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**INTERNATIONAL SCHOOL
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MASTER'S DISSERTATION

**Decision of the National Bank of the Republic of Kazakhstan: the
impact of monetary policy on foreign direct investments**

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ABSTRACT

FDI has been widely studied throughout history and the impact of FDI on the country's economic growth has been empirically proven. However, there are no studies that examining the impact of monetary policy on FDI through economic growth. In this paper, I test the hypothesis of the impact of monetary policy (namely, a tool for changing the base rate) on foreign direct investment through economic growth. In the study I used secondary data on indicators of economic growth in Kazakhstan - GDP, volume of lending, retail and wholesale trade, average monthly salary, unemployment rate, reinvested part of FDI, weighted average lending rates in the country, and as an external factor - the historical price of Brent. As a result of the analysis of the variables involved in the study, it was found that there are problems of endogeneity/exogeneity, as well as multicollinearity. The solution to the problem was to use certain models to study the relationship, exclude variables from the study & use of lags. To solve the above problems and explore the main issue in the study, I used three methods - mediator variable regression approach, two-stage residual regression and principal component analysis. As a result of the study, it was found that the impact of monetary policy on FDI through economic growth is statistically insignificant. However, as a result of testing the second hypothesis of the study, namely the impact of monetary policy on part of FDI reinvested income, it was found that the weighted average lending rate in the country affects part of reinvested income as part of FDI at a statistically significant level of 5%, meaning that a 1% increase in the weighted average rate in the previous quarter increases part of reinvested income in FDI by 15.68 billion USD. Principal component analysis method seems to be the most effective, since this method solves the problem of multicollinearity and focuses on the most important variables that explain the largest variance in the data, which allows to exclude unnecessary variables.

KEY WORDS: *FDI, monetary policy, Kazakhstan, the base rate, weighted average lending rates, economy growth, mediator variable approach, two-stage residual regression, principal component analysis.*

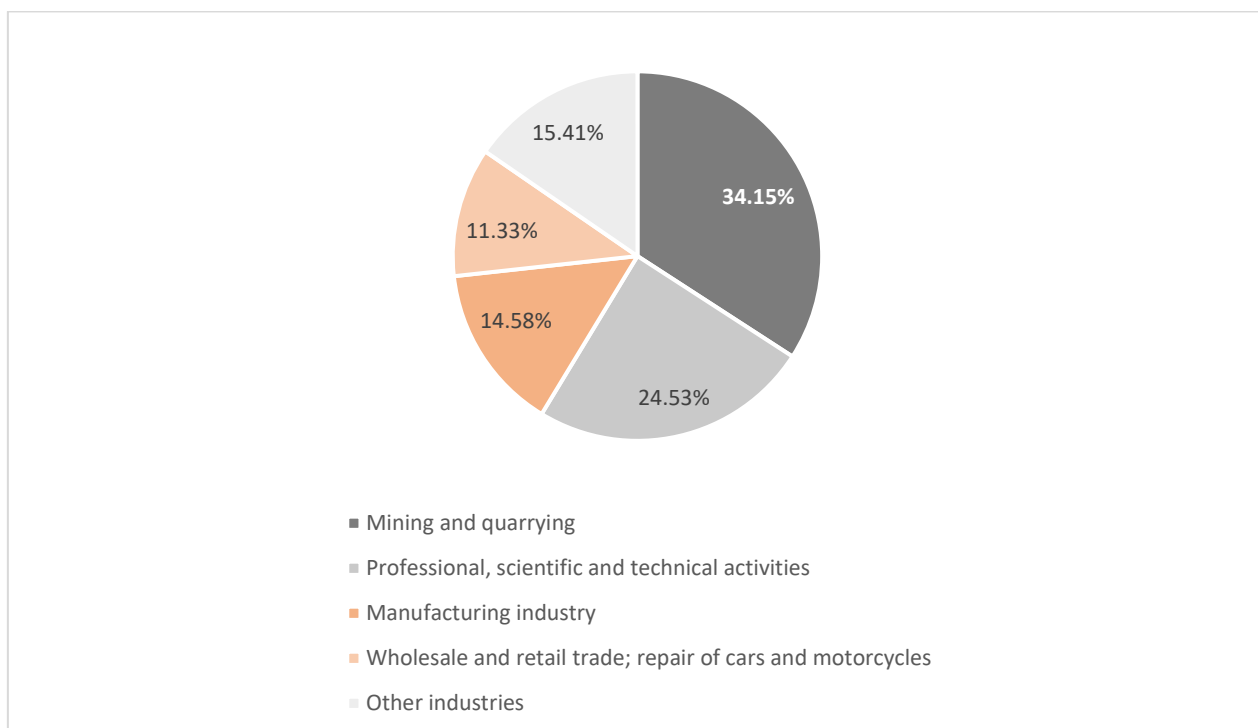
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1. INTRODUCTION

Foreign direct investment (FDI) is an integral part of any nation's economic development. Besides economic growth, FDI can also contribute to the transfer of technology and knowledge, as well as to the development of human capital. Additionally, a national economy can experience integration into the global economy through the international relationships formed through FDI. Other benefits of FDI may include improved management technology as well as the evolution of a more competitive business environment (Karahan and Bayır, *Future Business Journal* 2022). FDI is one of the important focuses of most developing countries, where governments of these countries make great efforts to encourage FDI inflows into their countries. The Republic of Kazakhstan (RoK) among developing countries also pays special attention to FDI inflows. According to the Resolution of the Government of the RoK dated July 15, 2022 No. 482, the RoK investment policy has been approved, the objectives of which focus on the development of two main indicators - 1. Increasing the level of investment in fixed capital; 2. Increasing the inflow of foreign direct investment. In 2005, gross FDI inflows to Kazakhstan amounted to 7.9 billion US dollars, in 2023 this figure amounted to 23.4 billion US dollars, which amounted to an increase of 195.7% or 6.2% compound annual growth rate (2005-2023).

Figure 1. The average structure of gross FDI inflows by industry in 2005-2023

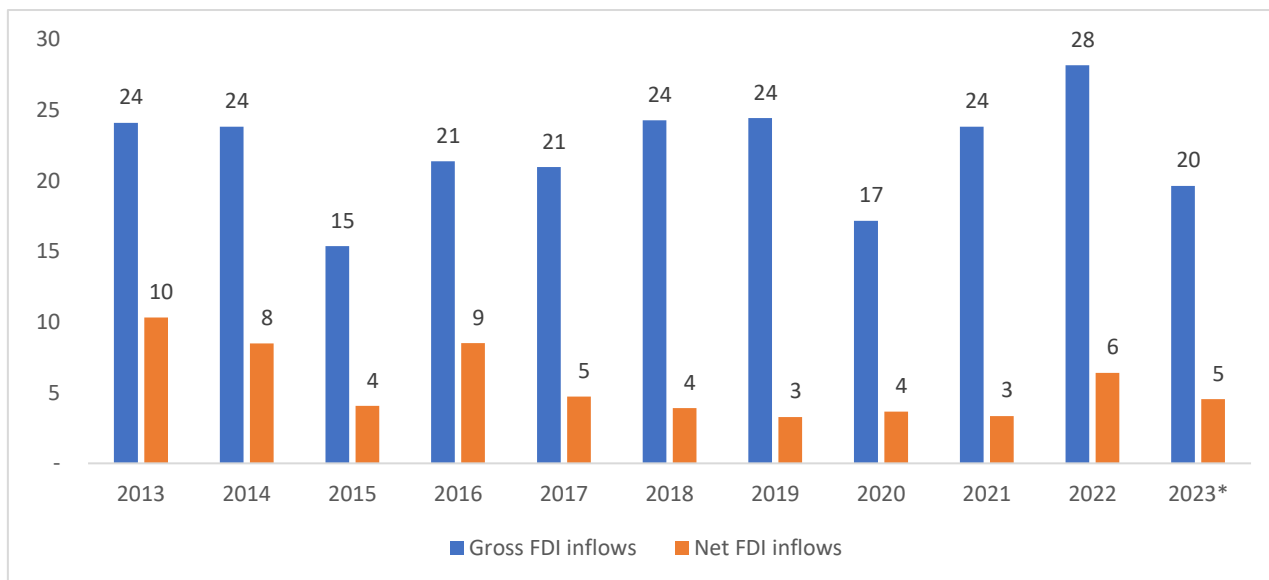


Source: NBRK

In its reports and news publications, the RoK state, with the desire to show its superior performance, in most cases cite the results of gross inflows of foreign direct investment. However, due to its statistical peculiarities, measuring the results by the indicator of gross FDI inflows is not correct (Bekisheva Z, Aimukhamedova A & Uskenbayev A, *NBRK - Analytical information on FDI, 2023*). According to the methodological commentary on direct investment statistics of the National Bank of the Republic of Kazakhstan (NBRK),

gross inflows of foreign direct investment do not take into account the outflow of investments and include reinvestment of income by a foreign investor. Accordingly, for a more accurate analysis of foreign direct investment, net foreign direct investment minus reinvested income should be the subject of FDI analysis. The real picture by analyzing RoK's net investment flows less reinvested income shows negative values since 2018, which means foreign capital outflows outside the country.

Figure 2. Gross and net inflow of foreign direct investment to Kazakhstan, USD billion



* data for 3 quarters of 2023

Source: NBRK

Many factors can affect the change in FDI. These factors include political stability within the country, and in the region where the country is located. Other factors may also include the legal system, competitive business environment, economic climate, trade agreements and openness policies, market size, and infrastructure. In my research, I want to understand the relationship and impact of a particular monetary policy instrument - change in the base rate on foreign direct investment. Monetary policy is an important tool in the management of the state's economy. Monetary policy as a result of its proper management can lead to the stimulation of economic growth and macroeconomic stability. On the other hand, monetary policy instruments can also have a destructive effect on the economy, slowing down economic growth and business activity. In times of crises and recessions, governments around the world widely apply monetary policy instruments, rapidly lowering the base rates, which leads to an increase in the attractiveness of borrowing, an increase in the circulation of money supply within the country, and, as a result, an increase in economic activity.

In Kazakhstan, monetary policy is widely applied and the NBRK is the responsible executive body. From 1992 to 2024, the base rate has changed more than 100 times. The base rate in Kazakhstan is one of the highest in comparison with other countries, however, in 2023-2024 the situation has started to improve and the trend of the base rate has been downward. Given the frequent changes in the base rate, its high indicators, as well as the net outflow of foreign direct investment, the purpose of the study is to detect the impact of monetary policy, namely the instrument for changing the base rate on foreign direct investment (net flows of foreign direct investment excluding reinvested income). In

addition to the identified dependent and independent variables, I will also use data on GDP, the price of Brent oil in the study, amount of total loans issued and average wages. However, due to the volume of the indicated data, as well as their wide macroeconomic dependence, the limitation of the study may include an incorrect display of the outcome based on the results of the model, since the variables cannot fully depend on each other and may depend on completely third-party factors.

2. LITERATURE REVIEW

2.1 THEORIES

There is a wide range of theories to explore. From economic theories, which form the basis for the study, to financial econometric theories, which form the basis for the research methodology. Theories about FDI. The key indicator used in research has many theories. Thus, according to Vintila's (2010) review of FDI theories, FDI can be classified into 4 theories. 1 theory according to this review is Production Cycle Theory of Vernon. It explains some of the types of FDI in manufacturing in the U.S. after World War II. Also, the author of this theory believes that there are 4 stages of the production cycle: innovation, growth, maturity and decline. The basic idea is that companies first create innovative products and export the surplus. The second theory is the theory of exchange rates in imperfect capital markets. According to a Vintila's theories review, Itagaki (1981) and Cushman (1985) analyzed the impact of uncertainty as a factor of FDI. Cushman proves that real exchange rate appreciation stimulated FDI in U.S. dollars when foreign currency appreciation led to a decrease in FDI. Specifically, Cushman concludes that the appreciation of the dollar led to a 25% reduction in foreign direct investment in the United States. In my study, I put a key conclusion from this theory into the main hypothesis of my study. Because the appreciation of the dollar in this theory means an increase in the prime rate of monetary policy, which leads to a decrease in foreign direct investment. I take this theory as the basis for my research. The other theories are The Internalization Theory, which explains the growth of multinational companies and their attraction of FDI and The Eclectic Paradigm of Dunning, developed by Professor Dunning, which is a mixture of the three FDI theories. Thus, according to this review, empirical research results show that there is no single definite theoretical explanation for foreign direct investments, and it is very unlikely that a definite explanation will ever appear.

2.2 SUMMARY OF LITERATURE REVIEW

Table 1. Conclusions formed based on the conducted literature review.

Study	Sample	Methodology	Findings
Albulescu and Ionescu (2018)	2001-2015 EU countries (16) data	Cointegration technique for heterogeneous panels and FMOLS and DOLS estimators	Uncertainty of the monetary policy negatively affects FDI inflows
Angelina (2020)	48 number of data observations of economic variables	Two-Stage Least Squared method	The money supply has a significant positive impact on inflation. SBI rate has a significant negative effect on inflation. FDI has a significant effect on the economy, while inflation does not

Dornean and Oanea (2014)	Macroeconomic variables (GDP, government debt, government budget, FDI)	Regression model and panel data methodology	Government revenue and government expenditure have an important impact on FDI
Olweny and Chiluwe (2012)	1996-2009 Macroeconomic data in Kenya	Cointegration testing using vector error correction	Decrease of monetary policy by 1 percent leads to reducing investment by -2.63
Karahan and Bayir (2022)	2008-2021 Brazil, China, Turkey and Poland stock market indexes and interest rates	Autoregressive distributed lag model	Low interest rates attract FDI inflows to developing countries
Chen (2018)	Monetary policy, FDI and production data	Product-cycle model	Decrease in the nominal interest rate increases the level of FDI

Throughout modern human history, monetary policy has been the focus of various groups of economists, policy makers and researchers. There are many studies on the impact of monetary policy on various components of government economic activity, from capital inflows to inflation and industrial sectors. Looking at the overall picture of existing research, it can be concluded that a wide range of tools are open to researchers to analyze this topic. The reason for this is the sheer number of economic variables that can be included in a study to identify economic linkages. Moreover, there are many ways to analyze these very relationships, which include the construction of linear regressions, correlation analysis, sensitivity analysis, as well as a wide range of econometric tools in the form of statistical models. In addition, there is a wealth of historical data that can be used to draw conclusions for this study. In combination with the importance of this topic, and because of the wide range of tools available to study the relationships of this topic, there are many studies available. However, studies specifically examining the impact of monetary policy on foreign direct investment (hereinafter – “FDI”) are exceptional. Therefore, there is a gap in this part of the research on the impact of monetary policy on FDI.

The research carried out by Albulescu and Ionescu (2018) is a key study, as the topic largely reflects target research topic. However, the researchers investigated the impact of monetary policy uncertainty and banking sector instability on FDI inflows in European countries, which means that there is still a gap in the literature of research on the direct impact of monetary policy on FDI and it needs to be filled. Nevertheless, this is an important study whose researchers use econometric tools to analyze the impact of banking instability and monetary policy uncertainty in the form of Fully Modified Ordinary Least Squares and Dynamic Ordinary Least Squares to examine the relationships between the variables. Moreover, researchers measure bank instability through the Z-score and use PMG estimation to support the results. This is a key study using important econometric concepts that are important to apply.

According to the research examining the effect of monetary policy on inflation and national economy conducted by Angelina (2020), monetary policy directly affects the

inflation rate in Indonesia, when the inflation rate has no effect on the economy. In addition, FDI and labor have a significant impact on the Indonesian economy. In this study, the author uses time series data and two-stage least squared method, which can be quite applicable in the study of the impact of monetary policy on foreign direct investment.

The research conducted by Dornean and Oanea (2014), examines a completely different direction in the context of these studies. The authors study the impact of fiscal policy on FDI in the context of the crisis in central and eastern European countries. The authors also try to find a specific model of different countries using different fiscal policy instruments in order to identify the most important instruments affecting foreign direct investment. The authors in their study use regression models and panel data methodology, which can also be applied in the target study. This study is useful in general for studying the topic, as well as what factors can influence foreign direct investment.

Another important research by Olweny and Chilwe (2012) studies the relationship between monetary policy and the private sector in Kenya. The authors focus the study on quarterly macroeconomic data and build linear regressions based on these data. More precisely, the authors base their methodology on integration testing using a vector error correction model to study the dynamic relationship of variables caused by the key factors of the study. The authors cite an accurate linear regression model in their study and come to a concrete conclusion that a decrease in monetary policy by -1 percent has an impact on a decrease in private sector investment by -2.63, when the inverse relationship states an increase by 2.63. This is one of the key literatures related to the topic, since the study reflects the most similar hypotheses, methodology and an extremely extensive range of research tools.

The research conducted by Karahan and Bayır (2022) examines the effect of monetary policy on inflows of foreign direct investment in emerging countries as part of the impact of COVID-19. This research is one of a small number of studies examining the impact of variables in emerging countries. Also, this study is unique from all research in that it examines the relationships within the global impact of the pandemic on variables. In addition to studying the interrelationships between different variables and monetary policy, Hung-Ju Chen (2018) in his research paper studied the impact of monetary policy on innovation and the pattern of production in a North-South product cycle model with foreign direct investment. In general, the study concludes that a reduction in the nominal interest rate increases the level of innovation when the scale of production decreases as foreign direct investment increases.

There is a lot of research on the impact of monetary policy on very different economic variables. Researchers choose an extensive geography, examining the impact by taking models and economic data from different countries. Thus, the research covers different countries from Southeast Asia to European states. Moreover, researchers study this topic in different conditions and using a wide range of variables, where they are limited only to the choice of the researchers. As can be seen from the current literature review, a wide range of economic variables is open to them to study the topic. In addition, most researchers use a wide range of econometric models, but most of these models are constructed in linear equations. Based on the entire literature review, there are a few studies that reflect the target research, however, there is still a gap in the literature, since there is no research that has studied the direct impact of monetary policy on the variable of foreign direct investment

3. RESEARCH QUESTION & HYPOTHESIS DEVELOPMENT

Based on the entire literature review, there are a few studies that reflect the target research, however, there is still a gap in the literature, since there is no research that has studied the direct impact of monetary policy on the variable of foreign direct investment. In addition, it is important to note that not only is there a lack of research on the direct impact of monetary policy on foreign direct investment, but this gap is particularly evident in the context of Kazakhstan and Central Asia as a whole. To date, no studies have specifically addressed this topic within the region, further emphasizing the need for empirical investigation in this area. Moreover, seeing the importance of FDI in the policy of Kazakhstan, established by the government resolution, as well as observing the incorrect display of information on the huge amounts of gross FDI inflows to Kazakhstan, I decided to research FDI (including outflows and without reinvested income). And the point of influence I chose the change of the base rate due to their high values and extremely high volatility, because initially, as a researcher, I believe that the base rate negatively affects economic growth, in consequence of which FDI may suffer.

1. Research question under study concerns what effect the base rate has on foreign direct investment through impact on economic growth:

H₀ - the effect of the base rate on foreign direct investment through economic growth is statistically insignificant

H₁ - the effect of the base rate on foreign direct investment through economic growth is statistically significant

2. Research question under study examines the impact of the weighted average loans rate issued to the economy on reinvested income as part of FDI.

H₀ - the effect of the weighted average loans rate on reinvested income in FDI is statistically insignificant

H₁ - the effect of the weighted average loans rate on reinvested income in FDI is statistically significant

4. METHODOLOGY

As part of analyzing the relationship and assessing the impact of clearly identifiable variables with determinable values, multilinear regression can meet the needs to find the relationship of causal effect. In this study, I use quantitative research method by constructing different types of multilinear regression to test my hypothesis on the effect of the base rate on foreign direct investments. However, there are certain limitations and assumptions that must be met in the construction of the multilinear regression model, which are the basis for all other subtypes of this method. Thus, according to Poole, M.A. & O'Farrell, P.N. (1971) six critical assumptions must be met when constructing a multilinear regression:

- I. Each value of **X** and of **Y** observed without measurement error;
- II. The relationships between **Y** and each of the independent variables **X** are linear in the parameters of the specific functional form chosen;
- III. Each conditional distribution of **u** has a mean of zero;
- IV. The variance of the conditional distribution of **u** is constant for all such distributions; this is the homoscedasticity assumption;
- V. The values of **u** are serially independent;
- VI. The independent variables, **X's** are linearly independent of each other;

Therefore, based on the above, when constructing a linear regression, basic assumptions must be followed to arrive at the correct results without statistical errors.

Multilinear regression contains the basic form expressed in:

Eq.1

$$Y = \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \dots + \beta_n * X_n + \varepsilon$$

Where,

Y – the predicted dependent variable;

β_0 – intercept;

β_1 – the coefficient of influence of the independent variable on the dependent variable;

X – predictive independent variable;

ε – error term, which shows the unexplained part of the multiple regression model;

In general, the methodology is based on the variation and modification of the multilinear regression model approach in order to fit the hypothesis testing and fulfill the assumption conditions of the multilinear regression model. Overall, within the methodology construction, I identified three approaches that I used to test the two hypotheses.

4.1 USING MEDIATOR VARIABLE APPROACH

Testing the first hypothesis on the effect of the base rate on foreign direct investment through economic activity satisfies the conditions for using the mediator variable approach. According to Matthew S. Fritz and Houston F. Lester (2016), mediator variables are variables that lie between the cause and effect in a causal chain. In other words, mediator variables are the mechanisms through which change in one variable causes change in a subsequent variable. Therefore, in this approach, I first identified the independent variable, the mediator variable, and the dependent variable. Subsequently, I determined the effect of the base rate on the mediator variable, which I also analysed for the presence of an effect on the dependent variable.

As a start, I estimated the effect of the independent baseline variable (Base Rate) on the dependent variable (Foreign Direct Investment) using the form of simple linear regression illustrated below:

Eq.2

$$Y = \beta_0 + \beta_1 * X + \varepsilon$$

Where,

Y – dependent variable (foreign direct investments);

β_0 – intercept for Eq.2;

β_1 – the coefficient of influence of the base rate on foreign direct investment

X – independent variable (the base rate);

ε – the error term;

The next step of the analysis in this approach involved identifying the relationship (testing) of the independent variable to the mediator variable in the form of simple linear regression illustrated below:

Eq. 2.1

$$M = \beta_2 + \beta_3 * X + \theta$$

Where,

M – dependent mediator variable (Economic activity);

β_2 – intercept for Eq 2.1;

β_3 – the coefficient of influence of the base rate on mediator variable (economic activity);

X – independent variable (the base rate);

The prefinal part of this approach is to estimate the effect of the mediator variable (economic activity) on the dependent variable (foreign direct investments) in a similar form as Eq 2 and Eq 2.1. Finally, all variables are combined into one model using multilinear regression as defined in Eq.1 to cumulatively analyse the effect of the independent variable with the mediator variable on the dependent variable.

However, there are some limitations to this approach that can significantly affect the statistical results:

- I. Ignoring other factors. Focusing on one independent variable through the mediator variable cannot accurately explain the causal relationship between the dependent and independent variable through the mediator variable. The model error may hide these flaws. As a consequence, the exogeneity / the endogeneity condition in the model may be violated.
- II. The independent variable and mediator variable may determine each other, thus the problem of multicollinearity arises.
- III. The mediator variable can be determined from the dependent variable, which raises the problem of endogeneity.

The solution to Limitation II, when there is a multicollinearity problem in the form that an independent variable can be determined by a mediator variable and vice versa, involves the use of 1 lag between the independent variable and the mediator variable. That is, using the base rate 1 lag backward with the assumption of an effect on the mediator variable without a lag.

Illustration 1.1

$$X (\text{independent variable})_{i-1} \rightarrow Y (\text{dependent variable})_i$$

First, we simply regress our baseline dependent variable and independent variable without including the mediator variable.

Illustration 1.2

$$X (\text{independent variable})_{i-1} \rightarrow M (\text{mediator variable})_i$$

Solving Limitation III involves a similar procedure for solving Limitation II. That is, the endogeneity solution involves using 1 lag for the mediator variable with the assumption of an effect on the dependent variable with no lag. (*Please see Illustration 1.2*)

Illustration 1.3

$$M (\text{mediator variable})_{i-1} \rightarrow Y (\text{dependent variable})_i$$

To summarize, the model with mediator variable approach will use a two-step lag for the independent variable to estimate the effect on the mediator variable with a one-step lag, which subsequently, affects the dependent variable without a lag. (*Please see Illustration 1.3*)

Illustration 1.4

$$X (\text{independent variable})_{i-2} \rightarrow M (\text{mediator variable})_{i-1} \rightarrow Y (\text{dependent variable})_i$$

Limitation I is a serious problem for this approach as there is nothing within this approach that can solve it as the variables are all defined and only adding additional variables with a linear relationship can solve the problem within this constraint. Therefore, I have considered a different approach for hypothesis testing within this research, which I will describe in the next section.

4.2 USING RESIDUALS IN TWO-STAGE LINEAR REGRESSION

Unfortunately, the use of a limited number of variables leads to various problems, including the main one - the problem of exogeneity of variables, when a variable may correlate with an error and not fully explain the relationship of the analysed variables. Therefore, for a more comprehensive approach and accurate determination of the relationship and, accordingly, testing the hypothesis, I am testing another method by adding new variables to the analysis and using a multilinear regression model. However, the analysis of variables revealed a strong relationship between the independent variables, that is, the problem of multicollinearity arose.

A similar method was carried out in a study by Joseph V. Terza, Anirban Basu and Paul J. Rathouz (2008), where researchers use the Two-Stage Residual inclusion method, however, in their model, researchers add additional residuals to endogenous variables, which I am not going to carry out in my 4.2 part of methodology. I interpreted this model to test my hypothesis, and to begin with, in order to remove multicollinearity in my study, I regress my main independent variable (base rate) as a dependent, with the rest of the independent variables, in the following form:

Eq 3

$$X (\text{Base rate}) = \beta_0 + \beta_2 X_2 + \beta_3 X_3 + \dots \beta_n X_n$$

In the next part, the residuals from this first stage (the difference between the predicted values of the model and the actual values of Y) of the regression are added to the second stage of the regression, with the assumption that the residual explain the error in the first stage of the model, that is, dependence on other factors, but not correlation with other independent variables within this approach.

Eq 3.1

$$\text{Residual (Base rate)} = Y - \check{Y}$$

Eq 3.2

$$Y(\text{FDI}) = \beta_0 + \beta_1 \text{Residual (Base rate)} + \beta_2 X_2 + \beta_3 X_3 + \dots \beta_n X_n$$

4.3 USING PRINCIPAL COMPONENT ANALYSIS

As part of the solution to the exogeneity problem, where variables may be correlated with error and explained by factors outside the model, I addressed this problem by adding other variables while forming a multilinear regression model within the 4.2 part of the methodology. However, within the aforementioned methodology, a multicollinearity problem arose, the solution to which was, as mentioned earlier, using the residuals in the first stage regression in the second stage regression. To test the hypothesis, I validated another method that is suitable for solving multicollinearity with a solution to the exogeneity problem, in addition to methodology 4.1 and 4.2 - this solution is the Principal Component Analysis method. The method was first invented by the famous mathematician Karl Pearson in 1901. The essence of the method is to reduce the dimensionality of the data by focusing on the most important variables without losing important information that determine the main variance of all variables. The Principal Component Analysis method is widely used to analyse the relationship of variables when there are a large number of variables and to solve multicollinearity.

Solving the problem of multicollinearity has been addressed in many studies through the use of principal component analysis method. Abubakari S.Gwelo (2019) in his study tested the use of principal component method to solve the problem of multicollinearity - the researcher identified the presence of covariance between his independent variables and after using principal component method, the researcher identified the most important components that explain the most variance in the data, thereby eliminating the problem of multicollinearity. Another study to test different methods to solve the problem of multicollinearity was conducted by N. Herawati, K. Nisa, E. Setiawan, Nusyirwan, Tiryono (2018). The researchers analysed different methods for solving the multicollinearity problem. The methods analysed were Ordinary Least Squares (OLS), Least Absolute Shrinkage and Selection Operator (LASSO), Ridge Regression (RR) and Principal Component Analysis (PCA). By performing Monte Carlo simulations, the researchers concluded that the principal component analysis method was the most effective way to solve the problem of multicollinearity. Principal Component Analysis among all other methods showed the lowest AMSE and AIC, indicating the most efficient result compared to the above mentioned methods. Therefore, after analysing other methods to address the emerging problem of multicollinearity, other studies prompted me to test this method to test my hypothesis.

The main condition under which this method works is that the data is centered. Since the method focuses on transforming the original data from the original space to a new space of lower dimensionality, it is necessary to translate the analyzed variables into a single unit or scale, since the variance of different quantities can seriously affect the model. First of all, we center the data in the form expressed from below:

Eq 4

$$z = \frac{\text{value} - \text{mean}}{\text{standard deviation}}$$

Or since we are using R, we prescribe the function `<- prcomp (data, scale = TRUE)`.

After centralizing the data, I used the PCA function `<- prcomp (data)` and `summary (pca)` to find the new variables (principal components) that would explain most of the variance in the data.

4.4 TESTING THE SECOND HYPOTHESIS

To test the second hypothesis, I used simple linear regression, however, as part of the testing of this hypothesis, the dependent variable is changed to reveal a different relationship from the first hypothesis (see the description of the variables in the Data collection and analysis section). In order to test the second hypothesis, the same regression model was used, but with different independent variables. The form of the model was described earlier by equation 2. The independent variables in the two models were similar indicators - the base rate and the weighted average rate on loans provided to the economy.

5. DATA COLLECTION AND ANALYSIS

For the purpose of this study, I am using a quantitative research method with secondary data analysis. I used publicly available statistical data from the official website of the National Bank of the Republic of Kazakhstan (NBRK) and from the website of Bureau of National Statistics Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (stat.gov). The total data included 11 variables (2 dependent and 10

independent), different combinations of which were used depending on the methods used, described previously. In my study, I used data starting in Q1 2013 and ending in Q4 2023. The choice of observations was based on the availability of data of the dependent variable (FDI), which was available from Q1 2013. The number of observations in the study is 44.

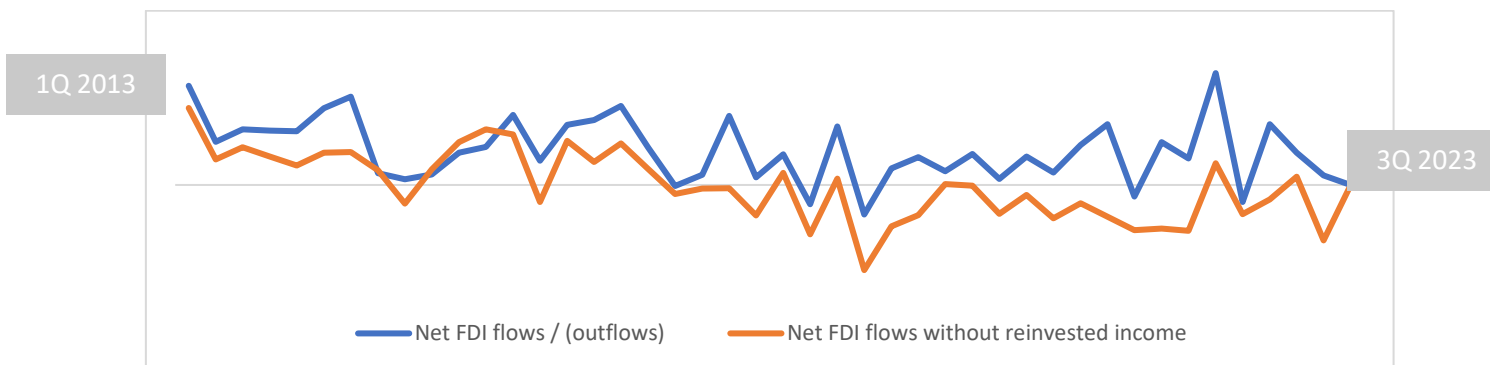
Table 2. Raw data description

Variable name	Characteristic	Used in Hypothesis 1	Used in Hypothesis 2	Source
Foreign direct investments	Dependent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	NBRK
The base rate	Independent (main)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	NBRK
Gross domestic product	Independent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	stat.gov
Loans to the economy	Independent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	NBRK
Retail trade	Independent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	stat.gov
Wholesale trade	Independent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	stat.gov
Average monthly salary for quarter	Independent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	stat.gov

Unemployment rate	Independent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	stat.gov
Brent price, Barrel/USD	Independent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Energy information administration (EIA)
Exchange rate, KZT/USD	Independent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	NBRK
Reinvested income in part of FDI	Dependent	<input type="checkbox"/>	<input checked="" type="checkbox"/>	NBRK
Weighted average interest rate on loans to the economy	Independent	<input type="checkbox"/>	<input checked="" type="checkbox"/>	NBRK

Primarily, I have cleaned up foreign direct investment from double counting factors that do not reflect the true position of foreign direct investment inflows. The NBRK statistics have more than one variation of foreign direct investment data, the main ones being gross inflows and net inflows of foreign direct investment. According to the methodological commentary of NBRK on FDI statistics, gross inflows include increases in equity instruments, reinvested income, and increases in debt instruments. Where as net inflow reflects data including sale or redemption of equity and debt instruments, i.e. taking into account the outflow of foreign capital from Kazakhstan. It would be correct to conclude that we can safely use this indicator as an object of analysis of the explanatory variable, but it is not so. According to the methodological commentary of the NBRK, this indicator also includes reinvested income, which cannot mean the inflow of new investments into the country, but only reinvestment of early inflows. Therefore, I used net FDI inflows less reinvested income to convert the FDI source data.

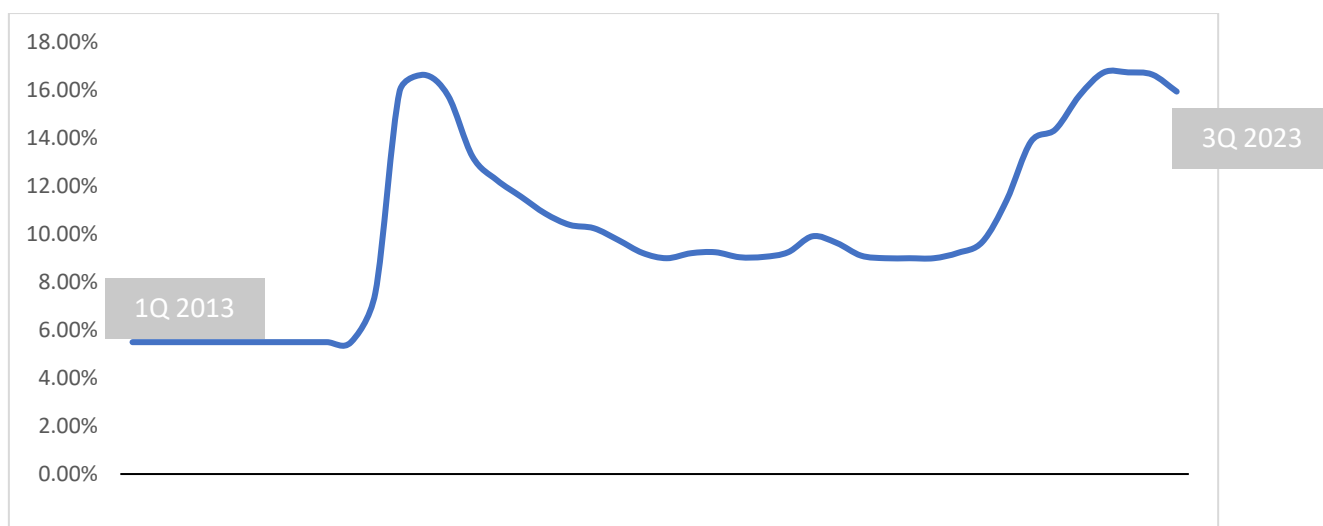
Figure 1. Dynamics of FDI net flow (outflow) to (from) Kazakhstan including and excluding reinvested income, mln USD



Source: NBRK

Second, it is necessary to transform the data on the main independent variable (the base rate), since the data on it are not consistent and the rate is set according to changes in the macroeconomic situation and the NBRK's own policies. Since the main variable (dependent variable) that I want to explain is provided in quarterly form, the base rate should also be converted into quarterly form. However, as mentioned earlier, the base rate does not have the same periodicity and its setting is not consistent. Therefore, initially, I collected all the changes in the base rate by date and calculated the average rate for the quarter of the weighted average rate by day for how long the rate was constant. To do this, I built a table with the rates in Excel - I counted the days between their changes with a ceiling set as the end of the quarter and divided the weighted average by the number of days in a particular quarter. The functions in excel that I used included `=sumif`, `=sumproduct` and `=days`.

Figure 3. Dynamics of weighted average base rate by quarters, %



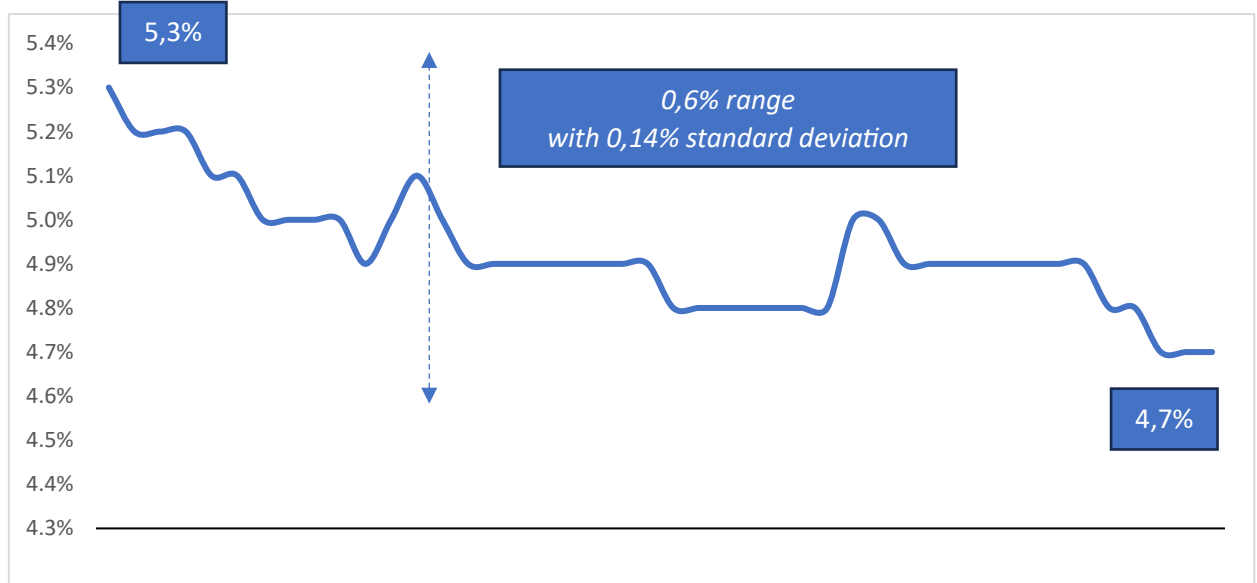
Source: NBRK

I converted the remaining independent variables that were added to the analysis into US dollars, at the average exchange rate for the quarter as reported by the NBRC, since the explained variable FDI is expressed in US dollars.

The rationale behind the choice of such variables is primarily due to the hypothesis, as the first hypothesis assumes that a change in the base rate has an impact on FDI through economic activity. Therefore, GDP, wholesale and retail trade, unemployment, quarterly average monthly wage, total loans reflect economic health, which subsequently translates into activity and hence its growth. Also during the analysis, as mentioned earlier, most of the FDI inflows come from mining and manufacturing industries, which are export-oriented. Therefore, external macroeconomic variables were added, which according to my assumption may have an impact on FDI inflows. The variables responsible for the external nature of the impact on the country are the price of brent and the exchange rate KZT/USD.

Preliminary analysis of the data showed a very small level of standard deviation for the unemployment rate compared to the other indicators, which could immediately imply a low linear relationship with the variables, so I excluded the unemployment variable at the initial stage. Its dynamics was different from the others and was more stable, while the previously mentioned variables had a large standard deviation, and this can be seen also in the dynamic's graphs shown earlier.

Figure 4. Dynamics of the Unemployment rate



Source: stat.gov.kz

After removing one variable (unemployment rate), I combined the retail sales and wholesale trade measures, which have similar natures and have similar trends.

Figure 5. Dynamics of retail and wholesale trade, mln KZT



Source: stat.gov.kz

However, when combining this data and generally by analyzing the wholesale and retail trade graph, I found seasonality in the data, which means that the data is not stationary. Therefore, we cannot analyze this data because it does not have a predictive nature and its values may be unrepresentative as min and variances change in history. Therefore, I simply narrow a set of variables again by removing these two indicators.

The next step before proceeding to identify any relationship through the methods described earlier was to analyze the correlation of the variables with each other. The analysis was conducted in order to check the variables for multicollinearity, a condition which, if violated, can lead to incorrect statistical results.

Table 3. Correlation matrix of variables

	FDI	The base rate	GDP	Average wage	Brent price	Total loans
FDI	1,00	(0,15)	(0,10)	(0,02)	0,03	0,41
The base rate	(0,15)	1,00	(0,00)	(0,06)	(0,25)	(0,42)
GDP	(0,10)	(0,00)	1,00	0,70	0,47	0,46
Average wage	(0,02)	(0,06)	0,70	1,00	0,71	0,75
Brent price	0,03	(0,25)	0,47	0,71	1,00	0,67
Total loans	0,41	(0,42)	0,46	0,75	0,67	1,00

Some correlation between the independent variables can be observed from the correlation matrix. It can be noticed the correlation of average wages with other variables - this is understandable as average wages depend on these factors. And since this factor can be accounted for and explained in a number of other factors, I excluded this variable from the model. The correlation of GDP with other variables such as average wage, brent price and total loans is especially noticeable. This is quite understandable, as GDP directly determines or is determined by these factors. Subsequently, as mentioned earlier, the problem of multicollinearity arises, which is solved by the methods described earlier. For methodology 4.1 (use of mediator variable), I used the variables - foreign direct investment, the base rate and GDP with lags defined earlier. Methodology 4.2 (use of residuals in two-stage regression) and 4.3 (method of principal component analysis) assume the use of all the above variables. As

part of testing the second hypothesis, I used a different dependent variable - the portion of reinvested income in FDI, I regressed on two independent variables - the base rate and the weighted average rate on loans to the economy.

6. RESULTS

6.1 RESULTS USING OF MEDIATOR VARIABLE APPROACH (Hypothesis 1)

Table 4. Mediator variable approach regression results

<i>Regression name</i>	<i>The base rate (Independent)</i>	<i>GDP (Mediator)</i>	<i>P-value</i>
1. Dependent (FDI)~ Independent (BR)	(5 266)	-	0,3958
2. Mediator ~ Independent	(15 263)	-	0,7813
3. Dependent ~ Independent & Mediator	(6 017)	2 343	0,6202

Table 3 shows the results of the 3 regressions conducted using the mediator variable approach. According to the results of this table, it can be seen that there is no linear relationship, and the results are statistically insignificant - the P-value on all regressions is more than 0.05. Therefore, the use of this approach did not lead to any results, meaning that there is no effect of the base rate in two lags on foreign direct investment through GDP in one lag.

6.2 RESULTS OF USING RESIDUALS IN TWO-STAGE LINEAR REGRESSION (Hypothesis 1)

Table 5. Results of phased addition of variables to the regression model

	<i>Base rate</i>	<i>Brent price</i>	<i>Total loans</i>	<i>GDP (Residuals)</i>
<i>Estimate</i>	(5 267)	(5,2020)	0,0269	(3,7420)
<i>Multiple R-squared</i>	0,0177	0,0242	0,2886	0,3698
<i>Adjusted R-squared</i>	(0,0063)	(0,0247)	0,2334	0,3034
<i>P-value</i>	0,3958	0,6133	0,0038	0,0012

Table 6. Summary of using residuals approach in two-stage linear regression

	<i>Estimate</i>	<i>Std. Error</i>	<i>t value</i>	<i>Pr (> t)</i>
<i>Intercept</i>	(1 998)	1 121	(1,78)	0,08257
<i>Base rate</i>	3 948	5 653	0,69800	0,48918
<i>Brent price</i>	(32,02)	10,64	(3,00900)	0,00463 **
<i>Total loans</i>	0,02772	0,00673	4,11600	0,00020 ***

<i>GDP (Residuals)</i>	(0,03742)	0,01692	(2,21200)	0,03306 *

<i>Signif. Codes: 0 '***' 0,001 '**' 0,01 '*' 0,05 '.' 0.1 ' ' 1</i>				
<i>Residual standard error: 1215 on 38 degrees of freedom</i>				
<i>Multiple R-squared: 0,3698</i>				
<i>Adjusted R-squared: 0,3034</i>				
<i>F-statistic: 5,574 on 4 and 38 DF, p-value: 0,001244</i>				

Following the results of the second approach and with the addition of all variables in turn, we can see how the R-squared increases, which was -0.00063 when adding the first main independent variable (the base rate) and 0.3034 when adding the GDP residuals, meaning that together these variables explain more variance in the regression data. The P-value also increases showing the statistical significance of the effect of the variables on foreign direct investment. Returning to hypothesis confirmation, this method confirms or does not reject the null hypothesis that there is no effect of the base rate change on foreign direct investment through economic growth. This can be understood from the results of the model where the base rate (the main independent variable) is statistically insignificant. GDP (residuals), on the other hand, has a statistical significance of 5%, however, it has a negative coefficient, implying an opposite relationship with the dependent variable of foreign direct investment, which is not suggested by alternative hypothesis 1. However, this regression used exactly residuals that are not correlated with other variables, which may not fully reflect the true picture of the effect of GDP on foreign direct investment. The remaining results of the multilinear regression show that the volume of total loans to the economy and the price of Brent are statistically significant at the 1% and 0.1% levels, respectively. Total loans has a coefficient of 0.02772, meaning that a 1 million USD increase in total loans will have an effect on increasing 27,7 thousand USD of foreign direct investment and vice versa. On the other hand, the coefficient of Brent price according to the statistical results showed a negative trend with foreign direct investment of -32.02, meaning that an increase in the price of 1 Brent per barrel entails a change in foreign direct investment of \$32.02 million. The increase in the price of USD 1 Brent per barrel entails a change of 32,02 million USD in foreign direct investments. This also is not consistent with the proposed hypothesis, since Kazakhstan's economy is very dependent, if not highly dependent, on the price of Brent, as it is an exporter of oil and oil products. Therefore, as a result of using this approach, we do not reject the null hypothesis or do not accept the alternative hypothesis, as the statistical summary shows us.

6.3 RESULTS OF USING THE METHOD OF PRINCIPAL COMPONENT ANALYSIS (Hypothesis 1)

Table 7. Principal component finding results and their explanation of variance in data

	<i>PC1</i>	<i>PC2</i>	<i>PC3</i>	<i>PC4</i>	<i>PC5</i>	<i>PC6</i>
<i>Standard deviation</i>	1,74430	1,44000	0,89750	0,70064	0,52292	0,28113
<i>Proportion of Variance</i>	0,50710	0,21810	0,13430	0,08182	0,04557	0,01317
<i>Cumulative Proportion</i>	0,50710	0,72520	0,85940	0,94125	0,98683	1,00000

According to Table 7 above, it can be seen that out of all the variables, the 4 principal components explain 94,12% of the variation in the data. Therefore, when interpreting the results, it is possible not to analyze the remaining variables, but only focus on the first 4.

Figure 6. Illustration of the explanation of variance in the data by the principal components

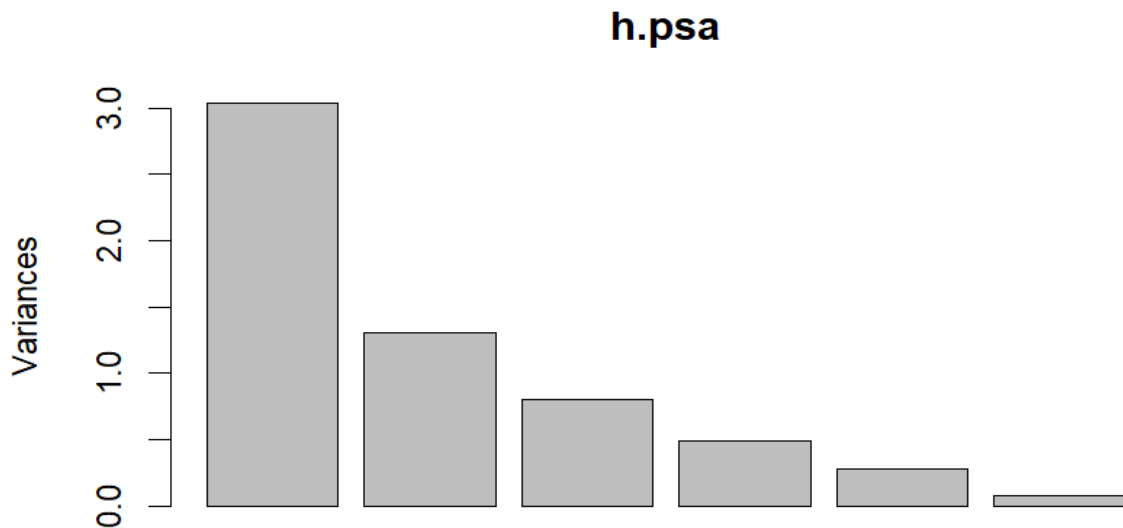


Table 8. Coefficients of variables in the principal components

	PC1	PC2	PC3	PC4	PC5	PC6
FDI	(0,1055)	(0,7349)	0,5143	0,2249	(0,2363)	(0,2790)
BR	0,2574	0,4205	0,8313	(0,1126)	0,0074	0,2306
GDP	(0,4032)	0,3749	0,0216	0,7787	(0,2898)	0,0779
WAGE	(0,5100)	0,2361	0,1870	(0,1351)	0,5001	(0,6171)
BP	(0,4831)	0,1130	0,0151	(0,5558)	(0,6663)	0,0288
TL	(0,5163)	(0,2720)	0,0937	(0,0567)	0,4076	0,6938

The principal component 1 explains 50% of the variance in the data. It is immediately striking that the contribution of the base rate to the first principal component is positive, with other variables having negative coefficients. This may imply a negative correlation with other variables such as GDP, average wages and total loans to the economy. It can also be interpreted that an increase in the base rate negatively affects the level of GDP, average wages and the total level of loans to the economy, which can be explained by the fact that the level of GDP and the total number of loans is slowing down due to the high cost of credit, which then affects the average wage. It can also be seen that the Brent price also has a negative coefficient with the other variables, which can also be

explained by the effect of the Brent price on GDP and average wages. However, the coefficient of foreign direct investment is small but nevertheless remains negative, showing a small relationship with the base rate in principal component 1. The result is still better than in the other approaches where there was no relationship between the base rate and FDI at all, but it is not enough to confirm the hypothesis.

In **the principal component 2**, foreign direct investment has a significant negative correlation with other variables with a positive coefficient. If we focus on the most significant variables, we can conclude that the principal component 2 increases with a decrease in foreign direct investment (-0,73), and an increase in GDP (0,37) and the base rate (0,42). This component can be interpreted as an illustration of near stagnation in the economy, when the base rate increases with an increase in GDP, but foreign direct investment decreases, implying an outflow of foreign capital from the country. The principal component 2 also cannot reject the null hypothesis or accept the alternative hypothesis.

In **the principal component 3**, all variables have positive coefficients, but the ones with the most effect and moving in the same direction are foreign direct investment and the base rate. It is noteworthy that it is the base rate that most determines the movement of the principal component 3 with a coefficient of 0,83. Within principal component 3, foreign direct investment and the base rate have a positive correlation and effect on principal component 3. Therefore, these results are also not consistent with the hypothesis, meaning that an increase in the base rate has a positive correlation with foreign direct investment.

The principal component 4 can be explained by the other part of GDP that is not related to the Brent price (i.e., areas of the economy other than the oil and gas sector). The component is also positively affected by foreign direct investment and negatively affected by the base rate, which can explain economic growth, however, the relationship of the base rate on FDI through economic growth, which is determined by the alternative hypothesis 1, is not explained by the principal component. In order to confirm alternative hypothesis 1 (the effect of the base rate on FDI through economic growth) the principal components should have had coefficients of the base rate, GDP and FDI greater than 0,5, implying some kind of relationship. Meanwhile, to confirm alternative hypothesis 1, in addition to having coefficients of 0,5, there had to be a continuation of the trend in the components – the base rate with a negative coefficient greater than 0.5 when both GDP and FDI with a positive coefficient whereby, the coefficient of GDP is higher than the coefficient of FDI. This would explain that the component increases as the base rate decreases, which increases GDP, which in turn increases FDI.

Based on the results of using the principal component method, the results did not confirm the alternative hypothesis. Therefore, the null hypothesis is not rejected.

6.3 RESULTS OF USING SIMPLE LINEAR REGRESSION ON THE FDI (REINVESTED INCOME PART) AND WEIGHTED AVERAGE LENDING RATES TO THE ECONOMY (Hypothesis 2)

Table 9. The results of the simple linear regression using reinvested income as part of FDI and the weighted average lending rate

	<i>Weighted average lending rate</i>
<i>Estimate</i>	15 681,1
<i>Multiple R-squared</i>	6 308,8
<i>Adjusted R-squared</i>	2,486
<i>P-value</i>	0,0171*

<i>Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1</i>	
<i>Residual standard error: 1036 on 41 degrees of freedom</i>	
<i>Multiple R-squared 0,131</i>	
<i>Adjusted R-squared 0,1098</i>	
<i>F-statistic: 6,178 on 1 and 41 DF, p-value: 0,0171</i>	

Table 9 shows the results of running simple regressions on the variables reinvested income in FDI and weighted average interest rates on loans to the economy. According to the results, it can be seen that the effect is significant at 5% level, meaning that the randomness of the relationship between reinvested income in FDI and weighted average interest rate is less than 5%. From the regression results, it can be concluded that an increase in the weighted average interest rate on loans to the economy of the previous quarter increases the reinvested income in FDI by 15,68 billion USD. Consequently, the null hypothesis that there is no effect of the weighted average interest rate on loans issued to the economy on reinvested income in FDI can be rejected, which confirms the alternative hypothesis that an increase in the Cost of debt increases the Cost of equity, which were stimulated by the contractionary monetary policy of increasing the base rate.

7. CONCLUSION

This study investigated the impact of monetary policy changes on foreign direct investment. Within the framework of this study, two hypotheses were put forward - a change in the base rate affects foreign direct investment through economic growth and a change in the weighted average rate of loans to the economy affects reinvested income as part of FDI. Linear regression methods with different sets of variables and principal component analysis method were used to confirm the hypotheses. As a result of testing the first hypothesis and the use of linear regressions and the method of principal component analysis - the impact of the base rate on foreign direct investment is not found. However, if we consider another component of foreign direct investment - reinvested income, statistical results show that the impact of weighted average rate on loans to the economy on reinvested income in FDI is statistically significant at 5% level. A 1% increase in the weighted average rate on loans issued can have an impact on the

increase of reinvested income in FDI by 15.68 billion USD in the next quarter. The initial hypothesis that there should be a relationship between these variables due to the fact that the cost of debt also drives the cost of equity was confirmed.

As a result of using the three methods, I would note the use of the principal component analysis method is the most interesting and useful because through this method, unnecessary variables can be discarded with minimal loss of information. Also, there is no true interpretation of the results of the principal component analysis method, however, it is sufficient to confirm or reject a hypothesis. The results of the principal component method can be completely different and interpreted in different ways as well, which can be of interest to researchers.

The focus of this study was economic and monetary policy data of Kazakhstan, as well as external macroeconomic data affecting Kazakhstan, in terms of quarterly data from Q1 2013 to Q3 2023. Therefore, the study was limited primarily by the lack of detailed statistics describing economic growth. Also, another limitation of the study is the small time span of the data, containing 44 observations. Therefore, further development of the study of the relationship between the effect of the base rate on foreign direct investment may involve the addition of new variables that may describe economic growth in a more robust and diverse manner. Moreover, with the passage of time and as the statistical data are updated and the time horizon of the study can be extended, it may be possible to come to different results. In addition, the study of this issue can be further developed by extending the geography by investigating the relationship in countries, especially in developing countries, as they tend to have large inflows of foreign direct investment. But on the other hand, it could be tried to investigate the issue not only in developing countries but also in developed countries, for more extensive results on the impact of monetary policy on FDI inflows.

REFERENCES

- Poole, M. A., & O'Farrell, P. N. (1971). The assumptions of the linear regression model. *Transactions of the Institute of British Geographers/Transactions - Institute of British Geographers*, 52, 145. <https://doi.org/10.2307/621706>
- Fritz, M. S., & Lester, H. F. (2016). *Mediator variables*. *Oxford Research Encyclopedia of Psychology*. <https://doi.org/10.1093/acrefore/9780190236557.013.19>
- Perez, L. V. (2017). *Principal component analysis to address multicollinearity*. *Whitman College: Walla Walla, WA, USA*, 99362.
- Herawati, Netti and Nisa, Khoirin and Setiawan, Eri and Nusyirwan, Nusyirwan and Tiryono, Tiryono (2018) Regularized Multiple Regression Methods to Deal with Severe Multicollinearity. *International Journal of Statistics and Applications*, 8 (4). pp. 167-172. ISSN -ISSN: 2168-5193 e-ISSN: 2168-5215
- Terza, J. V., Basu, A., & Rathouz, P. J. (2008). Two-stage residual inclusion estimation: Addressing endogeneity in health econometric modeling. *Journal of Health Economics*, 27(3), 531–543. <https://doi.org/10.1016/j.jhealeco.2007.09.009>
- Denisia Vintila (2010). Foreign Direct Investment Theories: An Overview of the Main FDI Theories. *European Journal of Interdisciplinary Studies*; Bucharest vol.2 Iss.2. <https://www.proquest.com/docview/1436936213>

- Claudiu Tiberiu Albuлесcu and Adrian Marius Ionescu (2018). The long-run impact of monetary policy uncertainty and banking stability on inward FDI in EU countries. *Research in International Business and Finance*.
<https://www.sciencedirect.com/science/article/abs/pii/S0275531917304105>
- Silvia Angelina (2020). Effects of Monetary Policy on Inflation and National Economy Based on Analysis of Bank Indonesia Annual Report. *Technicum Social Sciences Journal*.
<https://heinonline.org/HOL/LandingPage?handle=hein.journals/techssj10&div=38&id=&page=>
- Adina Dornean and Dumitru-Cristian Oanea (2014). The Impact of Fiscal Policy on FDI in the Context of the Crisis. Evidence from Central and Eastern European Countries. *Procedia Economics and Finance*.
<https://www.sciencedirect.com/science/article/pii/S2212567114004687>
- Tobias Olweny and Mambo Chilwe (2012). The Effect of Monetary Policy on Private Sector Investment in Kenya. *Journal of Applied Finance & Banking*.
https://www.sciencypress.com/Upload/JAFB/Vol%202_2_9.pdf
- Özcan Karahan and Musa Bayır (2022). The effects of monetary policies on foreign direct investment inflows in emerging economies: some policy implications for post-COVID-19. *Future Business Journal*.
<https://link.springer.com/article/10.1186/s43093-022-00152-6>
- Hung-Ju Chen (2018). Innovation, FDI, and the long-run effects of monetary policy. *Review of International Economics*.
<https://onlinelibrary.wiley.com/doi/abs/10.1111/roie.12351>