4 - 2013Q3	Turkey	NPL	Lending (-) ; Capital adequacy (-), Profitability (+) Inefficiency (-), Bank size (-), Inflation (+), GDP (-), Policy rate (-), Sovereign debt (+)			
Karahanoğlu and Ercan (2015)	2005M01 - 2015M05	Turkey	NPL	USD does Granger Cause NPL Ratio EURO does Granger Cause NPL Ratio BIST100 does Granger Cause NPL Ratio Industrial does production index Cause NPL Ratio			
Vatansev er and Hepşen (2013)	2007M01 - 2013M03	Turkey	NPL	Industrial production index (-) , İstanbul stock exchange 100 index (-), Inefficiency ratio of all banks (-) , Unemployment rate, (+), Return on equity (+) Capital adequacy ratio (+)			
Macit and Keçeli (2012)	2005Q1– 2011Q4	Turkey	NPL	Loans/Assets (-), Assets (Log) (-), GDP (-)			
Macit (2012)	2005Q1– 2011Q4	Turkey	NPL	Net Loans/Assets (-), Ratio of Equity To Total Assets (+) Log Of Real Assets TRY/USD Exchange Rate (+), Net Interest Margin (+), GDP (-)			
Yücememiş and Sözer (2011)	2003M02 - 2010M12	Turkey	NPL	TRY/USD Exchange Rate (+), Industrial production index (-)			
Karabulut and Bilgin (2007)	1987Q1- 2002Q1	Turkey	NPL	Deposits (+), Foreign Borrowing (-)			
Konstantinos et al (2016)	2001Q4– 2015Q1	Greece	NPL Response	VEC Impulse Response Function Results: Public Debt (+), GDP (+), Unemployment (+) Credit Growth (+)			
Dimitrios et al (2016)	1990q1- 2015q2	Euro-Area	NPL	Independent variables	Mortgages	Business	Consumer
				Sovereign debt	Yes	Yes	Yes
				Bad management	Yes	Yes	Yes
				Skimping	No	No	No
				Moral hazard	No	No	No

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Table-1 Literature Review On The Determinants Of Non-Performing Loans (NPLs)							
Author(s)	Period	Country / Region	Dependent Variable	Methodology / Results and Signs			
				Diversification	No	No	No
				Too-big-to-fail	Yes*	Yes*	No
				Bad management II	Yes	No	Yes
				Procyc.credit policy	No	No	No
				Tight control	No	No	No
				*: (up to a size threshold)			
Bussoli et al (2016)	2008-2014	Italy	Impaired and doubtful loans	Return On Average Assets (-), Banks' Size (-) Cost Income Ratio (-), Unemployment (+)			
Dimitrios et al (2016)	1990Q1-2015Q2	Euro-Area	NPL	ROA (-), ROE (-), The Ratio of Loans To Deposits (+) Income Tax as % Of GDP (+), Government Budget Deficit/Surplus (-), Public Debt as % Of GDP (-) Inflation (-), GDP Growth (-), Output Gap (-)			
Zaitenova and Baibulekova (2016)	2006-2015	Kazakhstan	NPL	GDP growth (+), Loans/GDP (-), Inflation (-), KZT/USD (Exchange Rate) (+), Unemployment (+)			
Yahaya and Oni (2016)	1990-2013	Nigerian	NPL	Growth in GDP (-), Money supply (+), Inflation (+) Exchange rate (+), Credit to Private Sector (+)			
Mary and Gekara (2016)	1997-2013	Kenya	NPL	Knowledge of borrowers' characteristics (+), Informational Rents (+), Borrowers' Discipline Device (+), Borrowers' Over-Indebted (+)			
Anjom And Karim (2016)	2010-2014	Bangladesh	NPL	GDP Growth(-1) (+), Real Interest Rate (-), Public debt as % of GDP (+), Inflation Rate (+), Loan growth for the bank (+), Return on equity (-), Return on assets (-), Total loan to total asset ratio (-), Total loan to total deposit ratio (-), Total capital to total asset ratio (+) Operating expense to operating income ratio (+) Total liabilities to total asset ratio (+) Non-interest income to total income ratio (-)			
Erdoğan and Gurov (2016)	2000 – 2011	Eurozone and Emerging European Countries	NPL	Risk-Weighted Assets (RWA) reported under IRB/ Total RWA, (IRB) (+), Real GDP growth (-), Inflation (-) Gross Profits/ Assets (return on assets) (+), Lending Rate (+), Bank Equity (capital) / Assets (+), Post Crisis dummy: post-2009 (DPOSTCR) (+), IRB*DPOSTCR (-)			
Şan (2016)	2007-2014	Albania	NPL	FDI (+), Inflation (+), Euro (Exchange Rate) (+), Remittances (-), Real GDP (-), Unemployment Rate (-)			
Vithessonthi (2016)	1993-2013	Japan	NPL	Bank Size (-/+), Capitalization Ratio (+) , Return On Assets Ratio (-) , Liquidity Ratio (-) , Deposit Ratio (-) Revenue Diversification Ratio (-) , Operating Risk (+) Bank Credit Growth (Bcg) (+), BCG*Global Crisis (-)			



Table-1 Literature Review On The Determinants Of Non-Performing Loans (NPLs)

Author(s)	Period	Country / Region	Dependent Variable	Methodology / Results and Signs
De Backer et al (2015)	2006-2013 Monthly	Belgian	NPL	Key policy interest rate (+), House prices, growth rate (-) Unemployment rate (+), Average interest rate (+) Proportion of portfolio with maturity > 20 years (+) Proportion of portfolio with DSTI > 40% (+) Market share for mortgage loans (-) Proportion of portfolio with LTV > 80% (+) Proportion of portfolio with variable interest rates (+) Growth rate of the mortgage portfolio compared to banking sector average (+)
Ghosh (2015)	1984–2013	50 US states	NPL	Equity capital-to-assets (+), Loans-to-assets (+/-) Loans&lease loss provision-to-total loans (+) Non-interest income-to-total income (+) Overhead costs to-total assets (-) Net pre-tax income-to-total assets (ROA) (-) Log of total assets-to-number of banks (-) Inflation adjusted percent change in GDP (-) Real personal income growth (-), Unemployed-to-labor force (+), Percent change in regional CPI (-) Housing price index (-), State homeownership rates (-) State housing starts (+), Real interest rates (+) Budget deficit&surplus / GDP (+), Public debt / GDP (+)
Abid et al (2014)	2003Q1-2012Q4	Tunisia	NPL	Inflation (+), GDP (-), Lending Rate (+), Inefficiency Index (+), Solvency Ratio (-), ROE (-), Size (+)
Zaib et al (2014)	2003-2011	Pakistan.	NPL	GDP growth rate (-), Risk appetite of the banks (-)
Beck et al (2013)	2005-2010	75 Countries	NPL	Real Gross Domestic Product (-), Nominal Effective Exchange Rate (NEER) (+), Lending Interest Rate (+) Share Prices (SP) (-), Low International Claims*(NEER) (+), High International Claims*(NEER) (-) Stock Market Capitalization*(SP) (-)
Klein (2013)	1998–2011	CESEE economies	NPL	Unemployment Rises, (+), Exchange Rate Depreciates, (+), Inflation (+), Excessive Risk (+), Quality of The Bank's Management (-), Moral Hazard Incentives (-) GDP (-)
Kauko (2012)	2000-2005	34 Advanced Countries	NPL	Current Account Surplus (-), Depository Institutions' Loans to The Domestic Private Sector (+), Inflation (-) GDP Change (+), Growth Rate of Export (+), Growth Rate of Import (-), M3/GDP (+), Government Net Lending (-), GDP Per Capita (+)
Nkusu (2011)	1998-2009	26 advanced eco	NPL	GDP growth (-), Unemployment (+), House prices (+) Policy rate (+), Equity prices (-)

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3. Data, Quantile Regression Estimation and Empirical Findings

3.1.Data

The data used in the econometric models covering Turkish economy for the period 2008M07-2015M03 monthly, are explained in detail in Table-2. Volatility changes are calculated by using volatility impulse response functions developed by Hafner and Herwartz (2006) by the authors.

Table-2 Period and Data for Quantile Regression Estimation		
Period	2008M07-2015M03 and 2011M04 – 2015M03	
Dependent Variable		
NPL	Non-performing Loans/Total Loans	
Independent Variables		
Lending	Balance Sheet - Loans (million TL)-Total for Turkish Banking Sector	
Currency Basket	Arithmetic mean of exchange rates Dollar /TL and Euro /TL exchange rates, (TL:Turkish Lira)	
CBRT Rate	(LON) Central Bank (Interbank) Quotations OFFER (%) (Late Liquidity Window)	
Commercial Rate	Weighted Average Interest Rates For Banks' Loans for Commercial Loans (%)	
CPI	Consumer Price Index (2003=100)	
Unemployed	Number of unemployed (Thousand)	
BIST	Istanbul Stock Exchange Index (1986M01=1)	
Foreign Debt	Short Term Foreign Debt (Million US Dollar)	
Volatility Euro Tapering	Volatility changes in Euro from the FED's tapering decision shock (18 December 2013)	
Volatility Tapering	Dollar	Volatility changes in Dollar from the FED's tapering decision shock (18 December 2013)
Volatility CBRTRate	Dollar	Volatility changes in Dollar from the CBRT's interest rate decision (28 January 2013)
Volatility Euro CBRTRate		Volatility changes in Euro from the CBRT's interest rate decision (28 January 2013)
Volatility Euro Lehman		Volatility changes in Euro from Lehman Brothers Bankruptcy (15 September 2008)
Volatility CBRTRate	2Bond	Volatility changes in 2 Years Bond Rates from the CBRT's interest rate decision shock
Volatility CBRTRate	10Bond	Volatility changes in 10 Years Bond Rates from the CBRT's interest rate decision shock
Volatility Orate Tapering		Volatility changes in Overnight Rate from the FED's tapering decision shock
Volatility Orate CBRT		Volatility changes in Overnight Rate from the CBRT's interest rate decision shock
Volatility Tapering	2Bond	Volatility changes in 2 Years Bond Rates from the FED's tapering decision shock
Volatility Tapering	10Bond	Volatility changes in 10 Years Bond Rates from the FED's tapering decision shock

Data Source: CBRT, BRSA, TSI and authors' own calculations

3.2. Quantile Regression Estimation

The linear quantile regression model developed by Koenker ve Bassett (1978) can be defined as (Green, 2012),

$$Q(y|x, q) = x'\beta_q \text{ such that } Prob(y \leq x'\beta_q|x) = q, \quad 0 < q < 1 \quad \text{Eq.1}$$

The median regression would be defined for $q = \frac{1}{2}$. Other focal points are the lower and upper quartiles $= \frac{1}{4}$ and $= \frac{3}{4}$, respectively. The quantile regression model is a richer specification than the linear model because the coefficients in (Eq.1) are indexed by q. The model is nonparametric, it requires a much less detailed specification of the distribution of $(y|x)$. In the simplest linear model with fixed coefficient vector, β , the quantiles of $(y|x)$ would be defined by variation of the constant term.



The quantile regression model used to estimate the coefficients as follows,

$$NPL_t = \beta_1(\tau) + \beta_2(\tau)X_{2t} \dots \dots + \beta_k(\tau)X_{kt} + \varepsilon_t \quad \text{Eq.2}$$

where,

NPL : Non-performing loans ratio,

X_t : Bank-specific, macroeconomic and volatility variables

$\beta_1(\tau)$: Coefficients for different level of quantiles

ε_t : The error term,

3.3. Empirical Findings

We study the consequences of the volatility induced by historical and random shocks on NPL ratios in various sectors such as a) manufacturing, construction, retail and wholesale trade, b) consumer credits and credit cards by using quantile regression technique. We select these sectors mainly because their NPL ratios exceed 5% (relatively much higher than other sectors) as of January 2013. Empirical findings (only significant models for all the sectors estimated) are reported in Appendices 1-13. Two periods (2008M07 – 2015M03 and 2011M04 – 2015M03) are estimated because of missing data for ten-year bonds.

Descriptive statistics for NPL in the sectors are given in Appendix 8. NLP series for consumer credits, manufacturing and construction are distributed normally according to Jarque-Bera test result at 0.001 significance level, while NLP series for credit card and business sectors are not.

Estimation results for the model regarding manufacturing industry (2008M07-2015M03) are given in Appendix 1. According to the results, lending and commercial rate affect NPL in manufacturing industry positively, increasing rates raise NLP while currency basket and CBRT rate affect negatively. Exchange rate changes may affect foreign trade positively. The Central Bank monetary policy by using CBRT rate affects expectations positively and thereby reinforce rationality in business sector. On the other hand, Volatility Euro Tapering, Volatility Dollar Tapering, Volatility Dollar CBRT rate, Volatility Euro CBRT rate and Volatility Euro Lehman affect NPL in manufacturing industry positively, unexpected shocks affect economic agents' balance sheets negatively.

Estimation results for the model regarding manufacturing industry (2011M04 – 2015M03) are given in Appendix 2. According to the results, CBRT Rate, Currency Basket, CPI, Volatility 2Bond CBRT rate, Volatility 10Bond CBRT rate, Volatility Orate Tapering, Volatility Euro Tapering, Volatility Euro CBRT rate, Volatility Dollar CBRT rate and Volatility Dollar Tapering affect NPL in manufacturing industry negatively. Increasing CPI leads to raising interest rates, decreasing demand and increasing NLP. Expected volatility shocks increase rationality of the economic agents via learning curve through time.

Estimation results for the model regarding business sector (2011M04 – 2015M03) are given in Appendix 3. According to the results, CBRT Rate, CPI, Volatility 2Bond CBRT rate, Volatility 2Bond Tapering, Volatility Orate Tapering, Volatility Euro Tapering, Volatility Euro CBRT rate, Volatility Dollar CBRT rate, Volatility Dollar Tapering and Volatility 10Bond CBRT rate affect NPL in business sector negatively. The interaction mechanism for CBRT Rate, CPI and expected shocks are similar to models explained above.

Estimation results for the model regarding consumer loans (2011M04 – 2015M03) are given in Appendix 4. According to the results, CBRT Rate, Unemployed, and BIST affect NPL in consumer loans (2011M04 – 2015M03) positively. The interaction mechanism for CBRT Rate, Unemployed, and BIST for NPL in consumer loans are different. Consumers make decisions under a restricted information set and adaptive expectations conditions. For this reason, an increase in CBRT Rate, Unemployed, and BIST may raise NLP for consumers on average. Expected and unexpected shocks are the same as models explained above.

Estimation results for the model regarding credit cards (2011M04 – 2015M03) are given in Appendix 5. According to the results, foreign debt affects NPL in credit cards negatively. Increasing foreign debt has two effects; first increasing supply of loanable funds and second reinforcing rationality for lending in the banking sector. BIST, LCurrency Basket, Volatility 2Bond CBRT rate, Volatility 2Bond Tapering, Volatility 10Bond CBRT rate, Volatility 10Bond Tapering, Volatility Orate CBRT rate, Volatility Orate Tapering, Volatility Euro Tapering, Volatility Dollar CBRT rate and Volatility Dollar Tapering affect NPL in credit cards positively. The interaction mechanism for BIST, LCurrency Basket and expected shocks with NPL in credit cards are the same as models explained formerly.

Estimation results for the model regarding construction sector (2008M07 – 2015M03) are given in Appendix 6. According to the results, Euro/TL and CBRT Rate affect NPL in construction sector negatively. As explained formerly, exchange rate changes may affect foreign trade positively, leading to the increasing the balance sheets of firms. The Central Bank monetary policy by using CBRT Rate affects expectations positively and reinforce rationality for business sector. Commercial Rate, Volatility Euro Lehman, Volatility Euro Tapering, Volatility Euro CBRT rate, Volatility Dollar Tapering and Volatility Dollar CBRT rate affect NPL in construction sector positively. The interaction mechanism for Commercial Rate and unexpected shocks for NPL in construction sector are the same as models explained formerly.

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Estimation results for the model regarding construction sector (2011M04 – 2015M03) are given in Appendix 7. According to the results, Lending, CBRT Rate and Volatility 2Bond CBRTrate affect NPL in construction sector negatively. The period 2011-2015 is a period in which economic agents had heightened rationality and were able to better learn the effects of the global economic crisis. For this reason, increasing Lending, CBRT Rate and Volatility 2Bond CBRTrate can be managed better. CPI, Volatility 10Bond CBRTrate, Volatility Orate Tapering, Volatility Euro Tapering, Volatility Euro CBRTrate, Volatility Dollar CBRTrate and Volatility Dollar Tapering affect NPL in construction sector positively. However, the interaction mechanism for unexpected shocks are the same as models explained formerly.

Quantile coefficients of volatility changes from shocks in the sectors for the periods 2008M07-2015M03 and 2011M04 – 2015M03 are given in Appendices 9-15. We find that, the coefficients' estimates change significantly mostly for the upper quantiles, indicating that the cumulative effects of the volatility changes affect the coefficients notably.

5. Conclusion

In this paper, using quantile regression techniques we analyze the effects of volatility changes in exchange rates and interest rates triggered by historical shocks (Lehman Brothers Bankruptcy (15 September 2008), the FED's tapering decision (18 December 2013), the CBRT's interest rate decision (28 January 2013)) on consumer and industrial nonperforming loans (NPLs) in Turkish economy.

The results demonstrate that shocks that cause volatility changes in foreign exchange rates and interest rates have important effects on NPLs in the Turkish banking industry. Unexpected shocks have more significant effects for the NPL in the sectors, especially the consumer sectors. This study could be extended by using sectoral-specific variables and by including Euro Area countries which suffered from the global economic shocks.

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Appendices

A 1. NPL in Manufacturing Industry (2008M07-2015M03)

	Eq-1	Eq-2	Eq-3	Eq-4	Eq-5
Lending	4.91e-08***	4.94e-08***	5.08E-08***	4.19E-08***	4.78E-08***
Currency Basket	-0.03403***	-0.03420***	-0.03378***	-0.025105***	-0.03309***
CBRT Rate	-0.00406***	-0.00406***	-0.00444***	-0.004675***	-0.00397***
Commercial Rate	0.00270***	0.00272***	0.00270***	0.002770***	0.00263***
C	0.08249***	0.08246***	0.08460***	0.074640***	0.08147***
Volatility Euro Tapering	0.15259**				
Volatility Dollar Tapering		0.0889**			
Volatility Dollar CBRTrate			3.185532***		
Volatility Euro CBRTrate				5.213045**	
Volatility Euro Lehman					0.254629**
Adj. R ²	0.564856	0.566302	0.588499	0.589865	0.558464

*, **, *** denote statistical significance for $p < 0.10$, $p < 0.05$ and $p < 0.01$, respectively. Robust standard errors are in parentheses.

A 2. NPL in Manufacturing Industry (2011M04-2015M03)

	Eq-1	Eq-2	Eq-3	Eq-4	Eq-5	Eq-6	Eq-7
CBRT Rate	-0.00387***	-0.0038***	-0.0034***	-0.00270***	-0.00270***	-0.00270***	-0.00270***
Currency Basket			-0.0095***				
CPI				-0.00040***	-0.00040***	-0.00040***	-0.00040***
C	0.08565***	0.08565***	0.10453***	0.17159***	0.1715***	0.17159***	0.171592***
Volatility 2Bond CBRTrate	-1.6932**						
Volatility 10Bond CBRTrate		-1.560**					
Volatility Orate Tapering			-0.0807***				
Volatility Euro Tapering				-210.115***			
Volatility Euro CBRTrate					-1987.11***		
Volatility Dollar CBRTrate						-567.684***	
Volatility Dollar Tapering							-60.0227***
Adj. R ²	0.591247	0.608079	0.685664	0.732571	0.732555	0.732566	0.732571

*, **, *** denote statistical significance for $p < 0.10$, $p < 0.05$ and $p < 0.01$, respectively. Robust standard errors are in parentheses.

**A 3. NPL in Business Sector (2011M04 – 2015M03)**

	Eq-1	Eq-2	Eq-3	Eq-4	Eq-5	Eq-6	Eq-7	Eq-8
CBRT Rate	-0.00580***	-0.0061***	-0.0045***	-0.0034***	-0.0034***	-0.003***	-0.0034***	-0.005***
CPI			-0.0004***	-0.0008***	-0.0008***	-0.0008***	-0.0008***	
C	0.109388***	0.1115***	0.18085***	0.28118***	0.28117***	0.28118***	0.28118***	0.1085***
Volatility 2Bond CBRTRate	-2.19612***							
Volatility 2Bond Tapering		-0.0832***						
Volatility Orate Tapering			-0.14911					
Volatility Euro Tapering				-361.50***				
Volatility Euro CBRTRate					-3418.83***			
Volatility Dollar CBRTRate						976.702***		
Volatility Dollar Tapering							-103.26***	
Volatility 10Bond CBRTRate								-2.453***
Adj. R ²	0.471384	0.3369	0.614926	0.646940	0.646923	0.646935	0.6469	0.4829

*, **, *** denote statistical significance for $p < 0.10$, $p < 0.05$ and $p < 0.01$, respectively. Robust standard errors are in parentheses.

A 4. NPL in Consumer Loans (2011M04 – 2015M03)

	Eq-1	Eq-2	Eq-3
CBRT Rate	0.058070***	0.062040***	0.056876***
Unemployed	0.48795**	0.51974**	0.49192**
BIST	0.688446***	0.828261***	0.66912**
C	-9.886290***	-11.73879***	-9.689334***
Volatility 10Bond Tapering	0.016401**		
Volatility Orate Tapering		0.003936*	
Volatility Orate Tapering			0.127091**
Adj. R ²	0.507886	0.510754	0.503311

*, **, *** denote statistical significance for $p < 0.10$, $p < 0.05$ and $p < 0.01$, respectively. Robust standard errors are in parentheses.



A 5. NPL in Credit Cards (2011M04 – 2015M03)

	Eq-1	Eq-2	Eq-3	Eq-4	Eq-5	Eq-6	Eq-7	Eq-8	Eq-9
BIST	5.1083***	5.71552***	5.1081***	5.09698***	5.09462***	5.35063***	5.40874***	5.40876***	5.4087***
Foreign Debt	-7.5989***	-9.2813***	-7.5758***	-8.45245***	-8.5042***	-6.69825***	-4.8467***	-4.8470**	-4.8470**
LCurrency Basket	11.4788***	12.2133***	11.468***	11.8132***	11.8301***	10.7815***	11.1839***	11.18403	11.18403
C	28.1037***	40.3370***	27.844***	37.9828***	38.6041***	15.37354	-7.594219	-7.59136***	-7.591***
Volatility 2Bond CBRTrate	134.19***								
Volatility 2Bond Tapering		3.8826**							
Volatility 10Bond CBRTrate			124.033***						
Volatility 10Bond Tapering				11.5701***					
Volatility Orate CBRTrate					9.2343***				
Volatility Orate Tapering						6.22538***			
Volatility Euro Tapering							14668.2***		
Volatility Dollar CBRTrate								39628.6***	
Volatility Dollar Tapering									4190***
Adj. R ²	0.513770	0.392677	0.526834	0.405428	0.409616	0.554285	0.502938	0.502939	0.502937

*, **, *** denote statistical significance for $p < 0.10$, $p < 0.05$ and $p < 0.01$, respectively. Robust standard errors are in parentheses.

A 6. NPL in Construction Sector (2008M07 – 2015M03)

	Eq-1	Eq-2	Eq-3	Eq-4	Eq-5
Euro/TL	-0.017067***	-0.016508***	-0.012031***	-0.016219***	-0.011705***
CBRT Rate	-0.002649***	-0.002767***	-0.003382***	-0.002769***	-0.003405***
Commercial Rate	0.002089***	0.002132***	0.002035***	0.002113***	0.002084***
C	0.070328***	0.069999***	0.069135***	0.069663***	0.068077***
Volatility Euro Lehman	0.201296**				
Volatility Euro Tapering		0.130462**			
Volatility Euro CBRTrate			7.181062***		
Volatility Dollar Tapering				0.078836**	
Volatility Dollar CBRTrate					3.621100***
Adj. R ²	0.234617	0.247747	0.301892	0.251866	0.286296

*, **, *** denote statistical significance for $p < 0.10$, $p < 0.05$ and $p < 0.01$, respectively. Robust standard errors are in parentheses.



A 7. NPL in Construction Sector (2011M04 – 2015M03)

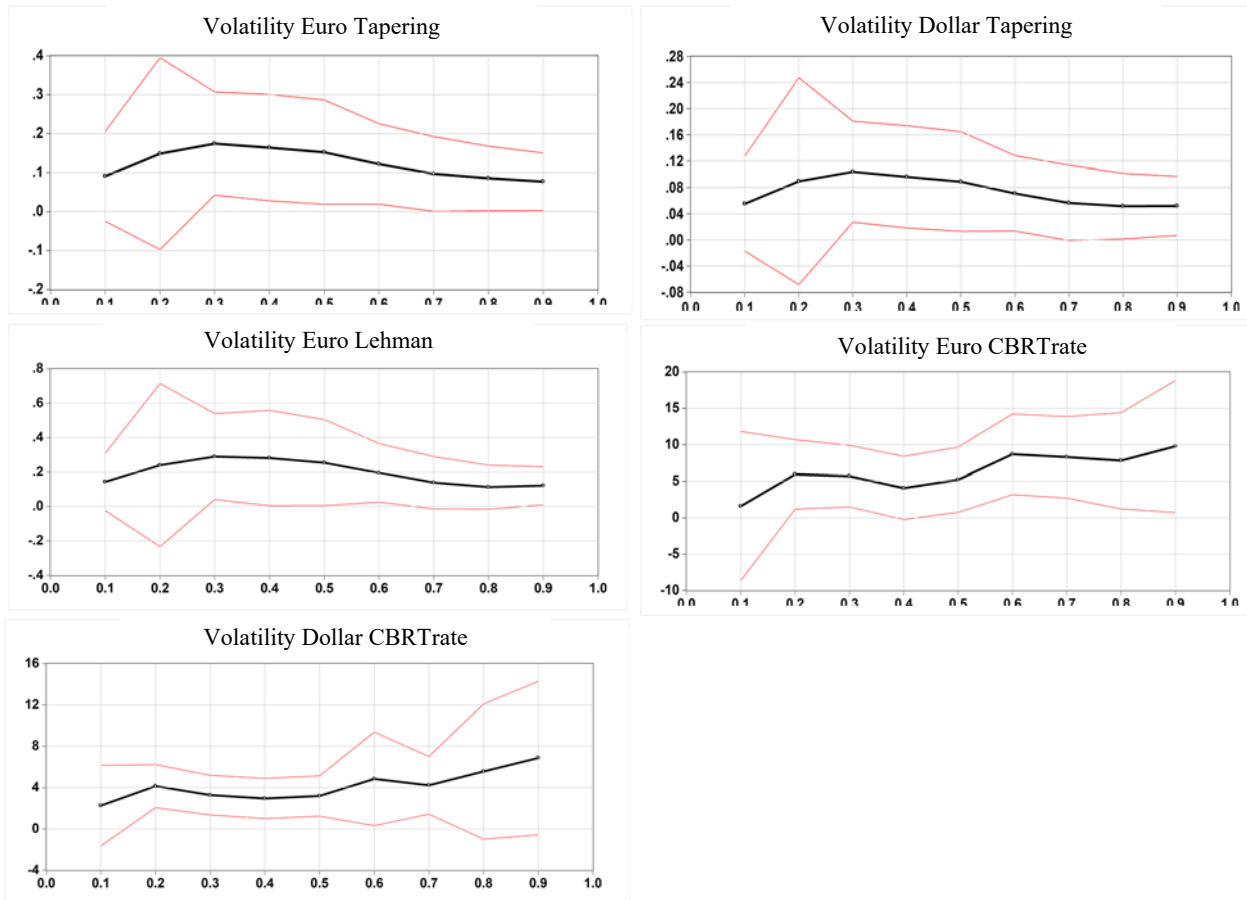
	Eq-1	Eq-2	Eq-3	Eq-4	Eq-5	Eq-6	Eq-7
Lending	-5.74E-8***	-2.30E-8***	-2.88E-08***	-4.25E-08***	-4.25E-08***	-4.25E-08***	-4.25E-08***
CBRT Rate	-0.002363***	-0.00242***	-0.00220***	-0.00205***	-0.00205***	-0.00205***	-0.00205***
CPI	0.000456***						
C	0.013756	0.084141***	0.088013***	0.102661***	0.102660***	0.102661***	0.102661***
Volatility 2Bond CBRTrate	-0.629427***						
Volatility 10Bond CBRTrate		-1.01246***					
Volatility Orate Tapering			-0.05054***				
Volatility Euro Tapering				-116.731***			
Volatility Euro CBRTrate					-1103.960***		
Volatility Dollar CBRTrate						-315.3814***	
Volatility Dollar Tapering							-33.3460***
Adj. R ²	0.585091	0.589831	0.640652	0.646463	0.646449	0.646458	0.646463

*, **, *** denote statistical significance for $p < 0.10$, $p < 0.05$ and $p < 0.01$, respectively. Robust standard errors are in parentheses.

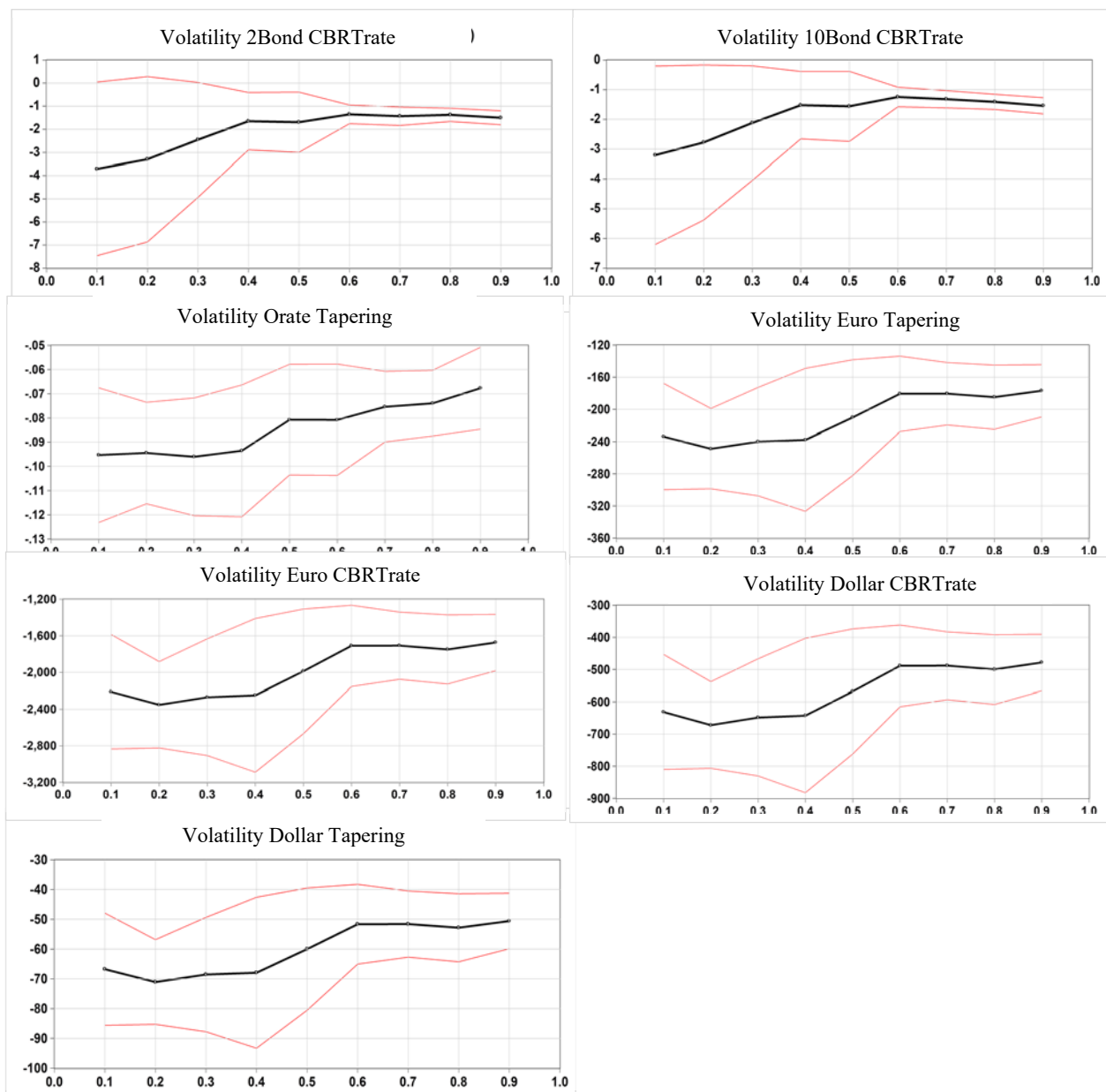


A 8. Descriptive Statistics for NPL (2008M07 - 2015M03)

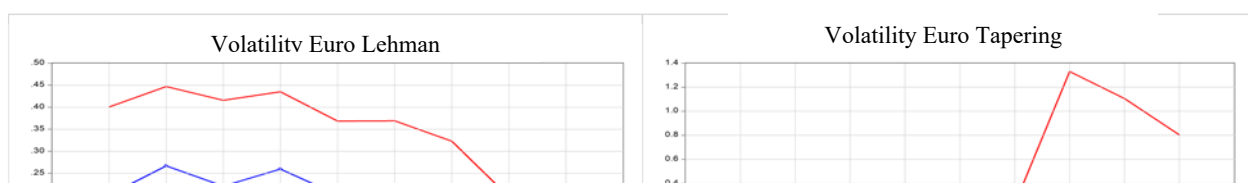
	Consumer	Manufacturing	Construction	Credit Card	Business
Mean	3.271605	0.038232	0.038631	7.698765	0.040254
Median	3.100000	0.033139	0.039530	7.000000	0.034477
Maximum	4.700000	0.059590	0.050963	12.10000	0.083230
Minimum	2.000000	0.023447	0.023610	5.100000	0.025967
Std. Dev.	0.756180	0.010600	0.006204	2.002155	0.014385
Skewness	0.437548	0.615925	-0.376392	0.767649	1.006259
Kurtosis	2.146078	2.163582	2.707733	2.316140	2.804464
Jarque-Bera	5.045550	7.482540	2.200849	9.533707	13.79856
Probability	0.080237	0.023724	0.332730	0.008507	0.001009
Sum	265.0000	3.096802	3.129094	623.6000	3.260572
Sum Sq. Dev.	45.74469	0.008989	0.003079	320.6899	0.016553
Observations	81	81	81	81	81



A 9. Quantile Coefficients of Volatility Changes from Shocks in Manufacturing Industry for the period 2008M07-2015M03



A 10. Quantile Coefficients of Volatility Changes from Shocks in Manufacturing Industry for the period 2011M04-2015M03



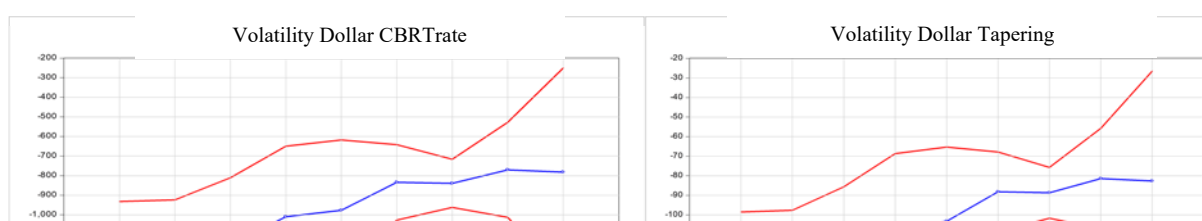
16		The Effects of the Volatility Changes in Exchange Rates and Interest Rates from Historical Shocks On the Non-Performing Loans in Turkish Economy
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A 11. Quantile Coefficients of Volatility Changes from Shocks in Construction Sector for the period 2008M07-2015M03



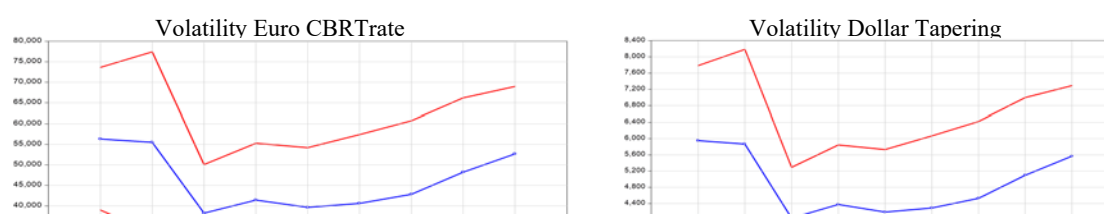


A 12. Quantile Coefficients of Volatility Changes from Shocks in Construction Sector for the period 2011M04-2015M03



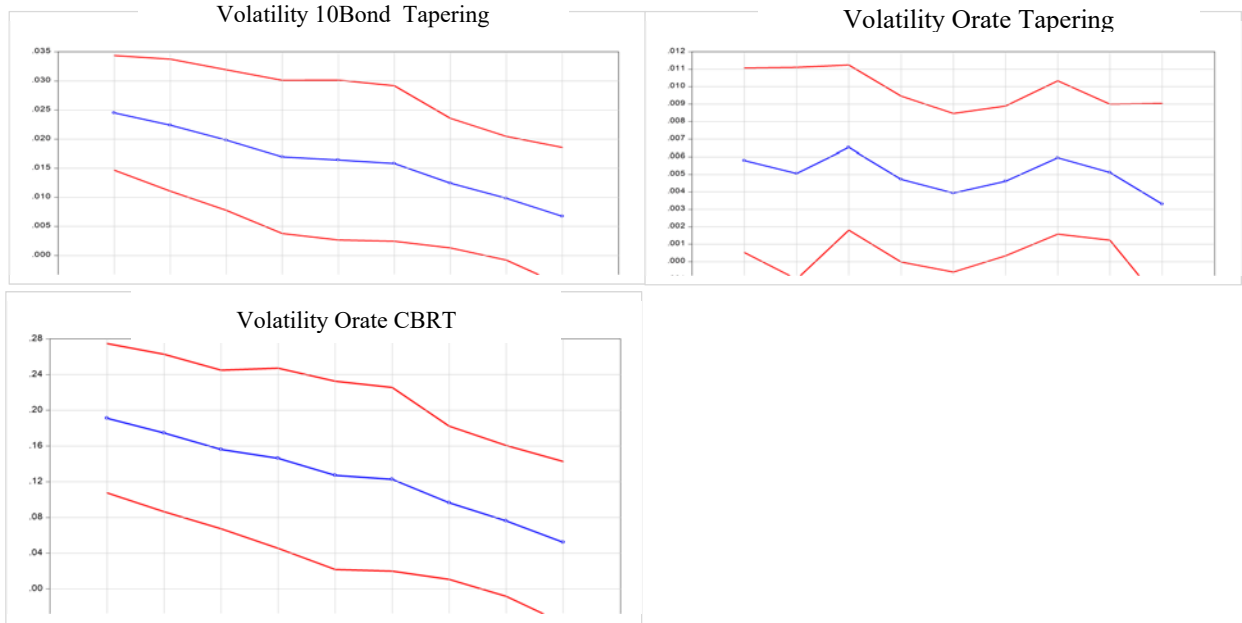
18		The Effects of the Volatility Changes in Exchange Rates and Interest Rates from Historical Shocks On the Non-Performing Loans in Turkish Economy
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A 13. Quantile Coefficients of Volatility Changes from Shocks in Business Sector for the period 2011M04-2015M03





A 14. Quantile Coefficients of Volatility Changes from Shocks in Consumer Credit Cards for the period 2011M04-2015M03



A 15. Quantile Coefficients of Volatility Changes from Shocks in Consumer Loans for the period 2011M04-2015M03