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Master's thesis

Machine learning techniques in Kazakhstan banks' sustainability assessment

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by

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Abstract

The research aims to find new approaches in bank sustainability assessment. During the last 15 years banks in Kazakhstan were affected by several global crises. Those events led to significant problems within the financial sector, which resulted in serious consequences. Untimely and incomplete identification of problems required governmental financial support or even liquidation of those banks. One basic problem appears to be the lack of an appropriate mechanism for preventive reaction. This thesis uses an approach of estimating bank's sustainability via invented Bank Sustainability Index (BSI) and Weighted Average Bank Sustainability Index (WABSI). BSI reflects liquidity, capital adequacy and credit portfolio nature of the bank. Such indicators help to determine the current position of a particular bank as well as the overall performance of the bank sector at a given point of time. Machine learning techniques were used as practical tool for models development. Those models allow one to make predictions and reveal which economic indicators most affect the financial system. The research provides comprehensive overview of the banking sector of Kazakhstan and analysis of reasons of default cases.

Keywords: sustainability of banks, financial sustainability, risk management, machine learning in risk management.

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1. Introduction

Kazakhstan established its own independent financial system in 1991. Since then the country has faced different crises and collapses, all of which affected economic stability in the region. The banking system is an important area for scientific research in that it covers all business activities, transactions, and interrelations among institutions. Being aware of critical events that impacted banks in the past, allows for the reduction of the risks of their repetition in the future. The work conducted covers areas of risk management, economics and finance.

This research revealed interdependence between factors affecting the banking system and the sustainability of banks. Moreover, the results of this research provide an opportunity to obtain processed monthly Bank Sustainability Index based on official reports. The index reflects the current situation of bank industry and highlights those banks that have problems. Such identification helps regulators undertake preventive actions. Machine learning techniques were used to develop forecasting models intended for the preliminary assessment of what will probably happen in the future. All calculations are done automatically based on prepared scripts according to the specific methodology.

Current problems of banks in Kazakhstan include an increased amount of retail credit facilities and growth of non-performing loans (NPL). For this reason, the research is aimed to elaborate preventive algorithms that will identify potential problems based on historical information. More specifically, the following research questions were addressed:

How can the sustainability of banks be measured?

What are the main factors affecting a bank's sustainability?

Which machine learning algorithms are the most efficient in bank sustainability assessment?

The research provides a comprehensive review of literature, conceptual frameworks and banking industry practices regarding risk management and machine learning. The primary research methods for this study are quantitative research methods and model development. Databases of National Bank of the Republic of Kazakhstan, The Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan, Kazakhstan Stock Exchange (KASE), Bloomberg and Thomson Reuters were used in this research. Additional tools such as SQL and R programming languages were used for machine learning model development. Moreover, RStudio software reinforced regression analysis, which allowed predictions to be made.

2. Literature review

A substantial amount of sources were considered before starting the research. This literature review covers the main ideas, frameworks, articles and methodologies related to bank sustainability assessment and machine learning. Thus, such completely different areas intersect in examining certain economic phenomena by applying modern machine learning techniques and software.

Economic stability is considered as the ability to conduct usual operations with limited resources as much and for as long as possible. Válek. and Jašíková (2013) examined sustainable and unsustainable systems. According to them sustainability depends on human resources and overall culture of the country. People create products, services and goods by using debt. Paid interest generates new money and this process continues indefinitely . An educated and highly skilled population living in the country with an appropriate political system tends to increase wealth of country, then this strengthens the system. (Válek & Jašíková 2013)

People are usually concerned about a bank's sustainability because of their savings, money they owe or simply carrying daily transactions. However, there is no strict methodology for how to assess the stability of bank. Therefore more detailed attention was paid to banks that were successful over a long period of time and survived during world crises. For instance, a World Bank publication refers to Grameen Bank's, which has flourished since 1983 in Bangladesh. The bank provided poor people access to credit facilities. People were united in separate responsibility groups, instead of pledging physical collateral. Changing minds of citizens positively affected the repayment rate which was always stable at 90% level. Group accountability improved social level, reduced unemployment of the country and allowed to take loans at lower interest rates. Grameen Bank was stable and had a low level of non-performing loans (NPL) (Khandker, Khalily & Khan, 1995).

Weber (2005). suggests a methodology for assessment of the sustainability of European banks and financial service organizations by conducting research with qualitative and quantitative methods. It has multi-level design consisting of several stages such as screening, benchmarking and detailed interviews. Benchmarking stage involves banks' sustainability assessment with regards to the following criteria: internal operations, investment and credit businesses. For example, energy consumption, use of paper and other aspects are investigated within internal operations criterion. Nevertheless, bank is considered from business side whether the bank invests in sustainable projects or creates sustainability advisory board. Providing loans to sustainable companies or projects, paying attention to environmental impact of the loan, transparency etc. are scrutinized in credit business criteria. If banks are supporting projects related to production of military goods, tobacco and fossil fuels and non-sustainable use of natural resources etc. they were evaluated imperfectly. Broadly speaking, banks align their strategy with main

sustainability ideas. It has been proven that European banks are stable due to providing finance to ecological, social and useful projects (Weber, 2005).

Similar concepts are represented in Jeucken's (2004) work, which considers sustainability in finance. Numerous banks representing different countries were selected based on their assets and equity capitalization. The sustainability of banks was evaluated by examining the effect of macroeconomic factors such as GDP, unemployment etc. Moreover, concepts of corporate governance, risk management practices and impact of environmental changes were used as critical indicators. Results indicate that banks tending to sustainable development are more successful (Jeucken, 2004).

However, success and sustainability requires more attention to the vulnerable points of banks. For this reason strong risk culture should be established. The risk management function helps to minimize uncertainty in a bank. Härle, Havas and Samandari (2016) state that future risk management will be focused on automatic identification of potential threats. Machine learning techniques will help to produce algorithms for credit underwriting, monitoring and fraud detection. As a result, it reduces operational costs as well as undesirable losses. Nowadays, bank industry leaders already use machine learning in risk management reporting, which automatically determines risks in the bank and propose solutions (Härle, Havas & Samandari, 2016).

The practical use of machine learning in risk management was considered by Chitra and Subashini (2013). According to their research, machine learning algorithms help to identify which borrowers will definitely repay loan and which ones will not. Predictions of non-performing loans (NPL) were made based on behavior of clients and historical information which helps to prepare forecasted amount of reserves on defaulted facilities. In this particular case, supervised machine learning is used which predicts the value of the dependent variable based on previously known independent variables. It involves training of model, which fits target. Main techniques are: Decision Tree, Regression Models, Naive Bayes etc. Unsupervised machine learning is another type, which does not use dependent and independent variables. It uses Apriori, k-Means, Non-Negative matrix factorization techniques and implement association, clusterization and anomaly detection functions. An unsupervised algorithm is built without preliminary-known guide information (Chitra & Subashini, 2013).

Aziz and Dowling (2019) have examined the practical use of machine learning in credit, market and operational risk assessment. Credit risk arises when a counterparty is not able to fulfill its obligations, which may lead to losses of the bank. Banks use linear, logistics or probit machine learning techniques for the purpose of modeling credit risks. As an example, changing the maturity and rating group on the credit default swaps (CDS) market helps to predict event of default and estimate potential loss. Market risk reflects losses resulting from changes in interest rates and market prices. It may be observed in determination of effect of change in market rate on the price of bond or changes in market indices. Machine learning techniques are used in stress testing of market models that monitor trading activities. Algorithms analyze deviation and fluctuations of assets before taking different

positions. Such preliminary analysis may prevent large losses due to market risk. One of the important areas in a bank's risk management is operational risk. Operational risk may arise due to the failure of internal systems or external events. It mostly applies classification and clusterization machine learning algorithms for credit card fraud detection, money laundering etc. (Aziz & Dowling, 2019).

The concepts and frameworks mentioned above provide a clear view of how sustainability concept can align with risk management function, which has updated by use of modern machine learning techniques. This combination of topic have significant impact on the conducting this particular research. Methodology of this research reflects main factors that affect banks sustainability. Moreover, it has been reinforced by new creative approaches in terms of banks sustainability assessment.

3. Overview of banking system of Kazakhstan

The new history of the financial system in the Republic of Kazakhstan started after gaining independence in 1991. Being a part of the former Soviet Union the country inherited certain economic and financial systems. However, it was rebuilt on the 15th of November 1993, when a new national currency, Kazakhstani Tenge (KZT), was introduced by the National Bank of Kazakhstan. National Bank of Kazakhstan is the central monetary authority, responsible for monetary policy in the country.

During the modern history, the country went through different crises, economic shocks, currency devaluations and other economic phenomena that will be considered later. Secondary-tier banks are represented by commercial, retail and mortgage banks. Several banks are the subsidiaries of foreign banks.

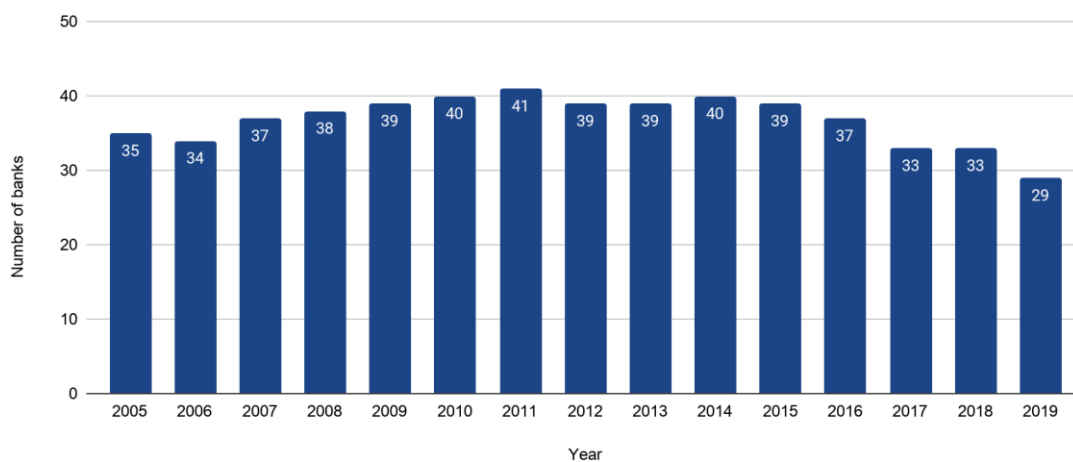


Figure 1: Number of banks in Kazakhstan from 2005 to 2019

The illustration above shows the number of banks in existence from 2005 to 2019. Such data is available on the National Bank’s official website. It has to be taken into account that during this time horizon total number of financial institutes has declined from 35 to 29 from 2005 to 2019 respectively, although some small intermediate increases are observed. Moreover, the number of institutions notably decreased since the 2014-2015 Russian crisis. Due to economic sanctions against Russia, Kazakhstan’s economy was affected as well.

A full list of existing banks and banks with terminated licenses is outlined in Appendix 1 and Appendix 2. Banks that remained operational during this period are marked by green color, while banks with terminated licenses are colored in red. 14 banks had their licenses terminated for various reasons, which will be considered in following chapters. However, a significant number of banks were opening each year as well, fueled by economic growth and development of financial system. Several banks went through merger and acquisition (M&A) procedures. Some were liquidated according to the Kazakhstan Rehabilitation and Bankruptcy Law.

3.1 Background

In order to identify the reasons of bank's license termination the nature of the problems of the banks should be considered. Detailed information on the disposition of the banks is disclosed in Appendix 2. Many cases have been observed since 2005. Highlights are as follows:

Tsesnabank was one of the largest banks that provided loans mostly for agricultural companies. It was involved in takeover by First Heartland Bank in February 2019. Prior to this takeover, Tsesnabank's \$1.6 billion of bad debt was purchased by the state Problem Loan Fund under the Ministry of Finance of Kazakhstan. It has to be taken into account that a new Chair of the Board of Directors and new Board members were appointed in January 2019. The previous Chair of the Board had been replaced in September 2018, and Chief Risk Officers were changed several times during the year. The bank had liquidity problems and made several attempts to attract money by ordering different packages of bonds. Their loan portfolio had been shrinking since January 2018, while non-performing loans (NPL) has dramatically increased in January 2019. Moreover, Standard & Poor's lowered the credit rating of Tsesnabank from "B-/B" to "SD-selective default" at the beginning of February 2019 (Thomson Reuters Eikon, 2019).

The history of First Heartland Bank started from ABN AMRO Bank Kazakhstan. This bank was acquired by The Royal Bank of Scotland Kazakhstan (RBS) as part of a worldwide acquisition process in 2008. RBS since determined that the Kazakh market was not a priority for development, and decided to sell all branches in Eastern Europe and Central Asia. Bank ExpoCredit acquired the Kazakhstan branch of RBS in 2016. Bank ExpoCredit was owned by an individual Russian investor. Finally, this investor sold this bank to the brokerage company, which renamed Bank ExpoCredit to First Heartland Bank (Bloomberg, 2016).

Bank TuranAlem (BTA) is one of the famous cases of Kazakhstan's banking history. The former Chair of the Board left the country after committing a crime related to money laundering in 2005. 2008 was known as a year of rebranding of BTA. However, the bank announced technical default in 2009 and was nationalized in February of that year. Thereafter KAZKOMMERTSBANK bank purchased a 50% interest in BTA from Samruk Kazyna National Wealth Fund. This transaction was supported by transferring operational control from National Wealth Fund to KAZKOMMERTSBANK. BTA has undergone debt restructuring twice, but its liquidity problems have not been resolved (Thomson Reuters Eikon, 2009).

KAZKOMMERTSBANK's rating was downgraded by Fitch because of deposit outflow in 2016. Injections from national budget were made in amount of 400 billion and 200 billion tenge in 2016 and 2017 respectively. The bank was renamed from KAZKOMMERTSBANK to Qazkom in November 2016. Qazkom and Halyk Savings Bank of Kazakhstan confirmed the acquisition of Qazkom Bank in July 2017. Prior to closing this deal, Problem Loan Fund under the Ministry of Finance of Kazakhstan purchased bad debt from BTA totaling 2,400 billion tenge. This amount was used to repay the loan given by Qazkom, therefore Qazkom

was represented as a healthy bank to be acquired by Halyk Savings Bank of Kazakhstan. Finally Qazkom was merged to Halyk in July 2018 and is now operating as Halyk Savings Bank of Kazakhstan (Bloomberg, 2018).

Alliance Bank is the second case of a bank which was nationalized. Standard & Poor's lowered the credit rating of the bank to "D/D" in June 2009. Moreover, the bank was delisted from London Stock Exchange (LSE) and Kazakhstan Stock Exchange (KASE) in 2009. Before being delisted Alliance Bank's investor raised \$704 million in bank's IPO. Over time the bank confirmed the plan of restructuring debt with creditors totaling \$4.5 billion dollars that was reduced to \$1 billion. Bank was fined by the monetary authority for incorrect representation of financial statements particularly in the case of the terms of guarantees totaling \$1.1 billion given to non-residents (Thomson Reuters Eikon, 2009).

Temirbank was acquired by BTA in December 2006. However, Samruk Kazyna nationalized this bank in May 2010. A plan for debt restructuring was developed. Obligations amounting to \$1.4 billion were restructured to \$700 million. Alliance Bank and Temirbank were sold to a private investor, the owner of METROKOMBANK, in 2013. METROKOMBANK had been renamed to ForteBank in 2012. Eventually Temirbank and Alliance bank were merged into ForteBank. More recently ForteBank has finalized a deal with Kassa Nova bank to become a subsidiary of ForteBank (Thomson Reuters Eikon, 2013).

Bank of Astana went through the liquidation process due to systematic violation of the law. It was subject to administrative sanctions and fines on several occasions from June 2015 on. Most of the sanctions were related to improper performance of contractual payment obligations, insufficient representation of financial reports, non-compliance with prudential requirements, not full disclosure of shareholders and affiliates. Bank of Astana launched an IPO in June 2017 followed by a secondary offering in December 2017. Fitch and Standard Poor's downgraded the rating of Bank of Astana from "B" to "CCC" in April 2018. Finally, the National Bank suspended its license in May 2018 (KASE, 2018).

EXIMBANK KAZAKHSTAN's license was revoked by National Bank in May 2018. During 2018 bank demonstrated poor financial performance, and was fined by the administrative court several times for systematic violation of the law and low quality of management performance. There was a 30.7% reduction in asset value according to IFRS-9 standards. (KASE, 2018).

Qazaq Bank inherited its name from Senim Bank in June 2013. Previously Senim-Bank was prohibited from conducting depository operations. The bank was regularly fined by the oversight authority dating back to October 2016. There were plans for a merger with Bank RBK initiated in May 2017, however, the banks abandoned the process in October 2017. This month the Qazaq Bank has faced with enormous amount of cash withdrawals that caused liquidity problems. Standard & Poor's lowered its long-term issuer credit rating to "CCC-" from "CCC+" (Thomson Reuters Eikon, 2013).

Delta Bank's license was revoked by the National Bank in May 2017, and the process of liquidation started. The bank was fined regularly due to non-compliance with regulatory

requirements. The limitation for attracting deposits from individuals was imposed by National Bank in December 2016 previously. Furthermore, Standard & Poor's has downgraded Delta Banks's credit rating to "D" in February 2017. Before being Delta that bank was named as Neftebank (KASE, 2017).

Kazinvestbank confirmed technical default in December 2016, at the same time its license was suspended. The bank faced severe problems with obligations fulfillment, payments and transfer transactions. Periodic violation of law requirements, aggressive growth in loan portfolio, with depreciated collateral and insufficient provisioning led to liquidation of bank. The bank's assets and liabilities were partially assumed by ALFA BANK (KASE, 2016).

EU Bank acquired 100% of Pozitiv Bank Kazakhstan in 2016. After this bank was joined to Eurasian Bank. Before this transaction has been made Bank Pozitiv Kazakhstan was previously known as Demir Kazakhstan Bank, which was purchased by Pozitiv Bank in June 2008. As a result EU Bank, which is a subsidiary of Eurasian Bank and acquired Bank Pozitiv Kazakhstan were fully joined to parent bank in 2015 and 2016 respectfully. (Thomson Reuters Eikon, 2016)

Danabank was acquired by Punjab National Bank and was renamed PNB - Kazakhstan in 2011. It was subsequently renamed again to Tengri Bank in 2016. Last 12 months the bank was planning to merge with Capital Bank and AsiaCredit Bank. The final decision of shareholders is planned to be made in May 2020 (Thomson Reuters Eikon, 2020).

LARIBA-BANK was renamed AsiaCredit Bank in 2009. A plan to merge with Tengri Bank and Capital Bank has been discussed. The Chair of the Board was changed twice within a one year period, in July 2018 and January 2019 (Thomson Reuters Eikon, 2019).

TAIB Kazakh Bank was established by Bahraini financial group. The bank was purchased by a private investor, who also owns AsiaCredit Bank, and renamed Capital Bank Kazakhstan in 2014 (Thomson Reuters Eikon, 2014).

TexaKaBank was one of the first foreign banks to enter the Kazakh market. Its American style of management, strategy and growth has kept this bank on the top of the list of growing banks. Although TexaKaBank was purchased by Russian Sberbank in 2007, it continues to develop further (Bloomberg, 2007).

Alash Bank was renamed Kazinkombank in 2005. It was undercapitalized before RBK Bank invested in the bank in 2011. Currently RBK Bank is owned by a private investor. An ex-advisor to the Chair of the Board of the bank was convicted of money laundering and fraud, resulting in 144 billion tenge being stolen from the bank during the period of 2011-17.. The same person was CEO in several different banks, none of which exist today. (Thomson Reuters Eikon, 2014).

British HSBC Bank sold its Kazakh branch to Halyk Savings Bank of Kazakhstan in November 2014, and this subsidiary bank was renamed Altyn Bank. Under the management of Halyk Savings Bank of Kazakhstan, the bank has shown stable financial

performance. However, control shares were sold to China CITIC Bank Corporation in April 2018 (Bloomberg, 2018).

MB Alma-Ata Bank was bought by Dutch Bank Home Credit in 2009. Russian Branch of Bank Home Credit purchased the shares of this bank in February 2013 (Thomson Reuters Eikon, 2013).

Credit Altyn Bank was restricted in banking activities due to lack of the internal control and poor risk management, in addition it was found to be undercapitalized in 2010.

Masterbank was voluntarily reorganized from a Joint Stock Company (JSC) to a Limited Liability Partnership (LLP) in 2010. Masterbank transformed its activities in micro credit financing. This bank was owned by the same individual, who was an investor of Bank ExpoCredit.

Express Bank was also reorganized as a Limited Liability Partnership (LLP) by voluntary withdrawal of bank license and permission of National Bank of Kazakhstan in July 2009.

Subsidiary of Russian Valut Tranzit Bank (VTB) was temporarily restricted to conduct financial activities in Kazakhstan from 2007 to 2008 due to non-compliance with law requirements. VTB bank reentered the market in July 2009 by providing services to corporate clients.

The license of Industrial Bank of Kazakhstan was suspended because of misstatement in financial reports and systematic violation of law requirements. Bank terminated its activities in 2007.

3.2 Key reasons of defaults

Analyzing the problems of the above Kazakhstan's banks that no longer exist reveals a similar pattern. Some of the issues the banks had in common are:

- Systematic violation of law – Several banks were found to be in violation of National Bank requirements. Most of fines were related to non-compliance with prudential requirements. Prudential requirements are known as key indicators of financial performance of second-tier banks. Several coefficients such as liquidity, solvency, leverage, and risk are considered (Samantaraya 2007,2). Those triggers should not deviate from the prescribed value. If the bank is fined 3 or more times during the certain year, the bank's license will be withdrawn immediately.
- Liquidity problems - This problem arises from the inability to cover liabilities of bank when the due date occurred. Usually banks enter in different positions to attract funding for short period of time. Unfortunately, banks enter into long and foreign exchange positions, which are closed with help of government.
- Credit rating downgrade - Before the bank's license is withdrawn, credit agencies will react to the financial performance of bank. In the event of financial difficulties, they

will downgrade short-term and long-term credit ratings supported by worldwide distributed announcements. This event negatively affects the bank.

- Governmental aid and injections – The Kazakh government helped second-tier bank several times, basically through the purchase of bad debts by Problem Loans Fund under the Ministry of Finance of Kazakhstan. Such financial injections are funded from national budget. Government tries support systemically important banks to ensure they do not fail. Therefore it enters only in time of crises by nationalization of banks that are in the list of Top-5.
- Changes in Board of Directors - Most of banks that no longer exist had changed their Board of Directors composition, CEO and CRO several times exactly one year before termination. Such changes might be caused by new shareholders decision or different motives.
- Ownership - Most of Kazakhstan second-tier banks are owned by individuals or affiliated companies owned by those individual investors. Some bank owners are closely related to politicians that have significant impact on operating decisions
- Merger & Acquisition - The willingness to merge with a stronger bank may indicate potential problems of another bank. Bank announces the desire to be merged or acquired by foreign investors or existing financial institutions. It depends on the willingness and confidence in this deal from both sides. This process takes from 1 up to 2 years, which involves banks, consultancies and authorities.
- Initial Public Offering (IPO) and Secondary Public Offering (SPO) - Banks will issue an IPO in order to sell shares of current owner to the public or institutional investors or attract funding from equity markets. **3.3 Ownership structure and representative countries**

Several types of owners of the banks are observed. 60 banks were considered, some of those banks continue to exist, while some have been merged or acquired. For a number of banks their license was withdrawn.

During its independent history, Kazakhstan was opened for the foreign investors. Such interest began in 2002, when the system was more or less established and market was very attractive for foreign investors, due to new opportunities in the new emerging markets of the Central Asian countries. Figure 2 shows the type of owners of Kazakhstan banks. Banks were mostly owned by sole private investors (35%) followed by commercial banks (16.7%) and private investor groups (16.7%). Private investor groups usually numbered from 2 to 10 people. It provided that more than a half of financial institutions are owned by group of people, hence it may cause several risks for the whole system. However, the only 15% of banks are owned by different foreign governments through the parent banks that they own. The only 11 banks were owned by holding companies, financial groups and services companies, investment and brokerage companies.

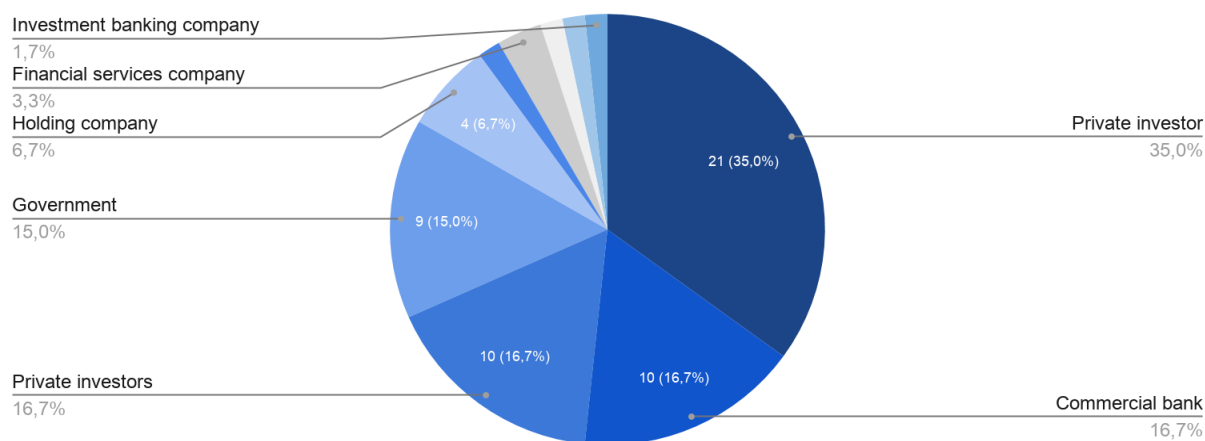


Figure 2: Ownership structure of banks in Kazakhstan

It has to be considered that banks in Kazakhstan are, or were, operating not only with capital of domestic investors but also with foreign participation. 58.33% of banks in Kazakhstan were owned by domestic investors. Only 3 banks are joint banks with foreign and domestic participation. Outstanding share of foreign investors - 36.67%. However, it represents whole picture since 2005 till 2019.

For instance, Micco, Panizza and Yañez (2004) investigated the relationship between ownership structure of the bank and its performance, using data covering bank ownership structure in 119 countries. For the performance assessment, variables such as ROE, ROA and NPL were used. Results indicate publicly owned banks are more profitable than solely owned or state owned banks, and developing countries have significantly higher levels of NPL than industrial countries. Another important finding is that the banks with foreign capital participation positively affect the overall financial system. They are more profitable due to low overhead costs, experience and highly skilled personnel (Micco, Panizza & Yañez 2004, 31).

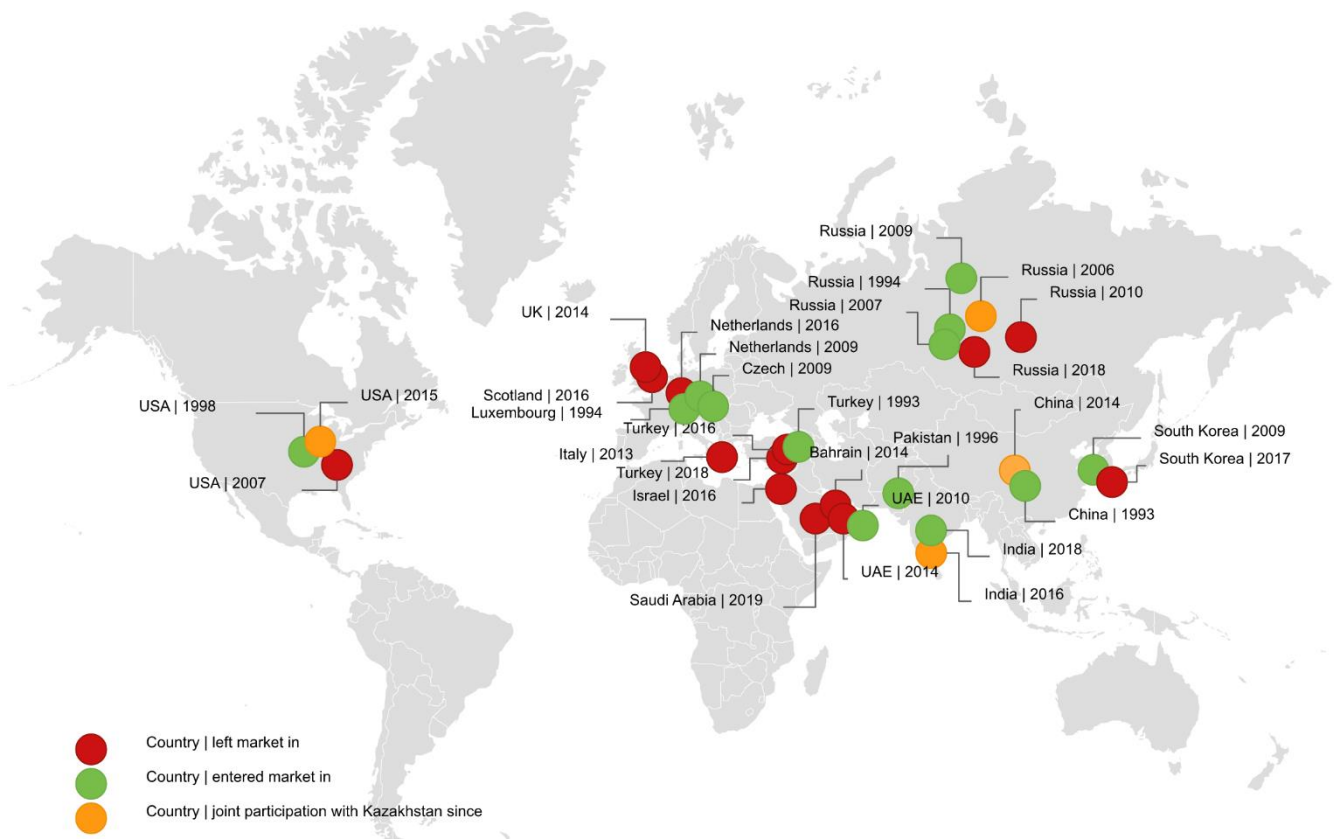


Figure 3: Shareholders of banks by country of residence

Figure 3 illustrates the countries of origin for banks that entered or left Kazakhstan over the years. The first bank that sold its shares was American TexaKaBank in 2007. In 2008 Turkish Demir bank and Dutch ABN AMRO Bank left the market. Afterwards the bank LARIBA-BANK was acquired by Kazakhstani bank. The owner of Masterbank also decided to terminate its activities.

Large financial players such as Italian UniCredit sold its shares of ATFBank in 2013, then Bahraini TAIB Bank has sold its stock of Kazakhstani bank to private investor. It was supported by the acquisition of Bahraini TAIB Bank by Dubai Financial Group. HSBC's brunch was sold to the shareholders of Halyk Savings Bank of Kazakhstan in 2014.

The Royal Bank of Scotland sold its branch in 2016. Indian Punjab National Bank also sold part of its shares to Kazakhstani investors the same year. Moreover, bank was renamed to Tengri Bank and continued to provide services to the clients further. Turkish-Israeli PozitifBank sold their shares to Eurasian Bank in 2016. In addition, the Russian investor and owner of Bank ExpoCredit sold his shares to First Heartland Bank. South Korean KOOKMIN, which owned BankCenterCredit sold its part to the private investor. Summarizing all Kazakhstan was interesting to the largest financial groups and banks during emerging period till 2008-2009 crisis. Due to financial instability in the region and political risk investors decided to leave the country.

Today 14 banks have foreign capital participation, including: American Citibank, Russian Sberbank, ALFA BANK, VTB Bank and HomeCredit Bank; Chinese Subsidiary Bank of China, Industrial And Commercial Bank of China, and partially Chinese Altyn Bank;

Turkish KZI Bank; partially Indian Tengri Bank, Korean Shinhan Bank; Pakistani Subsidiary Bank of National Bank of Pakistan; Islamic Al-Hilal Bank of United Arab Emirates.

Several details should be considered deeper. Russian ALFA BANK is owned by parent company from Luxembourg, while HomeCredit Bank is owned by affiliates from Netherlands and Czech Republic. KASPI BANK's shareholders include representatives of a Russian private equity firm and Goldman Sachs.

3.4 Credit ratings

Credit rating is the aggregate indicator that illustrates outlook of the financial institution to fulfill financial obligations based on previously conducted transactions. There are three credit agencies provide an assessment: Standard & Poor's (S&P), Moody's and Fitch. Those ratings are provided in short-term or long-term perspective (Hull & Predescu & White 2004, 2790). Following type of credit ratings were considered in this research particularly:

- Standard & Poor's (S&P) - Long-term issuer rating for foreign, domestic and national domestic scale ratings are reported with the relevant outlook. S&P's rating scale is, going from strongest to weakest, AAA, AA, A, BBB, BB, B, CCC, CC, C, D.
- Moody's - Long-term bank deposit rating in foreign or local currency reflects a bank's ability to repay deposit obligations in a timely fashion, with reflecting expected financial loss on default. Moody's national issuer rating is included. Moody's scale, from strongest to weakest, is Aaa, Aa1, Aa2, Aa3, A1, A2, A3, Baa1, Baa2, Baa3 (prime ratings) and Ba1, Ba2, Ba3, B1, B2, B3, Caa1, Caa2, Caa3, Ca, C (not prime ratings).
- Fitch - Long-term issuer rating in foreign and local currencies and national scale rating in foreign currency were considered. Fitch's scale, from strongest to weakest, is AAA, AA, A, BBB, BB, B, CCC, CC, C, RD, D. National rating has similar scale with noted country indicator in brackets.

Issuer is rated in foreign or local currency in case of having capacity to meet obligations in different currencies. National scale represents ability to meet financial obligations relatively to other issuers within specific country. Plus and minus signs show relative standing of the bank according to the rating category. Positive, stable and negative outlooks determine whether the rating may be raised, remained or lowered respectfully. All credit ratings are represented in Appendix 4.

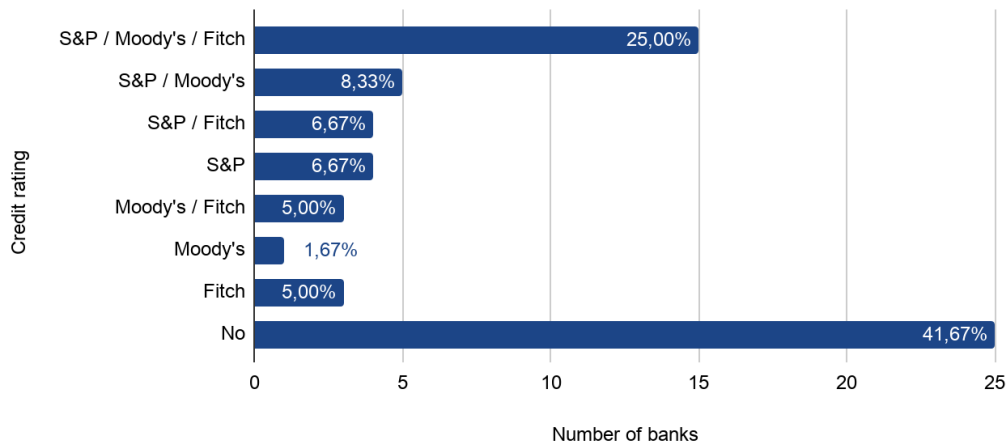


Figure 4: Credit ratings of banks in Kazakhstan

As noted in Figure 4, only 58% of banks in Kazakhstan were rated by global credit agencies. The other nearly 42% have not been rated at all since 2005. A credit rating reflects an independent view of the bank's level of credit quality and creditworthiness. 25% of banks, that are most interested in attracting debt from foreign markets have been rated by all three agencies. Other banks have ratings from two of the three agencies, while the other 13% of banks have a rating from just one.

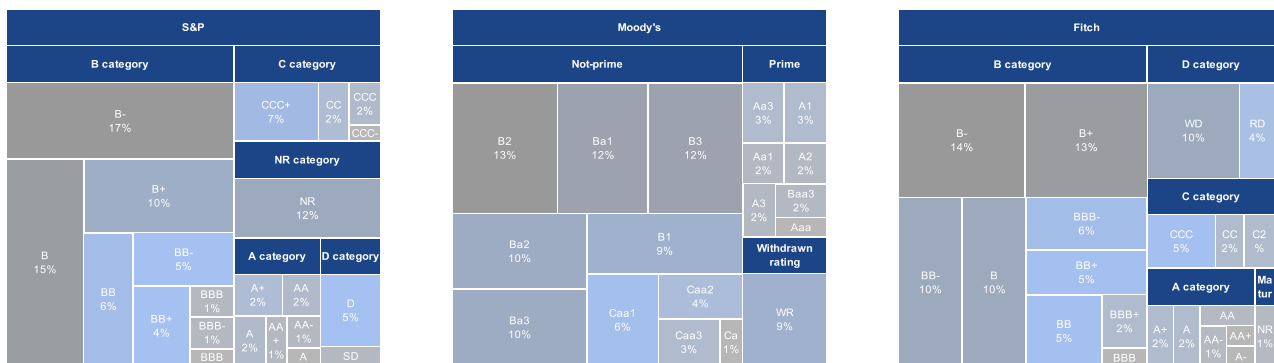


Figure 5: Long-term rating assignment events (Foreign)

Figure 5 above shows events of assignment credit ratings to Kazakhstani banks. S&P assigned its long-term issuer rating 162 times, Moody's long-term bank deposit rating 113 times and Fitch has assigned long-term default issuer rating 137 times. Those ratings are considered only in foreign currency. The total ratings figures cover all events related to rating assignment and changes since during the period of 1990 through March, 2020. Most of ratings are allocated in B category. According to S&P 5% of its rating were given to defaulted banks, for 12% of banks their rating was withdrawn. 66.4% of long-term bank deposit ratings were rated in the B category by Moody's, while 9% of ratings were withdrawn. Fitch's long-term issuer default rating was given in 66% of cases, while 15% of ratings were withdrawn or obtained status of restricted default.

4. Bank sustainability assessment

In order to identify potential problems, the Sustainability Index for Kazakhstani banks is created. It indicates the current position of each bank, highlighting those that face financial difficulties today. Data such as financial statements and prudential requirements were used from Bloomberg Terminal and National Bank's statistical data.

4.1 Bank Sustainability Index calculation methodology

Bank Sustainability Index allows for easy identification of banks with unstable performance. Current liquidity and capital adequacy requirement coefficients are calculated according to National Bank's Resolution #213 as of June 3rd, 2002. Following criteria were selected to obtain index:

- Current liquidity is important ratio reflecting a bank's ability to pay short-term liabilities within a 12 month period. High ratio represents high liquidity of assets. Banks were ranked from highest to lowest liquidity position.
- Asset growth indicates the growth rate of assets of the bank.. Negative growth shows outflow of assets, which causes liquidity risk. For this reason banks having negative rate were positioned at the bottom of the list.
- Capital adequacy requirement (CAR) reflects the sufficiency of equity and the quality of assets of the bank. In other words, this is ratio of equity to assets. Shareholder's equity should be sufficient in order to reduce risks.
- Level of NPL represents the proportion of non-performing loans (NPL) in the loan portfolio of the bank. A high proportion of NPL indicates credit risk. Banks having low share or even no NPL were ranked to the top positions.
- Level of provisioning is represented by calculation of NPL Coverage Ratio. It can be interpreted as how many times IFRS reserves exceed NPL. Banks with a low ratio are poorly assessed.

Banks are ranked from the best to the worst values within each particular criteria, then the position of the bank is multiplied by specifically calculated score. All calculations are done automatically according to the SQL script that was created for this purpose. Accuracy of the calculation was validated by comparing estimated index in Excel table and results obtained after running SQL script. The formula below shows how the score is calculated.

$$Score_{criterion} = \frac{n - p + 1}{n} \quad (1)$$

n – number of banks in particular month
 p – position number of the bank within criterion

The score is used to identify the relative position of each bank between each other within a particular criteria. SQL script identifies the number of banks that exist within a certain

month. For example, number of banks in December is 27, then the bank having lowest Current Liquidity coefficient will have position number 27 and a score of 0.04. It has to be taken into account that bank with highest performance will have 1st position in the list and score assigned will be equal to 1. This score subsequently applied in order to receive Bank Sustainability Index. Steps of calculation are represented in Figure 6.

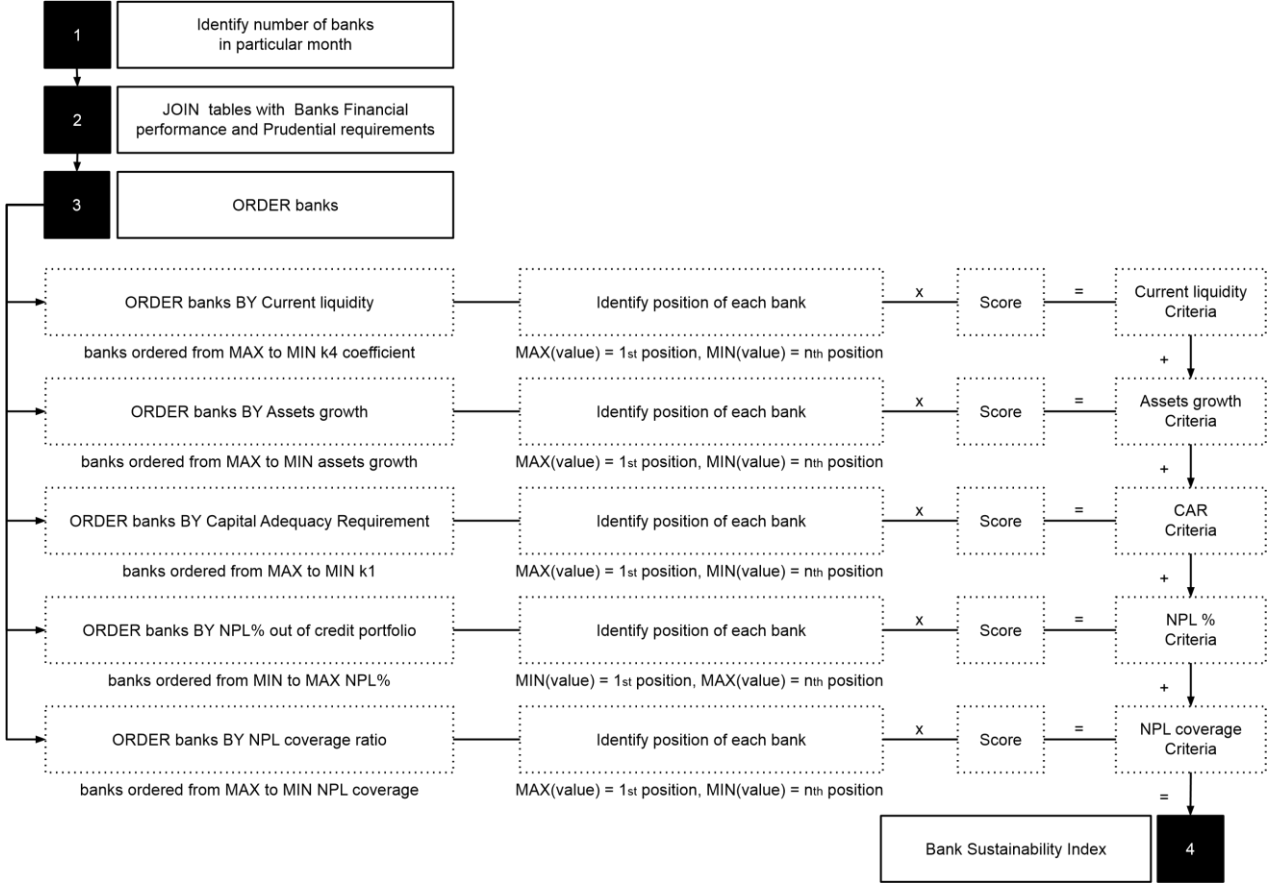


Figure 6: Bank Sustainability Index calculation steps

The figure above illustrates the sequence of operations that were conducted in order to calculate a Bank Sustainability Index for each bank. After joining input tables, the ordering process takes place. Banks are sorted and ordered according to particular criteria from maximum to minimum value by each criterion except NPL, which is ordered inversely. Then the process of positioning activates with the purpose of assigning a position number to the bank. The highest performance has 1st position number, then positions are automatically assigned from the first through the last bank in the list. However, if a bank has no NPL it will be positioned in first place and its score will be equal to 1.

For example, Capital Bank Kazakhstan JSC has the lowest value of Current Liquidity ratio, therefore it has position number 27, while SB JSC Bank Home Credit with highest Liquidity ratio has position number 1. After positioning process, position number of the bank within particular criterion is multiplied by score within the same criterion. Finally, scores are summarized into one index, which is the Bank Sustainability Index.

	Criteria					Criteria					
	Current Liquidity	Assets growth	Capital Adequacy	NPL out of credit	NPL coverage	Current Liquidity	Assets growth	Capital Adequacy	NPL out of credit	NPL coverage	

ticker	Positioning					Score					BSI
	Requirement	portfolio	Requirement	portfolio	Requirement	portfolio	Requirement	portfolio	Requirement	portfolio	
alhilal	17	4	5	1	1	0,41	0,89	0,85	1,00	1,00	4,15
zhsbk	5	6	9	6	8	0,85	0,81	0,70	0,81	0,74	3,93
altyn	21	1	14	5	1	0,26	1,00	0,52	0,85	1,00	3,63
tpbchina	22	24	1	1	1	0,22	0,15	1,00	1,00	1,00	3,37
zaman	10	3	8	26	2	0,67	0,93	0,74	0,07	0,96	3,37
bankchina	13	15	4	8	16	0,56	0,48	0,89	0,74	0,44	3,11
citibank	23	26	6	1	1	0,19	0,07	0,81	1,00	1,00	3,07
shinkhan	4	27	3	4	20	0,89	0,04	0,93	0,89	0,30	3,04
homecredit	1	10	22	11	15	1,00	0,67	0,22	0,63	0,48	3,00
nurbank	11	2	16	17	13	0,63	0,96	0,44	0,41	0,56	3,00
sberbank	14	8	19	12	6	0,52	0,74	0,33	0,59	0,81	3,00
jusan	2	20	7	25	10	0,96	0,30	0,78	0,11	0,67	2,81
nbpakistan	16	18	2	7	24	0,44	0,37	0,96	0,78	0,15	2,70
eurasian	7	9	26	23	5	0,78	0,70	0,07	0,19	0,85	2,59
kaspi	6	7	24	15	18	0,81	0,78	0,15	0,48	0,37	2,59
forte	8	16	15	18	14	0,74	0,44	0,48	0,37	0,52	2,56
halykbank	12	23	13	14	9	0,59	0,19	0,56	0,52	0,70	2,56
alfa	20	5	18	10	19	0,30	0,85	0,37	0,67	0,33	2,52
kzi	25	25	10	9	4	0,11	0,11	0,67	0,70	0,89	2,48
atf	19	12	25	16	3	0,33	0,59	0,11	0,44	0,93	2,41
rbk	3	13	20	21	21	0,93	0,56	0,30	0,26	0,26	2,30
kassanova	9	11	17	20	22	0,70	0,63	0,41	0,30	0,22	2,26
vtb	15	21	23	13	11	0,48	0,26	0,19	0,56	0,63	2,11
centercredit	18	14	27	19	12	0,37	0,52	0,04	0,33	0,59	1,85
tengri	24	19	21	22	7	0,15	0,33	0,26	0,22	0,78	1,74
asiacredit	26	22	12	24	17	0,07	0,22	0,59	0,15	0,41	1,44
capitalbank	27	17	11	27	23	0,04	0,41	0,63	0,04	0,19	1,30

Table 1: Bank Sustainability Index in December 2019

Table 1 represents results of calculated Bank Sustainability Index. The most sustainable bank is Islamic Bank Al Hilal JSC. The second is state-owned bank Housing Construction Savings Bank of Kazakhstan JSC. It should be noted that the top 10 banks are all banks that are owned by different governments and the world's largest financial institutions, indicating that foreign participation positively affects a bank in terms of compliance with regulation and a higher level of sustainability. More detailed view is reflected in Appendix 3. Some banks examined have a low index. Those banks have very low liquidity and a high proportion of NPL to the total credit portfolio of the bank. They do not have sufficient reserves to cover NPL. These banks are extremely likely to face default risk. The three banks with the lowest BSI are going to conduct M&A procedure in May 2020.

4.2 Comparison of Bank Sustainability Index and Credit ratings

Credit ratings can be used as benchmarks for comparison purposes. In case of deterioration of financial stability, global agencies will immediately react by downgrading the credit rating a bank. In this reason Bank Sustainability Index (BSI) was compared with credit ratings issued by global credit agencies such as S&P and Fitch. Table 2 shows global credit ratings transferred into a numerical scale as well as intervals of the Bank Sustainability Index.

Credit rating (S&P/Fitch)	Numerical scale	Index rating	Index	Numerical scale
AAA	10,00	AAA	≥ 4.6	10,00
AA	9,00	AA	4.3 - 4.6	9,00
A	8,00	A	4.0 - 4.3	8,00
BBB	7,00	BBB	3.3 - 4.0	7,00
BB	6,00	BB	3.0 - 3.3	6,00
B	5,00	B	2.0 - 3.0	5,00
CCC	4,00	CCC	1.3 - 2.0	4,00
CC	3,00	CC	1.0 - 1.3	3,00
C	2,00	C	0.6 - 1.0	2,00
D	1,00	D	0.0 - 0.6	1,00
NR	0,00	NR	= 0	0,00

Table 2: Index transformation table

Table 2 permits comparison between the global credit ratings and Bank Sustainability Index (BSI) rating. Transfer table helps to compare two ratings by assignment of numerical scales to each. Correlation between credit rating and BSI is 0.96. It states that calculated index is highly correlated with credit ratings that has been used as a benchmark.

ticker	assets	weight	BSI	WABSI	Interval	Credit rating	numerical scale	BSI rating	numerical scale
alhial	34,82	0,00	4,15	0,01	≥ 4.0	A	8,00	A	8,00
zhsbk	1 319,09	0,05	3,93	0,20	≥ 3.3	BBB	7,00	BBB	7,00
altyn	533,32	0,02	3,63	0,07	≥ 3.3	BBB	7,00	BBB	7,00
tpbchina	146,88	0,01	3,37	0,02	≥ 3.3	BBB	7,00	BBB	7,00
zaman	21,49	0,00	3,37	0,00	≥ 3.3	NR	0,00	BBB	0,00
bankchina	304,87	0,01	3,11	0,04	≥ 3.0	NR	0,00	BB	0,00
citibank	821,08	0,03	3,07	0,10	≥ 3.0	A	8,00	BB	6,00
shinkhan	45,93	0,00	3,04	0,01	≥ 3.0	NR	0,00	BB	0,00
homecredit	439,79	0,02	3,00	0,05	≥ 3.0	B	5,00	BB	6,00
nurbank	445,90	0,02	3,00	0,05	≥ 3.0	B	5,00	BB	6,00
sberbank	2 199,53	0,08	3,00	0,25	≥ 3.0	BBB	7,00	BB	6,00
jusan	1 301,32	0,05	2,81	0,14	≥ 2.0	B	5,00	B	5,00
nbpakistan	4,60	0,00	2,70	0,00	≥ 2.0	NR	0,00	B	0,00
eurasian	1 070,03	0,04	2,59	0,11	≥ 2.0	B	5,00	B	5,00
kaspi	2 075,98	0,08	2,59	0,21	≥ 2.0	BB	6,00	B	5,00
forte	1 905,90	0,07	2,56	0,19	≥ 2.0	B	5,00	B	5,00
halykbank	8 688,71	0,33	2,56	0,85	≥ 2.0	BB	6,00	B	5,00
alfa	571,97	0,02	2,52	0,06	≥ 2.0	BB	6,00	B	5,00
kzi	71,83	0,00	2,48	0,01	≥ 2.0	BB	6,00	B	5,00
atf	1 370,43	0,05	2,41	0,13	≥ 2.0	B	5,00	B	5,00
rbk	672,70	0,03	2,30	0,06	≥ 2.0	B	5,00	B	5,00
kassanova	122,94	0,00	2,26	0,01	≥ 2.0	B	5,00	B	5,00
vtb	189,67	0,01	2,11	0,02	≥ 2.0	BB	6,00	B	5,00
centercredit	1 464,89	0,06	1,85	0,10	≥ 1.3	B	5,00	CCC	4,00
tengri	133,35	0,01	1,74	0,01	≥ 1.3	B	5,00	CCC	4,00
asiacredit	75,22	0,00	1,44	0,00	≥ 1.3	CCC	4,00	CCC	4,00
capitalbank	81,51	0,00	1,30	0,00	≥ 1.3	CCC	4,00	CCC	4,00
Total	26 113,75	1,00		2,68		Correlation:			0,96

Table 3: WABSI and BSI ratings

4.3 Weighted Average Bank Sustainability Index (WABSI) estimation

Bank Sustainability Index is calculated to assess sustainability of each bank separately. The Weighted Average Bank Sustainability Index (WABSI) is introduced to obtain an overall understanding of how the banking system operates within a particular month.

$$WABSI = \sum_{i=1}^n BSI_i * w_i$$

WABSI – Weighted Average Bank Sustainability Index (2)

BSI – Bank Sustainability Index

w_i – weight of bank's assets in overall system

WABSI is estimated by summing all BSIs multiplied by the weight of each bank's assets within the aggregate assets in the bank sector in particular month. It allows for observation of the financial sustainability of the banking system over time.

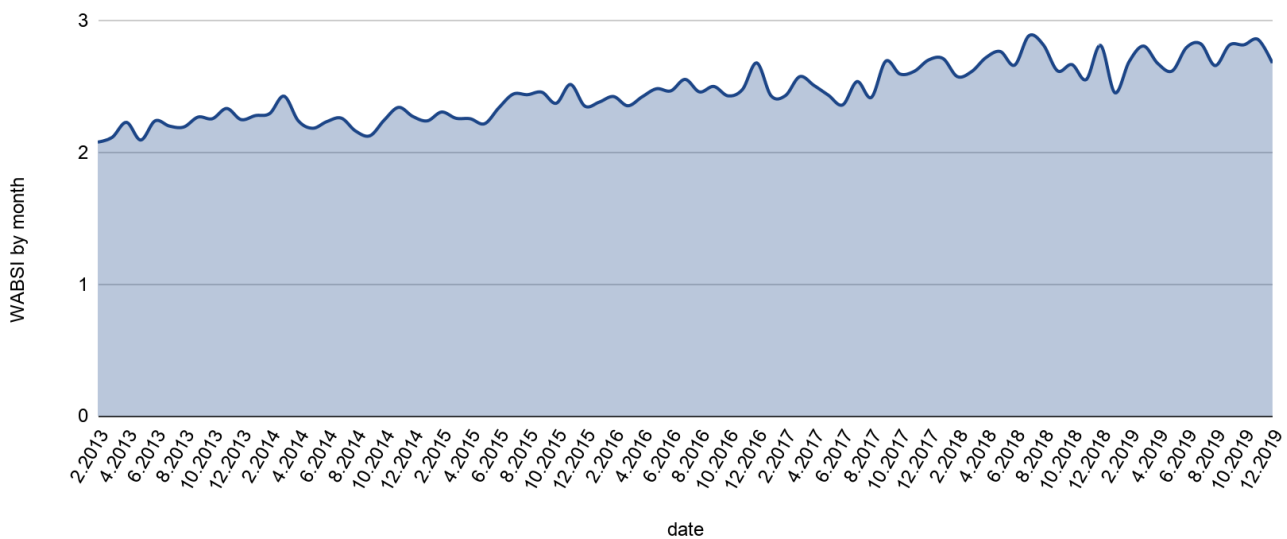


Figure 7: Monthly Weighted Average Bank Sustainability Index

WABSI represents the overall picture of banks sustainability of Kazakhstan. As we can see while it fluctuates over each month, a steadily growing trend can be seen. Significant changes can be observed after 2014 as well. Financial system has improved due to the fact that weak banks left market. If the sustainability of banks in 2019 is compared to that of 2013 , the financial system's stability improved by 29%.

5. Machine learning techniques

The 20th century is a century of an enormous amount of scientific discoveries, including machine learning. The basic concepts of machine learning were formulated earlier in the famous Least Square method and Bayes' Theorem. Machine learning is integrated area of mathematics, statistics, econometrics and computer science.

Machine learning is the collection of methods that are aimed to derive specific patterns in data for subsequent analysis and decision making. Moreover, machine learning helps to make forecasts by using probability and uncertainty concepts. There are two type of models determined. The first one is a parametric model, which is limited by certain amount of parameters. The second model type is a nonparametric that implies increasing amount of parameters with increased volume of data trained (Murphy 2012, 16).

Machine learning can bel classified as three main types: supervised, unsupervised and reinforcement machine learning. Supervised learning is represented as the type of machine learning that generates results based on specified and known in advance cases and data. There are two subtypes of supervised machine learning, regression and classification. Regression model copes with a sample of data from which mathematical function might be derived for forecasting. Unsupervised learning is aimed on autonomous data mining and categorization. It makes comprehensive source of data that is aggregated by predefined criteria. Subtypes include density estimation and clusterization are defined. Subsequently it is used in supervised machine learning. Reinforcement learning is a more advanced approach that comes together with supervised learning, but is more concentrated in analysis of behavior of certain value and generation of feedback (Sugiyama 2015, 4). The most appropriate type of machine learning techniques for this research is supervised models. Data that has been gathered can be applied only for linear multivariate regression, logistic regression and Naive Bayes' Classifier.

5.1 Linear multivariate regression

In order to identify how macroeconomic indicators affect WABSI, a correlation matrix was built. Table 4 shows that unemployment as well as oil prices negatively affect WABSI, while GDP and CPI have almost no correlation with WABSI. As GDP is available only on a quarterly basis, a monthly alternative of GDP was taken into account, denoted as Short-term Economic Indicator (STEI). STEI demonstrates a positive correlation with WABSI. Correlation analysis helps to select variables for multivariate regression model construction. However, variables with statistically significant estimates will be included in the model.

	wabsi	unemployment	gdp	cpi	oilprice	stei
wabsi	1					
unemployment	-0.819449949	1				
gdp	-0.023351486	0.14805167	1			
cpi	-0.060892129	0.083125444	-0.710004157	1		
oilprice	-0.468418772	0.596626818	0.654014991	-0.42451998	1	
stei	0.239079776	-0.111405162	0.684687166	-0.499211529	0.26418509	1

Table 4: Correlation matrix

Linear regression allows to reveal interdependence between multiple variables. It can be described using the formula below:

$$y(x) = w^t x + \varepsilon = \sum_{j=1}^D w_j x_j + \varepsilon \quad (3)$$

Where $w^t x$ is the scalar product between x and w^t and residual error ε . Also weight w can be noted as β coefficient, which shows sensitivity. Weighted Average Bank Sustainability Index (WABSI) was selected as the dependent variable. Multivariate regression model allows to determine how particular economic indicators affect WABSI. Independent variables such as Short-term Economic Indicator, Unemployment and CPI were included in the model.

The model below shows how estimated coefficients of Short-term Economic Indicator (stei), Unemployment rate (unemployment) and CPI (cpi) affect WABSI. The model includes 84 observations from 2013 to 2019. Data was split into samples of train and test datasets, according to the proportion 0.7 and 0.3 respectively. It was implemented with the help of machine learning library caTools in R that allows to create samples randomly.

Multivariate regression Estimation Results:

Call:

lm(formula = wabsi ~ stei + unemployment + cpi, data = train)

Residuals:

	Min	1Q	Median	3Q	Max
	-0.26002	-0.09560	0.01694	0.08941	0.22023

Coefficients:

	Estimate	Std. Error	z value	[x]Pr(> z)	Signif. codes:
(Intercept) ***	8.6278	0.4836	17.843	<2e-16	***
stei **	1.6288	0.5706	2.855	0.0055	**
unemployment ***	-126.2884	9.6870	-13.037	<2e-16	***
cpi.	0.6406	0.4228	1.515	0.1338	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1176 on 79 degrees of freedom

Multiple R-squared: 0.7023 Adjusted R-squared: 0.691

Table 5: Multivariate regression model summary

Table 5 represents the results of multivariate regression model. Regression model predicts WABSI in the financial system based on macroeconomic factors. Estimates of the regression and intercept are statistically significant. Residual standard error 0.12 describes the difference of standard deviation of errors between observed and fitted values. Multiple R-square indicates the quality of the regression, which is 70.23%.

According to the model, an increase of 1% in Short-term Economic Indicator positively affects WABSI, resulting in an increase of 0.016 points. Moreover, a 1% increase in unemployment leads to a 1.26 points decrease of WABSI. However, increased CPI increases WABSI by 0.006 points. In other words, increasing production capacity and increase in wealth of population increases stability of the financial system, while increases in the unemployment rate have substantial negative effect on WABSI.

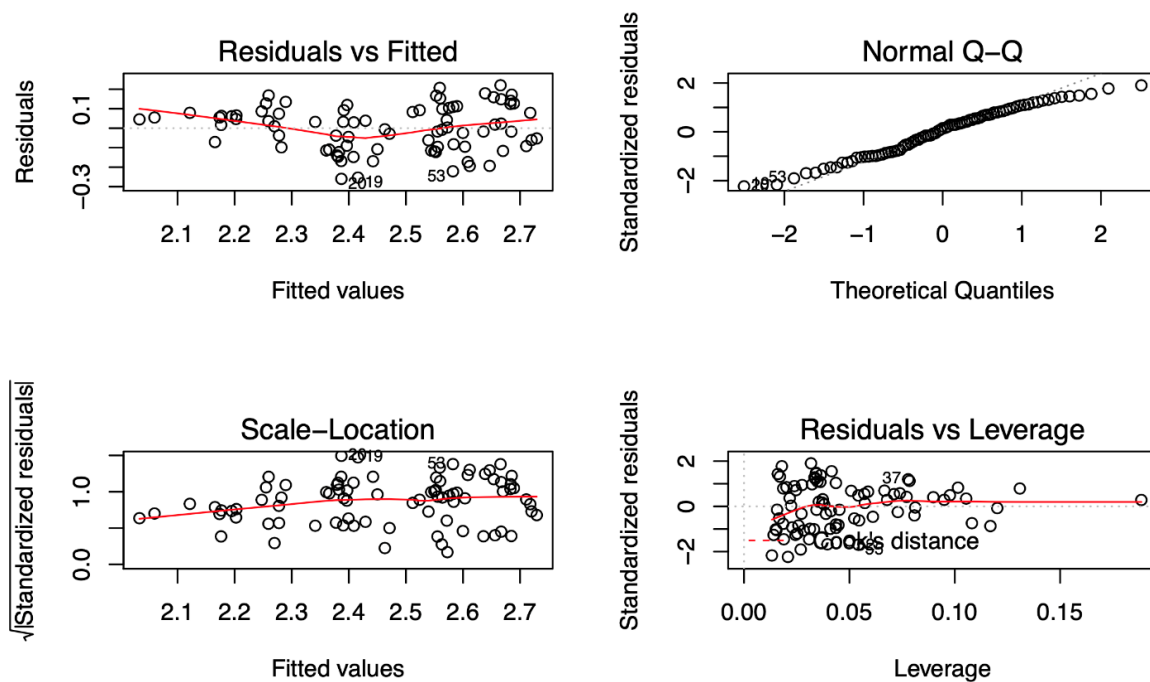


Figure 8: Detailed summary of the multivariate regression model

The charts above show the detailed summary of the model. The first one illustrates residual plot where the X-axis represents predicted or fitted values, while the Y-axis expresses residuals or errors. Variation is almost constant, no patterns are observed. The second plot is the Quantile-Quantile (Q-Q) chart where the Y-axis is ordered observed standardized residuals and the X-axis is ordered theoretical residuals. It is expected residuals values reinforced by normally distributed errors values. The third and fourth illustrations help to identify non-linearity and non-constant variance behavior.

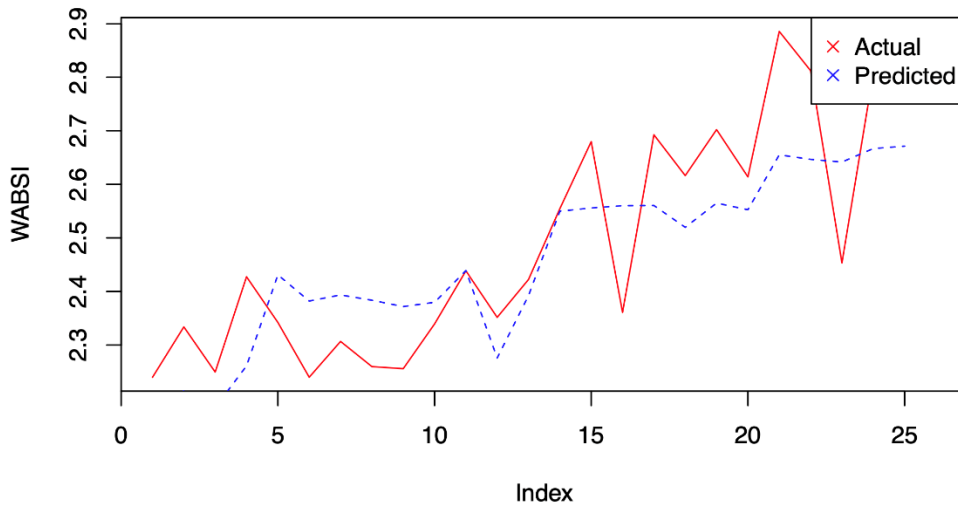


Figure 9: Actual vs Predicted WABSI value

As was mentioned above, the model followed machine learning principles such as training and testing of the model. The model shows how the WABSI of the financial system might be predicted. Figure 9 illustrates the results of the simulated model based on training and testing datasets. The dashed blue line represents predicted value versus actual value of WABSI, which is illustrated by the red line. This machine learning algorithm considers pattern in trained data and extrapolates it on the test data. As we can see the model matches well enough for WABSI prediction.

5.2 Logistic Regression

Logistic regression is a mathematical model that determines interdependence between row of X values and dichotomous or “dummy” variables. The $f(z)$ logistic function is limited by 0 and 1, which represents probability of the event to have occurred. This function has sigmoid or S-shaped form (Kleinbaum, Dietz, Gail, Klein & Klein 2002, 6). The function of the regression expressed as $f(z)$ is represented below:

$$f(z) = \frac{1}{1 + e^{-z}} \quad (4)$$

Logistic regression was used as machine learning technique in order to create a model that measures the level of NPL of the bank in terms of certain Bank Sustainability Index value. According to the statistics, average historical value of NPL is 20%. This level of NPL was determined as special threshold; all defaulted banks had NPL value significantly higher than 20%. If the bank exceeds threshold, binomial values such as “Yes” = 1 and “No” = 0 are assigned. Dataset has 2811 observations covered the period of 2013 through 2019. Data prior to 2013 were excluded due to lack of officially published NPL information.

RStudio is a helpful tool that allows creation of a machine learning algorithm via several packages. caTools library was used in this model. Dataset was split into two random samples by the proportion of 75% and 25%, where the first is the training dataset and second is the test dataset. The model obtained provides the following results:

Logistic regression Estimation Results:

Call:

glm(formula = threshold ~ index, family = "binomial", data = train)

Deviance Residuals:

	Min	1Q	Median	3Q	Max
	-1.9404	-0.7136	-0.3765	0.5074	2.6816

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	Signif. codes:
(Intercept) ***	3.6806	0.2446	15.05	<2e-16	***
index ***	-1.9127	0.1020	-18.75	<2e-16	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 2386.1 on 2107 degrees of freedom
 Residual deviance: 1845.2 on 2106 degrees of freedom
 AIC: 1849.2
 Number of Fisher Scoring iterations: 5

Table 6: Logistic regression results

Beta coefficient shows effect of index to the certain level of NPL of a particular bank. Pr(>|z|) values are statistically significant. Accuracy of model derived from actual and predicted values is 78%. Finally, if BSI increases by 0.1 points, then NPL will be reduced by 1.9%. Figure 10 shows the sigmoid function, which demonstrates value of Bank Sustainability Index with regards to particular level of NPL.

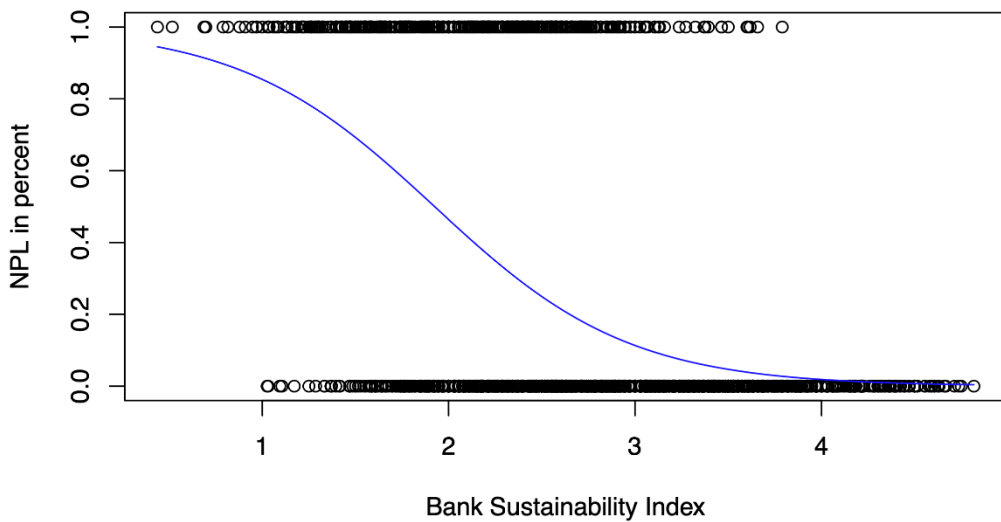


Figure 10: Logistic regression function

As a result, banks having BSI higher than 3.0 are more stable. For instance, if the bank has NPL that equals 40% then the Bank Sustainability Index will be equal to 2.0. Banks should be focused on actions to reduce bad loans in their portfolio, which in turn would increase their index value.

5.3 Naive Bayes Classifier model

Naive Bayes is a type of supervised machine learning. It is used for probabilistic classification purposes. Based on historical data, such a classifier algorithm determines the appropriate class of examined variable. For instance, E sets values such as (x_1, x_2, \dots, x_n) , where x_i is attribute of X_i , while C is cause variable c_i which can produce E . If the initial probability of $P(C_i)$ is known, then the conditional probability of i th element of cause to produce E equals $P(E|C_i)$ (D'Agostini 1994, 5). It comes from Bayes' Theorem:

$$P(C_i|E) = \frac{P(E|C_i) * P(C_i)}{\sum_{i=1}^{n_c} P(E|C_i) * P(C_i)} \quad (5)$$

It can be interpreted as follows: if the event of E is observed, the probability of the i th cause is proportional to the probability of C multiplied by the probability to produce E . Also Bayes' theorem is called Naive Bayes Classifier. It helps to make prediction model, which will show probability of occurrence of classified variables.

As an example, interdependence between bank default and ownership structure is analyzed via Naive Bayes machine learning technique. Banks were classified by three types of ownership groups: foreign investors, governments, and domestic private investors. All banks' NPL value was considered by two criteria, whether NPL exceeds 20% level or not. If yes then 1 is assigned, if no 0 is assigned. As was mentioned before, defaulted banks had NPL higher than 20%. If the bank has higher value than the threshold it is more likely to fail.

Dataset contains 2,811 observations of BSI for each bank from 2013 through 2019. R libraries such as `naivbayes` and `dplyr` helped to create a machine learning algorithm in RStudio. This algorithm helps to identify the probability of exceeding NPL threshold taking into account the Bank Sustainability Index and ownership structure of each bank. The purpose of this test is to reveal which ownership structure causes premises for risk of default.

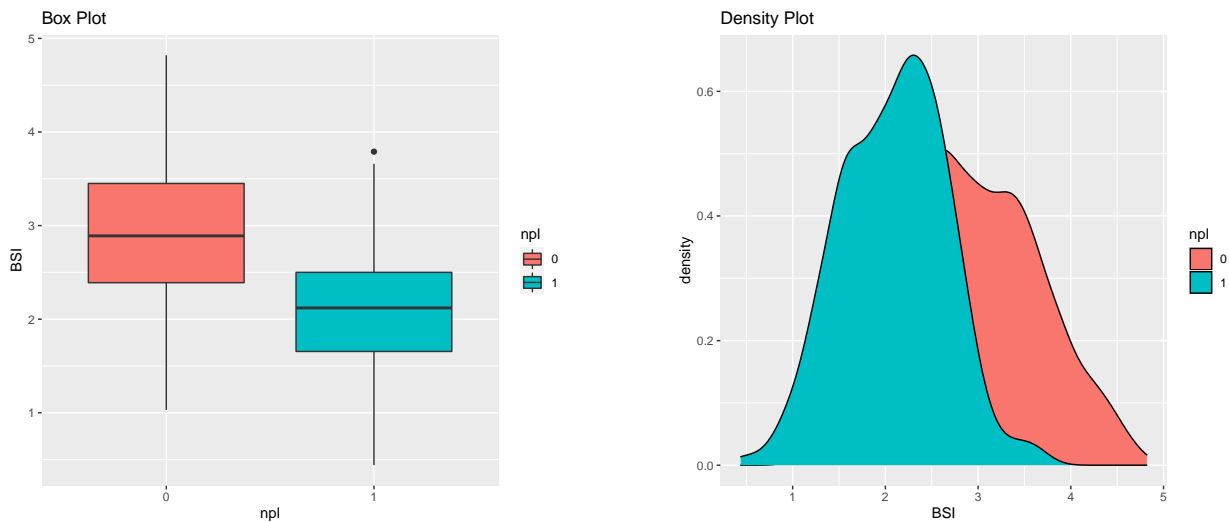


Figure 11: Box and Density plots for BSI

Figure 11 shows that average BSI of sustainable banks is higher than the average BSI of banks which exceeded the 20% threshold of NPL. Density plot demonstrates that BSI values of sustainable banks are normally distributed, while defaulted banks had significantly lower average BSI and right skewness. It can be observed via frequency of distributed values.

Dataset was split by two random samples in proportion of 80% of trained and 20% of test samples. Created machine learning algorithm obtained following results of classification:

Naive Bayes' Classifier

Call:
naive_bayes.formula(formula = npl ~ ., data = train, usekernel = T) Laplace smoothing: 0

A priori probabilities:

	0	1
	0.7497778	0.2502222

Tables:

BSI::0 (KDE)			[x]:: BSI::1 (KDE)		
Call:	density.default(x = x, na.rm = TRUE)		Call:	density.default(x = x, na.rm = TRUE)	
Data:	x (1687 obs.); Bandwidth 'bw' = 0.1477		Data:	x (563 obs.); Bandwidth 'bw' = 0.1474	
	x	y	x	y	
Min.:	0.587	Min. 0.0000296	Min. -0.00221	Min. 0.0000595	
1st Qu.:	1.749	1st Qu.: 0.0276275	1st Qu.: 1.05639	1st Qu. 0.0245577	
Median:	2.910	Median 0.1692159	Median: 2.11500	Median 0.1206576	
Mean:	2.910	Mean 0.2150324	Mean: 2.11500	Mean 0.2359276	
3rd Qu.:	4.071	3rd Qu.: 0.4167371	3rd Qu.: 3.17360	3rd Qu. 0.4926465	
Max.:	5.233	Max. 0.5193886	Max.: 4.23221	Max. 0.6907513	

ownership

	0 (stable)	1 (default)
1	0.307053942	0.007104796
2	0.215767635	0.206039076
3	0.477178423	0.786856128

The probability plot shows the ownership probabilities for categories 0 (stable) and 1 (default) across ownership levels 1, 2, and 3. The y-axis is labeled 'ownership' and ranges from 1 to 3. The x-axis is labeled 'ownership' and ranges from 0 to 1. The plot shows that for ownership level 1, category 0 has a high probability (green), while for ownership level 3, category 1 has a high probability (red).

Table 7: Naive Bayes Classifier results and Probability plot

According to the results obtained, there is 0.01 probability that banks owned by foreign investors will exceed 20% level of NPL with a given BSI. Therefore, those banks are not likely to default. However, banks that owned by private domestic investors are most likely to exceed critical value of NPL, probability value is 0.79. It provides that such banks have higher default risk and lower BSI. Banks owned by governments exceed NPL level, but it happens rarely. They will be capitalized in case of financial stability deterioration. If the private domestic investors, which are represented by roughly 100 people, sell their shares to the public or foreign investors the probability of default of banks in Kazakhstan would be reduced. The confusion matrix indicates that the model has 79% accuracy to predict probability of banks default based on BSI and ownership structure.

6. Current issues in banking industry

6.1 Lack of competitiveness

As was mentioned before, the largest international financial groups have left Kazakh market. Their presence was extremely useful in developing financial markets, improving proficiency of human capital and overall increasing competitiveness between banks. As of today, domestic banks do their usual operations and do not try to innovate their activities. For instance, National Bank provides large amounts of treasury notes that have stable risk-free return. From one side, it is the tool for inflation targeting, from another side, banks are not interested in taking risks by giving loans to the market. Only innovative and technological banks have increased their market shares by providing high quality services in Kazakhstan.

6.2 Risk of regulatory capture

Taking into account ownership structure of banks in Kazakhstan, 15% of banks are owned by foreign governments. There is the possibility that regulatory capture risk may occur. Regulatory capture is the process of political or economic state intervention by obtaining control over fiscal or monetary aspects (Dal Bó 2006, 203). The risk can arise if domestic companies are not able to repay loans taken from these banks. Typically, such banks have strong capacity to strengthen equity in case of necessity and maintain prudential requirements at higher level. However, the regulator controls this situation and domestic companies comply with the terms of credit agreements and fulfill their obligations in a timely manner.

6.3 Results of Asset Quality Review

Asset Quality Review (AQR) is one of the important actions that have been taken by National Bank of Kazakhstan. It is a process of comprehensive point-in-time analysis of banks' assets in order to identify problematic ones. Usually, it consists of two stages: the first one is Asset Quality Review and another one is stress test (Steffen 2014, 13). The second stage was not implemented in Kazakhstan.

AQR is conducted based on the European Central Bank methodology that states that samples should be created based on portfolios. Then collateral is fairly evaluated. According to the manual, credit files are reviewed, then classification of the credit is assessed. Correct classification determines quality of non-performing asset if it is reclassified to the 1st stage, 2nd or 3rd. Moreover, it influences the accurate collective creation of provisions and additional capitalization. Assets are evaluated at fair value and the Capital Adequacy Ratio (CAR) is determined with regards to AQR results.

According to the results of AQR, 14 banks were involved in this assessment. Those banks represent 87% of total bank assets and 90% of the aggregate credit portfolio. Review was carried out by bank teams, which are independent auditors, inspectors and Central Project

Management Office from National Bank's side. Moreover, an independent consultant was assigned to support the process from methodological view and propose solutions in case of contradictions.

The result of AQR are represented from true and fair view, also it reflects transparent and reliable assessment of equity of the banks under scope. Following conclusions are stated:

- k1 ratio or Capital Adequacy Ratio represents 70% out of minimal prudential requirement after adjustments of expected credit defaults and assets revaluation.
- k2 ratio or Capital Adequacy Ratio from prudential point of view covers risks sufficiently. For instance, assessment of bank's collective provisioning model, valuation of collateral or on-balance sheet real estate and applying of prudential triggers on credit facilities impairment.

Summarizing all, AQR has revealed that total amount of additional capitalization needed is 429 billion KZT. Assets in stage 3 are stated at 21% level. They are not bad credits and immediate losses of the banks. Collateral value is reduced by 23.8% after revaluation. Regulator provided the plan according to that banks agreed to undertake required actions. Risk for depositors of banks in scope is not in place. However, due to COVID-19 situation banks will have different level of provisioning and capitalization.

6.4 COVID-19 impact

The COVID-19 virus has significant impact on the global economy. The pandemic has started from China in December 2019. Kazakhstan being a country bordering with China immediately reacted by closing borders and interrupting trading activities. The first case of infection by Kazakhstan's citizen was registered in 14th of March 2020. The Government decided to restrict any public activities. State of emergency was announced on the 16th of March until the 11th of May. During this time horizon people were restricted in any activities and proposed to stay at home. Such restriction affected negatively almost all sectors of the economy. Most of citizens are working remotely. Only markets, shops and chemistries are permitted to work. Some people became unemployed, generally they are representatives of service sector of economy.

Such macroeconomics changes definitely affect the bank sector in Kazakhstan. People have been left without sources of income and are unable to pay their loans in a timely manner. Most of Kazakhstan banks decided to provide a credit vacation for individuals and small and medium enterprises, corporates. During the 3 month period, bank clients were not required to repay principal and interest on the loan.

Based on March's data, growth of inflation is observed, as well as a dramatic drop in oil prices. Due to high dependency on oil exports, the government's budget is suffering from oil price fluctuations. Low demand has resulted in the falling prices. Almost all airline companies canceled up to 99% of flights, thereby reducing consumption of oil products, while production continued. Effect of COVID-19 will have negative subsequences in the future. The effect of pandemic will be evaluated via WABSI after data becomes available.

Conclusion

The banking sector is the one of the most important areas that connects all units of the economy. Economy is a system of transactions processed between individuals, corporates, governments and countries worldwide. Today huge share of transactions go through the online world, usually banks are intermediaries. For this reason, the banking sector should be stable in order to maintain interaction among system participants. A bank facing difficulties will not be able to operate and provide services to the clients by lending or saving money.

The research conducted provided the results of which techniques of machine learning may be applied to a bank's sustainability assessment. Machine learning is a practical risk management tool that allows to proactively identify problems that may occur in the financial system or in a particular bank in the future. The research proposes regression models, economic indicators that can be used in bank's sustainability assessment. Due to the fact that machine learning may forecast possible outcomes, it can be used for decision making.

More specifically a Bank Sustainability Index was calculated. This index provides short analysis of the bank based on different criteria within a short period of time. It highlights which banks are not performing well, and identifies when those problems have occurred in the past. The main goal of the research was to develop methods that will help to identify banks under higher risks. Bank Sustainability Index was not invented for ranking purposes, it is aimed to express level of sustainability of bank. However, due to the market volatility, a bank's index may reflect a distorted value of certain banks, but it is sufficient to describe overall situation regarding sustainability. Having such a tool will help to decide where the money can be safely allocated, where the loans can be taken from. It has to be taken into account that real live cases of banks default were examined and mentioned in this research. As a result, foreign-owned banks have low probability of default, while banks owned by private domestic investors are more likely to fail.

WABSI index helped to compare the level of sustainability of banks overall. According to the index obtained, financial system has improved by 29% and became more stable. The liquidation of weak financial institutions positively affected financial sustainability.

One fact to be taken into account is that more than 50% of banks in Kazakhstan are owned by limited group of people. In order to improve this situation those banks should go public. Such actions would update the financial system and increase transparency.

As was mentioned in this research, large international financial groups have left the market. It happened due to number of currency devaluations in Kazakhstan. Such volatile exchange rate reduces attractiveness of foreign investors. Therefore, only strong economic policies and economy stabilization will return foreign investors back.

During the last 15 years, government was rescuing banks with help of national budget. In order to avoid this, the National Bank should elaborate more strict mechanisms of reaction. All ineffective financial institutions should be liquidated.

Financial sustainability may be achieved by changing overall risk culture, business model and strategy of banks. It is long-term process, but it will definitely improve wealth of country. Banks should concentrate on sustainable development principles, which have useful and understandable ideas.

In conclusion, topic of this research opens new areas for research and development. It proposes new subjects for research such as: Which machine learning techniques are applicable in risk management? What will be the lasting impact of COVID-19 on bank risk management system?

Appendix

Appendix 1: List of banks

#	Name of bank (English)	Name of bank (Russian)	SWIFT/BIC	Short name
1	AB KZI BANK JSC	АО "ДБ "КЗИ БАНК"	KZIBKZKA	kzi
2	Altyn Bank JSC (SB of China Citic Bank Corporation Ltd)	АО "Altyn Bank" (ДБ China Citic Bank Corporation Ltd)	ATYNKZKA	altyn
3	AsiaCredit Bank (AsiaCredit Bank) JSC	АО "AsiaCredit Банк (АзияКредит Банк)"	LARIKZKA	asiacredit
4	Bank Bank RBK JSC	АО "Банк "Банк RBK"	KINCKZKA	rbk
5	Bank Kassa Nova JSC (SB of JSC ForteBank)	АО "Банк Kassa Nova" (ДБ АО "ForteBank")	KSNVKZKA	kassanova
6	Bank of Astana JSC	АО "Банк "Астаны"	ASFBKZKA	astana
7	JSC AB Bank of China Kazakhstan	АО ДБ "БАНК КИТАЯ В КАЗАХСТАНЕ"	BKCHKZKA	bankchina
8	Bank Pozitiv Kazakhstan JSC	АО "Банк Позитив Казахстан"	DEMIKZKA	pozitiv
9	Capital Bank Kazakhstan JSC	АО "Capital Bank Kazakhstan"	TBVBKZKA	capitalbank
10	Credit Altyn Bank JSC	АО "Кредит Алтын Банк"	N/A	creditaltyn
11	EU Bank JSC (SB Eurasian Bank JSC)	АО "EU Bank (ДБ АО "Евразийский банк")"	N/A	eubank
12	Eurasian Bank JSC	АО "Евразийский Банк"	EURIKZKA	eurasian
13	First Heartland Bank JSC	АО "First Heartland Bank"	ABNAKZKX	fhb
14	First Heartland Jusan Bank JSC	АО "First Heartland Jýsan Bank"	TSESKZKA	jusan
15	ForteBank JSC	АО "ForteBank"	IRTYKZKA	forte
16	Halyk Savings Bank of Kazakhstan JSC	АО "Народный Банк Казахстана"	HSBKKZKX	halykbank
17	Housing Construction Savings Bank of Kazakhstan JSC	АО "Жилстройсбербанк Казахстана"	HCSKKZKA	zhsbk
18	Islamic Bank Al Hilal JSC	АО "Исламский Банк "Al Hilal"	HLALKZKZ	alhilal
19	JSC SB RBS (KAZAKHSTAN)	АО ДБ "RBS (Kazakhstan)"	ABNAKZKX	rbskaz
20	JSC SB PNB Bank in Kazakhstan	АО "ДБ "PNB" - Казахстан"	DABNKZ2P	pnb
21	ALASH-BANK JSC	АО "АЛАШ-БАНК"	N/A	alash
22	Alliance Bank JSC	АО "Альянс Банк"	IRTYKZKA	alliance
23	ATFBank JSC	АО "АТФБанк"	ALMNKZKA	atf
24	Bank CenterCredit JSC	АО "Банк ЦентрКредит"	KCJBKZKX	centercredit
25	Bank TuranAlem JSC	АО "Банк ТуранАлем"	HSBKKZKX	bta
26	Citibank Kazakhstan JSC	АО "Ситибанк Казахстан"	CITIKZKAX	citibank
27	JSC DAB ABN AMRO Bank Kazakhstan	АО "ДАБ "ABN AMRO Банк Казахстан"	ABNAKZKX	abnamro
28	Danabank JSC	АО "Данабанк"	DABNKZ2P	danabank
29	Delta Bank JSC	АО "Delta Bank"	NFBAKZ23	delta
30	Demir Kazakhstan Bank JSC	АО "Демир Казахстан Банк"	DEMIKZKA	demir
31	EXIMBANK KAZAKHSTAN JSC	АО "ЭКСИМБАНК КАЗАХСТАН"	EXKAKZKA	eximbank
32	Express Bank JSC	АО "Экспресс Банк"	INKZKZK1	express
33	IB Zaman-Bank JSC	АО "ИБ "Заман-Банк"	ZAJSKZ22	zaman
34	Industrial Bank of Kazakhstan JSC	АО "Индустриальный Банк Казахстана"	N/A	industrial
35	KASPI BANK JSC	АО "KASPI BANK"	CASPZKZKA	kaspi
36	Kazinvestbank JSC	АО "Казинвестбанк"	KAZSKZKA	kazinvest
37	KAZKOMMERTSBANK JSC	АО "КАЗКОММЕРЦБАНК"	KZKOKZKX	qazkom
38	Masterbank JSC	АО "Мастербанк"	MSRBKZKA	masterbank
39	MB Alma-Ata JSC	АО "МБ "Алма-Ата"	N/A	mbalmaty
40	METROKOMBANK JSC	АО "МЕТРОКОМБАНК"	N/A	metrokombank
41	Neftebank JSC	АО "Нефтебанк"	NFBAKZ23	neftebank
42	Nurbank JSC	АО "Нурбанк"	NURSKZKX	nurbank
43	ALFA BANK JSC SB	АО "ДБ "АЛЬФА-БАНК"	ALFAKZKA	alfa
44	Senim-Bank JSC	АО "Сеним-Банк"	SENIKZKA	senim
45	Temirbank JSC	АО "Темирбанк"	JSRBKZKA	temirbank
46	TexaKaBank JSC	АО "ТехаКаБанк"	N/A	texaka
47	INDUSTRIAL & COMMERCIAL BANK OF CHINA (ALMATY) JSC	АО "ТПБ Китая в г. Алматы"	ICBKKZKX	tpbchina
48	Tsesnabank JSC	АО "Цеснабанк"	TSESKZKA	tsesna
49	Kazinkombank JSC	АО "Казахстанский Инновационный Коммерческий Банк"	KINCKZKA	innkom
50	LARIBA-BANK SB JSC	АО "СБ "ЛАРИБА-БАНК"	LARIKZKA	sbalariba
51	Qazaq Banki JSC	АО "Qazaq Banki"	SENIKZKA	qazaq
52	SB HSBC Bank Kazakhstan JSC	ДБ АО "HSBC БАНК КАЗАХСТАН"	HSBCKZKA	hsbckaz
53	SB JSC Bank Home Credit	ДБ АО "Банк Хоум Кредит"	INLMKZKA	homecredit

54	SB JSC NB of Pakistan in Kazakhstan	АО ДБ "НБ Пакистана" в Казахстане	NBPAKZKA	nbpakistan
55	SB Sberbank JSC	ДБ АО "Сбербанк"	SABRKZKA	sberbank
56	SB TAIB Kazakh Bank JSC	АО ДБ "ТАИБ КАЗАХСКИЙ БАНК"	TBKBKZKA	taibkaz
57	Bank ExpoCredit JSC	АО "Банк ЭкспоКредит"	ABNAKZKX	expocredit
58	Shinhan Bank Kazakhstan JSC	АО "Шинхан Банк Казахстан"	SHBKZKA	shinkhan
59	Tengri Bank JSC	АО "Tengri Bank"	TNGRKZKX	tengri
60	SB VTB Bank (Kazakhstan) JSC	ДО АО Банк ВТБ (Казахстан)	VTBAKZKZ	vtb

Appendix 2: Matrix of existing and license terminated banks by clusters

#	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi	kaspi
2	atf	atf	atf	atf	atf	atf	atf	atf	atf	atf	atf	atf	atf	atf	atf
3	alfa	alfa	alfa	alfa	alfa	alfa	alfa	alfa	alfa	alfa	alfa	alfa	alfa	alfa	alfa
4	kzi	kzi	kzi	kzi	kzi	kzi	kzi	kzi	kzi	kzi	kzi	kzi	kzi	kzi	kzi
5	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk	zhsbk
6	zaman	zaman	zaman	zaman	zaman	zaman	zaman	zaman	zaman	zaman	zaman	zaman	zaman	zaman	zaman
7	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit	centercredit
8	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank	nurbank
9	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina	bankchina
10	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan	nbpakistan
11	citibank	citibank	citibank	citibank	citibank	citibank	citibank	citibank	citibank	citibank	citibank	citibank	citibank	citibank	citibank
12	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina	tpbchina
13	demir	demir	demir	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired
				pozitiv	pozitiv	pozitiv	pozitiv	pozitiv	pozitiv	pozitiv	pozitiv	pozitiv	pozitiv	acquired	acquired
												eubank	joined	joined	joined
	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian	eurasian
14	bta	bta	bta	bta	bta	bta	bta	bta	bta	bta	bta	terminated	terminated	terminated	terminated
	qazkom	qazkom	qazkom	qazkom	qazkom	qazkom	qazkom	qazkom	qazkom	qazkom	qazkom	qazkom	qazkom	qazkom	terminated
	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank	halykbank
15	alliance	alliance	alliance	alliance	alliance	alliance	alliance	alliance	alliance	alliance	alliance	terminated	terminated	terminated	terminated
	temirbank	temirbank	temirbank	temirbank	temirbank	temirbank	temirbank	temirbank	temirbank	temirbank	temirbank	terminated	terminated	terminated	terminated
				metrokom	metrokom	metrokom	metrokom	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed
								forte	forte	forte	forte	forte	forte	forte	forte
						kassanova	kassanova	kassanova	kassanova	kassanova	kassanova	kassanova	kassanova	kassanova	kassanova
16	alash	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed
	innkom	innkom	innkom	innkom	innkom	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired
						rbk	rbk	rbk	rbk	rbk	rbk	rbk	rbk	rbk	rbk
17	danabank	danabank	danabank	danabank	danabank	danabank	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired
							pnb	pnb	pnb	pnb	pnb	renamed	renamed	renamed	renamed
												tengri	tengri	tengri	tengri
18	sblariba	sblariba	sblariba	sblariba	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed
					asiacredit	asiacredit	asiacredit	asiacredit	asiacredit	asiacredit	asiacredit	asiacredit	asiacredit	asiacredit	asiacredit
19	taibkaz	taibkaz	taibkaz	taibkaz	taibkaz	taibkaz	taibkaz	taibkaz	taibkaz	taibkaz	acquired	acquired	acquired	acquired	acquired
											capitalbank	capitalbank	capitalbank	capitalbank	capitalbank
20	texaka	texaka	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired
			sberbank	sberbank	sberbank	sberbank	sberbank	sberbank	sberbank	sberbank	sberbank	sberbank	sberbank	sberbank	sberbank
21	mbalmaty	mbalmaty	mbalmaty	mbalmaty	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated
					homecredit	homecredit	homecredit	homecredit	homecredit	homecredit	homecredit	homecredit	homecredit	homecredit	homecredit
22	senim	senim	senim	senim	senim	senim	senim	senim	senim	terminated	terminated	terminated	terminated	terminated	terminated
								qazaq	qazaq	qazaq	qazaq	qazaq	qazaq	qazaq	terminated
23	tsesna	tsesna	tsesna	tsesna	tsesna	tsesna	tsesna	tsesna	tsesna	tsesna	tsesna	tsesna	tsesna	tsesna	terminated
	abnamro	abnamro	abnamro	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired	acquired
				rbskaz	rbskaz	rbskaz	rbskaz	rbskaz	rbskaz	rbskaz	rbskaz	acquired	acquired	acquired	acquired

											expocredit	expocredit	acquired	acquired
													fhb	terminated
														jusan
24	neftebank	neftebank	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed	renamed
			delta	delta	delta	delta	delta	delta	delta	delta	delta	delta	terminated	terminated
25	hsbckaz	hsbckaz	hsbckaz	hsbckaz	hsbckaz	hsbckaz	hsbckaz	hsbckaz	hsbckaz	hsbckaz	hsbckaz	hsbckaz	terminated	terminated
													albyn	albyn
26	eximbank	eximbank	eximbank	eximbank	eximbank	eximbank	eximbank	eximbank	eximbank	eximbank	eximbank	eximbank	terminated	terminated
27				astana	astana	astana	astana	astana	astana	astana	astana	astana	terminated	terminated
28	kazinvest	kazinvest	kazinvest	kazinvest	kazinvest	kazinvest	kazinvest	kazinvest	kazinvest	kazinvest	kazinvest	kazinvest	terminated	terminated
29						creditalyn	creditalyn	terminated	terminated	terminated	terminated	terminated	terminated	terminated
30		masterbank	masterbank	masterbank	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated
31		express	express	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated
32	industrial	industrial	industrial	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated	terminated
33	vib	vib	terminated	terminated	vib	vib	vib	vib	vib	vib	vib	vib	vib	vib
34				shinkhan	shinkhan	shinkhan	shinkhan	shinkhan	shinkhan	shinkhan	shinkhan	shinkhan	shinkhan	shinkhan
35				alhial	alhial	alhial	alhial	alhial	alhial	alhial	alhial	alhial	alhial	alhial

status - bank was acquired or license was terminated or joined

bank - existing bank

renamed - bank was renamed

subsidiary - subsidiary of existing bank

Appendix 3: Bank owners and countries of representatives

#	Name of bank (English)	Shareholder's country	End owner	From	To	Credit rating
1	AB KZI BANK JSC	Turkey	Government	1993		S&P / Moody's / Fitch
2	Altyn Bank JSC (SB of China Citic Bank Corporation Ltd)	China / Kazakhstan	Commercial bank	2014		S&P / Moody's / Fitch
3	AsiaCredit Bank (AsiaCredit Bank) JSC	Kazakhstan	Private investor	2009		S&P / Fitch
4	Bank Bank RBK JSC	Kazakhstan	Private investor	2011		S&P / Moody's
5	Bank Kassa Nova JSC (SB of JSC ForteBank)	Kazakhstan	Commercial bank	2010		S&P
6	Bank of Astana JSC	Kazakhstan	Private investor	2008	2018	S&P / Fitch
7	JSC AB Bank of China Kazakhstan	China	Government	1993		No
8	Bank Pozitiv Kazakhstan JSC	Turkey / Israel	Commercial bank	2008	2016	No
9	Capital Bank Kazakhstan JSC	Kazakhstan	Private investor	2014		S&P
10	Credit Altyn Bank JSC	Kazakhstan	Private investor	2010	2011	No
11	EU Bank JSC (SB Eurasian Bank JSC)	Kazakhstan	Commercial bank	2015	2015	No
12	Eurasian Bank JSC	Kazakhstan	Private investors	1994		S&P / Moody's / Fitch
13	First Heartland Bank JSC	Kazakhstan	Holding company	2018	2019	No
14	First Heartland Jusan Bank JSC	Kazakhstan	Brokerage company	2019		S&P / Moody's / Fitch
15	ForteBank JSC	Kazakhstan	Private investor	2012	2018	S&P / Moody's / Fitch
16	Halyk Savings Bank of Kazakhstan JSC	Kazakhstan	Private investors	1923		S&P / Moody's / Fitch
17	Housing Construction Savings Bank of Kazakhstan JSC	Kazakhstan	Government	2003		Moody's / Fitch
18	Islamic Bank Al Hilal JSC	UAE	Financial group	2010		Fitch
19	JSC SB RBS (KAZAKHSTAN)	Scotland	Holding company	2008	2016	No
20	JSC SB PNB Bank in Kazakhstan	India	Government	2011	2016	Moody's / Fitch
21	ALASH-BANK JSC	Kazakhstan	Holding company	1996	2005	No
22	Alliance Bank JSC	Kazakhstan	Private investor	2002	2015	No
23	ATFBank JSC	Kazakhstan	Private investors	2003		S&P / Moody's / Fitch
24	Bank CenterCredit JSC	Kazakhstan	Private investor	1998		S&P / Moody's / Fitch
25	Bank TuranAlem JSC	Kazakhstan	Private investor	1997	2015	S&P / Moody's / Fitch
26	Citibank Kazakhstan JSC	USA	Financial services company	1998		S&P / Moody's / Fitch
27	JSC DAB ABN AMRO Bank Kazakhstan	Netherlands	Commercial bank	1994	2008	No
28	Danabank JSC	Kazakhstan	Commercial bank	1992	2011	No
29	Delta Bank JSC	Kazakhstan	Private investors	2007	2017	S&P / Moody's
30	Demir Kazakhstan Bank JSC	Turkey	Commercial bank	2007	2008	No
31	EXIMBANK KAZAKHSTAN JSC	Kazakhstan	Private investors	1994	2018	S&P / Fitch
32	Express Bank JSC	Kazakhstan	Commercial bank	2007	2009	No
33	IB Zaman-Bank JSC	Kazakhstan	Private investors	1991		S&P
34	Industrial Bank of Kazakhstan JSC	Kazakhstan	Private investors	2004	2007	No
35	KASPI BANK JSC	Kazakhstan / Russia / USA	Private equity firm	1997		S&P / Moody's / Fitch
36	Kazinvestbank JSC	Kazakhstan	Private investors	2003	2016	S&P / Moody's
37	KAZKOMMERTSBANK JSC	Kazakhstan	Private investor	1991	2018	S&P / Moody's / Fitch
38	Masterbank JSC	Russia	Private investor	2007	2010	No
39	MB Alma-Ata JSC	Kazakhstan	Private investor	1995	2008	No
40	METROKOMBANK JSC	Kazakhstan	Private investor	2008	2012	No
41	Neftebank JSC	Kazakhstan	Private investor	1993	2007	No
42	Nurbank JSC	Kazakhstan	Private investor	1992		S&P / Moody's
43	ALFA BANK JSC SB	Russia / Luxembourg	Financial services company	1994		S&P / Moody's / Fitch
44	Senim-Bank JSC	Kazakhstan	Private investor	1993	2013	No
45	Temirbank JSC	Kazakhstan	Private investor	1992	2013	S&P / Moody's / Fitch
46	TexaKaBank JSC	USA	Private investors	1993	2007	No
47	INDUSTRIAL & COMMERCIAL BANK OF CHINA (ALMATY) JSC	China	Commercial bank	1993		Fitch
48	Tsesnabank JSC	Kazakhstan	Private investor	1992	2019	No
49	Kazinkombank JSC	Kazakhstan	Private investor	2005	2011	No
50	LARIBA-BANK SB JSC	Saudi Arabia	Private investor	1992	2009	No
51	Qazaq Banki JSC	Kazakhstan	Private investors	2013	2018	S&P
52	SB HSBC Bank Kazakhstan JSC	UK	Investment banking company	1998	2014	No

53	SB JSC Bank Home Credit	Netherlands / Russia / Czech	Holding company	2009	Fitch
54	SB JSC NB of Pakistan in Kazakhstan	Pakistan	Government	1996	Moody's
55	SB Sberbank JSC	Russia	Government	2007	Moody's / Fitch
56	SB TAIB Kazakh Bank JSC	Bahrain / UAE	Government	1992	2014 No
57	Bank ExpoCredit JSC	Russia	Private investor	2016	2018 No
58	Shinhan Bank Kazakhstan JSC	South Korea	Commercial bank	2009	S&P / Moody's / Fitch
59	Tengri Bank JSC	India / Kazakhstan	Government	2016	S&P / Moody's
60	SB VTB Bank (Kazakhstan) JSC	Russia	Government	2009	S&P / Fitch

S&P Long-term Issuer Rating (Domestic)	B+	B	C	CC	SD	D	B-	CCC+	CCC	D	B	B+		
S&P Long-term Issuer National Scale Rating (Domestic)							kzBB-	kzB	kzCCC+	D	kzBB	kzBB+	kzBBB-	kzBBB
Outlook	STBL													
Halyk Savings Bank of Kazakhstan JSC	12-Oct-1998	14-Aug-2003	22-Jul-2005	10-Feb-2006	18-Jul-2006	16-Feb-2009	06-May-2009	11-Jun-2009	12-Dec-2011	16-Jul-2014	19-Feb-2016	08-Jul-2016	25-Jun-2018	
S&P Long-term Issuer Rating (Foreign)	B	B+	BB-	BB	BB+	BB	BB-	B+	BB	BB+	BB			
S&P Long-term Issuer Rating (Domestic)	B	B+	BB-	BB	BB+	BB	BB-	B+	BB	BB+	BB			
S&P Long-term Issuer National Scale Rating (Domestic)										kzAA-	kzA+	kzA	kzA+	
Outlook	STBL													
ATFBank JSC	21-Oct-2004	22-Jul-2005	16-Nov-2007	12-Dec-2008	05-Sep-2016	11-Jul-2018	25-Feb-2019							
S&P Long-term Issuer Rating (Foreign)	B	B+	BB+	NR	B		B-							
S&P Long-term Issuer Rating (Domestic)	B	B+	BB+	NR	B		B-							
S&P Long-term Issuer National Scale Rating (Domestic)					kzBB	kzBB+	kzBB							
Outlook	STBL													
Bank CenterCredit JSC	29-Dec-2011	28-Oct-2015	20-Jul-2018	19-Jul-2019	12-Mar-2020									
S&P Long-term Issuer Rating (Foreign)	B+	B												
S&P Long-term Issuer Rating (Domestic)	B+	B												
S&P Long-term Issuer National Scale Rating (Domestic)	kzBBB	kzBB+	kzBBB-	kzBB+										
Outlook	STBL													
Bank TuranAlem JSC	11-Apr-2003	10-Feb-2006	16-Feb-2009	20-Mar-2009	26-Mar-2009	31-Mar-2009	24-Apr-2009	26-Oct-2010	10-Nov-2011	11-Oct-2018	24-Sep-2019			
S&P Long-term Issuer Rating (Foreign)	BB-	BB	B+	CCC+	C	CC	D	B-	NR	B				
S&P Long-term Issuer Rating (Domestic)	BB-	BB	B+	CCC+	C	CC	D	B-	NR	B				
S&P Long-term Issuer National Scale Rating (Domestic)								kzBB-	NR	kzBB	kzBB+			
Outlook	STBL													
Citibank Kazakhstan JSC	01-Jul-1985	26-Apr-1990	05-Nov-1990	15-Oct-1991	14-Mar-1994	06-Jul-1995	06-Sep-2001	14-Feb-2007	15-Jan-2008	19-Dec-2008	29-Nov-2011	16-Dec-2016		
S&P Long-term Issuer Rating (Foreign)	AA+	AA	AA-	A	A+	AA-	AA	AA+	AA	A+	A	A+		
S&P Long-term Issuer Rating (Domestic)	AA+	AA	AA-	A	A+	AA-	AA	AA+	AA	A+	A	A+		
S&P Long-term Issuer National Scale Rating (Domestic)														
Outlook	STBL													
Delta Bank JSC	27-Jun-2011	30-Dec-2016	23-Jan-2017	02-Feb-2017	16-Feb-2017	10-Nov-2017								
S&P Long-term Issuer Rating (Foreign)	B	CCC+	CCC-	CC	D	NR								
S&P Long-term Issuer Rating (Domestic)	B	CCC+	CCC-	CC	D	NR								
S&P Long-term Issuer National Scale Rating (Domestic)	kzBB+	kzB-	kzCCC-	kzCC	D	NR								
Outlook	STBL													
EXIMBANK KAZAKHSTAN JSC	08-Apr-2015	20-Feb-2017	09-Feb-2018	25-Apr-2018										
S&P Long-term Issuer Rating (Foreign)	B-		CCC+	NR										
S&P Long-term Issuer Rating (Domestic)	B-		CCC+	NR										
S&P Long-term Issuer National Scale Rating (Domestic)	kzBB-	kzB+	kzB-	NR										
Outlook	STBL													
IB Zaman-Bank JSC	27-Dec-2011	28-Nov-2014												
S&P Long-term Issuer Rating (Foreign)	CCC+	NR												
S&P Long-term Issuer Rating (Domestic)	CCC+	NR												
S&P Long-term Issuer National Scale Rating (Domestic)	kzB-	NR												
Outlook	STBL													
KASPI BANK JSC	05-Dec-2012	26-Feb-2015	11-Jul-2018	15-Aug-2018										
S&P Long-term Issuer Rating (Foreign)	BB-													
S&P Long-term Issuer Rating (Domestic)	BB-													
S&P Long-term Issuer National Scale Rating (Domestic)	kzA-	kzBBB+	kzA-	kzA										
Outlook	STBL													
Kazinvestbank JSC	04-Dec-2006	23-Jun-2008	29-Jun-2009	25-Jul-2013	03-Jun-2014	24-May-2016	28-Dec-2016	17-Feb-2017						
S&P Long-term Issuer Rating (Foreign)	B		B-	NR	B-		D	NR						

S&P Long-term Issuer Rating (Domestic)	B		B-	NR	B-		D	NR										
S&P Long-term Issuer National Scale Rating (Domestic)	kzBB+	kzBB	kzBB-	NR	kzBB-	kzB+	D	NR										
Outlook																		
KAZKOMMERTSBANK JSC	28-Mar-2003	22-Jul-2005	10-Feb-2006	11-Dec-2007	16-Feb-2009	06-May-2009	11-Jun-2009	12-Dec-2011	23-Oct-2012	23-Sep-2013	13-Oct-2014	15-Oct-2015	16-May-2016	19-Oct-2016	18-Jul-2017	25-Jun-2018	03-Aug-2018	
S&P Long-term Issuer Rating (Foreign)	BB-	BB	BB+	BB	BB-	B+	B	B+		B		B-	CCC+	B-	B+	BB	NR	
S&P Long-term Issuer Rating (Domestic)	BB-	BB	BB+	BB	BB-	B+	B	B+		B		B-	CCC+	B-	B+	BB	NR	
S&P Long-term Issuer National Scale Rating (Domestic)										kzBBB-	kzBB+	kzBB	kzBB-	kzB-	kzB+	kzBBB-	kzA+	NR
Outlook																		
Nurbank JSC	22-Jan-2002	22-Jul-2005	24-Jan-2011	27-Jan-2012	23-Jan-2013	02-Feb-2016	08-Jun-2017	29-Jun-2018	12-Mar-2020									
S&P Long-term Issuer Rating (Foreign)	B-	B		B-	B		B-											
S&P Long-term Issuer Rating (Domestic)	B-	B		B-	B		B-											
S&P Long-term Issuer National Scale Rating (Domestic)			kzBB+	kzBB-	kzBB+	kzBB	kzB+	kzBB-										
Outlook																	STBL	
ALFA BANK JSC SB	23-Jan-2012	03-May-2013	26-Feb-2015	03-Nov-2016	11-Jul-2018	29-Oct-2019												
S&P Long-term Issuer Rating (Foreign)		B+		BB-														
S&P Long-term Issuer Rating (Domestic)		B+		BB-														
S&P Long-term Issuer National Scale Rating (Domestic)	kzBBB		kzBBB-	kzA-	kzA													
Outlook																	POS	
Temirbank JSC	13-Nov-2006	39427	16-Feb-2009	20-Mar-2009	26-Mar-2009	31-Mar-2009	24-Nov-2009	04-Oct-2010	28-Oct-2013	16-Dec-2014	13-Apr-2015							
S&P Long-term Issuer Rating (Foreign)	B+		B	CCC+	C	CC	D	B	B-	B	NR							
S&P Long-term Issuer Rating (Domestic)	B+		B	CCC+	C	CC	D	B	B-	B	NR							
S&P Long-term Issuer National Scale Rating (Domestic)	kzBBB+	kzBBB	kzBB+	kzB-	kzC	kzCC	D	kzBB	kzBB-	kzBB	NR							
Outlook																		
Qazaq Banki JSC	04-Aug-2014	29-Jul-2016	13-Feb-2018	24-Apr-2018														
S&P Long-term Issuer Rating (Foreign)	B-		CCC+	NR														
S&P Long-term Issuer Rating (Domestic)	B-		CCC+	NR														
S&P Long-term Issuer National Scale Rating (Domestic)	kzBB-	kzB+	kzB-	NR														
Outlook																		
Shinhan Bank Kazakhstan JSC	14-Mar-2000	24-Sep-2002	09-Jul-2003	15-Apr-2004	06-Jun-2005	27-Sep-2005	06-Dec-2011	08-Aug-2016										
S&P Long-term Issuer Rating (Foreign)	BB	BB+	BBB-	BBB	BBB+	A-	A	A+										
S&P Long-term Issuer Rating (Domestic)	BB	BB+	BBB-	BBB	BBB+	A-	A	A+										
S&P Long-term Issuer National Scale Rating (Domestic)																		
Outlook																	STBL	
Tengri Bank JSC	08-Jan-2015	11-Jul-2018	17-Aug-2018	28-Nov-2018	06-Dec-2018													
S&P Long-term Issuer Rating (Foreign)	B+		B	B-	NR													
S&P Long-term Issuer Rating (Domestic)	B+		B	B-	NR													
S&P Long-term Issuer National Scale Rating (Domestic)			kzBBB															
Outlook																		
SB VTB Bank (Kazakhstan) JSC	27-Sep-2013	28-Apr-2014	04-Feb-2015	27-Nov-2015	06-Mar-2018	11-Jul-2018												
S&P Long-term Issuer Rating (Foreign)	BBB-	BB+	BB		BB+													
S&P Long-term Issuer Rating (Domestic)	BBB-	BB+	BB		BB+													
S&P Long-term Issuer National Scale Rating (Domestic)	kzAA	kzAA-	kzA+	kzA	kzAA-	kzAA												
Outlook																	STBL	

Moody's

AB KZI BANK JSC	06-Apr-2001	30-Sep-2004	20-Dec-2005	24-Apr-2007	09-Nov-2009	08-январь-2010	03-Jul-2012	20-May-2013	03-Jun-2014	26-Sep-2016	09-Mar-2018	07-Jun-2018	28-Aug-2018	26-Sep-2018	18-Jun-2019
Moody's Long-term Bank Deposit (Foreign)			B1			Ba3	Ba2	Baa3		Ba2	Ba3		B1	B2	B3
Moody's Long-term Bank Deposit (Domestic)	B3	B2	B1	Baa1	Baa3		Baa2		Baa3	Ba1	Ba2	Ba3	B1		B2
Moody's Long-term Issuer National Scale Rating (Domestic)															
Outlook													NEG		
Altyn Bank JSC (SB of China Citic Bank Corporation Ltd)	19-May-2016	26-Jun-2018	12-Dec-2018												
Moody's Long-term Bank Deposit (Foreign)	Ba2		Ba1												
Moody's Long-term Bank Deposit (Domestic)	Ba2		Ba1												
Moody's Long-term Issuer National Scale Rating (Domestic)	A2.kz	Aa3.kz	Aa1.kz												
Outlook			STBL												
Bank Bank RBK JSC	16-Jul-2019														
Moody's Long-term Bank Deposit (Foreign)	B2														
Moody's Long-term Bank Deposit (Domestic)	B2														
Moody's Long-term Issuer National Scale Rating (Domestic)	Baa3.kz														
Outlook	STA														
Eurasian Bank JSC	09-Jul-2003	24-Apr-2015	07-Sep-2015	25-Feb-2016	13-Sep-2019										
Moody's Long-term Bank Deposit (Foreign)	B1	B2	Caa1	WR	B2										
Moody's Long-term Bank Deposit (Domestic)	B1	B2	Caa1	WR	B2										
Moody's Long-term Issuer National Scale Rating (Domestic)						Baa2.kz									
Outlook						STBL									
First Heartland Jusan Bank JSC	04-Nov-2004	24-Feb-2009	01-Jul-2010	13-Sep-2011											
Moody's Long-term Bank Deposit (Foreign)	B1	B3	Caa1	WR											
Moody's Long-term Bank Deposit (Domestic)															
Moody's Long-term Issuer National Scale Rating (Domestic)															
Outlook															
ForteBank JSC	06-Feb-2009	01-Apr-2009	02-Jul-2010	02-Oct-2013	30-Apr-2015	27-Sep-2016	15-Jul-2019								
Moody's Long-term Bank Deposit (Foreign)	B2	Caa3	B3	Caa2	Caa1	B3	B1								
Moody's Long-term Bank Deposit (Domestic)		Caa3	B3	Caa2	Caa1	B3	B1								
Moody's Long-term Issuer National Scale Rating (Domestic)															
Outlook							STBL								
Halyk Savings Bank of Kazakhstan JSC	08-Nov-2002	31-Aug-2006	18-Dec-2008	24-Feb-2009	27-Jun-2017	27-Aug-2019									
Moody's Long-term Bank Deposit (Foreign)	Ba1			Ba2	Ba1										
Moody's Long-term Bank Deposit (Domestic)	Ba1	Baa2	Baa3	Ba2	Ba1										
Moody's Long-term Issuer National Scale Rating (Domestic)															
Outlook							POS								
Housing Construction Savings Bank of Kazakhstan JSC	22-Nov-2007	24-Feb-2009	04-May-2010	01-Aug-2014	27-Aug-2019										
Moody's Long-term Bank Deposit (Foreign)															
Moody's Long-term Bank Deposit (Domestic)	Baa2	Baa3	Ba1	Baa3											
Moody's Long-term Issuer National Scale Rating (Domestic)															
Outlook							POS								
JSC SB PNB Bank in Kazakhstan	05-Feb-2003	24-Apr-2007	21-Oct-2009	17-Dec-2009	21-Dec-2011	16-Aug-2013	21-May-2018	4-Sep-19							
Moody's Long-term Bank Deposit (Foreign)	Ba2		Ba1	Baa3		Ba1									

Moody's Long-term Bank Deposit (Domestic)	Ba2	A2	Baa2		Baa3	Ba1						
Moody's Long-term Issuer National Scale Rating (Domestic)												
Outlook	POS											
ATFBank JSC	08-Apr-2004	19-Nov-2007	24-Feb-2009	26-Jul-2010	11-Oct-2011	15-May-2012	17-May-2013	29-Oct-2013	07-Sep-2015	14-Nov-2017	14-Nov-2019	
Moody's Long-term Bank Deposit (Foreign)	Ba1			Ba2	Ba3	B1	B3	Caa1	Caa2	B3	B2	
Moody's Long-term Bank Deposit (Domestic)	Ba1	Baa2	Ba1	Ba2	Ba3	B1	B3	Caa1	Caa2	B3	B2	
Moody's Long-term Issuer National Scale Rating (Domestic)												
Outlook	STBL											
Bank CenterCredit JSC	27-May-2004	24-Feb-2009	18-Apr-2011	02-Oct-2013	19-Nov-2019	26-Jun-2018	19-Nov-2019					
Moody's Long-term Bank Deposit (Foreign)	Ba1	Ba3	B1	B2								
Moody's Long-term Bank Deposit (Domestic)			B1	B2								
Moody's Long-term Issuer National Scale Rating (Domestic)			Ba3.kz	B1.kz	Ba2.kz	Baa3.kz	Baa2.kz					
Outlook	POS											
Bank TuranAlem JSC	08-Nov-2002	24-Feb-2009	27-Mar-2009	26-Oct-2010	24-May-2011	10-Nov-2011	07-Dec-2011	21-Feb-2013	04-Feb-2014	10-Jul-2015	11-Oct-2018	24-Sep-2019
Moody's Long-term Bank Deposit (Foreign)	Ba1	B1	Caa3		B3		Caa2	Caa1	B3	WR		
Moody's Long-term Bank Deposit (Domestic)	Ba1	B1	Caa3		B3		Caa2	Caa1	B3	WR		
Moody's Long-term Issuer National Scale Rating (Domestic)				kzBB-		NR					kzBB	kzBB+
Outlook												
Citibank Kazakhstan JSC	11-Oct-2001	26-Sep-2006	13-Dec-2007	18-Dec-2008	27-Feb-2009	21-Jun-2012	14-Nov-2013	28-May-2015	21-Feb-2019			
Moody's Long-term Bank Deposit (Foreign)	Aa1	Aaa	Aa1	Aa3	A1	A3	A2	A1	Aa3			
Moody's Long-term Bank Deposit (Domestic)												
Moody's Long-term Issuer National Scale Rating (Domestic)												
Outlook	STBL											
Delta Bank JSC	19-Dec-2014	23-Mar-2015	24-Mar-2015									
Moody's Long-term Bank Deposit (Foreign)	Caa1	Ca	WR									
Moody's Long-term Bank Deposit (Domestic)	B3	Ca	WR									
Moody's Long-term Issuer National Scale Rating (Domestic)												
Outlook												
KASPI BANK JSC	20-Sep-2005	04-MAY-2007	18-Dec-2008	24-Feb-2009	06-Nov-2012	24-Apr-2015	11-May-2016	31-Oct-2017	26-Jun-2018	27-Aug-2019	22-Oct-2018	27-Aug-2019
Moody's Long-term Bank Deposit (Foreign)	Ba2	Ba3		B1							Ba3	Ba2
Moody's Long-term Bank Deposit (Domestic)			Ba3	B1							Ba3	Ba2
Moody's Long-term Issuer National Scale Rating (Domestic)					Ba2.kz	Ba3.kz	Baa3.kz	Baa2.kz	A3.kz	A2.kz		
Outlook	STBL											
Kazinvestbank JSC	29-Oct-2007	30-Mar-2009	21-Jul-2010	28-Jul-2011	10-Mar-2016							
Moody's Long-term Bank Deposit (Foreign)	B2	WR	B2	B3	WR							
Moody's Long-term Bank Deposit (Domestic)	B2	WR	B2	B3	WR							
Moody's Long-term Issuer National Scale Rating (Domestic)												
Outlook												
KAZKOMMERTSBANK JSC	08-Nov-2002	03-Oct-2007	01-Nov-2007	24-Dec-2009	18-Sep-2012	07-Sep-2015	27-Jun-2017	05-Sep-2018	06-Sep-2018			
Moody's Long-term Bank Deposit (Foreign)	Ba1			Ba3	B2	B3	Ba2	Ba1	WR			
Moody's Long-term Bank Deposit (Domestic)	Ba1	Baa2	Ba1	Ba3	B2	B3	Ba2	Ba1	WR			
Moody's Long-term Issuer National Scale Rating (Domestic)												
Outlook												
Nurbank JSC	03-Dec-2002	04-May-2007	24-Feb-2009	01-Jul-2010	29-Apr-2014							

Moody's Long-term Bank Deposit (Foreign)	Ba3	B1	B2	B3	WR					
Moody's Long-term Bank Deposit (Domestic)		B1	B2	B3	WR					
Moody's Long-term Issuer National Scale Rating (Domestic)										
Outlook										
ALFA BANK JSC SB	26-Jan-2004	09-Mar-2010	22-Nov-2011	28-Feb-2012	15-Apr-2013					
Moody's Long-term Bank Deposit (Foreign)	Ba3	B2		WR						
Moody's Long-term Bank Deposit (Domestic)	Ba3	B2		WR						
Moody's Long-term Issuer National Scale Rating (Domestic)			B1.kz		WR					
Outlook										
Temirbank JSC	02-Dec-2004	22-Dec-2006	01-Nov-2007	07-May-2008	18-Dec-2008	09-Feb-2009	24-Feb-2009	27-Mar-2009	21-Sep-2009	
Moody's Long-term Bank Deposit (Foreign)		Ba1	Ba2	Ba3		B2	B3	Caa3	WR	
Moody's Long-term Bank Deposit (Domestic)	B1				Ba3	B2	B3	Caa3	WR	
Moody's Long-term Issuer National Scale Rating (Domestic)										
Outlook										
SB JSC NB of Pakistan in Kazakhstan	22-Oct-2003	24-Apr-2007	21-May-2008	29-Oct-2008	10-Dec-2010	31-May-2012	17-Jul-2012	26-Mar-2015	17-Jun-2015	04-Dec-2019
Moody's Long-term Bank Deposit (Foreign)	B2		B3					Caa2		Caa1
Moody's Long-term Bank Deposit (Domestic)	B2	Baa2		Ba2	Ba3	B2	B3	Caa1		
Moody's Long-term Issuer National Scale Rating (Domestic)										
Outlook										STBL
SB Sberbank JSC	20-May-2003	26-Jul-2006	18-Dec-2008	27-Feb-2015	18-Jul-2018	27-Aug-2019				
Moody's Long-term Bank Deposit (Foreign)		Ba1	Ba2	Ba3		Ba1				
Moody's Long-term Bank Deposit (Domestic)	B1	Ba1	Ba2	Ba3		Ba1				
Moody's Long-term Issuer National Scale Rating (Domestic)										
Outlook										STBL
Shinhan Bank Kazakhstan JSC	06-Nov-2003	03-Apr-2006	10-Aug-2006	25-Jul-2007	14-Apr-2010	26-May-2015	08-Dec-2017			
Moody's Long-term Bank Deposit (Foreign)			A3	A2	A1	Aa3				
Moody's Long-term Bank Deposit (Domestic)	Baa1	WR								
Moody's Long-term Issuer National Scale Rating (Domestic)										
Outlook										STBL
Tengri Bank JSC	30-Oct-2018									
Moody's Long-term Bank Deposit (Foreign)	B2									
Moody's Long-term Bank Deposit (Domestic)	B2									
Moody's Long-term Issuer National Scale Rating (Domestic)	Baa3.kz									
Outlook	STBL									

	21-Mar-2002	28-Mar-2003	01-Oct-2003	09-Feb-2004	27-Aug-2004	14-Jan-2005	08-Dec-2005	01-Jun-2007	14-Dec-2007	11-Dec-2009	13-Nov-2012	28-Jul-2016	02-Feb-2017	20-Jul-2018	01-Oct-2018	19-Jul-2019	12-Nov-2019
AB KZI BANK JSC																	
Fitch Long-term Issuer Default Rating (Foreign)		B-	B	B+		BB-				BB+	BBB-		BB+	BB-	B+		
Fitch Long-term Issuer Default Rating (Domestic)		B-	B	B+		BB-			BB	BB+	BBB	BBB-		BB+	BB	BB-	
Fitch Long-term Issuer National Scale Rating (Foreign)	A-(tur)	BBB+(tur)			A-(tur)		A(tur)	AA(tur)	AA+(tur)		AAA(tur)				AA(tur)		
Outlook																	STBL
Altyn Bank JSC (SB of China Citic Bank Corporation Ltd)	02-Apr-2015	18-May-2018	12-Mar-2020														
Fitch Long-term Issuer Default Rating (Foreign)	BB	BBB-															
Fitch Long-term Issuer Default Rating (Domestic)	BB	BBB-															
Fitch Long-term Issuer National Scale Rating (Foreign)	A+(kaz)	AA+(kaz)															
Outlook																	STA
AsiaCredit Bank (AsiaCredit Bank) JSC	23-Jul-2013	16-Apr-2014	06-Apr-2017	05-Apr-2018													
Fitch Long-term Issuer Default Rating (Foreign)	B-	B	B-	WD													
Fitch Long-term Issuer Default Rating (Domestic)	B-	B	B-	WD													
Fitch Long-term Issuer National Scale Rating (Foreign)		BB(kaz)	BB-(kaz)	WD													
Outlook																	STA
Bank of Astana JSC	28-Oct-2015	06-Apr-2017	05-Apr-2018														
Fitch Long-term Issuer Default Rating (Foreign)	B	B-	WD														
Fitch Long-term Issuer Default Rating (Domestic)	B	B-	WD														
Fitch Long-term Issuer National Scale Rating (Foreign)	BB(kaz)	BB-(kaz)	WD														
Outlook																	
Eurasian Bank JSC	12-Jul-2006	06-Jul-2010															
Fitch Long-term Issuer Default Rating (Foreign)	B-	WD															
Fitch Long-term Issuer Default Rating (Domestic)																	
Fitch Long-term Issuer National Scale Rating (Foreign)																	
Outlook																	
First Heartland Jusan Bank JSC	20-Sep-2006	19-Feb-2009	11-Jun-2009	27-Oct-2015	20-Dec-2016	21-Sep-2017											
Fitch Long-term Issuer Default Rating (Foreign)	B-	CCC	WD	B+	B	WD											
Fitch Long-term Issuer Default Rating (Domestic)				B+	B	WD											
Fitch Long-term Issuer National Scale Rating (Foreign)				BBB-(kaz)	BB+(kaz)	WD											
Outlook																	
FortBank JSC	08-Apr-2005	20-Dec-2005	19-Feb-2009	25-Mar-2009	14-Apr-2009	19-Jul-2010	24-May-2013	23-Dec-2013	31-Mar-2014	30-Dec-2014	25-Jul-2018	3-Dec-19					
Fitch Long-term Issuer Default Rating (Foreign)	B+	BB-	B	CCC	RD	B-	CCC	C	RD	WD	B						
Fitch Long-term Issuer Default Rating (Domestic)						B-	CCC	C	RD	WD	B						
Fitch Long-term Issuer National Scale Rating (Foreign)											BB+(kaz)						
Outlook																	POS
Halyk Savings Bank of Kazakhstan JSC	28-Aug-2003	17-Apr-2003	28-Oct-2004	09-Sep-2005	20-Dec-2005	10-Nov-2008	19-Feb-2009	06-May-2009	25-Apr-2011	23-Jan-2014	03-Dec-2019						
Fitch Long-term Issuer Default Rating (Foreign)	B+	BB-	BB		BB+	BB	BB-	B+	BB-	BB	BB+						
Fitch Long-term Issuer Default Rating (Domestic)				BB+	BBB-	BB	BB-	B+	BB-	BB	BB+						
Fitch Long-term Issuer National Scale Rating (Foreign)											AA(kaz)						
Outlook																	POS
Housing Construction Savings Bank of Kazakhstan JSC	25-Nov-2014	11-May-2016	20-Mar-20														
Fitch Long-term Issuer Default Rating (Foreign)																	

Fitch Long-term Issuer Default Rating (Domestic)	BBB+	BBB-											
Fitch Long-term Issuer National Scale Rating (Foreign)													
Outlook	POS												
Islamic Bank Al Hilal JSC	09-Sep-2013	02-Jul-2019											
Fitch Long-term Issuer Default Rating (Foreign)	A+	WD											
Fitch Long-term Issuer Default Rating (Domestic)													
Fitch Long-term Issuer National Scale Rating (Foreign)													
Outlook	STBL												
JSC SB PNB Bank in Kazakhstan	01-Dec-2000	13-Nov-2001	26-May-2006	10-Feb-2012	12-Sep-2012	29-Sep-2008	04-Oct-2019						
Fitch Long-term Issuer Default Rating (Foreign)	B+	NR					BBB-						
Fitch Long-term Issuer Default Rating (Domestic)													
Fitch Long-term Issuer National Scale Rating (Foreign)			AAA (ind)	Fitch AAA (ind)	WD (ind)								
Outlook	STBL												
ATFBank JSC	01-Dec-2000	17-Apr-2003	20-Dec-2005	15-Nov-2007	10-Nov-2008	22-Oct-2009	22-Dec-2011	21-Mar-2013	08-May-2013	15-Dec-2017	12-Mar-2019	03-Dec-2019	
Fitch Long-term Issuer Default Rating (Foreign)	B	B+	BB-	BBB+	BBB			BBB-	B-	B	B-		
Fitch Long-term Issuer Default Rating (Domestic)					BBB			BBB-	B-	B	B-		
Fitch Long-term Issuer National Scale Rating (Foreign)						AAA (kaz)	AA+ (kaz)	AA (kaz)	BB- (kaz)	BB+ (kaz)	BB- (kaz)		
Outlook												STBL	
Bank CenterCredit JSC	01-Dec-2000	16-Aug-2002	17-Apr-2003	20-Dec-2005	19-Feb-2009	06-May-2009	19-Apr-2012	16-Apr-2013	11-Apr-2014	12-Mar-2019	03-Apr-2019		
Fitch Long-term Issuer Default Rating (Foreign)	B	B-	B+	BB-	B+	B	B+			B	B-	WD	
Fitch Long-term Issuer Default Rating (Domestic)								B+	B	B-	WD		
Fitch Long-term Issuer National Scale Rating (Foreign)								BBB (kaz)	BB+ (kaz)	BB- (kaz)	WD		
Outlook													
Bank TuranAlem JSC	23-Feb-2006	10-Nov-2008	19-Feb-2009	24-Mar-2009	24-Apr-2009	10-Dec-2010	14-Nov-2011	23-Dec-2011	19-Jan-2012	16-Apr-2013	15-Aug-2014	12-Aug-2015	
Fitch Long-term Issuer Default Rating (Foreign)	BB+	BB	B+	CC	RD	B-	CCC	C	RD	CCC	B-	WD	
Fitch Long-term Issuer Default Rating (Domestic)	BBB-	BB	B+	CC	RD	B-	CCC	C	RD	CCC	B-	WD	
Fitch Long-term Issuer National Scale Rating (Foreign)													
Outlook													
Citibank Kazakhstan JSC	18-Aug-1993	14-Apr-1994	26-Apr-1996	03-Jun-2002	05-Nov-2007	18-Apr-2008	24-Nov-2008	15-Dec-2011	19-May-2015	12-Jun-2019			
Fitch Long-term Issuer Default Rating (Foreign)	A	AA-	AA	AA+	AA	AA-	A+	A	A+				
Fitch Long-term Issuer Default Rating (Domestic)													
Fitch Long-term Issuer National Scale Rating (Foreign)													
Outlook	STBL												
EXIMBANK KAZAKHSTAN JSC	22-Sen-2015	28-Sen-2017	05-Oct-2017										
Fitch Long-term Issuer Default Rating (Foreign)	B-	CCC	WD										
Fitch Long-term Issuer Default Rating (Domestic)	B-	CCC	WD										
Fitch Long-term Issuer National Scale Rating (Foreign)	B+ (kaz)	B (kaz)	WD										
Outlook													
KASPI BANK JSC	23-Feb-2006	19-Feb-2009	01-Apr-2010	28-Dec-2012									
Fitch Long-term Issuer Default Rating (Foreign)	B+	B	B-	WD									
Fitch Long-term Issuer Default Rating (Domestic)													
Fitch Long-term Issuer National Scale Rating (Foreign)													
Outlook													
KAZKOMMERTSBANK JSC	23-Sep-1997	10-Apr-2002	07-Apr-2003	09-Sep-2005	20-Dec-2005	10-Nov-2008	19-Feb-2009	06-May-2009	19-Apr-2012	12-Aug-2015	19-Jan-2016	31-Aug-2017	02-Aug-2018

Fitch Long-term Issuer Default Rating (Foreign)	B+	BB-	BB		BB+	BB	BB-	B-	B	B-	CCC	BB-	WD
Fitch Long-term Issuer Default Rating (Domestic)				BB+	BBB-	BB	BB-	B-	B	B-	CCC	BB-	WD
Fitch Long-term Issuer National Scale Rating (Foreign)													
Outlook													
ALFA BANK JSC SB	19-Jun-2013	03-Apr-2017	12-Mar-2020										
Fitch Long-term Issuer Default Rating (Foreign)	B+	BB-											
Fitch Long-term Issuer Default Rating (Domestic)	B+	BB-											
Fitch Long-term Issuer National Scale Rating (Foreign)	BBB (kaz)	BBB+ (kaz)											
Outlook				STBL									
Temirbank JSC	03-Nov-2005	22-Dec-2006	19-Feb-2009	24-Mar-2009	30-Apr-2009	04-Aug-2009	23-Nov-2009	12-Nov-2010	18-Jul-2011				
Fitch Long-term Issuer Default Rating (Foreign)	B-	BB-	B+	CC	C	CC	RD	B-	WD				
Fitch Long-term Issuer Default Rating (Domestic)								B-	WD				
Fitch Long-term Issuer National Scale Rating (Foreign)													
Outlook													
INDUSTRIAL & COMMERCIAL BANK OF CHINA (ALMATY) JSC	06-Dec-2019	12-Mar-2020											
Fitch Long-term Issuer Default Rating (Foreign)	BBB+												
Fitch Long-term Issuer Default Rating (Domestic)	BBB+												
Fitch Long-term Issuer National Scale Rating (Foreign)													
Outlook				STBL									
SB JSC Bank Home Credit	24-Apr-2013	10-Nov-2014	17-Apr-2015	11-Nov-2016	12-Mar-2020								
Fitch Long-term Issuer Default Rating (Foreign)	BB-	B+	B	B+									
Fitch Long-term Issuer Default Rating (Domestic)	BB-	B+	B	B+									
Fitch Long-term Issuer National Scale Rating (Foreign)	BBB+ (kaz)	BBB (kaz)	BB+ (kaz)	BBB (kaz)									
Outlook						STBL							
SB Sberbank JSC	07-Apr-2010	22-Jan-2015	19-Aug-2019	03-Dec-2019									
Fitch Long-term Issuer Default Rating (Foreign)	BBB-	BB+	BBB-										
Fitch Long-term Issuer Default Rating (Domestic)	BBB-	BB+	BBB-										
Fitch Long-term Issuer National Scale Rating (Foreign)	AA (kaz)	AA- (kaz)	AA+ (kaz)										
Outlook						STBL							
Shinhan Bank Kazakhstan JSC	01-Dec-2000	15-May-2001	28-Aug-2003	24-Oct-2005	29-Feb-2008	30-Apr-2019							
Fitch Long-term Issuer Default Rating (Foreign)	BBB-	NR	BBB+	A-	A								
Fitch Long-term Issuer Default Rating (Domestic)													
Fitch Long-term Issuer National Scale Rating (Foreign)													
Outlook							STBL						
SB VTB Bank (Kazakhstan) JSC	06-Sep-2010	22-Jan-2014											
Fitch Long-term Issuer Default Rating (Foreign)	BBB-	WD											
Fitch Long-term Issuer Default Rating (Domestic)	BBB-	WD											
Fitch Long-term Issuer National Scale Rating (Foreign)	AA (kaz)	WD											
Outlook													

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