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**Effectiveness of risk management of mature companies**

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# Abstract.

Risk management in the financial sector is very important in the context of the management of private and public banks in order to increase the performance of the company. The study identified the main risks faced by the bank: market risk, liquidity risk, operational risk and credit risk. Metrics have also been defined to measure them. As a measure of the bank's performance, ROE and ROA were used. The study was conducted on a database consisting of 217 financial organizations of the Russian Federation. During the analysis of regression models, it was determined that the main influence on the development of the company is only the risk of a fall in the value of securities owned by the bank. It was also determined that with increasing maturity, the need to implement risk management in the bank's strategy disappears.

# Introduction.

In case of modern world, most of the serious companies are trying to avoid risk issues and for that they are trying to implement several risk management strategies. But sometimes it didn’t work quite well for several reasons.

Many studies have demonstrated that risk management in companies that are engaged in financial activities (in particular banks) is an important part of their activities. Traditional approaches to risk management are now undergoing changes, companies are increasingly implementing risk management strategies. In today's volatile, unstable and unreliable cash environment, banks face various risks: liquidity risk, operational risks, and so on. The risks faced by financial institutions may lead to their closure as a result of inability to fulfill their financial obligations. Thus, we can conclude that banking is a risky business, so effective risk management is crucial for the survival of commercial banks (Carey, 2001).

Risk management is a very important part of management in the monetary environment, much more important than in other sectors of the economy. The undoubted motivation of cash-related organizations is to increase income in terms of profit and offer additional value for shareholders' investments by offering various financial services and, in particular, adequately controlling risks. Over the past decade, the Russian banking industry has suffered significant losses in combination with the mismanagement of commercial banks. Several commercial banks that were doing well were suddenly hit by huge failures that led to the closure of the operation due to unbalanced credit risks and the inability to reduce risks in general (TRUST Bank, “Otkrytiye” Bank).

For example, a study of the Kenyan financial sector conducted by Ismi, A., 2004, revealed a gap between the methods of identification, measurement and risk management.

In our work we were tried to answer on several research questions:

1. How to measure Risk management performance for financial companies?
2. How does Risk management performance changes due maturity of the company?

Our work consists of 6 sections with 28 tables:

In the first section we explain the importance of applying risk management practices in companies and the relationship between ERM and PM.

In the second section, we find out the types of risk management faced by a financial organization, financial metrics for determining various risk management parameters, and also find out methods for measuring the company's performance.

At the third stage of the work, we analyzed previous studies and compiled a conceptual model of the work. We decided on the choice of the methodology of work - quantitative research and secondary data analysis. The data was collected from SPARK. Initially, 925 banks were collected, but after filtering, 217 financial organizations remained. We have described all the variables that were used during the work. With the help of the average annual increase in assets, banks were divided into 3 categories: young, adolescence and mature. The optimal control variable, the average annual capital gain, was determined and analyzed. The analysis of correlation matrices (6 matrices were constructed) and various types of regression (6 regressions each for ROA and ROE parameters) was carried out. As a result of the hypothesis testing, hypotheses related to mature companies were confirmed, while only value at risk was confirmed from hypotheses related to young banks.

At the conclusion stage, we demonstrated our conclusions regarding the applicability of risk management to improve the performance of the company. It was found out that in terms of a positive impact on a young financial institution, it is necessary to invest resources in market risk control. Regarding mature companies, hypotheses have been confirmed that mature companies can neglect risk management strategies.

Appendix and References consist of extra results of empirical study and literature.

**Importance of risk management for organizations performance:**

According to Rasid, S., etc (2017) enterprise risk management (ERM) and performance measurement systems (PMS) of the company leads to organizational performance (OP) of the company: they provide several regression analyses in case of each factor importance to OP, plus how they influence when they are both in the model.

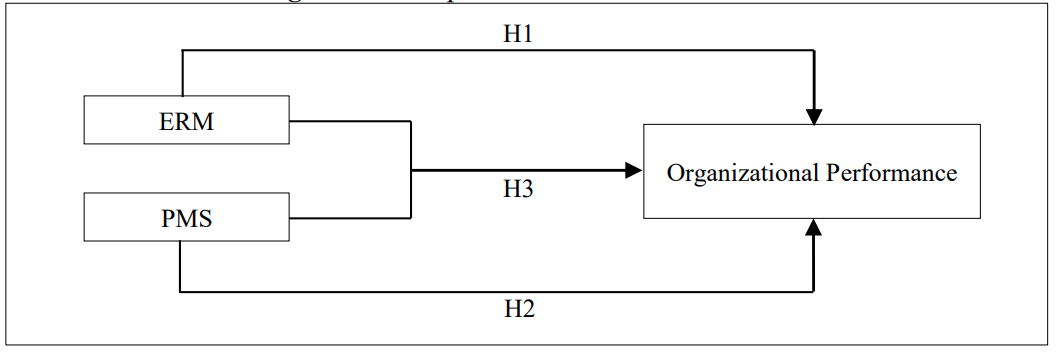
In their work, they confirmed the following hypotheses:

H1: ERM adoption positively influences organizational performance.

H2: The use of PMS or BSC as a comprehensive PMS framework positively influences organizational performance.

H3: Integrating the two management tools of ERM and PMS will enhance organizational performance to higher levels than practicing two frameworks in parallel without any linkage.

Figure 1: conceptual framework of Rasid, S., et al. (2017) research.



All the hypotheses were confirmed in Rasid, S., et al. (2017) research.

# Literature review

First, we need to state basic definitions in risk management.

Risk management is the identification of priority risks and their assessment, followed by using resources (economical and harmonious) to control the likelihood and parry the impact of adverse events, and as a result - the maximum realization of opportunities.

**Why do companies implement risk management strategies?**

One of the explanatory factors for the introduction of ERM into production are traditional theories that are responsible for motivated risk management. For example, Liebenberg, A and Hoyt, R, 2003, in their study cite theories that motivate traditional risk management activities, such as hedging and the demand for corporate insurance - these parameters that determine the traditional stages of risk management activities are well documented, unlike ERM, since there was not enough literature at that time, data on applicability were limited to industry questionnaires. According to the traditional theory, companies need to purchase insurance, as this can reduce the risks and, accordingly, the costs associated with the conflict of interests of the owner and management (shareholders seek to maximize profits, and management to the sustainability of the company), the expected costs of bankruptcy, taxes and expenses for the maintenance of regulatory control. In the course of the study, they showed that companies using ERM and in particular CRO (Chief Risk Officer), through a questionnaire of the company's management and the construction of logistic regression, reduce the risk of information asymmetry, which leads to a reduction in the risks to which the company is exposed.

Pagach and Warr (2011) in their work also talk about the lack of academic literature related to the implementation of ERM. They also reflect the stagnant nature of the development of the theoretical foundations of ERM. In the study, they showed that firms implement risk management and hire CRO in order not just to report to the regulator, but to increase profits (they showed this on the example of financial organizations, and came to the conclusion that banks with small capital more often implement risk management).

Other motives for implementing RM were presented by Lundqvist S. (2015). The author has shown that the factors influencing the introduction of corporate risk management instead of traditional instruments in the firm are connected, in addition to the size of the company and leverage, with the payment of dividends and the influence of the chief executive officer on the board of directors, so one of the reasons is the control of the company's management. In general, in the study it turned out that firms are implementing ERM in order to improve the risk management system (especially the CEO is interested in this).

**Types of risks that bank can be faced.**

In this chapter we present risks that can occurred by the financial companies. For example, Omondi O. defines three financial risk management problems that banks can be faced: Market risk, Operational risk, Credit risk and Liquidity risk:

1. **Market risk** - is the risk associated with the fact that the value of investments can decrease due to changes according to market factors. Volatility of investments often refers to the standard deviation of the change in the value of a financial instrument with a certain time horizon.
2. **Operational risk** - this risk is not characteristic of systemic risk, financial risk and/or market risk. That is the the type of the risk that remains after the determination of financial or systematic risk and includes risks arising from failures in the internal processes of the company, the behavior of people and/or systems**.**
3. **Credit risk** - this risk may arise due to problems on the part of the borrower (there is no payment for the loan issued to him). This is the risk of delinquency and, as a consequence, default on the debt. In this case, the risk comes from the borrower to the lender and includes the loss of the loan body and interest, disruption of cash flow and an increase in the cost of credit insurance.
4. **Liquidity risk** - arises as a result of the inability of a company or an individual to repay their debts, to sell assets (physical assets and securities) in the short term at a price close to the market without incurring catastrophic losses.

To avoid these risks, companies implement various strategies for risk planning and management According to Senior Supervisor Group (2010), there are typical management methods that can be implemented to solve the risk problem:

* Valuation Practices Relevant to Risk Management
* Use of a Range of Risk Measures
* Stress Testing and Scenario Analysis
* Hedging of Market and Credit Risks
* Credit Underwriting and Reporting
* Counterparty Risk Measurement and Management

**Performance evaluation of the company.**

According to Redir, H. and Mekonnen, Y., 2015, a typical bank performance rating is based on the following variables: profitability, Return on Assets (ROA) and Return on Equity (ROE). However, performance ratings calculated in this way may not accurately illustrate institutions that use strategies to maintain high performance.

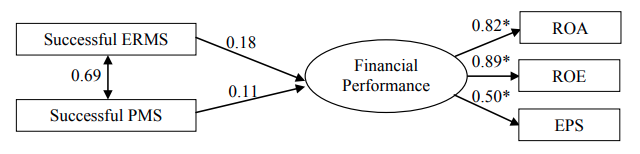
For example, the US Federal Reserve and the Central Bank of the Russian Federation use the CAMELS system to assess the bank's condition (Capital Adequacy, Asset Quality, Management Competence, Earnings, Liquidity, Sensitivity to Market risk), all five indicators are evaluated on a scale from 1 (reliable) to 5 (very unstable). One of the methods for predicting this parameter was proposed by Gilbert, R. et al, 2002. They suggested using the following tools instead of standard ones: financial indicators from balance sheets and profit and loss statements, and building econometric models based on them (information from financial coefficients) to predict CAMELS.

Also, the Nepal Rastra Bank Banking Supervision Department (BSD) evaluates the effectiveness of banks on the CAMELS scale.

In many studies, return indicators are used as a financial performance. For example, in case of study of Laisasikorn, K., and Rompho, N., 2014, they provide several models of the connection between financial performance of the company – return on assets, return on equity and earnings per share. Their results provide us that most impact of RM on these three comes to ROE and ROA.

Most important measurements for us in case of our study is ROE and ROA.

Figure 2. Laisasikorn, K., & Rompho, N. (2014 results)



So, according to this we say that successful ERM has the most impact on return on assets and return on equity (over 80% for both) and that’s why we can measure impact of ERM on business through ROE and ROA.

So according to this we can conclude first hypothesis:

H1. RM has impact on ROA and ROE

This correlates with hypothesis of Rasid S., et al., 2017, about the impact of the enterprise risk management on firm performance.

**How to measure? Market risk.**

Calculation of value at risk are proposed by the Basel committee for identifying market risks of portfolio that banks faces. In redaction of Basel from 2019 they propose to evaluate market risk as SVaR (Stress-VaR), but there is no information that central bank of Russian Federation has implemented this (latest translation was in 2009-2010). Therefore, we will rely on the old edition of Basel. According to it, central banks headed by the Basel Committee on Banking Supervision (see Basel Committee 2009-2010 from the Central Bank of the Russian Federation), banks of international settlements, should measure the market risk of their assets and trade balances using value-at-risk (VaR). In order to limit the risky activities of banks, the Basel Committee links the capital requirements of banks with the size of their VaR (through the price difference of market assets).

**How to measure? Operational risk.**

Operational risk control is important for commercial banks. For example, CBR controls this in the Russian Federation. And in order to manage them, they need to be evaluated.

One of the options was proposed by Yao et al., 2013. They developed a model called Conditional value-at-risk (Var), using random distribution of the variable X and adjusting it through the extreme values theory (EVT) to measure operational risk (through the probability of occurrence of a risk event). However, with different settings of the confidence interval, the estimated operational risk using EVT turned out to be no better than using the Standard Method or the base index method proposed by the Basel Committee.

Risk management is a variation of reserves for operational risks. The success of the application of risk management can be assessed using the ratio of success and losses (for a stable company, from the point of view of risks, the ratio of is important), respectively, the success of operational risk management will be reflected in the stability of ORC, that is, ORC can be considered as a measure of OR (Operational risk).

According to Basel III, the Russian edition of which the Central Bank of the Russian Federation (cbr.ru) uses, operational risk is calculated as a certain coefficient multiplied by the amount of capital allocated to cover operational risks – ORC (Formula 1). As the minimum capital allocated to cover operational risks, the multiplication of a certain coefficient established by the regulator by the average amount of the bank's income for 3 years is used (Formula 2). Formulas are provided in table 1.

Table 1. Formulas for OR and ORC.

|  |
| --- |
| Formula 1: |
| - coefficient, pointed by the regulator |
| Formula 2: |
| - average annual gross income for 3 years |

**How to measure? Credit risk.**

One of the most important risks faced by financial institutions is credit risk. The success of the bank depends on the success of working with this risk (accurate measurement and effective management), to a greater extent than in other types of organizations (Gieseche, 2004). According to the Basel Committee on Banking Supervision of 1999, an increase in credit risk leads to an increase in the marginal cost of debt and equity, which leads to an increase in the cost of funds for the bank. To assess credit risk, the researchers used a list of coefficients as following: The ratio of Loan Loss Reserves to Total Loans (LOSRES) is an indicator of the quality of the bank's assets, which shows how much of the total portfolio was secured, but not written off. The indicator shows that the higher the coefficient, the worse the quality and, consequently, the higher the risk of the loan portfolio. In addition, the provision for possible loan losses in the form of a share of net interest income (LOSRENI) is another indicator of credit quality, which indicates high credit quality, showing low indicators. In cross-country analysis studies, this may also reflect a difference in the rules of service provision.

In assessing the impact of lending activities on the risks of the financial sector, Bourke (1989) used the ratio of bank loans to assets (LTA). This is due to the fact that bank loans are relatively illiquid and subject to a high risk of default in relation to other types of bank assets, which leads to a positive correlation between LTA and credit risk indicators. However, according to other studies (Altunbas, 2005), relative improvements in credit risk management strategies may indicate that LTA is negatively associated with bank risk measures.

Bourke (1989) reported that the impact of credit risk on profitability appears to be clearly negative. The result obtained by the researcher can be explained considering the fact that the more financial institutions are exposed to high-risk loans, the higher the accumulation of unpaid loans, which ultimately leads to a decrease in profitability. This confirms the conclusions that better credit risk management leads to an increase in the efficiency of the bank (ROE, ROA as a measure of the bank's profitability).

But as a measure of credit risk, we need a variable that would more accurately reflect the relationship and correlate with the definition of credit risk. Studies, for example Miller and Noulas, 1997 and Kolapo et al., 2012, have shown that loan losses have led to a decrease in the profitability of many commercial banks. The findings of Felix and Claudine (2008) also demonstrated that return on equity (ROE) and return on assets (ROA), indicating the profitability of a financial company, are negatively related to the ratio of overdue loans to total loans (NPL/TL) of financial institutions, which leads to a decrease in profitability of financial institutions.

In our case, the best way is NLP/TL as an efficient measurement of credit risk management in banks.

**How to measure? Liquidity risk.**

There is no specific methodology for measuring bank liquidity risk. Financial organizations apply various standards (prescribed by their financial analysts) to measure current and future liquidity, since no single indicator gives a complete picture. In the past, methodologies for measuring liquidity risk were tied to the use of liquidity ratios.

Poorman and Blake (2005) in their study demonstrated that this method is not feasible: measuring liquidity only with the help of liquidity ratios is insufficient and does not contribute to solving the problem of liquidity risk. They showed that in addition to liquidity ratios, banks should develop a new approach to measuring liquidity. Thus, in recent years there have been many ways to assess the bank's liquidity risk, in addition to liquidity ratios. Based on the current literature, most studies have used the liquidity ratio as an indicator of liquidity risk, but our study uses the financing gap ratio (FGAPR) based on the findings of Saunders and Cornett, 2006 and DeYoung and Jang, 2016.

Saunders and Cornett, 2006 in their study indicated that financial institutions measure their exposure to liquidity risk by determining their funding shortfall. Bank managers often view their main deposits as a stable source of funds that allows them to constantly finance and refinance bank loans. DeYoung and Jang (2016), referring to the Basel III edition, showed that the financing deficit is related to the net stable financing ratio (NSFR), according to which banks must comply with the conditions for conducting their business activities in order to create sufficiently stable financing (deposits) to fully finance their illiquid assets (loans, non-refundable loans). Banks consider customer deposits as cheap sources of financing, and financing gap is equal to the difference between average bank loans and average deposits. If the financing deficit turns out to be positive, then the bank must finance it at the expense of its own funds, the sale of liquid assets and borrowing funds on the money market. Thus, the financial gap can be estimated by deducting borrowed funds from the amount of liquid assets. This funding shortfall indicates the bank's need for financing after the sale of its liquid assets. When banks issue more loans with fewer liquid assets and receive fewer deposits, banks may be more exposed to liquidity risk. Thus, this study argues that the financing deficit is more appropriate as an indicator of bank liquidity risk. To standardize the financing deficit, we divide it by total assets (FGAPR). In our study, FGAP is defined as the difference between bank loans and customer deposits. Next, we divide by the total amount of assets and get FGAPR. The same variable was used in study by Chen, Y. K., and etc. 2018, to identify credit risks. Table 2 provides formula for FGAPR and FGAP.

Table 2. FGAPR formula

|  |
| --- |
| Formula: |
|  |

**Maturity**

Often, banking projects are well planned, use all the necessary resources and software, qualified personnel are present, provided by a financial organization. But for some reason, projects are carried out extremely slowly, in some cases they do not reach completion, and if they are completed, it happens that they are not even completed, and if they are finalized, it is far from the result that the bank's management expected.

There can be quite a lot of reasons for this behavior of the project, and overcoming them all is often an impossible task. So, to solve the problem, it is necessary to look at it from above, systematically.

It turns out that most of these reasons come down to one thing - insufficient maturity of the bank for the implementation of a certain development project.

The maturity of the bank is the ability of the company to finance current and future projects and achievements.

Often, internal audits are conducted in companies to assess maturity, in which various parameters are evaluated from the point of view of maturity, such as: strategy, shareholders and top management, personnel, etc. The assessment is carried out on a five-point scale and the maturity of the company is assessed on the basis of the points received.

Another approach to the maturity of the bank was used in the article DeYoung at al., 1999. In their article, they assessed the maturity of the bank in terms of issuing loans to small businesses. They came to the conclusion that the less a financial institution finances a small business, the more mature it is considered. The authors divided the degrees of maturity into 3 types: young, adolescence and mature. As one of the variables, they used the growth of the company's assets and showed that with the growth of assets, the bank begins to finance small businesses less, which also coincides with the results of Peek, J., and Rosengren, E., 1998.

Brief summary of this part provided in table 3.

Table 3. Summary of the maturity

|  |  |
| --- | --- |
| Object | Definition |
| Maturity | The ability of the company to finance current and future projects and achievements. |
| How to measure? | Description |
| 5-point scale | Internal audit |
| Granting loans to small businesses | Growth of assets |
| Types: | * Young * Adolescence * Mature |

**Hypothesis**.

Based on the literature on the importance of implementing risk management, we can conclude that young and adolescence companies have more incentives to include RM strategies than mature companies and, accordingly, based on what affects the value of the company, its profitability (Liebenberg, A., and Hoyt, R., 2003, Pagach, D., and Warr, R., 2011). They need it, because they are small and they have to develop further, ensuring explosive growth accordingly. We can draw conclusions about how to make hypotheses aimed at implementing the inclusion of risk management.

For the market risks:

H1: Market risk management has significant impact on performance of the young and adolescent company.

H2: Market risk management has no significant impact on performance of the maturity company.

For the Operational risks:

H3: Operational risk management has significant impact on performance of the young and adolescent company.

H4: Operational risk management has no significant impact on performance of the maturity company.

For the Liquidity risks:

H5: Liquidity risk management has significant impact on performance of the young and adolescent company.

H6: Liquidity risk management has no significant impact on performance of the maturity company.

For the Credit risks:

H5: Credit risk management has significant impact on performance of the young and adolescent company.

H6: Credit risk management has no significant impact on performance of the maturity company.

**Summary of measurements.**

Brief results of literature review are provided in table 4.

Table 4. summary of the risks results and maturity.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Part | | Variable | Description | Formula | Authors |
| Success of Risk management implementation: | | ROE | Return on Equity |  | Kedir, H., and Mekonnen, Y., 2015, Gilbert, Meyer, and Vaughan, 2002. |
| ROA | Return on Assets |  |
| Measurements of risks: | Market Risk | VaR | Value at risk |  | Basel committee and central bank of Russian Federation |
| Operational Risk | OR / ORC | Operational Risk / Operational Risk Capital | - coefficient, pointed by the regulator  - average annual gross income for 3 years | Basel committee and central bank of Russian Federation |
| Credit Risk |  | Ratio of overdue loans to total loans |  | Felix and Claudine (2008) |
| Liquidity Risk | FGAPR | Financing gap ratio |  | Chen, Y. K., and etc. 2018 |
| Maturity | Stages of maturity | * Young * Adolescence * Mature | | | |
| How to split? | Through the growing of the assets | | | |

**Summary of literature review**

Brief results of literature review are provided in table 5.

Table 5. General summary of the company performance.

|  |  |  |  |
| --- | --- | --- | --- |
| Theme | Article | General info | Common things |
| Importance of risk management for organizations performance: | Rasid, S., etc (2017) | Enterprise risk management (ERM) and performance measurement systems (PMS) of the company leads to organizational performance (OP) of the company | ERM is important for profitability of the company |
| Why do companies implement risk management strategies? | Liebenberg and Hoyt (2003) | Import of implement ERM in traditional company governance | ERM is important for profitability, cost controlling and stability of the company |
| Pagach and Warr, (2011) |
| Lundqvist (2015) | Motives for governance ERM (audit and so on) |
| Types of risks that bank can be faced. | Omondi, O. G. (2015). | 1. Market risk 2. Operational risk 3. Credit risk 4. Liquidity risk | Risks |
| Mutuku, C. (2016) |
|  | Senior Supervisors Group. (2010): | How to deal strategy:   1. Valuation Practices Relevant to Risk Management 2. Use of a Range of Risk Measures 3. Stress Testing and Scenario Analysis 4. Hedging of Market and Credit Risks 5. Credit Underwriting and Reporting 6. Counterparty Risk Measurement and Management | What to do? |
| Performance evaluation of the company. | Kedir, H., & Mekonnen, Y. (2015) | Typical bank performance rating is based on the following variables: profitability, Return on Assets (ROA) and Return on Equity (ROE) | financial returns, Returns on Asset (ROA) and Returns on Earning (ROE), CAMELS |
| Nepal Rastra Bank's Banking Supervision Department | CAMELS (Capital Adequacy, Asset Quality, Management competence, Earning, Liquidity, Sensitivity to Market Risk) for banking system of Nepal |
| Meyer, & Vaughan, 2002 | Used off-site tools are supervisory screens (financial ratios from periodic balance sheets and income statements ) and econometric models (information from financial ratios) to predict CAMELS |
| Laisasikorn, K., & Rompho, N. | Provided several models of the connection between financial performance of the company – return on assets, return on equity and earnings per share. | Connection between ROA, ROE, EPS and ERM |
| Performance measurement of Risk management policy. (future discuss) | Mutuku, C. (2016) | In case of modern portfolio theory performance RM can be measured as CAPM | CAPM is equal to performance of RM |

**Future discuss. Performance measurement of risk management policy.**

As a future study, we can apply our risk assessment parameters when evaluating portfolio, according to Markowitz theory – MPT. Research of risk management using CAPM (Capital Asset Pricing Model), through Modern Portfolio Theory. The Modern Portfolio Theory (MPT) refers to an investment theory that allows investors to assemble an asset portfolio that maximizes expected return for a given level of risk. The theory assumes that investors are risk-averse; for a given level of expected return, investors will always prefer the less risky portfolio.

According to the Capital Asset Pricing Model, each financial sales specialist should have a market portfolio, used or reduced with positions, in a risk-free resource. That is, as a hypothesis, it can be assumed that an increase in capital assets, through risk reduction (and, accordingly, the growth of CAPM can be used as a measure of the successful application of risk management), leads to an increase in the attractiveness of the securities portfolio and an increase in the return on capital. That is, the effect of CAPM on ROE can be put as a testable hypothesis.

# Methodology.

**Previous researches.**

Charles M., 2016, paper was about the fill of knowledge gap on the problem of relationship between risk management and financial performance in commercial banks. Previous studies have focused on only five independent variables. Increasing the independent variable therefore resulted to reduction in error term and the results are more accurate and precise. The researcher utilized a subjective way to interview bank mangers in the risks division since they are experienced experts who were seen as a profound comprehension of the theme under study. The study used both primary and secondary data. The auxiliary data was obtained from the CBK Bank Supervision Annual Reports. Than constructed regression based on it. (Quantitative research, primary and secondary data).

Another example, Mohd A. et al., 2011. They investigated the risk management of Islamic banks and combined this practice with the financial performance of Islamic banks. In their work, they focused on the experience of Malaysian financial organizations, since the financial services industry in this country is well developed, which allowed them to collect data. This study provides recommendations on the risk management of Islamic banks, in order to obtain advantages for the Islamic banking system.

To achieve the goals of studying the relationship between risk management practices and financial performance of Islamic banks in Malaysia, a two-stage analysis was conducted. At first, questionnaires were developed and distributed among top management to assess the current level of risk management practices in Malaysian banks.

The second goal is to study the relationship between risk management methods and financial indicators. To achieve it, the correlation between the average indicators of each risk management practice and the financial indicators of Islamic banks was analyzed.

The study uses both the primary and secondary data. The primary data obtained through a questionnaire survey, secondary - BankScope Database.

Ayman A. et al., 2021, propose work that a defined risk management program is articulated relatively effectively through the organization's board of employees at all rates. According to them, risk management practices have significant effects on financial performance over other activities, i.e., risk-policies have been considered essential risk management practices that directly impact financial performance and risk management integration in setting organizational objectives. The research used the regular questionnaire to gather primary data from the credit officers/managers and regression construction.

Kioko C., et al., 2019, have done research on the effect of financial risk on financial performance, but there have been incomplete and confusing results on the studies. This is because some researchers obtain that the relationship between financial risk and financial performance to be positive, others obtain a negative, while other researchers obtain a mixed relationship (both positive and negative). General objective was to investigate how financial risk affects the financial performance of commercial banks listed in the Nairobi Stock Exchange in Kenya. The independent variables in this study were: credit risk, market risk, liquidity risk and operational risk. The dependent variable was financial performance. Type of research: descriptive research/quantitative (ANOVA). Data - secondary data.

Table 6. Summary table of previous methodologies.

|  |  |  |
| --- | --- | --- |
| Research | Type | Data |
| Charles M. (2016) | Quantitative | Primary/Secondary |
| **Mohd A., etc (2011)** | Qualitative/Quantitative | Primary/Secondary |
| **Ayman A., etc. (2021)** | Qualitative | Primary |
| Kioko C., etc. (2019) | descriptive research/quantitative | Secondary |
| Liebenberg, A. P., & Hoyt, R. E. (2003) | Quantitative | Primary/Secondary |
| Lundqvist, S. A. (2015) | Quantitative | Secondary |
| Pagach, D., & Warr, R. (2011) | Quantitative | Primary/Secondary |

In our case we used quantitative type of research plus secondary data collection.

**Conceptual model of research.**

Based on the literature we have read and the methodologies used to assess the impact of risk management parameters, we have built the following concept of work:

**Firm performance**

**Hypothesis**

**Risk management performance**

**Data collection**

Due to the fact that our research is empirical, data collection was one of the most important parts of the work. Various parameters of banks were collected, such as capitalization, earning before taxes, net assets, return on assets, return on equity and so on. For the research data were collected through SPARKS. Data were about 925 financial organizations. After filtering – deleting non-exist, in coming liquidation, missing data and so on there were only left 217 Banks. As data, the average values from 2019 to 2021 were used as the most filled. Data that were used provided in table 7.

Table 7. Data description.

|  |  |
| --- | --- |
| Name | Description |
| Name of the bank | Name of the bank |
| Registration number | Unique ID, were for filtration |
| Age of the bank |  |
| Net Assets | For splitting, based on quartile of average growth through years |
| Deposits of individuals | For FGAP calculation |
| Deposits of companies | For FGAP calculation |
| Credits | For FGAP calculation |
| Earnings before taxes | For ORC calculation |
| Investments | For VaR calculation |
| ROA | Return on Assets |
| ROE | Not enough data, multicollinearity with ROA |
| Capital | Capital growth were used as control variable |
| The coefficient of non-repayment of the principal amount of the debt | Our NPL/TL |

**Variables calculation.**

The variables associated with risk management were calculated using the formulas presented in table 8.

Table 8. Risk management variables

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Variable | Descriprion | Formula |
| Market Risk | VaR | Value at risk  (Basel) |  |
| Operational Risk | ORC | Operational Risk Capital  (Basel) | – Earning before taxes  (provided in data) |
| Credit Risk |  | Ratio of overdue loans to total loans  (Felix and Claudine, 2008) | Debt default ratio (provided in data) |
| Liquidity Risk | FGAP | Financing gap  (Chen, Y. K., and etc. 2018) |  |

**Research method**

At the beginning of the study, it was necessary to split banks according to their maturity. This was done by increasing net assets because, according to DeYoung at al., 1999, the reduction in lending to small businesses leads to the maturity of a financial organization, and the volume of lending to small businesses is negatively associated with an increase of assets (DeYoung at al., 1999). The increase in net assets was calculated from 2017 to 2021 years. The companies were divided into young, adolescence and mature. Then, in the course of the research, the main model was chosen as linear regression with main parameters:

1. ROE and ROA as dependent variable
2. Independent variables - parts risk management of the bank: FGAP (financial gap as liquidity risk measurement), ORC (operational risk capital as operational risk measurement), DDPR (debt default ration as credit risk measurement) and VaR (value at risk as market risk measurement) as parts risk management of the financial organization.

The main model looks like:

Where:

1. a – coefficient
2. ROE or ROA – return on equity or return on assets
3. FGAP – financial gap ration
4. ORC – operational risk capital
5. DDPR – debt default ratio
6. VaR – Value at Risk

As the framework of the research R-studio were chosen.

**Splitting banks.**

For the first part of the practice realization, we have splitted our banks in two groups: maturity and adolescent plus young. We used average growth of Net Assets for it because as known that all other things being equal, mature companies are capable of more efficient resource growth. Splitting are provided in table 9.

Table 9. quantiles of Net Assets for splitting.

|  |  |
| --- | --- |
| Quantile | Description |
| 0.033% | Young |
| 5.836% | Adolescent |
| 12.745% | Maturity |

Dummy variable was created: 1 for mature, 0 for everyone else. In total we got 159 banks as young and adolescence and 54 financial organizations as mature companies.

**First results.**

At the first results of the model construction, the inconsistency of the constructed regressions was revealed, due to the too small. In the results, R-squared (for the young and adolescence companies R-squared were equal to 0.0006 (return on equity) and 0.098 (return on assets), for the mature companies R-squared were equal to 0.05 (return on equity) and 0.04 (return on assets). The main results are provided in tables 10, 11, 12, 13. Which can be explained by a lack of data. After that we have decided to complete correlation tests.

Table 10. Return on equity regression results for young and adolescence banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| ORC | -3.849e-12 | 0.788 |
| FGAP | -1.970e-13 | 0.778 |
| VAR | 1.212e-05 | 0.951 |
| DDPR | -1.232e-01 | 0.971 |
|  | Value | |
| R-squared | 0.0006 | |

Table 11. Return on assets regression results for young and adolescence banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| ORC | 2.281e-13 | 0.464 |
| FGAP | 8.900e-15 | 0.559 |
| VAR | 1.686e-05 | 0.0001 |
| DDPR | 4.751e-02 | 0.515 |
|  | Value | |
| R-squared | 0.0988 | |

Table 12. Return on equity regression results for mature banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| ORC | 1.193e-12 | 0.616 |
| FGAP | -1.400e-14 | 0.637 |
| VAR | 5.374e-03 | 0.425 |
| DDPR | 3.044e+00 | 0.367 |
|  | Value | |
| R-squared | 0.0507 | |

Table 13. Return on assets regression results mature banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| ORC | 2.536e-13 | 0.481 |
| FGAP | 3.600e-15 | 0.423 |
| VAR | 8.597e-05 | 0.933 |
| DDPR | 5.591e-01 | 0.274 |
|  | Value | |
| R-squared | 0.04483 | |

As we can see from the results of the first built regressions, all the variables were not significant, except for the regression model for young and adolescence financial organizations, but here the problem is the significance of the regression itself.

**Correlation tests**

In the course of conducting correlation tests for various types of data groups on financial organizations, a weak direct and/or inverse correlation between dependent variables was revealed (the results are presented in tables 13, 14, 15). This indicates that it became necessary to introduce a control variable that would control the return on assets and/or return on capital in order to improve the indicators of the significance of variables and the significance of regression.

For the compared (dummy 0 plus dummy 1) data results are provided in table 9.

Table 14. Main data set results.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ROA | VAR | ORC | FGAP | DDPR | ROE |
| ROA | 1 | 0.24 | 0.06 | -0.02 | 0.05 | -0.28 |
| VAR | 0.24 | 1 | -0.008 | 0.01 | -0.009 | 0.006 |
| ORC | 0.06 | -0.008 | 1 | -0.797 | -0.006 | 0.007 |
| FGAP | -0.02 | 0.01 | -0.797 | 1 | 0.008 | -0.01 |
| DDPR | 0.05 | -0.009 | -0.006 | 0.008 | 1 | 0.009 |
| ROE | -0.28 | 0.006 | 0.007 | -0.01 | 0.009 | 1 |

For the young and adolescence banks results (dummy variable are qual to zero) are provided in table 10.

Table 15. Young and adolescence results.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ROA | VAR | ORC | FGAP | DDPR | ROE |
| ROA | 1 | 0.29 | 0.07 | -0.06 | 0.05 | -0.39 |
| VAR | 0.29 | 1 | -0.008 | 0.009 | -0.01 | 0.005 |
| ORC | 0.07 | -0.008 | 1 | -0.984 | -0.01 | 0.004 |
| FGAP | -0.06 | 0.009 | -0.984 | 1 | 0.02 | -0.008 |
| DDPR | 0.05 | -0.01 | -0.01 | 0.02 | 1 | -0.003 |
| ROE | -0.39 | 0.005 | 0.004 | -0.008 | -0.003 | 1 |

For the mature financial organizations results (dummy variable are qual to one) are provided in table 11.

Table 16. Young and adolescence results.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ROA | VAR | ORC | FGAP | DDPR | ROE |
| ROA | 1 | -0.002 | 0.08 | 0.06 | 0.17 | 0.6 |
| VAR | -0.002 | 1 | -0.02 | 0.03 | -0.09 | 0.1 |
| ORC | 0.08 | -0.02 | 1 | -0.51 | 0.19 | 0.15 |
| FGAP | 0.06 | 0.03 | -0.51 | 1 | -0.057 | -0.12 |
| DDPR | 0.17 | -0.09 | 0.19 | -0.057 | 1 | 0.14 |
| ROE | 0.6 | 0.1 | 0.15 | -0.12 | 0.14 | 1 |

**Control variable**

First we need to determine what we mean by the control variable. According to Freedman at al., 2007, a control variable is a variable that does not significantly affect the response, but taking into account which the influence of meaningful predictors on the response may vary. Usually such variables are included in mathematical models as the main effects. Geometrically, this means that the line reflecting the influence of the meaningful predictor on the response can move up with positive values of the control variable or down with negative values.; at the same time, the slope of the line reflecting the influence of the content predictor on the response remains unchanged.

There is an idea (it has been actively spreading since the 2000s) to include control variables in the model and as an interaction effect. This idea looks very logical, based on the definition of the control variable itself, since the control variable in the role of the interaction effect reveals its potential to take into account the variation of the influence of meaningful predictors on the response to the greatest extent.

In our case we have decided to take the average capital gain from 2018 to 2021, hereinafter referred to as “Capital growth” or CAP\_Gr. The main formula provided below.

Capital growth formula:

Where:

1. – Capital of the bank for 2018
2. – Capital of the bank for 2019
3. – Capital of the bank for 2020
4. – Capital of the bank for 2021

**Finally results**

Firstly, we built correlation matrices to test the applicability of our control variable. Results are provided in table 17, table 18 and table 19.

Table 17. Main data set results.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ROA | VAR | ORC | FGAP | DDPR | ROE | Cap\_Growth |
| ROA | 1 | 0.24 | 0.06 | -0.02 | 0.05 | -0.28 | 0.45 |
| VAR | 0.24 | 1 | -0.008 | 0.01 | -0.009 | 0.006 | 0.05 |
| ORC | 0.06 | -0.008 | 1 | -0.797 | -0.006 | 0.007 | 0.034 |
| FGAP | -0.02 | 0.01 | -0.797 | 1 | 0.008 | -0.01 | -0.04 |
| DDPR | 0.05 | -0.009 | -0.006 | 0.008 | 1 | 0.009 | -0.02 |
| ROE | -0.28 | 0.006 | 0.007 | -0.01 | 0.009 | 1 | 0.54 |
| Cap\_Growth | 0.45 | 0.05 | 0.034 | -0.04 | -0.02 | 0.54 | 1 |

Table 18. Young and adolescence results.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ROA | VAR | ORC | FGAP | DDPR | ROE | Cap\_Growth |
| ROA | 1 | 0.29 | 0.07 | -0.06 | 0.05 | -0.39 | 0.59 |
| VAR | 0.29 | 1 | -0.008 | 0.009 | -0.01 | 0.005 | 0.08 |
| ORC | 0.07 | -0.008 | 1 | -0.984 | -0.01 | 0.004 | 0.04 |
| FGAP | -0.06 | 0.009 | -0.984 | 1 | 0.02 | -0.008 | -0.04 |
| DDPR | 0.05 | -0.01 | -0.01 | 0.02 | 1 | -0.003 | -0.01 |
| ROE | -0.39 | 0.005 | 0.004 | -0.008 | -0.003 | 1 | -0.73 |
| Cap\_Growth | 0.59 | 0.08 | 0.04 | -0.04 | -0.04 | 0.73 | 1 |

For the mature financial organizations results (dummy variable are qual to one) are provided in table 19.

Table 19. mature results.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ROA | VAR | ORC | FGAP | DDPR | ROE | Cap\_Growth |
| ROA | 1 | -0.002 | 0.08 | 0.06 | 0.17 | 0.6 | 0.56 |
| VAR | -0.002 | 1 | -0.02 | 0.03 | -0.09 | 0.1 | 0.004 |
| ORC | 0.08 | -0.02 | 1 | -0.51 | 0.19 | 0.15 | 0.02 |
| FGAP | 0.06 | 0.03 | -0.51 | 1 | -0.057 | -0.12 | 0.06 |
| DDPR | 0.17 | -0.09 | 0.19 | -0.057 | 1 | 0.14 | -0.03 |
| ROE | 0.6 | 0.1 | 0.15 | -0.12 | 0.14 | 1 | 0.49 |
| Cap\_Growth | 0.56 | 0.004 | 0.02 | 0.06 | -0.03 | 0,49 | 1 |

Based on the results of the constructed correlation matrices for young and adolescence financial organizations, we observe a strong positive correlation between capital gain and return on assets, as well as a strong negative correlation between return on capital and capital gain, which is logical (capital growth reduces the ratio of income to capital).

At the same time, we see a weak positive correlation for mature banks in relation to the return of assets to capital growth and a weak correlation in relation to the return of capital to its growth (which can be explained by the fact that mature banks with an increase in capitalization can also afford an increase in income, with a much greater ratio than young and adolescence financial organizations)

To begin with, we needed to check our control variable for adequacy by constructing a regression from it:

Results are provided in table 20, table 21, table 22, table 23.

Table 20. Return on equity regression results for young and adolescence banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| Cap\_Gr | -3.02 | 2e-16 |
|  | Value | |
| R-squared | 0.5331 | |

Table 21. Return on assets regression results for young and adolescence banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| Cap\_Gr | 0.056 | 2e-16 |
|  | Value | |
| R-squared | 0.3526 | |

Table 22. Return on equity regression results for mature banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| Cap\_Gr | 0.182 | 0.0176 |
|  | Value | |
| R-squared | 0.1036 | |

Table 23. Return on assets regression results for mature banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| Cap\_Gr | 0.018 | 0.0134 |
|  | Value | |
| R-squared | 0.14 | |

During the study, changes were made to the final regression, it began to look like this:

Where:

1. a – coefficient
2. ROE or ROA – return on equity or return on assets
3. FGAP – financial gap ration
4. ORC – operational risk capital
5. DDPR – debt default ratio
6. VaR – Value at Risk
7. – our control variable, capital growth gain

The main results for the regression construction are provided in table 24, table 25, table 26 and table 27.

Table 24. Return on equity regression results for young and adolescence banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| ORC | -3.427e-12 | 0.725 |
| FGAP | -2.184e-13 | 0.647 |
| VAR | 1.638e-04 | 0.227 |
| DDPR | -4.510e-01 | 0.843 |
| Cap\_Gr | -3.056 | 2e-16 |
|  | Value | |
| R-squared | 0.5393 | |

Table 25. Return on assets regression results for young and adolescence banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| ORC | 2.205e-13 | 0.379 |
| FGAP | 9.281e-15 | 0.449 |
| VAR | 1.416e-05 | 7.07e-05 |
| DDPR | 5.334e-02 | 0.363 |
| Cap\_Gr | 0.05438 | 2e-16 |
|  | Value | |
| R-squared | 0.4229 | |

Table 26. Return on equity regression results for mature banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| ORC | 7.952e-13 | 0.7258 |
| FGAP | -2.006e-14 | 0.4794 |
| VAR | 5.377e-03 | 0.4016 |
| DDPR | 3.383e+00 | 0.2932 |
| Cap\_Gr | 0.1874 | 2e-16 |
|  | Value | |
| R-squared | 0.4795 | |

Table 27. Return on assets regression results mature banks.

|  |  |  |
| --- | --- | --- |
| Variable | Coefficients | p-value |
| ORC | 2.169e-13 | 0.543 |
| FGAP | 3.041e-15 | 0.495 |
| VAR | 8.617e-05 | 0.932 |
| DDPR | 5.904e-01 | 0.244 |
| Cap\_Gr | 0.01728 | 2e-16 |
|  | Value | |
| R-squared | 0.4885 | |

As a result, we saw that in the case of immature banks, the explanation of the dependent variable increased to 42% for asset recovery and 54% for capital return. At the same time, we see that our VaR has remained significant for assets.

**Hypothesis checking.**

The first hypothesis (H1) is confirmed by the previous authors, from the previous research section, as well as by our study, on the example of the significant impact of market risk as part of the risk management strategy on the return on assets.

According to the results of the study, there is a confirmation of all hypotheses related to mature companies. What cannot be said about the young and adolescence. For them, only the hypothesis regarding market risk is confirmed, which may be due to a lack of data and so on. Also, the lack of correlation between the company's success indicators and risks can be explained by the results of research in previous papers and the goals of managing these types of risks (reducing volatility, increasing predictability). Summary table about hyothesis confirmation are provided in table 28.

Table 28. Hypothesis checking.

|  |  |  |
| --- | --- | --- |
| Part | Hypothesis | Result |
| Market Risk | H2: Market risk management has significant impact on performance of the young and adolescent company | + |
| H3: Market risk management has no significant impact on performance of the maturity company | + |
| Operational Risk | H4: Operational risk management has significant impact on performance of the young and adolescent company | - |
| H5: Operational risk management has no significant impact on performance of the maturity company | + |
| Liquidity Risk | H6: Liquidity risk management has significant impact on performance of the young and adolescent company | - |
| H7: Liquidity risk management has no significant impact on performance of the maturity company | + |
| Credit Risk | H8: Credit risk management has significant impact on performance of the young and adolescent company | - |
| H9: Credit risk management has no significant impact on performance of the maturity company | + |

# Conclusion

Based on the results of the study, we have identified a strong relationship between our introduced control variable (capital growth) and dependent variables - return on assets and return on equity.

In addition, we have found that market risk management can improve the company, and the management of other types of risk does not have a direct impact. This is confirmed on the basis of the hypotheses that we have identified, as well as confirmed by the results of research in previous papers that were conducted by mine supervisor Makarova V.A. and the goals of managing these types of risks (reducing volatility, increasing predictability).

We also confirmed that with the growth of the company's maturity indicators, the dependence of its profitability on risk management decreases, in particular on the basis of market risk.

Thus, we have completed the tasks assigned to us:

1. Analyzed the types of risks faced by banks.

2. Defined metrics for measuring the performance of the company.

3. We also defined parameters for different types of risks.

4. Conducted an empirical study.

5. Tested hypotheses.

6. Our conclusions regarding young companies coincided (for the importance of ERM) with the results of Rasid S., et al (2017)

We have shown that risk management has a partial impact on the increase in return on assets and capital, while the impact of risk management in mature companies differs from young ones, becomes statistically insignificant.

We have determined that company managers do not need to allocate resources to manage operational, credit and liquidity risk, which in turn will help save money for shareholders and investors of companies, as well as reallocate resources so necessary for young companies to market risk.

# Appendix.

Figure 1. regression results for young and adolescence financial organizations.

Изображение выглядит как текст, квитанция

Автоматически созданное описание

Изображение выглядит как текст, квитанция

Автоматически созданное описание

Figure 2. regression results for mature banks.

Изображение выглядит как текст, квитанция, снимок экрана

Автоматически созданное описание

Изображение выглядит как текст, квитанция, снимок экрана

Автоматически созданное описание

Figure 3. Correlation matrix for general data set.

Изображение выглядит как текст

Автоматически созданное описание

Figure 4. Correlation matrix for young and adolescence.

Изображение выглядит как текст

Автоматически созданное описание

Figure 5. Correlation matrix for mature companiesИзображение выглядит как текст

Автоматически созданное описание

Figure 6. Correlation matrix for general data set.

Изображение выглядит как текст

Автоматически созданное описание

Figure 7. Correlation matrix for young and adolescence.

Изображение выглядит как текст

Автоматически созданное описание

Figure 8. Correlation matrix for mature companies.

Изображение выглядит как текст

Автоматически созданное описание

Figure 9. Regression results for young and adolescence financial organizations (capital growth testing).

Изображение выглядит как текст, квитанция

Автоматически созданное описание

Изображение выглядит как текст, квитанция

Автоматически созданное описание

Figure 10. Regression results for mature financial organizations (capital growth testing).

Изображение выглядит как текст, квитанция

Автоматически созданное описание

Изображение выглядит как текст

Автоматически созданное описание

Figure 11. Regression results for young and adolescence financial organizations (final results).

Изображение выглядит как текст, квитанция, снимок экрана

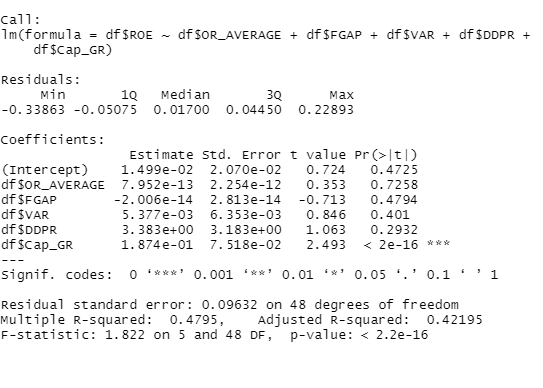
Автоматически созданное описаниеИзображение выглядит как текст, квитанция

Автоматически созданное описание

Figure 12. Regression results for mature banks (final results).

Изображение выглядит как текст, квитанция

Автоматически созданное описание



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