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Does FDI affect GDP in Kazakhstan?

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Abstract

The aim of this research is to analyze the relationship between Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) in Kazakhstan. As FDI is considered one of the accelerators of economic growth and the importance of attracting more foreign investments is one of the key topics for any country, we are keen to analyze it deeply. In order to test the effect of FDI on GDP in Kazakhstan and the hypothesis states that FDI positively affects GDP, we built an economic model and used time series data starting from 1991 until 2021 reported by the Bureau of National Statistics on GDP, FDI, Labor Force and Gross Capital Formation. Our results and findings demonstrate that FDI does not have a significant impact on GDP, however, Gross Capital Formation significantly affects GDP, which means that it plays a vital role in economic development in Kazakhstan. Based on the analysis made, the hypothesis that FDI has a significant effect on Kazakhstan's GDP is not confirmed. Possibly, the effect of FDI on GDP is more complicated and, for example, routes via gross capital formation.

Introduction

In 2020 at the Kazakhstan Global Investment Roundtable president Kassym-Jomart Tokayev declared that our country must keep attracting foreign investment in order to establish a favorable and profitable environment for businesses by giving the opportunity for domestic organizations to develop. The importance of Foreign Direct Investments for the economy of the country is a well-known fact from first sight. However, we are interested to understand whether FDI indeed has an impact on GDP in Kazakhstan.

Foreign Direct Investments (FDI) indicates investment made to the economy of a country by a company or individual from another country. Foreign direct investment assumes a long-term relationship between the person or nation who invests and the company or project in which the financial contribution is made. In most cases, the investor actively manages the investment and frequently acquires a controlling interest in the enterprise.

Currently, there is a consensus in the scientific literature that the growth of a country's involvement in international trade, as well as the attraction of capital in the form of foreign direct investment (FDI), leads to various positive effects for it in the long run. The positive effects of trade openness are an increase in the diversity and accessibility of goods for the population, increased competition in the markets, benefits from the country's specialization in goods of its comparative advantage, etc. Positive effects from inflows of foreign direct investment into the country are associated with the growth of GDP, a decrease in unemployment, an increase in tax revenues to the budget, etc., as well as various indirect effects: technology transfer, an introduction of advanced production and management practices by foreign companies, improving the quality of goods, etc.

Meanwhile, the character of the relationship between the flows of foreign direct investment and international trade in the modern economy is not unambiguous: FDI and international trade can both replace or complement each other. In addition, under different conditions, changes in trade can lead to changes in incoming and outgoing FDI flows, and, conversely, changes in FDI flows can lead to changes in the exports and imports of a country.

The existing theoretical approaches to the study of foreign direct investment are not fully suitable for describing the processes existing in the world economy, since they mainly consider

two types of foreign direct investment: horizontal (aimed at finding a market) and vertical (aimed at finding resources). Other things being equal, the first type of investment is a substitute for international trade, the second leads to an increase in international trade. At the same time, in the real economy, the flows of imports, exports and FDI have a significantly more complex nature and do not fully fit into the system of assumptions of theoretical models. Consequently, in order to gain knowledge about the mutual influence of the considered indicators in the real economy, it is necessary to conduct an empirical study.

The goal of this research is an analysis of the effect of foreign direct investment flows on the GDP of Kazakhstan. In order to identify the relationship between these two variables there was conducted a time series study using annual data for 1992-2021. In the remaining part of the research, theoretical approaches to explaining the economy of Kazakhstan, FDI by sectors and countries are consistently presented, an econometric model and research hypotheses are formulated, and the methodology and results of the regression model are presented. In conclusion, suggestions are made on possible directions for further research.

Economy of Kazakhstan

Kazakhstan is a tremendous country located in central Asia. In the development of the economy, several factors such as the number of natural resources, geographic features, and policies, played a significant role. Government policies, such as the deregulation of industries and liberalization of trade, were essential steps in the development of the economy. Every reform created fortunate circumstances for the further development of the country. One of the

opportunities was the attraction of foreign direct investment (FDI), especially in the oil and gas sector.

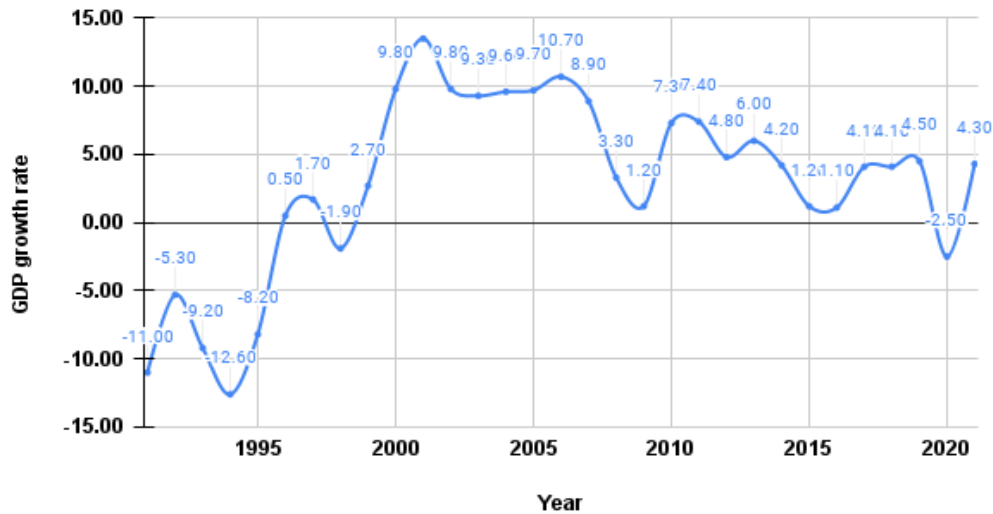
Foreign direct investment has an enormous contribution to the growth of Kazakhstan's economy. To become a favorable country for investments, the government provided tax benefits, constructed economic zones, and enriched the investment climate. Investments of global companies such as Chevron, ExxonMobil, and Total have enhanced the oil and gas sector of the country. It has led to an expansion of FDI in the mining sector. Nowadays, Kazakhstan is attracting FDI to further industries, including manufacturing, services, and infrastructure.

The majority of Kazakhstan's GDP is the service sector making up 57%, industry at 37%, and agriculture at 6%. The World Bank estimates that the country's GDP was roughly \$197.1 billion in 2021, and the per capita income was \$10,374. The nation had an 8% of the inflation rate and a 4,3% of unemployment rate in 2021. Crude oil, natural gas, and metals are the principal export commodities, while China, Russia, and Italy are the nation's top trading partners.

Notwithstanding Kazakhstan's economic growth, the nation still faces several obstacles, such as its high reliance on natural resources and susceptibility to world commodities market shocks. As a result, Kazakhstan has realized that its economy has to be more diverse and less dependent on the oil and gas industry. The nation has taken initiatives to stimulate investment in a number of key areas for economic diversification, including agriculture, manufacturing, and tourism.

Figure 1. GDP growth rate (from [worldbank.org](https://www.worldbank.org))

GDP growth rate



Moreover, due to external reasons like the COVID-19 pandemic and declining oil prices, Kazakhstan's economy has recently encountered severe difficulties. The pandemic has had a significant negative effect on the economy of the nation, which decreased GDP by 2.5% in 2020. Nevertheless, the country was able to recover up to 4.3% of GDP in 2021. The low oil prices are another reason why governments' revenue decreased. Despite these challenges, the government considered a variety of ways to develop and boost the economy, like tax breaks, infrastructure projects, and stimulus packages.

Since gaining independence, Kazakhstan's economy has experienced remarkable growth because of favorable external conditions (long-term growth in oil and other commodities prices), a variety of macroeconomic policies and structural changes meant to foster expansion, diversify the economy, and attract foreign direct investment (FDI). The country's future goals include entering the top 30 industrialized nations by 2050.

FDI in Kazakhstan

There have been a series of reforms in Kazakhstan to open its economy and modernize its production structure since independence. Kazakhstan has implemented economic changes, such as the liberalization of trade and investment regulations, special economic zones establishment, and the privatization of state-owned firms, specifically to draw in international investment. Several steps such as the stabilization of its macroeconomic climate, legal changes and regulatory policies have been taken in the country, after which the role of FDI started to enhance as well. As a result, it has emerged as one of Central Asia's most desirable locations for foreign investments.

Several structural adjustments were made from the government side in recent years to attract foreign investments. For instance, a council that coordinates efforts to draw FDI was created in 2019, the management of the investment committee as well as managing foreign investors became under the supervision of the Ministry of International Affairs in 2019. As a center for regional investments, the Astana International Financial Center (AIFC) was opened and now provides a number of advantages in terms of taxes, laws and other factors for foreigners that want to run a business in our country. Moreover, the AIFC is now the home of the Kazakhstan Direct Investment Fund, which was established by the government in 2019 to encourage economic diversification. AIFC legislation also became the center for regulation of investment agreements between the countries which positively affect the stimulation of more foreign investments.

In the beginning of 1992, the country received significant investment from Western nations such as Germany, the United States and the United Kingdom . It was mainly directed towards the gas and oil industry, which is the backbone of our economy.

In 2010, Kazakhstan, Russia, and Belarus formed a customs union, followed by the creation of the Eurasian Economic Union in 2014, which also included Kyrgyzstan and Armenia. The EAEU is governed by the Eurasian Economic Commission, based in Moscow, with the goal of deepening, strengthening economic integration and promoting free movement of goods, people, and capital among member countries. After this cross-border economic cooperation, Kazakhstan received increased investment from Russia, Ukraine, Belarus, and Uzbekistan.

Nowadays, according to the Kazakh Invest, the top ten investing countries in Kazakhstan in 2022 were:

Table 1. FDI inflow to Kazakhstan (billion US dollars) (from invest.gov.kz)

1	Netherlands	8.1
2	USA	5.1
3	Switzerland	2.8
4	Belgium	1.6
5	Russia	1.5
6	South Korea	1.5

7	China	1.4
8	France	770 million
9	United Kingdom	661 million
10	Germany	469.5 million

The Netherlands is a top international investor, as can be seen from the table. In 2022, the investment indicators accounted for 8.1 billion dollars. The Netherlands since the independence of Kazakhstan is one of the active investors, with overall investments reaching approximately \$110 billion. The number of Dutch companies operating in Kazakhstan is more than 900. The leading role of the Netherlands in the world FDI is explained by its policy attracting tax-evading companies from all over the world (Weyzig, 2013). The USA stands second, with \$5.1 billion in investments. Third place goes to Switzerland, investments amounted to \$2.8 billion. Three countries accounted for 59% of total FDI inflows in Kazakhstan.

In the last year, the FDI inflow to Kazakhstan reached 28 billion US dollars, which is in comparison with 2021 (23.8 billion dollars) higher with an increase of 17,7%. In the last 10 years, this indicator has set records (28.9 billion dollars in 2012). In 2022, the majority of FDI inflows to Kazakhstan came from a few key countries, including the Netherlands, Switzerland, and the United States. The main sectors attracting FDI in Kazakhstan in 2022 are shown in table 2.

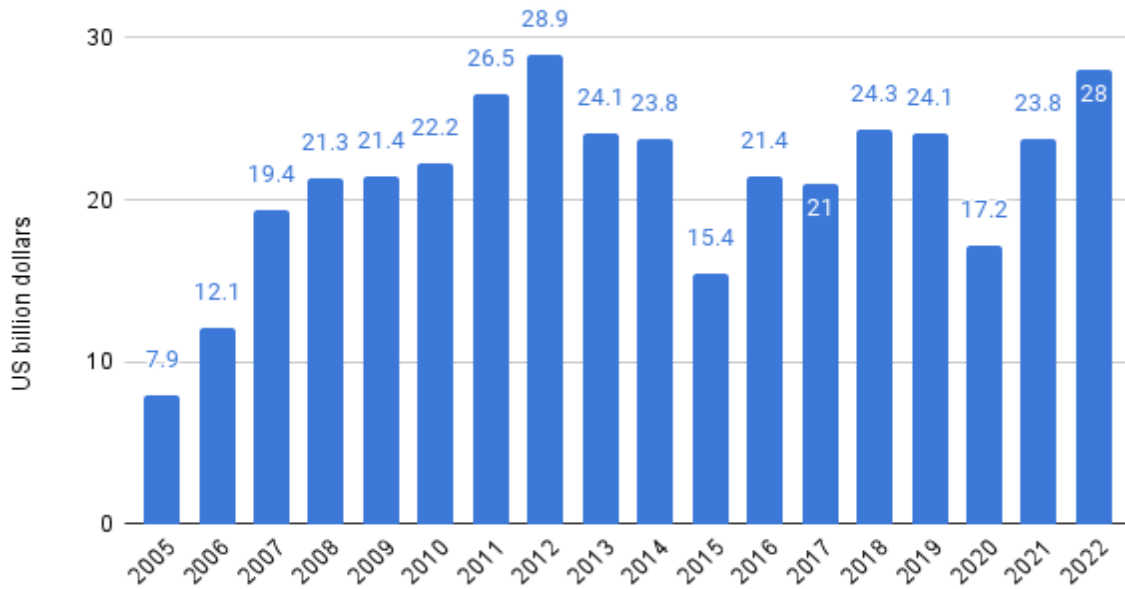
Table 2. Main sectors attracting FDI inflows in 2022 (billion US dollars) (from invest.gov.kz)

1. Mining	12.6
2. Manufacturing	5.6
3. Wholesales and retail trade	5.1
4. Professional, scientific, technical activities	1.2
5. Transport and warehousing	1.2

The expansion of the national economy in Kazakhstan demonstrates the effect of FDI on GDP. The World Bank estimates that between 2000 and 2013, Kazakhstan's GDP increased at an average annual rate of 8.4%, partly due to high oil prices and strong FDI inflows. Over the past decade, FDI inflows in Kazakhstan have shown significant fluctuations, with peaks in 2011 (26.4 billion dollars), 2012 (28.9 billion dollars) and 2022 (28 billion dollars). However, as a result of global economic turmoil and low oil prices, GDP growth has slowed down since 2014. However, starting in 2016, the dynamics of FDI recovered and grew, reaching its peak in 2022.

Figure 2. Gross Inflow FDI in Kazakhstan (from nationalbank.kz)

Gross Inflow FDI in Kazakhstan



In Kazakhstan, mergers and acquisitions type of FDI is more popular and important, but there has been a trend in 2015, 2016 and 2017 where FDI flows decreased in the cross-border shares and in new projects. But still, FDI flows remained positive compared to other CIS countries in Kazakhstan and continued to make a greater impact on the economy. According to the National Statistical Agency of Kazakhstan, the share of foreign companies operating in the country currently accounts for 6.6% of total employment, 66.2% of exports and 61% of the country's industrial production.

According to the data, it can be clearly seen that the recent economic history of Kazakhstan has been significantly influenced by foreign direct investment (FDI). FDI flows also fluctuated, because of the consequences of the global prices and decline in world commodity prices it was challenging to attract investments. Despite this fact, international companies continue to invest in Kazakhstan. According to the 2016 EY report, business surveys show that

Kazakhstan is still a desirable place to invest and attracts many international foreign players. Also, the growth of FDI inflows to Kazakhstan in recent years proves that the country is still an attractive destination for investments.

FDI by sectors

According to the Central Asian Bureau for Analytical Reporting, the mining sector continued to be the most attractive for investors on a sectoral level. The mining sector drew a record amount of investments in 2019 before the pandemic, totaling \$ 13.7 billion, in 2020 the amount of financing fell by 40% to \$ 8.2 billion. The reason for such a decrease was a structural modification, where FDI inflows into crude oil and natural gas fell by 47%, while investments in the production of coal and lignite decreased by 51%. However, FDI inflows into the mining and quarrying industry's technical services operations increased by 20%, and other businesses in this industry also saw a significant increase. The majority of FDI in the mining sector was connected to a large-scale American project in Tengiz operated by Chevron, which is anticipated to be completed by 2022, according to the UNCTAD World Investment Report for 2021. The mining industry had 56% of the total gross inflow of FDI.

The second most appealing industry for investment is manufacturing, which takes 8% of the FDI inflow in 2021. Investments in the manufacturing sector are considered a priority for the development of Kazakhstan's economy. However, financing in this industry fell by 9% overall in 2020 and totaled \$3.16 billion USD. The production of food, drinks, and tobacco products had a 50% increase in FDI inflows, as did the production of textiles, coke, and refined petroleum products. These increases were all significantly higher than they were the year before.

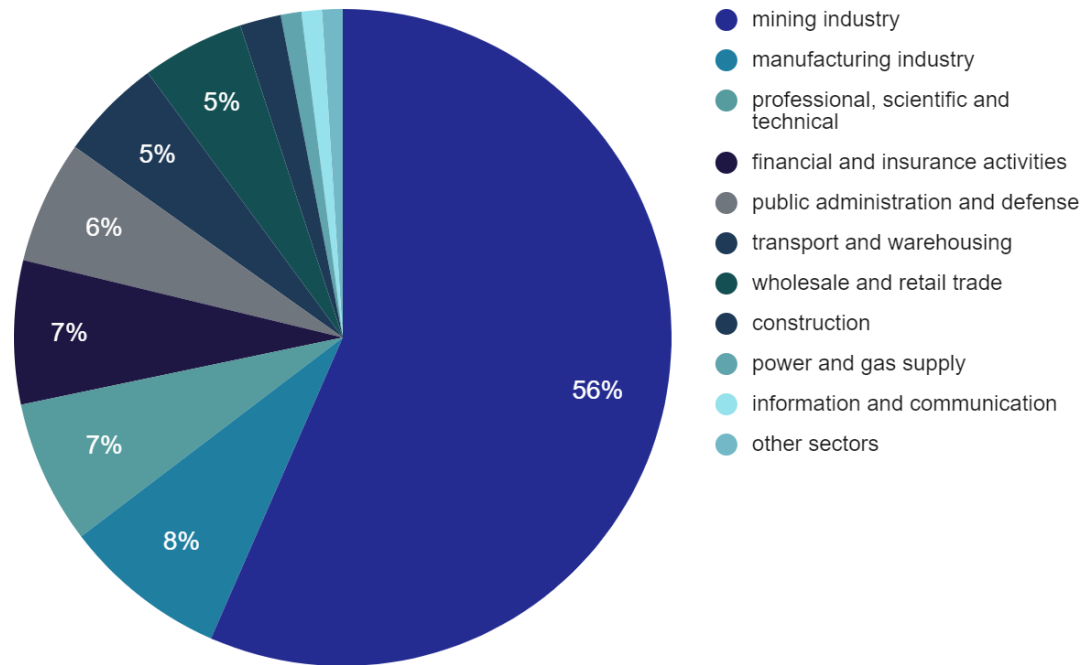
Production of machinery and equipment outside of the other categories, as well as electrical equipment, saw a substantial decline in FDI inflows.

At the end of 2020, FDI inflows to Kazakhstan's wholesale and retail trade, auto and motorcycle repair, and financial and insurance activities totaled over 1.0 billion USD, to transportation and warehousing - 0.87 billion USD, and to agriculture, forestry, and fisheries - 12.6 million USD. These sectors accounted for 15% of Kazakhstan's total FDI in 2020.

The FDI inflow to the country in 2020 fell significantly in four different sectors: professional, scientific and technical activities (by 60%), real estate activities (2.1 times), and construction (by 26.8%). It is important to note that the decline in FDI inflows in the information and communications sector was offset by an increase of foreign direct investments, which attracted 214 million USD, or 68% more FDI than the previous year.

In 2020, Kazakhstan launched 41 investment projects worth 1.6 billion USD with international involvement. Construction firms from Turkey YDA Holdings and Sembol Construction and Engineering, an electricity company from France Total Eren, an engineering organization from Germany Linde Group, Dutch venture capital fund Food Ventures, and an automaker from South Korea HYUNDAI were among the major foreign investors. Nine projects totaling 665 million USD were launched in the first quarter of 2021. These include initiatives in the fields of tourism, oil and gas, metallurgy, construction material production, and alternative energy. Another 36 projects totaling 4.4 billion USD are anticipated to be commissioned before the end of the year.

Figure 3. FDI by sectors in 2021 (from cabar.asia)



Literature review

Nistor (2014) explored how FDI affects GDP in Romania. He examined whether FDI inflows had an effect on the GDP in the Romanian economy using data from the World Bank for the years starting from 1990 to 2012. The results revealed that FDI inflows have a significant influence on GDP, with a coefficient of 2.299. Nistor concluded that FDI can be considered a factor that accelerates the economic, market, and technological growth of a country and contributes to its future development.

Abbes, Mostefa, Seghir, and Zakarya (2015) used cross-country studies of 65 countries taken from the United Nations Conference on Trade and Development database from 1980 to 2010 to test the relationship between economic growth and FDI. They analyzed the relationship between the FDI and GDP variables using the co-integration approach. As a consequence, they detected that all computed coefficients show that FDI is positively and strongly connected with economic growth at the 1% level. Overall, the results of the FDI and growth regression showed a substantial long-term link between both, as well as the significance of FDI for economic development in the countries that they studied.

Haider, Ahmad, Anwar, and Iqbal (2013) used the Cobb-Douglas production function to examine the influence of FDI on GDP in Pakistan. They gathered time series data from the State Bank of Pakistan and the World Bank for 1982-2012, including FDI, GDP, capital formation, labor force, and trade openness. From the analysis made, the authors determined that FDI is positively correlated with GDP, but they also discovered that FDI has a bigger impact on GDP in export-oriented countries than in import-substitution economies. The authors proposed that Pakistan's economic growth potential is determined by its aptitude to draw FDI, and the extent to which FDI impacts GDP is determined by its trade policy regime, for instance, by the export policy regime.

Susic, Stojanovic-Trivanovic and Susic (2016) found that FDI has different effects on macroeconomic variables in Bosnia and Herzegovina in a positive way. Their research reveals that FDI has a triple impact on economic development; firstly, it enhances the domestic investment rate, secondly, it increases business efficiency by introducing new technologies and knowledge and finally, it inspires local competitors to innovate, leading to the production of diverse high-quality goods.

Boresztein, De Gregorio and Lee (1998) focused on the impact of foreign direct investment on economic growth. They used information on FDI flows from industrial countries to 69 developing countries over the past 20 years to study the relationship between FDI and the development of the economy. According to their research, FDI is a key technology transfer medium and contributes to growth more than domestic investment. Moreover researchers found out that there is a correlative effect between foreign direct investments and human capital. The effectiveness of FDI on the economy only holds true if the host economy can employ advanced technologies.

Rakhmatullayeva, Khajiyeva, and Abduraimov (2021) examined the attractiveness of Foreign Direct Investment in Kazakhstan since independence. From 1991 to 2021, they conducted macroeconomic analyses of data on the dynamics of countries' GDP and the cyclical nature of the national economy. They found that despite the overall decrease of FDI inflows to CIS countries, the inflow to Kazakhstan increased by 35%, because of the two main large projects: the airport terminal with an investment of 244 million U.S dollars and rubber and plastic products with \$192 million investment. Overall, based on their analysis, they recommended that an effective investment policy is significant to constantly improve the investment climate and FDI attraction to the country.

Lee, Baimukhamedova, and Akhmetova (2010) examined the connections between Kazakhstan's economic development, currency rate, and foreign direct investment (FDI). In this research, fixed capital investment, employment ratio, retail trade turnover, industrial production, FDI inflows, and dollar exchange rate are examined. They used a multivariate regression model with weighted least squares estimates covering ten years from 1997 to 2006. The researchers demonstrated that FDI has a statistically insignificant effect on Kazakhstan's GDP growth. To be

precise, according to the results, resource-based FDI may not give a huge impact on growth as manufacturing-based FDI. That is why their recommendation was to reconsider the strategic objectives of FDI.

Ibhagui (2020) conducted a threshold analysis to examine how FDI impacts Sub-Saharan Africa's economic development. He made use of a collection of panel data spanning the years 1985 to 2013 from 45 SSA (Sub-Saharan Africa) nations, including six variables: initial income, population growth, inflation, trade openness, human capital, and financial market development. The findings demonstrate that FDI occasionally fosters economic growth. For instance, when particular inflation rates, population expansion, and financial market expansion have been reached. The author also discovers that nations with greater levels of institutional quality, such as better governance and more effective legal systems, have bigger effects of FDI on economic growth.

Hansen and Rand (2006) looked at the causal links between FDI and growth in developing countries. They used heterogeneous panel data from 31 developing countries covering 31 years. Their findings show that FDI has a lasting effect on GDP, in the sense that FDI causes the development of the economy in developing nations. This effect is fueled by mechanisms like knowledge transfer and the adoption of technologies. Additionally, the researchers emphasized that a nation's gross capital formation had a long-term effect on the model for GDP and FDI.

Agrawal and Aamir Khan (2011) explored the relationship between FDI and the economic development of China and India. To investigate the effect, the authors used data for 1993-2009 and generated modified growth models. They used GDP as a dependent variable and

FDI, Human Capital, Labor Force and Gross Capital Formation as independent variables. According to the results, a positive effect on the growth of GDP in China is greater than in India. Moreover, the larger market size, highly developed infrastructure, government stimulus were the main factors why investors prefer to invest in China rather than in India.

Hypothesis

In this research, we want to test how Foreign Direct Investment (FDI) affects Gross Domestic Product (GDP) in Kazakhstan. Based on a literature review provided in the previous section, FDI is expected to have a statistically significant positive effect on GDP. This hypothesis suggests that when a country attracts more FDI, it will lead to increased economic activity and growth, such as job creation and enlarged productivity, which leads to higher GDP.

There are many factors that can affect the relationship between FDI and GDP and it is complex. Therefore, this research attempts to test these hypotheses and to determine the strength and direction of the relationship between FDI and GDP.

Methodology

R Studio was used for data analysis to look at the relationship between Foreign Direct Investment (FDI) and Gross Domestic Product (GDP). A time-series study was conducted to examine the correlation between FDI inflows and GDP in Kazakhstan. To identify patterns and trends, the data was initially subjected to a descriptive analysis using R Studio. Subsequently, a regression analysis utilizing the Ordinary Least Squares (OLS) approach was performed to identify the connection between Kazakhstan's GDP and FDI inflows. Python tools such as

pandas, numpy, and matplotlib were used to modify and display the data. Interactive visualizations were developed in R studio to present the findings.

The econometric model used in this analysis is based on the Cobb-Douglas production function. The Cobb-Douglas production function is a popular economic model that explains the connection between production inputs and outputs of commodities and services. The model is developed on the assumption that the output of a production process is governed by the quantities of labor and capital utilized in that process, in addition to a constant factor of technical advancement.

The production function expresses the link between inputs and outputs as a mathematical equation. The formula is commonly stated as $Y = A * K * L^{(1-\alpha)}$, where Y stands for output, K for capital, L for labor, A represents the level of technology, and α is a parameter that determines the share of output that goes to capital versus labor.

Since it offers a framework for comprehending the elements that lead to improvements in output and productivity over time, the Cobb-Douglas production function has been widely used in the examination of economic growth and development. The link between GDP and the factors fostering economic growth has been described using the Cobb-Douglas production function.

Foreign Direct Investment (FDI) is another element that may have an impact on economic expansion. In the Cobb-Douglas production function framework, FDI may be viewed as an extra input element, in addition to labor and capital, that can support economic growth and boost output (GDP).

$$Y = \beta_0 + \beta_1 (K) + \beta_2 (L) + \beta_3 (FDI) + \epsilon$$

Where Y = Gross Domestic Product

K = Gross Capital Formation

L = Labor Force

FDI = Foreign Direct Investment

Data collection

Time series data were collected from open credible sources such as the Bureau of National Statistics for the period from 1992 to 2021. We used statistics on the following variables for our analysis:

- GDP (current in KZT) - it is the economic performance of a country, commonly used as a broad measure of economic welfare.
- Labor force - it is the sum of employed and unemployed people in a country.
- Gross capital formation (current in KZT) - capital accumulation means the expansion of production, its increase due to additional costs for fixed capital (machinery, equipment, buildings) and working capital (labor, raw materials). Generally speaking, the higher the capital development rate, the quicker an economy may raise its overall revenue.
- FDI (in KZT) - it is an investment made from a foreign country to Kazakhstan.

Results and findings

OLS regression analysis

The OLS regression analysis examines the relationship between Gross Domestic Product (GDP) as the dependent variable and several independent variables, namely Gross Capital Formation, Labor Force, Foreign Direct Investment (FDI), and lagged GDP variables. The analysis is presented in three distinct models, each with different combinations of independent variables.

Figure 4. OLS Regression Results

	<i>Dependent variable:</i>		
	(1)	(2)	(3)
	GDP		
Gross_Capital_formation	3.556*** (0.278)	3.853*** (0.357)	3.622*** (1.091)
Labor_force	1.445 (4.090)	-7.432 (6.774)	-6.890 (7.447)
FDI	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)
FDI_lag_1		0.002 (0.002)	0.002 (0.002)
FDI_lag_2		0.004* (0.002)	0.003 (0.002)
GDP_lag_1			-0.006 (0.222)
GDP_lag_2			0.073 (0.214)
Constant	-9,852,188.000 (31,480,002.000)	57,903,279.000 (51,608,320.000)	53,714,036.000 (56,822,336.000)
Observations	30	28	28
R ²	0.980	0.983	0.983
Adjusted R ²	0.978	0.979	0.977
Residual Std. Error	3,704,450.000 (df = 26)	3,631,203.000 (df = 22)	3,797,389.000 (df = 20)
F Statistic	425.165*** (df = 3; 26)	250.033*** (df = 5; 22)	163.322*** (df = 7; 20)
Note:			*p**p***p<0.01

The F statistic for Model 1 yielded a highly significant value of 425.165 ($p < 0.01$), indicating that the overall model is statistically significant with R-squared reaching 100%. This suggests that the variation in GDP over the years explained by the joint variation in all independent variables (Gross_Capital_formation, Labor_force, FDI) is significantly larger than

the unexplained variation. Consequently, the model demonstrates a strong fit to the data, implying that the aforementioned independent variables collectively exert a substantive influence on GDP. Model (1) reveals that Gross Capital Formation exhibits a statistically significant positive relationship with GDP at a 1% level of significance. This implies that an increase in Gross Capital Formation leads to an expansion of the economy. However, the coefficient of FDI is not statistically significant, suggesting that FDI does not exert a significant influence on GDP, as well as the Labor Force.

In Model 2, the F statistic attained a significant value of 250.033 ($p < 0.05$), albeit lower than that of Model 1. This result indicates that the enhanced model, which includes two more independent variables (FDI_lag_1 and FDI_lag_2), continues to be statistically significant. The lagged values of FDI for one and two years back are included to allow for a possible postponed effect of FDI. Indeed, FDI lagged to two years is statistically significant at a 5% level and positive suggesting that FDI probably has a positive effect on GDP but two years later. The inclusion of lagged variables, in conjunction with those from Model 1, contributes significantly to the overall explanatory power of the model. In this model Gross Capital Formation retains its positive and statistically significant effect on GDP, providing further evidence that increased investment in physical capital contributes to economic growth. Conversely, the coefficient of the Labor Force variable is not statistically significant, indicating that variations in the labor force do not have a substantial impact on GDP. According to this model's R-squared, it has a value of 0.983, which is almost 98.3% of the changes in GDP can be accounted for by the independent variables that were included.

For Model 3, the F statistic generated a value of 163.322 (p 0.01) which was statistically significant. even though it is less than Models 1 and 2. This indicates that Model 3, with the inclusion of lagged dependent variables to control for a possible autocorrelation (GDP_lag_1 and GDP_lag_2), provides a statistically meaningful fit to the data. The collective set of independent variables in this model significantly contributes to explaining the observed variation in GDP. Model (3) includes Gross Capital Formation, lagged FDI variables (FDI_lag_1 and FDI_lag_2), and lagged GDP variables (GDP_lag_1 and GDP_lag_2). The positive and statistically significant coefficient of Gross Capital Formation reaffirms its importance as a determinant of GDP. However, the lagged FDI variables do not exhibit statistical significance, suggesting that past levels of FDI do not significantly impact current GDP when lagged GDP is controlled for. Furthermore, the lagged GDP variables are not statistically significant, indicating that historical levels of GDP do not have a significant influence on current GDP. The R-squared value of 0.983 for Model (3) is consistent with the previous model, illustrating its ability to explain approximately 98.3% of the variations in GDP.

In conclusion, the results of the regression analysis show that the growth of the GDP is significantly influenced by gross capital formation. However, the Labor Force and FDI variables do not appear to have a significant impact on GDP. Additionally, the inclusion of lagged variables related to FDI and GDP does not provide any explanatory power for current GDP levels. These results advance our knowledge of the factors that influence economic expansion, highlighting the significance of physical capital investment for long-term economic growth.

Durbin-Watson test

The Durbin-Watson test findings indicate if there is autocorrelation or a correlation among a regression model's residuals. Autocorrelation suggests that there is a pattern or relationship among the residuals, which violates one of the assumptions of ordinary least squares (OLS) regression.

Figure 5. The Durbin-Watson test

Model	Lag	Autocorrelation	D-W Statistic	p-value	Alternative hypothesis
Model 1	1	0.1088243	1.762977	0.264	$\rho \neq 0$
Model 2	1	-0.0142887	1.992052	0.572	$\rho \neq 0$
Model 3	1	-0.0142887	1.992052	0.586	$\rho \neq 0$

The table provides data on the models, the lag considered by the Durbin-Watson test, the autocorrelation coefficient, the D-W statistic, the p-value, and the alternative hypothesis being tested ($\rho \neq 0$ indicates the existence of autocorrelation).

For the given results:

Durbin-Watson Test for Model 1:

The test reveals a Durbin-Watson (D-W) statistic of 1.763 and a p-value of 0.264. The D-W statistic measures the presence of first-order autocorrelation, with a value between 0 and 4. In this case, the D-W statistic is closer to 2, indicating a lack of first-order positive autocorrelation. The p-value of 0.264 suggests that there is insufficient evidence to conclude that there is significant autocorrelation in the residuals at the 5% significance level. Therefore, the model (Model 1) does not exhibit significant first-order autocorrelation.

Durbin-Watson Test for Model 2:

The test yields a D-W statistic of 1.992 and a p-value of 0.572. The D-W statistic, again close to 2, implies a lack of first-order autocorrelation. The p-value of 0.572 supports this finding, indicating that there is no significant evidence of first-order autocorrelation in the residuals of the model (Model 2). Therefore, the model does not suffer from significant first-order autocorrelation.

Durbin-Watson Test for Model 3:

The test returns a D-W statistic of 1.992 and a p-value of 0.586. Similar to the previous result, the D-W statistic is close to 2, indicating the absence of first-order positive autocorrelation. The p-value of 0.586 further supports this observation, suggesting no significant evidence of first-order autocorrelation in the residuals of the model (Model 3).

According to the findings of the Durbin-Watson test, the residuals of all three models do not significantly indicate any signs of first-order positive autocorrelation.

Conclusion

To conclude, the presented research was conducted to identify whether Foreign Direct Investments have an influence on the GDP of Kazakhstan. In order to define the relationship between these two variables we used the yearly data taken from the national official website stat.gov.kz from 1992 until 2021. We used GDP as a dependent variable and Gross capital formation, FDI and Labor Force as independent variables in our first model, GDP as a dependent variable and Gross capital formation, Labor Force, FDI, FDI with a lag of one year and FDI with a lag of two years as independent variables in the second model, GDP as a dependent variable and Gross capital formation, Labor Force, FDI, FDI with a lag of one year and FDI with a lag of two years, GDP with a lag of one year and GDP with a lag of two years as independent variables in the third model. All estimated OLS regressions were tested for first-order autocorrelation with the Durbin-Watson test. According to the results, F-statistic is significant, Gross capital formation has a significant effect and Labor Force and FDI have a non-significant effect on GDP in three models, however, in Model 2 FDI lagged two years back is positive and statistically significant at a 5% significance level. Thus, the FDI has an effect on the GDP but two years later. According to the results of the Durbin-Watson test, there is no significant evidence of positive autocorrelation which indicates that the assumption of no autocorrelation in the OLS regression is not violated, strengthening the reliability of the regression results. Finally, our hypothesis which states that FDI has a positive impact on the GDP of Kazakhstan is not directly confirmed. It could be that the effect of FDI on GDP is more complicated. Also referring to the Lee, Baimukhamedova, and Akhmetova (2010), they investigated that Foreign Direct Investment has a minimal impact on economic growth of Kazakhstan. In addition, the data that was used may

not be extremely accurate, due to the fact that in 1991 statistics were not fully correctly formed and we have a limited period of time as 30 years from 1991 to 2021.

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