

# **DETERMINANTS OF NON-PERFORMING LOANS IN KAZAKHSTAN**

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### Abstract

This paper examines the determinants of Non-performing Loans (NPL) in Kazakhstan banking sector for aggregate volume of bad loans. In particular, it investigates the impact of macroeconomic and bank specific factors on the volume of NPL. The sample comprises 29 banks over the period from 2007 to 2014. This study uses the dynamic panel data method based on the Generalized Method of Moments estimation proposed by Arellano and Bond (1991). It should be noted that macroeconomic factors together with bank specific characteristics have a substantial effect on the level of NPL in a particular bank. More diversified and highly capitalised banks tend to have less NPL. On the contrary, highly leveraged banks conditional on their size tend to have higher volume of NPL. This is so far the first attempt to look at the determinants of NPL in Kazakhstan using the novel data set on commercial banks.

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## 1 Introduction

The health of the banking system is of great importance both for financial stability and economic resilience of any country. One important characteristic of the health of the banking sector is the credit risk, which is represented by the amount of bad loans. In line with world banking standards, bad loans are measured by non-performing loans (NPLs). Generally the loan is called non-performing if it has not fulfilled one or more of the terms or conditions under the loan agreement. Conventionally, NPLs are those loans that are at least 90 days overdue. The standard definition of NPLs is provided by the International Monetary Fund (IMF). According to the IMF, “a loan is non-performing when payments of interest and/or principal are past due by 90 days or more, or interest payments equal to 90 days or more have been capitalized, refinanced, or delayed by agreement, or payments are less than 90 days overdue, but there are other good reasons - such as a debtor filing for bankruptcy - to doubt that payments will be made in full. After a loan is classified as nonperforming, it should remain classified as such until written off or payments of interest and/or principal are received”.<sup>1</sup>

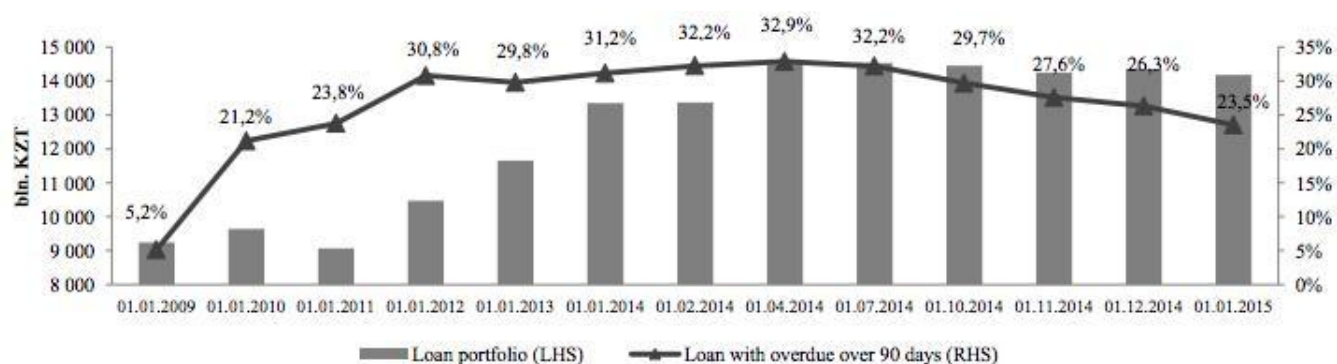
This definition includes restructured loans as well, which are loans with altered terms and conditions that are usually beneficial to the borrower. The definition of NPLs in the present study does not include restructured loans. Problem loans in Kazakhstan will include restructured loans only starting from 2017 in order to be aligned to world standards. Thus, the definition of NPL will become more broader.

The quality of a loan portfolio is a widely discussed topic, as it is an important indicator of the condition of the banking sector. Substantial accumulation of non-performing loans can well lead to a banking crisis, which then spreads to the whole economy. Thus, it is crucial to monitor the overall level of NPLs in the economy. A bank needs to keep the volume of bad loans at a minimum so that it can earn a profit from extending new loans in the future. Once NPLs exceed a certain level, the banks' profitability from credit business suffers. Banks should put special reserves aside, or in other words, make provisions in case they write down or write off the loan. Both the provisioning and a fall in revenues from credit activity result in the banks having fewer funds available to provide new loans, which further reduces profits. A bank with a very high level of bad loans cannot properly provide both the general public and corporate sector with the credit, which in turn leads to the fall in investments and job creation. When this problem hits on a large scale, this impacts the economy as a whole. As a result, high levels of NPL require special attention from supervisory bodies. In the light of recent negative developments in the NPLs in the banking sector of Kazakhstan, the level of NPLs stood at 4.924 trillion tenge reaching nearly 34% of total loans as of May 2014. The dynamics of loans and NPLs are shown in Figure 1. As a comparison, in the European Union countries, the average rate of non-performing loans was 6.4% as of December 2014, with the maximum value hardly reaching 8%, while in the United States this figure was just about 2%, with maximum value less than 6%. Kazakhstan is in the list of top countries with the highest high level of NPLs. Those countries include Greece, Cyprus, Ireland, Slovenia, Romania and Bulgaria with NPLs ratios higher than 15%. Figure 9 in Appendix depicts the NPLs ration in US and Europe.

Kazakhstan's banking sector started accumulating bad loans since the global economic crisis of 2008 and 2009, starting from 5.2% as of 1 January 2009. The crisis became pronounced in Kazakhstan at the end of 2008 when problems occurred with meeting international obligations. That was a liquidity crisis as banks were unable to refinance their debts. Before the crisis in 2007, the economy was expanding and was characterized by low inflation and affordable external funding, which promoted rapid development of the financial institutions of the country. The banking sector of Kazakhstan was also growing rapidly. Economic boom was accompanied by strong credit expansion, as the bank credits were 64% of GDP on average during 2006 - 2007. And the majority of the bad loans were extended during this period. The National Bank of the Republic of Kazakhstan (NBRK) was forced to embark on clean-up procedures and tighter regulations in order to tackle problem loans. As a result there were cuts on long term credits and mortgage loans as well as monetary tightening. As part of the recovery plan, NBRK created the Fund of Problem Loans

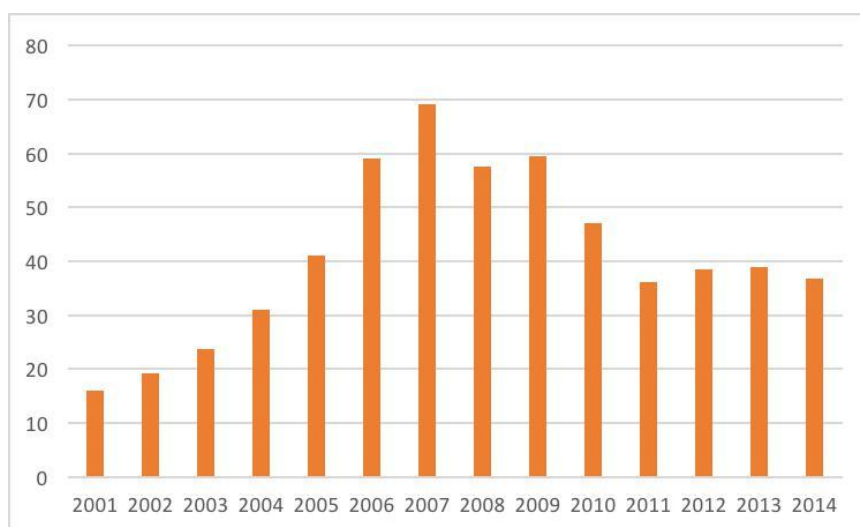
<sup>1</sup>“Clarification and Elaboration of Issues Raised by the December 2004 Meeting of the Advisory Expert Group of the Intersecretariat Working Group on National Accounts”. INTERNATIONAL MONETARY FUND. June 2005. <http://www.imf.org/external/pubs/ft/bop/2005/05-29.pdf>.

Figure 1: Dynamics of NPL's, 2009-2015



Source: The National Bank of the Republic of Kazakhstan

Figure 2: Loans as % of GDP, 2001-2014



Source: Author's calculations based on the data from the NBRK

(FPL) in 2012, which aims at improving the quality of the banks' loan portfolios in accordance with the regulatory legislation. In addition, commercial banks started creating special subsidiary organizations to manage doubtful assets. However before 2014, FPL was not so effective in fulfill-ing its functions due to stringent regulations and very low level capital, which was not enough to deal with the problem loans of the whole banking sector. The Law on Debt Collection Activities is still in the process of approval and probably will come into force in 2017. Before that there was no law regulating debt collecting activity. Some banks worked with debt collecting firms, but this was not enough to clean up the balances from toxic loans.

This research focuses on the linkages between NPLs and macroeconomic as well as bank spe-cific factors. In particular, the study assesses the quantitative effect of the stated factors on the volume of NPLs in the commercial banks of Kazakhstan. The main contribution of this research is that it studies bad loans in the Kazakhstan banking system and uses a novel data set constructed from several sources. Most results are intuitively expected but have not been documented before. To the best of my knowledge, this is the first study of its kind for Kazakhstan.

The rest of the paper is organized as follows. Section 2 presents an overview of the banking system of Kazakhstan as well as the regulatory framework. Section 3 gives a brief overview of the structure of loan portfolio. Section 4 contains a literature review. Section 5 presents the theoretical framework and formulates the hypotheses

regarding the link between bank specific variables and NPLs. Section 6 describes the methodology used in the present study. Section 7 presents the data set, while section 8 describes the results of econometric estimation. Section 9 summarizes the findings. Finally, sections 10 and 11 contain references and appendix.

## 2 Overview and Regulatory Framework

Kazakhstan has a two-tiered banking system. The first tier includes the central bank - NBRK, which reports to the President. The second tier comprises commercial banks, including one state-owned bank and banks with foreign participation. As of January 1, 2015, there were 38 commercial banks, including 16 banks with foreign participation. The top 10 banks controlled roughly 79.2% of the country's banking assets as of 2015. Kazakhstan's banking sector is relatively highly con-centrated. The largest and systemically important banks are Kazkommertsbank, Halyk Bank, BTA Bank, Tsesna Bank, and Sberbank controlling about 52% of total banking assets as of the end of 2014. NBRK fulfils functions of a financial regulator after merging with the Financial Supervision Agency in April 2011, and is therefore in charge of overall supervision of the banking sector. There were three major waves of currency devaluations: in 2009, 2014 and 2015. During 2015, the exchange rate of the tenge was devalued most severely, being actually put in a free float. There loans started growing in the banking system beginning from 2001. A sharp increase in loan volume took place in 2006, with a peak in 2007, when loans were almost 70% of GDP. Figure 2 presents loans as a percentage of GDP. Before 2013 Kazakhstan had its own classification of assets and liabilities, including loans. There were three main types of bank loans: standard, doubtful and hopeless. Basically, doubtful and hopeless loans constituted the problem loans. Standard loans were defined as riskless. Doubtful loans comprised five categories (Category 1 to Category 5) in themselves, depending on the level of risk. Category 5 was considered the most risky with very low chance of recovery, including loans with 60-90 days overdue in payments. Hopeless loans were considered to have a very low chance of recovery including loans with over 180 days overdue. Starting from 2013 International Financial Reporting Standards (IFRS) were adopted in terms of classification of assets, liabilities and loans. From then on NBRK started to publish reports with data on NPLs (90 days past due), which satisfies the standard definition of NPLs. As credits are not insured against the failure of customers to service their debts, this activity bare potential risks. This depends on many factors, including economic downsides, misreportings of the borrower or other hidden information that was not accounted for during the credit decision. Standard practice of banks is to create loan loss provisions which are special reserves that are set aside to offset un-collected loans and loan payments. Provisions are considered to be expenses, and on the contrary, recovery of provions is recognized to be a profit for a bank. Provisions were created for doubtful and bad loans according to the rules of NBRK, which were based on the scoring system for the classification of loans. The rules for the formulation of provisions were changed as well according to the IFRS standards in 2013. The main concern is that there is no market for stressed assets and therefore no specialization in this sphere. In addition, legislation in Kazakhstan is not clear enough to manage bad loans. Though, there is the Law of the Republic of Kazakhstan on Rehabilitation and Bankruptcy, it is not able to fully deal with problem loans. The law on personal bankruptcy is still under development. Regarding the limitation period, credits don't expire in Kazakhstan, in the sense that a borrower never stops being liable for the loan, with a few exceptions. Loans are written off only in the case when all recovery measures and procedures have not led to the loan repayment. Another reason for rare write-offs is the accounting procedures. According to the Tax Code of Kazakhstan, write-offs are considered to be a profit and banks have to pay taxes. For these reasons, bad loans kept accumulating on the bank balances for a long time, as it is extremely costly for banks to write off those loans. Currently, recovery of the banking sector remains a top priority for the government. Particularly, President Nursultan Nazarbayev ordered to curb the level of problem loans in the banking system to stabilize the financial sector of the country. The goal of reducing problem loans is a part of the program to support the banking system. This program is in turn a part of the big program of the government - 'Nurly Zhol' (Bright Path), which is a new economic policy aimed at stimulating the economy after the world crisis. Thus, the Government together with the NBRK started taking measures to reduce bad loans in the second half of 2014.

First of all, the NBRK set the maximum target for the NPLs ratio to be 15% by the beginning of 2015, and 10% by the beginning of 2016. The NBRK has decided that the level of NPLs less than 10% will eventually become a prudential norm starting from 1 January 2018. This means that all banks in the system will have to follow this norm.

The NBRK set the ceiling for the annual consumer loan growth of 30% at the individual bank level to prevent rapid credit growth. Also at the end of 2014 the government made amendments to tax legislation, extending income tax relief for write-offs of bad loans.

Another measure taken by the government was that banks are now prohibited to extend mortgage credits in foreign currency to individuals who don't receive their income in the same currency. In addition, banks were obliged to abolish interest penalties on mortgage credits after loans are 180 days overdue.

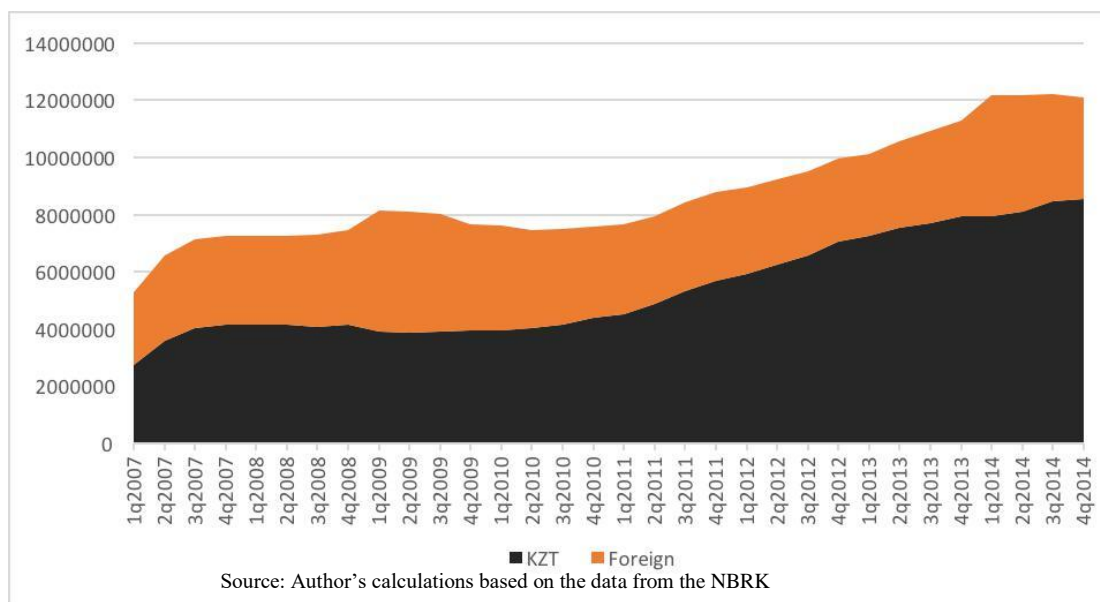
The Government announced in April 2014 a 1 trillion tenge stimulus package aimed in part at resolving the sectors bad loans and in turn encouraging new lending to businesses. The funds were allocated from the National Fund. The stimulus package injected approximately 250 billion tenge into the Fund of Problem Loans which the NBRK uses to purchase bad loans from local banks, and an additional 100 billion tenge to increase lending to businesses. Thus, by the end of 2014, FPL took over a large share of bad loans. At the same time a merger of worst-hit banks took place. In late 2013, the sale of three banks bailed out by the government during the global financial crisis was announced: BTA Bank, Alliance Bank, and Temirbank. Under the terms of sale, BTA Bank merged with Kazkommertsbank to become the largest commercial bank in Kazakhstan. The deal was completed on 1 July 2015. As a result, Kazkommertsbank received healthy assets of two banks and BTA Bank took the bad loans of Kazkommertsbank and BTA Bank. Alliance Bank and Temirbank merged under ForteBank in 2014. As a result, the number of commercial banks fell from 38 to 35 banks.

Moreover, the NBRK announced in 2014 that it would implement more stringent capital and NPLs requirements on banks operating in Kazakhstan. The NBRK indicated that it may significantly raise capital requirements on banks for greater consolidation within the sector.

Thus, integration of two large banks (BTA Bank and Kazkommertsbank) and government support, were the main factors in the sharp decrease in NPLs. Out of 3.34 trillion tenge of NPLs in the banking system, 1.85 trillion tenge of NPLs belonged to BTA Bank and 0.5 trillion tenge of NPLs belonged to Kazkommertsbank as of 1 January 2015. By the end of 2015 overall NPL decreased by 2.103 trillion tenge and stood at 1.236 trillion tenge. Out of this amount of decrease in NPLs, Kazkommertsbank and BTA Bank accounted for 2 trillion tenge decrease. This fall in problem loans was due to write-offs and transfer to the FPL and subsidiary managing companies of the commercial banks.

Owing to these actions, the banking sectors NPLs were reduced to 23% at the beginning of 2015, as measures were taken only at the end of 2014. NPLs fell even sharply after that to 8% at the beginning of 2016. This was accompanied with the fall in provisions. However, that happened mainly due to the write-offs that were part of the complex recovery plan. In addition, assets and capital as well as credit activity decreased in the banking sector.

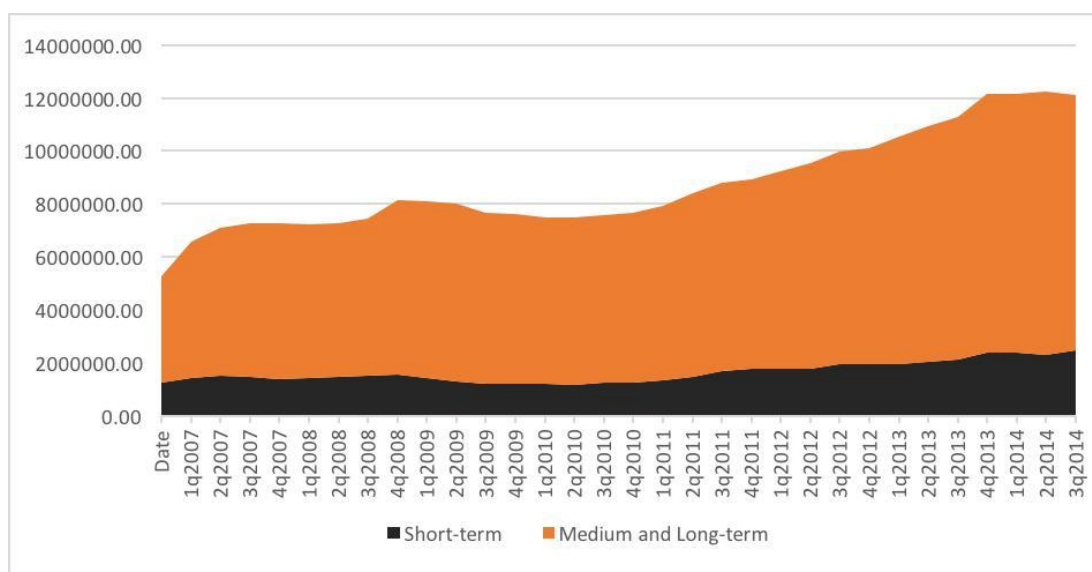
Figure 3: Loans by Currency, KZT mln.



## 3 Structure of Loan Portfolio in the Banking System

Figures 3 - 5 show the structure and dynamics of the loan market of the Kazakhstan banking system. Those numbers show the total credits of the banking system, excluding interbank lending, such as credits to other banks and repurchase agreement operations. The majority of credits in the economy are medium and long-term credits. Short-term credits are those with a term of one year or less, while medium and long-term credits are those with a term greater than one year. One important feature of the analyzed loan market is that a substantial amount of loans are extended in foreign currency, mainly in US dollars. In 2015 after the national currency depreciated the most, the Government announced the so called 'dedollarization' measures of the economy that is dependent on the US Dollar. More tight regulations for the loans in foreign currency was considered by the NBRK. This led to the fall in the amount of loans in foreign currency to 30% of total compared to 50% in 2009. Regarding the type, legal entities account for the greatest share of all debtors.

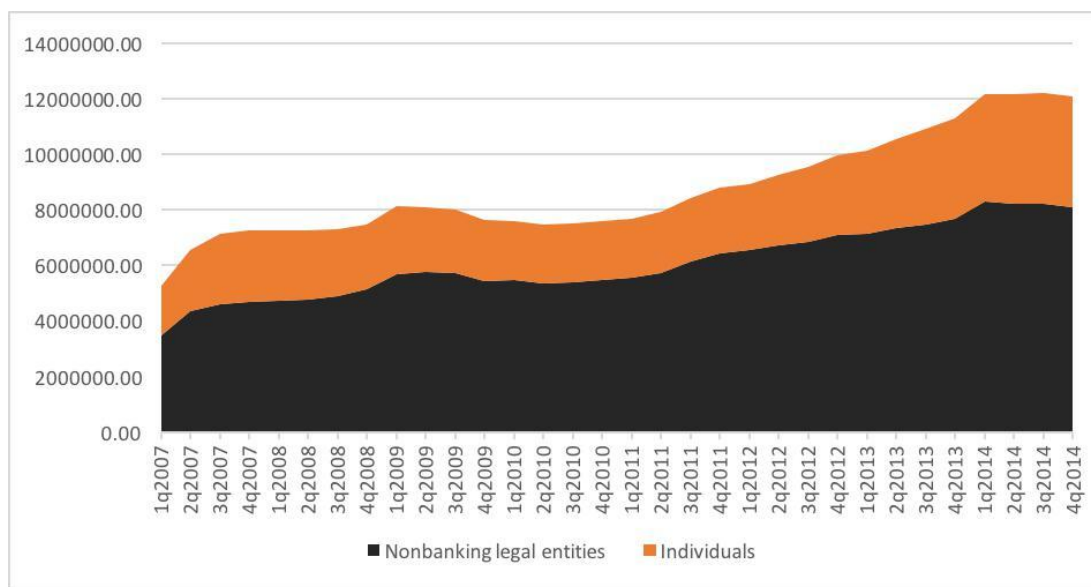
Figure 4: Loans by Term, KZT mln.



Source: Author's calculations based on the data from the NBRK



Figure 5: Loans by Type, KZT mln.



Source: Author's calculations based on the data from the NBRK

#### 4 Literature Review

A great deal of economic papers focus on the determinants of asset quality as well as the links through which deterioration in the asset quality may cause economic crises. Widely cited determinants of NPLs in the literature are basically of two types - macroeconomic and microeconomic or individual. Macroeconomic factors usually relate to economic activity or business cycles. A common finding of the majority of studies is the positive impact of economic growth on the loan quality. In addition to economic activity, widely cited macroeconomic factors include monetary indicators like lending and exchange rates. Microeconomic factors usually include individual characteristics or some financial indicators and ratios.

Louzis et al. (2011) in their study of the NPLs in Greek banking system use both macroeconomic and bank specific variables to show how various types of NPLs are determined. In particular, they use GDP growth rate, the unemployment rate and the real interest rate as macroeconomic factors. The bank specific factors that they used include return on equity and asset size. They found substantial relationship between both macroeconomic and bank specific variables and NPLs. They conclude that good quality of management of bank leads to less NPL. In particular, they found that highly leverage banks have more NPLs conditional on their size. But the effect of leverage is positive up to a certain size threshold. The present study closely follows this research, as Kazakhstan has also faced very high levels of NPLs which could be caused by similar factors described in the work of Louzis et al. (2011).

Vardar and Ozguler (2015) also investigate linkages among the NPLs and both macroeconomic and bank specific factors in the Turkish banking sector over the period 2007 - 2013. The results show that there exists strong relationship between NPLs and those factors. They found that the volume of individual loans and GDP per capita has a negative significant relationship with NPLs.

Empirical study by Salas and Saurina (2002) uses the data on aggregate NPLs in Spanish commercial and savings banks for the period 1985-1997. They include both macroeconomic and microeconomic variables to investigate how they affect the volume of NPLs. They found a significant negative contemporaneous effect of GDP growth on NPLs and suggest that there is a quick transmission of macroeconomic factors to the ability of economic agents to service their loans. Another finding is that the size of the banks negatively affect the level of NPLs. Their

paper concludes that bank specific determinants can serve as early warning signs for future changes in problem loans.

Berger and De Young (1997) study the relationship among loan quality, cost efficiency, and bank capital. They found that cost efficiency of bank managers may be an important indicator of future NPLs. In particular, they showed that low cost efficiency is positively associated with the volume of NPLs. They conclude that low capitalization lead to the increase in NPLs.

Another empirical study by Beck et al. (2013) analyses the macroeconomic determinants of NPLs across 75 countries using dynamic panel method. According to their findings variables that significantly affect the NPLs ratio are GDP growth rate, share prices, the exchange rate and lending interest rate. Particularly, they found that contemporaneous effect of GDP growth is negative. However, lagged GDP growth has positive effect on NPLs, which they explain by the fact that asset quality deteriorates with a lag in response to positive growth which is accompanied by the overextension of loans to risky customers. Another important finding is that the nominal exchange rate has positive impact on NPLs, and the impact is higher in countries with pegged or managed exchange rates. They also found that lagged lending interest rates have positive and significant effect on NPLs.

Espinoza and Prasad (2010) examine the determinants of NPLs ratio in 80 banks in Gulf Co-operation Council over 1995-2008 using dynamic panel approach. The study uses both macroeconomic and bank specific factors. They find that economic growth negatively affects NPLs. While for interest rates they find positive association. Another finding is that higher credit growth causes more NPLs.

## 5 Theoretical Framework

As NPLs are considered to be highly persistent, the lagged NPLs level will be included in the models as a regressor. As was mentioned earlier both macroeconomic and bank specific variables will be used to explain the NPLs. There are frequently cited variables in the literature including GDP, interest rates and unemployment rate. As for microeconomic variables widely used variables to explain NPLs are financial ratios and performance indicators. Current analysis will employ macroeconomic variables such as GDP growth rate, base lending rate and exchange rate of tenge. Some studies use credit card volume as an explanatory variable. This is not the case in Kazakhstan, as credit cards are not used widely.

One important macroeconomic factor is GDP growth as it is the best representation of economic cycles. Usually economic upturns contribute to the decrease in NPLs. The main channel is through income effect, as during economic booms incomes and profits in the economy increase. This makes easier to service debt.

Another widely cited determinant is the interest rate. Most often main lending rate of any economy is used. Usually increase in the lending rate leads to the increase in problem loans, which is intuitive. As the aggregated NPLs are analyzed it is more appropriate to use the the base rate which is the base lending rate in Kazakhstan. The base lending rate is the main reference interest rate in the country, which is used to set bank lending rates.

A currency exchange rate is also widely used to explain problem loans in the economy. There could be several mechanisms through which the exchange rate could affect problem loans. Direct effect is through loans denominated in foreign currency. Another effect could be through the income effect, in the sense that currency depreciation decreases the wealth, which in turn affects the ability to service loans. Thus, currency depreciation usually leads to the increase in NPLs. Exchange rate of tenge to US dollar will be used as explanatory variable, as the economy of Kazakhstan is highly dollarized both in terms of credits and saving deposits.

Unemployment is another widely cited variable to explain NPLs. Higher unemployment is regarded as one of the factors contributing to the increase in problem loans. Un the present study, unemployment will not be included in the model, as there is no much variation in unemployment rate. Actually, official employment is roughly unchanged and stable in Kazakhstan.

Bank specific variables will be used in addition to macroeconomic variables to test the impact

of microeconomic factors on the problem loans. As for bank specific variables, I use main financial indicators of banks such as assets, liabilities, profits and volume of loans to calculate relevant ratios. Below are the hypothesis that I state in terms of bank specific variables:

1) Diversification hypothesis. Widely cited view us that diversification lowers credit risk (Louzis at al., 2011). More diversified banks have less concentrated portfolios which contribute to fewer NPLs. Bank assets size is used to proxy for diversification. Thus, the bank size is negatively related to NPLs. For example, Salas and Saurina (2002) find that bank size negatively affects the NPLs level.

2) Bad management hypothesis. Bad bank performance is positively related to NPLs. Return on equity will be used to proxy for bank performance, which is in turn signals the quality of management. As the quality of management deteriorates, less skills are attributed to the management of bad loans. Louzis et al. (2011) find that return on equity is negatively associated with NPLs.

3) Credit expansion hypothesis. Loan growth is positively associated with NPLs, as more loans increase the probability of bad loans. In addition, rapid loan growth is argued to reduce the quality of the borrowers. Loan growth rate is used to test this hypothesis. However, the effect can be ambiguous. Salas and Saurina (2002) report insignificant positive effect of loan growth, while Vardar and Ozguler (2015) found an opposite relation.

4) 'Too Big To Fail' hypothesis. The hypothesis states that banks with high leverage tend to extend loans to low quality borrowers, which in turn leads to more NPLs. Especially, large banks may increase their leverage. Thus, leverage conditional on size of a bank will be used as a bank specific regressor. This hypothesis was formulated in Louzis et al. (2011).

5) 'Moral Hazard' hypothesis. There is a view that low capitalization of banks leads to the increase in bad loans. Those banks can be tempted to take larger risk because there is lower potential loss in terms of capital when it is low. This hypothesis was formulated in Berger and De Young (1997). Capital size will be used to test this hypothesis.

Six models will be developed, including baseline model with macroeconomic variables, and five additional models with bank specific variables. Bank specific variables will be added one by one to the baseline model in order to check the additional explanatory power of each specific variable. This is also done to avoid collinearity problem in the model, as all bank specific factors are related to each other. Moreover, it is crucial that the number of regressors is below the number of panels to save the degrees of freedom.

The table 1 describes the variables and their expected effect on NPLs.

Table 1: List of Variables and Expected Signs

Variable	Definition	Expected Sign
NPL	NPLs ratio = NPLs/Total loans	+
GDP	GDP growth rate	-
EXRATE	Exchange rate KZT/USD	+
BASERATE	Base lending rate	+
SIZE	$\frac{P}{\text{Total Assets}} / \text{Total assets}$	-
ROE	Return on Equity = Profits/Total equity	-
LOANGR	Loan growth rate of a bank	+
LEVR	Leverage Ratio = Total liabilities/Total assets	+
LEVR*SIZE	Leverage ratio conditional on size	+
CAPAS	Capital-to-Asset Ratio = Owned capital/Total assets	-

## 6 Methodology

To study the proposed relationship an econometric analysis will be employed. I will use dynamic panel data (DPD) model in order to account for the persistence of NPL.<sup>2</sup>

Panel data is usually associated with the unobserved heterogeneity. And there are generally two ways of dealing with it, including within demeaning transformation as in fixed effects model and taking the first difference. Particularly in the context of DPD models the first-differencing is appropriate to remove the unobserved heterogeneity. In the model used in this paper the unobserved bank specific effects are correlated with the independent and lagged dependent variables.

<sup>2</sup>First-order autoregressive coefficient for NPL is 0.79.

The DPD approach is considered to be the work of Arellano and Bond (1991). The parameters of the model can be consistently estimated by the Generalized Method of Moments (GMM). This approach involves instrumental variables (IVs) technique. General rule is that the number of in-struments should be less or equal to the number of panels. The Arellano-Bond estimator sets up a model as a system of equations for each period, where the number of instruments in each equation change, as more lagged values are available in later periods. This estimation method is well suited for small samples, typically for the cases with few T and relatively big N. In addition, GMM estimator doesn't require normality of the variables. In particular, heteroskedasticity robust one-step estimation will be applied. The estimation is based upon the first differencing with subsequent elimination of bank specific effects. The model is as follows:

$$Y_{it} = \alpha_0 + \alpha_1 Y_{it-1} + X_{it} \beta + \mu_i + \epsilon_{it} \quad (1)$$

where subscripts i and t denote cross sectional and time respectively. Y is NPLs ratio,  $Y_{it-1}$  is the first lag of NPLs ratio,  $X_{it}$  is 1 K vector of regressors, and  $\alpha$  are respective coefficients,

$\mu_i$  is unobserved bank specific effect, and  $\epsilon_{it}$  is the error term. Regressors in equation 1 include lags of variables as well to account for the delayed effect of the macroeconomic and bank specific variables.

Lagged value of GDP growth rate will be used to account for the delayed effect of the economic cycle. Base lending rate is also assumed to have lagged effect on NPLs. On the contrary, exchange rate of tenge is assumed to have only contemporaneous effect on the NPLs, as changes in the exchange rate quickly transmit to the rest of the economic variables.

I assume contemporaneous effects of bank specific variables. In addition to contemporaneous effect of loan growth rate and return on equity, their lagged values will also be included in the model to account for the effect of the previous period.

The estimator requires that there be no second-order autocorrelation in the idiosyncratic errors

ii. However, there could be first-order autocorrelation in errors, since differencing generates the autocorrelation of order 1. Thus, the second-order autocorrelation will be tested after the GMM estimation. The null hypothesis is that there is no second-order autocorrelation in the first-differenced errors. Rejection of the null hypothesis implies serial correlation for the level error term and thus inconsistency of the GMM estimates.

The differenced equation is as follows:

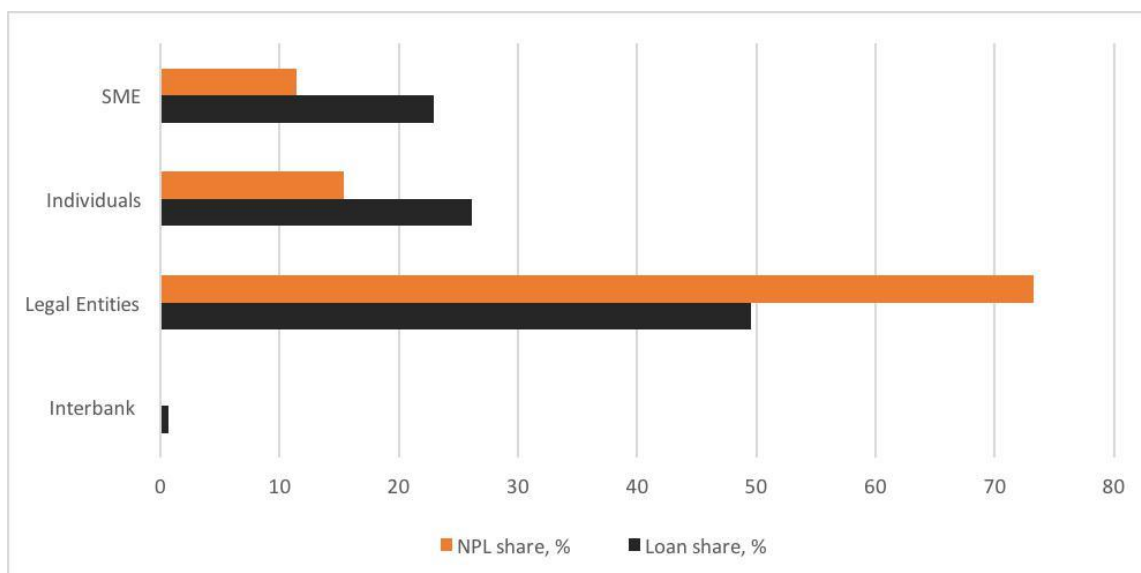
$$\Delta Y_{it} = \alpha_0 + \alpha_1 \Delta Y_{it-1} + \Delta X_{it} \beta + \epsilon_{it} \quad (2)$$

where  $\Delta$  is a first difference operator. Differencing removed the individual effect. By construction

$\Delta Y_{it-1}$  is correlated with the  $\Delta Y_{it}$ , which causes bias in the estimation. To tackle this problem, IVs will be needed. In particular, all available lagged levels of  $Y_{it-1}$  can be used as IVs as long as the number of instruments is below the number of panels. As  $Y_{it-2}$  and all previous lags are correlated with  $\Delta Y_{it-1}$  and at the same time are not correlated with  $\Delta Y_{it}$ , they will be used as IVs. I assume that macroeconomic variables are strictly exogenous, i.e. the following moment conditions are satisfied:



Figure 6: Loans and NPL Shares by Type, 2014



Source: Author's calculations based on the data from the NBRK

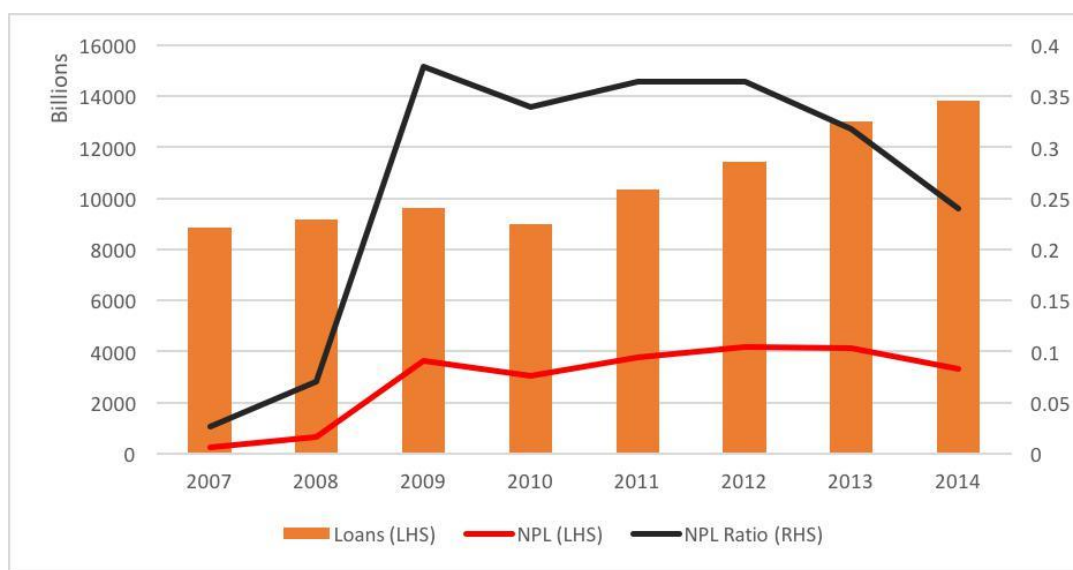
worst after the global economic downturn - BTA, Alliance, Temirbank, KazKommertsbank, Halyk Bank, Bank CenterCredit, ATF and Kaspi Bank. Their combined NPLs ratio stood at around at 93% of total loans as of 1 January 2015. The smallest share of NPLs is concentrated in small and tiny banks, that are rapidly growing. The proportion of loans and NPLs by the type remained roughly the same throughout the analyzed period. Figure 6 shows the loans by type and NPL shares by type as at the end of 2014. Legal entities constitute the largest share of loans as well as non-performing loans. Loans to legal entities were almost 50% of total loans, while their NPLs constituted 73% of total NPLs, which is a huge number. The second largest category by both loan share and NPLs is individual loans. As of 2014 individual loans accounted for 26% of total loans with NPLs share of 15.4% of total NPLs. Individual loans include retail and mortgage loans, with the former taking the largest share. In fact, mortgage loans were 7-8% of total loans on average during the analyzed period. And mortgage loans continue to decline, as many banks curbed substantially this type of credit activity. The third category is loans to small and medium-sized enterprises (SME) which constituted 23% of total loans, while their NPLs constituted 11.4% of total NPLs. The least share belongs to Interbank loans - 0.7% , with no NPLs at all.

The data set comes mainly from the NBRK, Bloomberg Professional Service and Statistical Agency. The data from mentioned sources were entered manually for each of the 29 banks into Excel spreadsheet. The ratios were calculated using these data. The period is chosen due to data availability and to keep the sample of banks constant. Another reason that data were not extended beyond 2014 is that major write-offs occurred in 2015 and NPLs decreased on the balances of banks.

Macroeconomic variables include real GDP growth rate, base lending rate and exchange rate of tenge, which is expressed as tenge for 1 US dollar. For bank specific variables I am going to use the ratio of aggregate NPLs to total loans, assets, capital, return on equity, loan growth rate, and leverage ratio. It is worth noting that the aggregate level of NPLs is used for analysis, as there is no breakdown of NPLs available. Data for the volume of NPL before 2013 were constructed by adding doubtful loans of category 5 and hopeless loans. This data manipulation was done in order to get the equivalent of NPLs with 90 days overdue. As was mentioned earlier only starting from 2013 NBRK adopted IFRS standards in classification of problem loans as those with overdue over 90 days. This technique is widely used by analytical sources for reporting data for the volume of NPL 90 in Kazakhstan before 2013.

Table 1 in Appendix shows the summary statistics of the variables of interest. NPL series are not normally distributed. Particularly it is skewed to the right and fat-tailed. This is confirmed by the normal quantile plot depicted in Figure 8 in Appendix. The plot shows the comparison between the distribution of npl with the normal distribution. Figure 7 depicts total loans volume and NPL ratios for the analysed period. One can see a sharp increase in non-performing loans starting from 2008 onwards when the world economic crisis began. Dynamics of macroeconomic variables and NPLs ratio are presented in Figure 10 in the Appendix. One can clearly see that GDP growth and NPL move in opposite directions.

Figure 7: Loans and NPL ratios, KZT bln.



Source: Author's calculations based on the data from the NBRK

## 8 Results

The results of the regression are presented in the Table 2 in Appendix. In the baseline model all available lags of the dependent variable were used as IVs. In the rest of the models the number of IVs were restricted so as to keep it below the number of panels (groups). In the second, third and fifth models two lags of predetermined variables in the level form were used as IVs, while one lag was used in the fourth model.



Overall the estimated models are able to explain the NPLs. The effect of the lagged value of non-performing loans is positive, which is in line with expectations. The coefficients are significant, except Model 3. For comparison, the sign of coefficient for lagged NPLs ratio is negative in Louzis et al (2011). Their explanation is that NPLs decrease next period mainly due to write-offs. But this is not the case in Kazakhstan, as write-offs didn't occur that often, and the volume of NPLs has been remaining relatively high since 2009.

Regarding GDP growth rate, the coefficients are negative and statistically significant. Only in Model 4 the coefficient is not significant. The signs are in line with the expectations. This means that NPLs are negatively affected by the economic upturns in the previous period. This result confirms the hypothesis that during economic booms it is easier to service debt, as incomes and profits are stable.

The coefficients on lagged base lending rate are positive and statistically significant. However it is not significant in Model 3, which can be due to collinearity. Overall, the effect is consistent with the expectations, as higher interest rates are associated with the increase in problem loans. Usually, higher interest rates make it more difficult to service debt.

The coefficients on exchange rate of the tenge are positive, which is in line with the expectation. But the coefficient is significant only in the Baseline Model. The insignificance in the rest of the models may be related to multicollinearity issues. Overall, this means that as tenge depreciates more problem loans appear during the same year. And this happens not only as a result of the revaluation of foreign currency loans. Indeed, depreciation of national currency weakens overall purchasing power and this makes more difficult for customers to service their debts.

The coefficient on size is negative as expected, but not statistically significant. This partially supports the stated hypothesis that diversification leads to the decrease in the NPLs. The reason for insignificant effect of the size could be that the size on its own may not properly capture diversification. Louzis et al. (2011) also report insignificant coefficient for the size. Nevertheless, the sign is in line with the hypothesis.

The effect of the return on equity is negative but not significant. The coefficient on lagged value is positive and insignificant. The overall impact (sum of contemporaneous and lagged coefficients) is negative, which is in line with expectations. One can conclude that good performance as expressed by the return on equity is associated with less NPLs.

Loan growth coefficient is negative but not significant. The coefficient on the lagged value of loan growth is negative and significant. The sign is opposed to the 'credit expansion' hypothesis. This result means that high credit growth leads to less problem loans. This can be explained by the fact that loans in Kazakhstan grow faster than NPLs, and thus NPLs decline as a ratio of total loans.

Model 4 considers the effect of the size and leverage ratio along with interaction effect of leverage ratio and size of the bank. The effect of the leverage ratio is positive and significant. The coefficient on size is significant and has expected sign, as opposed to the Model 1, where the size alone was not significant. The sign of the coefficient on interaction term is positive and statistically significant, which is in line with the 'too big to fail hypothesis'. It means that the size magnifies the positive effect of the leverage on the volume of NPLs. Generally, leverage ratio conditional on size increases the NPLs.

Regarding the last model, NPL is negatively associated with the capital-to-asset ratio and the effect is significant. This supports the 'moral hazard' hypothesis, which states that highly capitalized banks are less prone to high NPL.

Table 3 in Appendix presents the Arrelano-Bond test for zero autocorrelation of order 2 in first-differenced errors. The null hypothesis of no autocorrelation cannot be rejected. The test implies that there is no serial correlation in first-differenced error terms and thus consistency of GMM estimates. The result presents no evidence of model misspecification.

## 9 Conclusion

This study investigates the effect of macroeconomic and bank specific variables on the volume of non-performing loans using the dynamic panel data methods. Econometric analysis used in the study suggests that macroeconomic factors together with bank specific characteristics have a substantial effect on the level of NPLs in a particular bank. Absence of serial autocorrelation in first-differenced errors indicate to the right model specification.

Particularly, all macroeconomic variables proved to be equally significant, except the exchange rate. GDP growth rate negatively affects the NPLs, which is in line with the well established hypothesis that economic expansion is associated with low NPLs. The effect of the base lending rate is in line with the expectation that higher interest rates lead to the increase in problem loans. Higher exchange rate of tenge to US dollar lead to more NPLs.

It turns out that four out of five hypotheses stated in this paper have been proven by the empirical results, though the coefficients on some of them are not significant. Highly capitalized banks tend to have less NPLs. On the contrary, highly leveraged banks conditional on their size tend to have higher NPLs. Credit growth is associated with lower NPLs, which is opposed to the stated hypothesis. This is in part due to the fact that the volume of loans grow faster than NPLs.

The results of this paper suggest that macroeconomic indicators may be used in stress tests to forecast future changes in asset quality at banks and financial institutions.

In addition to macroeconomic factors, bank indicators turned out to be important predictors of the increase in problem loans. The results suggest that there are serious problems with internal management in commercial banks of Kazakhstan. Bank indicators like capitalization, profitability and leverage could be used as early signals of future deterioration in the loan portfolios.

The main limitation of this study is that it uses the aggregate level of NPLs. It would be more informative to use the disaggregated data for different types of loans at individual bank level. Loan categories could include corporate, consumer and mortgage loans.

The research can be extended further in several ways. One of the extensions may be to include other credit entities like microcredit organizations or online credit services into the analysis. An-other possibility is to look at online credits or the payday loans, which are short-term loans for unexpected expenses. The effect of the ownership concentration on the problem loans would also be of interest to analyse.

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Table 2: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
NPL	0.129	0.172	0	0.863	232
GDP	5.45	2.345	1.2	8.9	232
BASERATE	7.438	2.057	5.5	11	232
EXRATE	146.609	18.385	120.68	182.35	232
SIZE	0.035	0.053	0	0.247	232
ROE	0.15	0.859	-2.202	9.420	232
LEVR	0.757	0.251	0.028	1.837	232
LOANGR	0.563	3.612	-0.999	52.57	232
CAPAS	0.243	0.251	-0.837	0.972	232

Figure 8: Normal Quantile Plot for NPL

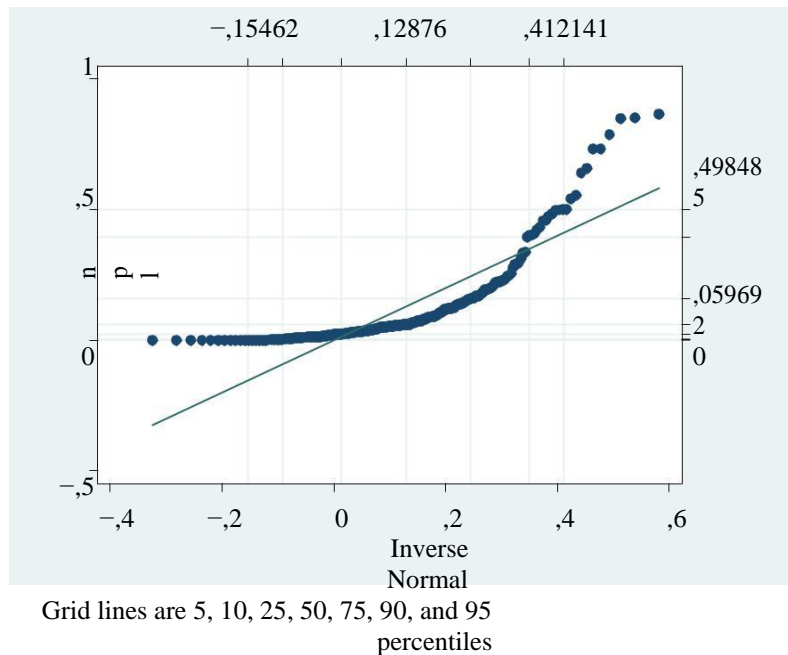


Table 3: GMM Estimation Results

	BL	Model 1	Model 2	Model 3	Model 4	Model 5
L.NPL	0,701 (0,349)	0,419 (0,190)	0,684 (0,125)	0,230 (0,266)	0,833 (0,120)	0,548 (0,184)
L.GDP	-0,006 (0,003)	-0,008 (0,003)	-0,007 (0,004)	-0,006 (0,003)	-0,003 (0,003)	-0,006 (0,002)
L.BASERATE	0,016 (0,007)	0,011 (0,004)	0,016 (0,006)	0,007 (0,007)	0,013 (0,005)	0,011 (0,003)
EXRATE	0,001 (0,001)	0,000 (0,000)	0,001 (0,001)	0,000 (0,000)	-0,000 (0,000)	-0,000 (0,001)
SIZE		-0,965 (2,269)			-2,136 (1,215)	
ROE			-0,005 (0,012)			
L.ROE			0,002 (0,004)			
LOANGR				-0,016 (0,013)		
L.LOANGR				-0,009 (0,003)		
LEVR					0,423 (0,158)	
LEVR*SIZE					1,722 (0,921)	
CAPAS						-0,336 (0,110)
N	174	174	174	174	174	174
Groups	29	29	29	29	29	29
IV's	24	26	25	25	27	26
Wald, p-val	0.049	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses. L. is the first lag operator.

$p < 0:1$ ,  $p < 0:05$ ,  $p < 0:01$

The number of instruments is kept below the number of groups in all models.

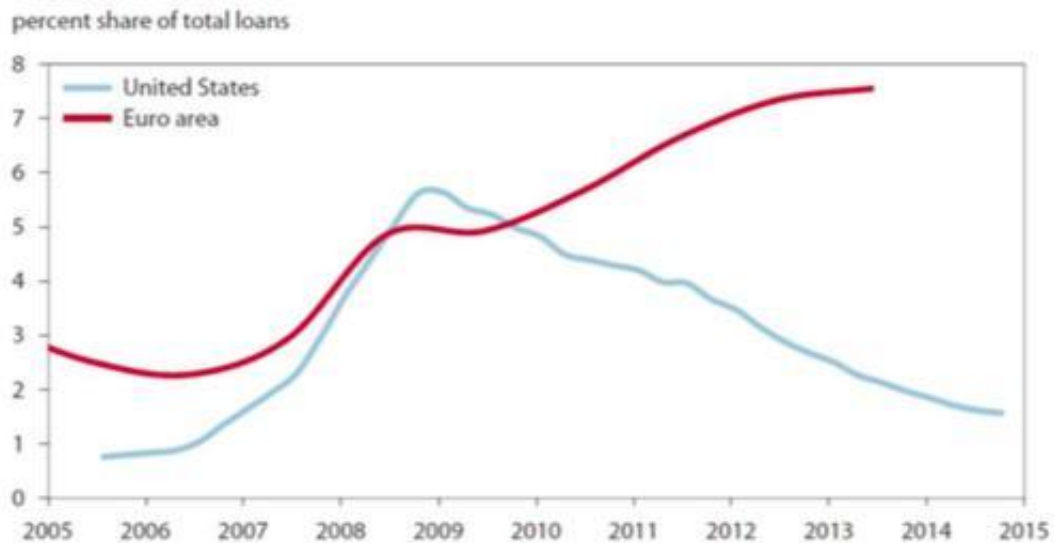
Wald test suggests that all coefficients are jointly significant.

Table 4: Arellano-Bond test for second-order autocorrelation of the residuals

Model	z	p-value
BL	0.439	0.661
Model 1	0.239	0.811
Model 2	0.092	0.927
Model 3	-0.895	0.371
Model 4	0.057	0.955
Model 5	-0.037	0.971

$H_0$ : No Autocorrelation

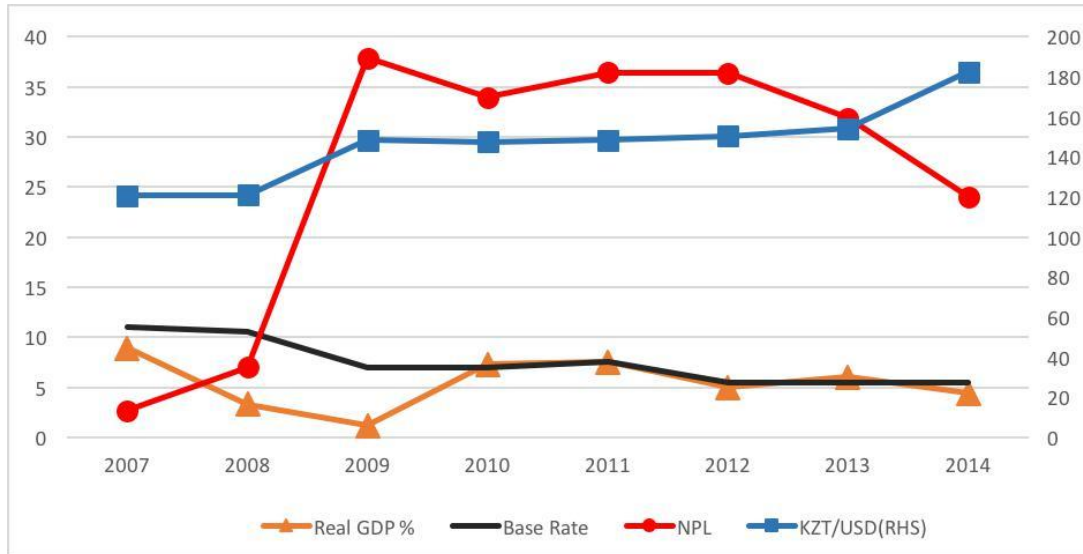
Figure 9: Dynamics of NPL Ratio in US and Europe, 2005-2015



Source: European Parliament policy briefing PE 574.400, 2016



Figure 10: NPL, GDP, Exchange Rate and Base Lending Rate, 2007-2014



Source: Author's calculations based on the data from the NBRK and Bloomberg

## List of Commercial Banks

Large:

1. Kazkommertsbank JSC
2. Halyk Bank JSC
3. Tsesnabank JSC
4. Subsidiary Bank Sberbank of Russia JSC
5. BTA Bank JSC
6. Bank CenterCredit JSC

Medium-sized:

7. Kaspi Bank JSC
8. ATF Bank JSC
9. Eurasian Bank JSC
10. Alliance Bank JSC
11. Bank RBK JSC
12. House Construction Savings Bank JSC
13. Temirbank JSC
14. Nurbank JSC
15. Citibank Kazakhstan JSC

Small:

16. Delta Bank JSC
17. Subsidiary Bank Alfa-Bank JSC
18. AsiaCredit Bank JSC
19. Qazaq Banki JSC
20. Altyn Bank JSC

21. Bank of China Kazakhstan JSC
22. Home Credit Bank JSC
23. KazInvestBank JSC
24. Bank ExpoCredit JSC
25. Capital Bank Kazakhstan JSC
26. Eximbank Kazakhstan JSC
27. AB KZI Bank JSC
28. Tengri Bank JSC
29. Zaman-Bank JSC