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Determining Impacts on Non-Performing Loan Ratio in Turkey

Metin Vatansever[1] and Ali Hepşen[2]

Abstract

Banking sector is an essential part of a nation's economy and represents one of the most important components of a nation's capital. Similarly, the loan portfolio represents an important component of a bank's total assets. These assets generate huge interest income which is a critical measure of the bank's financial performance and stability. Therefore**,** the non-performing loan ratio is a critical tool to measure a bank's performance. There is recently a growing recognition between macroeconomic indicators, bank-level factors and the non-performing loans (NPLs) ratio. The purpose of this study is to investigate whether there is a significant relationship between macroeconomic indicators, bank-level factors and non-performing loan ratio in Turkey. In this study linear regression models and cointegration analysis are utilized to determine the significant relations between the periods from January 2007 to March 2013. Our empirical results show that debt ratio, loan to asset ratio, real sector confidence index, consumer price index, EURO/ Turkish lira rate, USD/ Turkish lira rate, money supply change, interest rate, Turkey's GDP growth, the Euro Zone's GDP growth and volatility of the Standard & Poor's 500 stock market index does not have significant effect to explain NPL ratio on multivariate perspective. On the other hand, industrial production index, Istanbul Stock Exchange 100 Index, inefficiency ratio of all banks negatively affect NPL ratio; unemployment rate, return on equity and capital adequacy ratio positively affect NPL ratio.

JEL classification numbers: C53, E00, E27, E29
Keywords: Turkey, Non-performing loans, Macroeconomic indicators, Bank specific indicators, Cointegration

[1]Yildiz Technical University, Faculty of Arts and Science, Department of Math and Stats. Istanbul.
[2]Assoc.Prof.Dr., Istanbul University, School of Business, Department of Finance. Istanbul

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1 Introduction

There is a growing recognition that the quantity or percentage of non-performing loans (NPLs) is related to bank failures and the financial status of a country. Especially after current global financial crisis, which started in US and spread to whole world especially Europe, the issue of non-performing loans (NPLs) has gained increasing attentions because of the rapid increased default of sub-prime mortgage loans.

Moreover, there are some evidences that financial and banking crisis in East Asia and Sub Saharan African countries were preceded by increasing non-performing loans. From the point of this view, the non-performing loan ratio is therefore a critical measure to evaluate a bank's performance, the economic activity, and the national financial stability and soundness. In the literature macroeconomic indicators and bank specific factors may cause increase in NPLs.

From this point and the necessity, the aim of this study is to determine the long term effects of macroeconomic and bank specific factors on non-performing loan ratio in Turkey. In particular, we run linear regression models and cointegration analysis to find a significant and long term relations between NPL ratio and several specific factors by using time series dataset covering the monthly period between January 2007 and March 2013.

The structure of the rest of this research is organized as follows. The next section provides a literature review that attempts to delineate the determinants of loan portfolio quality and NPL ratio. Section three provides overview the data set and theoretical framework adopted in this paper and section four gives the empirical results. Finally, section five offers concluding comments.

2 Literature Review

This section reviews the previous empirical studies on determining factors of the NPLs. Many studies investigate the factors that induce NPLs by examining potential links between bank-specific variables and macroeconomic factors.

[1] study finding a regression equation to explain the trends of NPL ratio in Hang Kong by using nominal interest rates, the CPI, property prices, equity prices, number of bankruptcies, the unemployment rate, and real GDP as explanatory variables They find that the NPL ratio rises with increasing nominal interest rates and an increasing number of bankruptcies, but decreases with higher CPI inflation, economic growth, and property price inflation. Additionally, [2] shows that Czech NPL of the corporate sector rate can be positively affected by increasing real effective exchange rate, the loan to GDP ratio, unemployment and interest-rate increases.

Beside on classic linear regression model, [3] and [4] use VAR methodology to investigate which factors is most effect on NPLs. [5] indicates yields can be used to make accurate predictions of the future effects of the business cycle on asset quality. [6] show the impact of GDP growth and the business cycle on credit risk and also on the quality of bank loans.

On the other hand, [7] and [8] study panel date set to understand of NPLs' behaviors on their own researches. They use both macroeconomic and bank-specific factors. According to their studies, the quality of loans can be explained mainly by macroeconomic variables.

3 Data and the Theoretical Framework

3.1 Overview of Data

There is a growing literature which suggests that NPL ratio maybe be explained by both macroeconomic and bank specific factors. In this study, we take into consideration, 6 bank specific factors, 10 macroeconomic factors and 2 global factors. Table 1, table 2 and table 3 gives those variables.

Table 1: Bank Specific Factors

Bank Level Factors	Definitions
INEF	$Inefficiency\ Ratio\ = \frac{Operating\ Expense}{Operating\ Income}$
Dept	$Dept\ Ratio = \frac{Central\ Government\ Dept}{Nominal\ GDP}$
ROE	$Return\ on\ Equity = \frac{Profits}{Total\ Equity}$
LOAS	$Loan\ to\ Asset\ Ratio = \frac{Loans}{Asset}$
CAR	$\text{Capital Adequacy Raio} = \frac{(Tier\ 1\ Capital\ +\ Tier\ 2\ Capital)}{Risk\ Based\ Assets}$

Table 2: Macroeconomic Factors

Macroeconomic Factors	Definitions
RSCI	Confidence Index-Real Sector
CPI	Consumer Price Index
EUR	Euro/ Turkish Lira Rate
USD	USD/ Turkish Lira Rate
IPI	Industrial Production Index
ISE	Istanbul Stock Exchange100 Index
M3Y	Money Supply Change
UR	Unemployment Rate
IR	Interest Rate
GNP	Gross National Product Growth

Table 3: Global Factors

Global Factors	Definitions
EGNP	The Euro Zone's GDP Growth
VIX	Volatility of the Standard & Poor's 500 Stock Market Index

Based on countries' financial condition and legislation, non-performing loans' term (NPLs) can be different. In Turkey, loan performing loans are defined as a loan that has been unpaid for ninety days or more. As a target variable, we use the non-performing aggregate loan ratio calculated by dividing non-performing loans by total aggregate (including consumer, housing, auto, credit cards and the other loans) and non-performing

loans. The target and the other factors' time period cover the monthly period January 2007 – March 2013, a total of 75 observations and are collected from the official web site of [9] and [10].

Table 4: Summary Statistics of the NPL Ratio

Series:	NPL
Sample	2007:01 2013:03
Observations:	75
Mean	0.034576
Median	0.033225
Maximum	0.050747
Minimum	0.025157
Std. Dev.	0.007677
Skewness	0.693126
Kurtosis	2.279410
Jarque-Bera	7.627949
Probability	0.022060

Table 4 summaries some descriptive statistics of NPL ratio and presents that the average ratio, minimum and maximum value is roughly 3.46%, 2.25% and 5.07% respectively, during the period of January 2007 to March 2013. Figure 1 indicates how the NPL ratio is distributed across the time period.

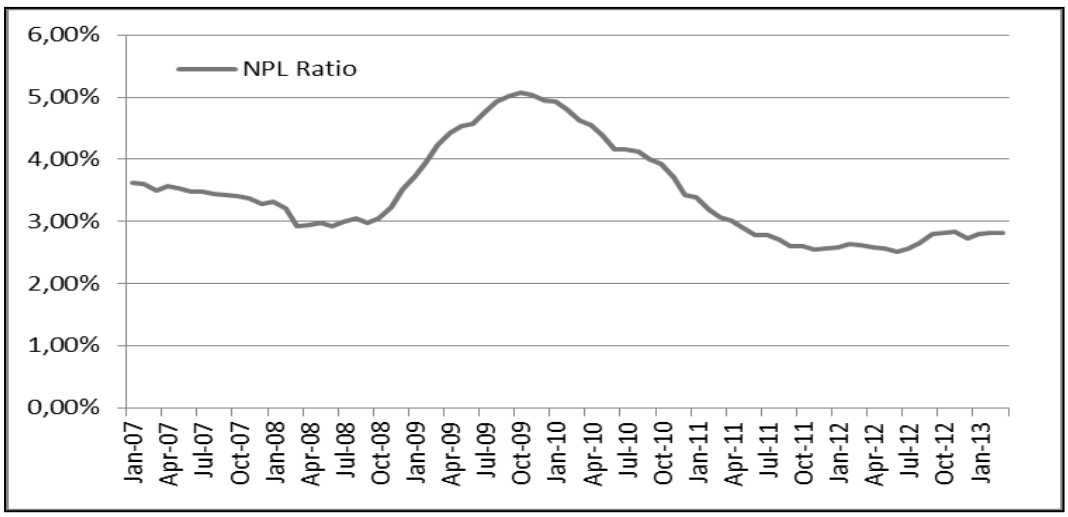

Figure 1: Total NPL Ratio in Turkey, January 2007-March 2013

As seen from the figure 1, there is one significant jump in the NPL ratio in Turkey, which occurs in the starting period of the Global Financial Crisis that originated in the USA with the 2007 collapse of the sub-primes mortgage market. It shows how the global crises effects NPL ratio in Turkish credit market. However, NPL ratio goes down slightly after

the global crises. The economy quickly recovered and continued to grow over the next following months, which is reflected in the improvement of the NPL ratio.

3.2 Theoretical Framework

3.2.1 Cointegration analysis

The concept of cointegration and the implications of cointegrating relationships are very relevant in the real estate market. Real estate economic and investment theory often suggests that two or more variables would be expected to hold some long-run relationship with one another. Therefore, cointegration analysis is a crucial tool for the existence of such a long-run relationship [11]. There are a number of methods for testing cointegration in the literature. This article considers two most commonly used tests of cointegration; namely Engle-Granger (EG) or Augmented Engle-Granger (AEG) test and Cointegrating Regression Durbin Watson (CRDW) test [12].

3.2.2 Engle-Granger (EG) or augmented Engle-Granger (AEG) test

Regression of a nonstationary time series on other nonstationary time series may produce a spurious regression. To avoid the spurious regression problem that may arise from regressing a nonstationary time series on one or more nonstationary time series, we have to transform nonstationary time series to make them stationary. If we subject our time series data individually to unit root analysis and find that they are all I(1); i.e., they contain a unit root; there is a possibility that our regression can still be meaningful (i.e., not spurious) provided that the variables are cointegrated. In order to find out whether they are cointegrated or not, we simply carry out our original regression and subject our error term to unit root analysis. If it is stationary; i.e., I(0), it means that our variables are cointegrated and have a long-term, relationship between them. In short, provided that the residuals from our regression are I(0) or stationary, the conventional regression methodology is applicable to data involving nonstationary time series [13].

3.2.3 Cointegrating regression Durbin Watson (CRDW) Test

An alternative and quicker method of testing for cointegration is the CRDW test, whose critical values were first provided by [14]. In CRDW, the Durbin Watson statistics d obtained from cointegrating regression is used[3]. But the null hypothesis is d=0 that rather than the standard d=2. The 1% critical value to test the hypothesis that the true d=0 is 0.511. Thus, if the computed d value is smaller than 0.511, we reject the null hypothesis of cointegration at the 1% level. Otherwise, we fail to reject the null, meaning that the variables in the model are cointegrated and there is a long-term relationship between the variables [15].

[3]We know that $d \approx 2(1-\hat{\rho})$, so if there is to be a unit root, the estimated ρ is about 1, which implies that d is about zero.

4 Empirical Results

4.1 Development of the Model

The aim of this study is to investigate whether there are significant long-term effects (which is divided into three parts such as country, global and bank specific factors) on non-performing aggregate loan ratio in Turkish banking systems. To find the effects between them, NPL ratio is regressed on those bank specific, macroeconomic and global indicators.

The simplest regression model can be written for NPL ratio as:

$$NPL_t = \beta_0 + \beta_1 \mathrm{RSCI}_t + \beta_2 \mathrm{CPI}_t + \beta_3 \mathrm{EUR}_t + \beta_4 \mathrm{USD}_t + \beta_5 \mathrm{IPI}_t + \beta_6 \mathrm{ISE}_t + \beta_7 \mathrm{M3Y}_t + \beta_8 \mathrm{UR}_t + \beta_9 \mathrm{GNP}_t + \beta_{10} \mathrm{EGDP}_t + \beta_{11} \mathrm{SP500}_t + \beta_{12} \mathrm{ROE}_t + \beta_{13} \mathrm{LOAS}_t + \beta_{14} \mathrm{INEF}_t + \beta_{15} \mathrm{DEBT}_t + \beta_{16} \mathrm{CAR}_t + \varepsilon_t \quad (1)$$

where NPLs are non-performing aggregate loan ratio; ε_t is the error term and the subscript t represent time. β_0 is intercept term; and finally $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}, \beta_{15}$ *and* β_{16} are the estimators of confidence index-real sector, consumer price index, Euro/ Turkish Lira rate, USD/ Turkish Lira rate, industrial production index, Istanbul Stock Exchange 100 Index, money supply %, unemployment rate, gross national product growth, the euro zone's GDP growth, volatility of the Standard & Poor's 500 Stock Market Index (VIX), return on equity, loan-to-assets ratio, inefficiency, debt and capital adequacy ratio respectively.
By using Eviews 4.1 statistical package, we run regression analysis on equation 1. According to the estimated ordinary least square results, p-values of β_0, β_5, β_6, β_8, β_{12}, β_{14} *and* β_{16} are respectively all within acceptable range and they are significance at 5% significance level. On the other hand, the rest of variables are not significance at 5% significance level. So we ignore those insignificance variables in those modes. By ignoring them, we obtain the following estimated ordinary least square results for equation 1.

$$\widehat{NPL} = 7.948 - 0.015IPI - 0.117ISE + 0.086UR + 0.032ROE - 0.095INEF + 0.168CAR \quad (2)$$

At equation 2, P-values of β_0, β_5, β_6, β_8, β_{12}, β_{14} *and* β_{16} are respectively all within acceptable range and they are significance at 5% significance level. Finally, p value of the F-statistics is zero for all the three models. Additionally, we have estimated more models in order to determine the right specification, by choosing from the different models estimated R-Squared, Adjusted R-Squared, the Akaike, Schwarz's Bayesian information criteria. After experimenting with various functional forms, from R-Squared, Adjusted R-Squared, the Akaike and Schwarz criteria point of view, the proper model to best adjust the data below is specified and estimated.

$$NPL = \beta_0 + \beta_1 IPI + \beta_2 ISE + \beta_3 UR + \beta_4 ROE - \beta_5 INEF + \beta_6 CAR + \beta_7 \varepsilon_{t-1} + \beta_8 \varepsilon_{t-2} + \beta_9 \varepsilon_{t-4} + \varepsilon_t \quad (3)$$

where $\varepsilon_{t-1}$is the first lag of error term, and t is a trend that increases by one for each observation.

By using Eviews 4.1 statistical package, we obtain the following estimated ordinary least square results for the above equation:

$$\widehat{NPL} = 4.327 - 0.004IPI - 0.109ISE + 0.152UR + 0.011ROE - 0.063INEF + 0.146CAR + 1.118\varepsilon_{t-1} + 0.522\varepsilon_{t-2} + 0.272\varepsilon_{t-4} \quad (4)$$

This last model is obviously the best one. p-values of β_0, β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8 and β_9 are all within acceptable range and they are significance at 5% significance level. As for "goodness-of" measures "R^2" and "$Adjusted\ R^2$" values are about 0.97 and 0.96 respectively, which indicate the regression fits quite well. Finally, p-values of the F-statistics are zero. The Akaike, Schwarz's Bayesian information criteria are -0.901 and -0.597 respectively which are minimum values in experimenting with various functional forms. It obviously shows that the first, second and fourth lag of error term have significant and important effect on our model.

There is, however, a possibility that the ordinary least square results may be misleading due to inappropriate standard errors because of the presence of heteroskedasticity. In order to test whether error terms are heteroskedastic or not the heteroskedasticity test (with cross term) is carried out [16]. The probability value of 0.209 in this test show that error term is jointly insignificant even at 5% significance level, meaning that they are no heterosketastic in our models.

We need also to test for serial correlation. Breusch – Godfrey Serial Correlation LM test is applied for the three different models. The (effectively) zero probability values in this test strongly indicate the presence of serial correlation in the residuals. In the presence of serial correlation, the ordinary least square estimators are still unbiased as well as consistent and asymptotically normally distributed, but they are no longer efficient, meaning that standard errors are estimated in the wrong way and, therefore, usual confidence intervals and hypotheses tests are unreliable. Moreover, usually, the finding of autocorrelation is also an indication that the model is misspecified. [17] proposed a general covariance estimator. The covariance estimator is used to try overcome standard errors for autocorrelation in the error terms in the model. In order to correct the standard errors for autocorrelation, the model is re-estimated by ordinary least square with Newey-West[4] procedure and then all indicators become significant at 5% significance level. Based on these results, the model is correct specified.

4.2 Cointegration Analysis

As indicated before, since it is critical to find out whether the results obtained from our model are meaningful (i.e., not spurious) or not, let we apply formal unit root tests in each series to test the reliability of our estimates.

4.2.1 Unit root tests

The established standard procedure for cointegration analysis is to start with unit root tests on the time series data being analyzed. The Augmented Dickey-Fuller (ADF) and

[4]Newey and West procedure may not appropriate in small samples. Since we have 75 observations, our samples may be regarded as reasonable large.

Phillips-Perron (PP) unit root test are used to test for the presence of unit roots and establish the order of integration of the variables in the model.

Table 5: Summary of ADF and PP Tests for Unit Roots in the Variables

Variable	ADF Test	Probability	PP Test	Probability	Results
NPL	-0.535	0.481	-0.638	0.437	Fail to reject the null
IPI	1.068	0.924	0.741	0.872	Fail to reject the null
ISE	1.075	0.925	1.091	0.927	Fail to reject the null
UR	-0.195	0.612	-0.474	0.507	Fail to reject the null
ROE	-1.570	0.109	-1.659	0.092	Fail to reject the null
INEF	-0.963	0.297	-0.906	0.321	Fail to reject the null
CAR	-1.279	0.184	-1.330	0.169	Fail to reject the null

Table 5 shows the results of the ADF and PP unit root tests[5]. The null hypothesis of the test is that there is a unit root against the alternative one that there is no unit root in the variables.

The ADF and PP statistics for NPL, IPI, ISE, UR, ROE, INEF and CAR are all insignificant at 5% level of significance, which leads to non-rejection of the null hypothesis that there is a unit root problem in the variables. According to ADF and PP test, it is obvious that the variables are non-stationary.

As mentioned previously, differencing has the effect of making the variable stationary. Table 6 summarizes the results of unit root tests for first difference variables.

Table 6: Summary of ADF and PP Tests for Unit Roots in the Variables (In 1st Difference)

Variable	ADF Test	Probability	PP Test	Probability	Results
Δ NPL	-2.176	0.029	-4.047	0.000	Reject the null
Δ IPI	-2.232	0.026	-15.303	0.000	Reject the null
Δ ISE	-3.480	0.000	-7.439	0.000	Reject the null
Δ UR	-.5.825	0.000	-3.178	0.002	Reject the null
Δ ROE	-5.742	0.000	-9.484	0.000	Reject the null
Δ INEF	-4.610	0.000	-4.610	0.000	Reject the null
Δ CAR	-6.157	0.000	-6.185	0.000	Reject the null

The ADF and PP test statistics for the first difference variables are all significant at 5% level of significance, which leads to rejection of the null hypothesis that there is a unit root problem in the variables. Based on ADF and PP test, it is apparent that the first difference variables are stationary, which implies that the variables are integrated of order one, I(1).

[5]Two lags have been used in ADF unit root tests.

4.2.2 The augmented Engle-Granger (AEG) test

The residuals from the estimation of equation 3 used to test for the existence of cointegrating relationship between the NPLs ratio and several macroeconomic and bank specific factors. The null hypothesis is that the residuals have a unit root problem against the alternative that the variables cointegrate. The AEG test is presented in the below table (Table 7).

Table 7: Summary of ADF and PP test output for 3 equation

ADF Test	Probability	PP Test	Probability	Results
-2.770	0.006	-8.138	0.000	Reject the null

The probability values in those tests indicate that residuals are significant at 5% significance level, meaning that that the null hypothesis is rejected. To reject the null hypothesis implies that the residuals have not a unit root problem, i.e., they are stationary. It can therefore be concluded that, based on the AEG method, the variables are cointegrated.

4.2.3 Cointegrating regression Durbin–Watson test

Since cointegration is very crucial to the reliability of estimated parameters, a second test, namely CRDW test, was carried out to make sure that the variables in this study are definitely cointegrated. The Durbin–Watson statistic for the regression represented by equation (3) is 1.61, which is above the 1% critical value of 0.511. Therefore, we fail to reject the null hypothesis of cointegration at the 1% level.

To sum up, our conclusion is based on both the AEG and CRDW tests giving the variables that NPL, IPI, ISE, UR, ROE, INEF and CAR are cointegrated. Depending on these results, we may infer that the appropriate model for NPL is the one represented in equation (3) and determines that our estimations are reliable, i.e., not spurious.

Equation 4 reflects that unemployment rate, return on equity, inefficiency, capital adequacy rate have positive long-term effect on NPL ratio. In figures, when unemployment rate (UR), return on equity (ROE), capital adequacy (CAR) increased by 1 point then NPL rate increased 0.15, 0.011 and 0.146 by point respectively and when industrial production index (IPI), Istanbul Stock Exchange100 Index (ISE), Inefficiency ratio of all banks (INEF) increased by 1 point then NPL ratio decreased by 0.004, 0.109 and 0.063 point, respectively

In addition, equation 4 reveals that there is a significant positive relation between NPL rate and the first, second and also fourth lag of error term. In figures, when ε_{t-1}, ε_{t-2} and ε_{t-4} increased by 1 point, the DRPPI increased by 1.118, 0.522 and 0.272 point respectively.

5 Conclusion

This study analyzes the relationship between the NPLs ratio and several macroeconomic and bank specific factors in Turkey by using ordinary least square estimation approach with integration analysis and the time series from January 2007 to April 2013.

Empirical results show that that debt ratio, loan to asset ratio, confidence index-real sector, consumer price index, EURO/ Turkish lira rate, USD/ Turkish lira rate, money supply change, interest rate, GDP growth, the Euro Zone's GDP growth and volatility of the Standard & Poor's 500 stock market index does not have significant effect to explain NPL ratio on multivariate perspective.

On the other hand, industrial production index (IPI), Istanbul Stock Exchange 100 Index (ISE), Inefficiency ratio of all banks (INEF) negatively, Unemployment rate (UR), return on equity (ROE), capital adequacy ratio (CAR) positively affect NPL ratio.

Additionally the positive and negative effects are such a long-term, not spurious. Our findings have several implications in terms of policy and regulation. It can help identify the causes of NPL ratio and thus lead analysts, policymakers, investors and financial institutions to a better understanding of banking and credit market conditions as well as their impact on economic activity, and the national financial stability and soundness.

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