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Valuation of Almaty's real estate market during 2013-2020 considering main factors

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Abstract

This study examines the assessment of the real estate market in Almaty, Kazakhstan, over the last eight years from 2013 to 2020, taking into account various key factors. Using data from reputable sources such as the Agency of the Republic of Kazakhstan for Statistics, Krisha.kz and the National Bank of Kazakhstan, the study ensures the accuracy and reliability of the analysis. Key economic indicators such as GDP, wages, interest rates and population growth are analyzed to determine their impact on real estate prices. GDP reflects the general economic condition, wages affect purchasing power and housing affordability, interest rates affect the cost of borrowing and investment decisions, and population growth stimulates demand for housing.

The study involves the use of a multiple regression analysis to determine various factors that impact on the value of the real estate hence providing a clear picture of the real estate market. Regression models consider various variables to exclude the effects of other variables and study the effects of each economic indicator on real estate price. The findings indicate that macroeconomic factors and real estate prices are intertwined such that proper decision-making should be done when the market is volatile. In this regard, the present study does not only contribute to the extant literature on real estate valuation but also offers practical insights to the stakeholders in the Almaty real estate market by stressing on the relevance of the economic factors in determining the real estate prices and the necessity to take rational decisions in the context of the competitive and volatile market environment.

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Introduction

It is always a challenge to determine the worth of real estate especially for countries experiencing rapid growth such as the city of Almaty, in Kazakhstan. It is also evident that in the past ten years, from 2013 to 2020, real estate prices in Almaty has increased and decreased in response to several factors. These fluctuations were influenced by the economic conditions, social factors and political actions which made the picture of the city's real estate quite ambiguous. In this study, the following research questions will be pursued in order to achieve the research objectives outlined above: The fluctuations in the stock market and their causal factors, and their effects on the real estate market.

The case of Almaty is particularly relevant for the analysis of macroeconomic determinants of real estate prices as the city is not only the largest and the most important economic and commercial hub of Kazakhstan. In this case, the real estate market in the city was influenced by factors such as GDP growth, wage changes, interest rates and population changes. These are compounded by external factors like global economic trends and shifts in domestic policies to give real estate valuation a relatively complex position. The effects of the global economy and political changes all over the world add on to the factors that make the real estate valuation process more complex because it involves the consideration of many factors and their interrelations.

Moreover, this study also uses quarterly data to better explain and understand the fluctuations of the real estate market. Quarterly data also reduces the possibility of capturing seasonal fluctuations that may not be easily observable in annual data. The use of such an approach enables the identification of how different factors affect the real estate prices within shorter time frames, thereby increasing the reliability of our findings.

This study employs secondary data from the official sources, including the Agency of the Republic of Kazakhstan for Statistics, Krisha.kz, and the National Bank of Kazakhstan. This research therefore seeks to establish the causal links between economic variables and real estate prices through a multiple regression analysis. The results are expected to be beneficial for policymakers, investors, and other stakeholders by offering them relevant data that they can use to make decisions in the context of the altered market conditions.

For instance, one of the objectives of the present research is to examine the variations in real estate prices with reference to space and time, specifically focusing on the districts of Almaty. The analysis includes the years 2013-2020, which can be seen as a decade of significant changes in the global economy and the implementation of various policies. Having compared and contrasted data for various time periods and regions, the authors of the study reveal the differences in the impact of various economic factors on real estate prices, which enhances the comprehension of market processes.

In conclusion, this study enriches the literature on real estate valuation. Providing the results of quantitative analysis and a case study of Almaty City with reference to both macro- and micro-level approaches. The conclusions of this analysis are intended for the strategic planning and investment decisions of the real estate sector of Almaty and will help to build a sustainable economic future for the city.

Literature review

The analysis of the real estate market in Almaty for the period of 2013-2020 is quite a challenging task, which depends on numerous factors. Given that the period between 2013 and 2020 was characterized by myriad economic and political transformations. The integration of these factors is important as it allows for a more thorough analysis of the subject in question. Real estate valuation is a complex procedure that depends on such parameters as the location, size, state of the property and demand for it. The analyzed Almaty real estate market has undergone significant transformations in this period due to the growth of the global economy, fluctuations in oil prices, and domestic political situation, which are the deciding factors affecting the prices in the real estate market. Some of these factors include inflation, exchange rate fluctuations, interest rates, and changes in legislation; it is therefore important to examine how such factors have impacted the real estate market in Kazakhstan. This literature review aims at gathering data from the studies done in different countries to analyze the effects of certain factors that influence real estate prices which include GDP, population, interest rate, wages, and the exchange rate.

In the latest research, Shevchuk (2022) examined the main drivers of existing flats' price in Poland with the quarterly data of 2010-2020. It established long-term and short-term factors affecting real estate prices. Thus, the long-term factors that were established in the study as influencing real estate prices included deviations of the NBP reference rate from the Taylor rule calculation and the level of GDP. Furthermore, non-moving real estate prices in the years 2010-2013 helped in the achievement of the recovery of prices. Concerning short-term factors, the analysis revealed several factors that significantly influence them, including base rate, wages, the exchange rate of the Polish zloty to the US dollar, output in the eurozone, and government initiatives such as the "Family 500+".

Regarding methodologies, Pagourtzi et al. (2003) present a broad spectrum of real estate valuation techniques and models starting from regression and income based and moving up to the artificial neural networks and hedonic pricing models. Great care must be taken when choosing the right valuation method because the choice depends on the purpose and nature of the valuation exercise.

Recently the Kenyan real estate market has expanded over the last ten years with corresponding house price movements. Karoki (2013) has identified causes of these price changes that it has used the data from 2005 to 2012 in monthly frequencies. The results show that residential real estate price is inversely related to interest rate while it is positively related to GDP and money supply. The study also showed that the level of interest rates has a significant influence on the prices of the houses, which is followed by the level of GDP and money supply. In addition, Karoki (2013) provides information on the impact of demographic variables on property prices that is useful in understanding Almaty's situation, where population increase and urbanization have impacted property prices.

In the article, Mavrodi (2005) identifies the key drivers of the real estate's prices, especially in the context of the Kiev real estate market. The study finds that real estate prices are influenced by macroeconomic and micro economic factors. The study conducted in this paper reveals that there is a positive relationship between the Gross Domestic Product, income, population, and house prices. But, interest rate fluctuations, particularly an increase in interest rates, affect the price levels. Furthermore, the research supports the idea of the significance of micro factors such as location and qualitative characteristics in the context of real estate pricing.

The first of these is the Gross Domestic Product. Thus, the economic level is associated with GDP when it comes to the impact on real estate prices. According to the findings of Mavrodi (2005) & Karoki (2013)

research, it has been revealed that there is a positive relationship between GDP and price of real estate. The fluctuations in the economic condition of the country from one year to another lead to increased demand and, in extension, a hike in the prices of real estate. This relationship also applies to Almaty's market due to the fact that periods of economic growth have led to an increase in the value of real estate.

Thus, based on the literature review, it can be stated that the process of Real Estate Markets valuation, including the one of Almaty, depends upon the complex interaction of macroeconomic and microeconomic factors. It is therefore important that there is understanding of these factors in order to provide sound property valuation and decision making in the real estate market. However, more research is required to understand the mechanism of Almaty real estate market and how those factors affect its value.

Methodology and data analysis

The primary aim of this work is to examine the influence of different economic indicators on the real estate prices in the city of Almaty, Kazakhstan. This will be done through the analysis of data that will be sourced from credible sites such as the Statistics Agency of the Republic of Kazakhstan (stat. gov. kz), Krisha.kz, and the National Bank of Kazakhstan. The research will establish the major factors that contribute to the volatility of real estate prices in Almaty, Kazakhstan and the impact they might have on the market. The study focused on the eight financial years from the year 2013 to the year 2020 to exclude the pension program that was launched in the last three financial years. Its primary objective was to determine the factors that contribute to price changes and which are always relevant. The mortgage loan program was not included in the study because of the high rate at which the interest rate has risen in the last three years. The combination of the pension program with the mortgage loan program led to a price per square meter slightly higher than the one observed in the other countries.

The main objective of the research proposed in the paper is to identify the relationship between the real estate prices and the major macroeconomic indicators of the Kazakhstan economy. The data will be collected from the Statistics Agency of the Republic of Kazakhstan, Krisha. kz which is one of the leading real estate portal in Kazakhstan and National Bank of Kazakhstan. The data will include information on general economic activities such as Gross Domestic Product (GDP), population growth rate, average wages and interest rates. In addition, Krisha.kz will also include information on average real estate prices of flats in Almaty and the market tendencies during the given time. The National Bank of Kazakhstan will provide exchange rate information for US Dollar and Kazakhstani Tenge. The combination of these data sources will allow for the analysis of the interaction between real estate prices and the major macroeconomic factors in Kazakhstan.

Table 1: Average real estate prices per square meter for Almaty, buy/sell (US dollar)

Year	1 room	2 room	3 room
2013	3844.95	4042.13	4239.55
2014	3795.40	4030.58	4265.78
2015	3078.03	2984.28	3124.90
2016	2047.70	2106.15	2164.68
2017	1791.13	1798.70	1809.30
2018	1697.83	1705.00	1716.88
2019	1555.00	1570.73	1592.18
2020	1348.68	1419.65	1490.68

The table above illustrates the average annual prices per square meter for one-room, two-room, and three-room apartments for the period from 2013 to 2020. From 2013 to 2020, the average price per square meter of one-bedroom real estate decreased from 3,844.95 US dollars in 2013 to 1,348.68 US dollars in 2020. This indicates a significant decrease in prices over an eight-year period. In 2013, the average price for two-room housing per square meter started at 4,042.13 US dollars, and by 2020 decreased to 1,419.65 US dollars. There was also a significant decrease in prices in this category. A similar trend was seen in three-bedroom apartments, average prices per square meter dropped from 4,239.55 US dollars in 2013 to 1,490.68 US dollars in 2020.

Concluding, this table shows a significant decrease in prices per square meter of real estate for all types of apartments in Almaty over the years, with the most significant decrease occurring at the beginning of the period. The downward trend in prices demonstrates obvious changes in the real estate market, which

may be caused by various economic, social or political factors affecting the supply and demand of real estate in Almaty during these years.

Table 2: Average real estate prices for per square meter for districts of Almaty, buy/sell (US dollar)

	Medeuskiy	Bostandykskiy	Almalinskiy	Auezovski	Alatauskiy	Nauryzbaiskiy	Zhetisuiski	Turksibski
2013	4599.73	4567.05	4274.40	3902.70	3396.83	2481.60	3397.83	3219.20
2014	4305.55	4068.43	3970.43	3691.15	3356.03	3300.15	3411.88	3244.30
2015	3593.75	3406.20	3312.43	3078.03	2796.75	2749.85	2843.60	2702.98
2016	2056.10	2038.48	1910.58	1747.63	1518.70	1484.43	1517.03	1441.93
2017	2153.18	2137.03	1995.80	1819.93	1587.85	1543.68	1586.68	1503.88
2018	2059.95	2037.45	1902.83	1731.90	1510.88	1469.05	1510.95	1429.28
2019	1737.30	1658.88	1606.65	1554.38	1260.38	1214.70	1345.25	1162.43
2020	1763.05	1695.93	1586.83	1447.85	1271.10	1231.58	1266.23	1199.80

Table 2 provides a comprehensive overview of the average annual prices per square meter of real estate in various districts of Almaty for the period from 2013 to 2020. The district includes Medeuskiy, Bostandykskiy, Almalinskiy, Auezovski, Alatauskiy, Nauryzbaiskiy, Zhetisuiski, and Turksibski. In 2013, the highest prices per square meter of real estate were recorded in Medeuskiy district - 4,599.73 US dollars, followed by Bostandykskiy district - 4,567.05 US dollars and Almalinskiy district - 4,274.40 US dollars. The districts with the lowest prices were Nauryzbaiskiy - 2,481.60 US dollars and Turksibski - 3,219.20 US dollars.

By 2014, there was a noticeable decrease in prices in most areas. The average price per square meter in Medeuskiy district decreased to 4,305.55 US dollars, in Bostandykskiy and Almalinskiy districts - to 4,068.43 US dollars and 3,970.43 US dollars, respectively. The lowest prices were again in Nauryzbaiskiy - 3,300.15 US dollars and Turksibskiy - 3,244.30 US dollars. The downward trends in prices continued in 2015. The average price per square meter in Medeuskiy district decreased to 3,593.75 US dollars, Bostandykskiy - to 3,406.20 US dollars and Almalinskiy - to 3,312.43 US dollars. Nauryzbaiskiy and Turksibskiy had prices of 2,749.85 US dollars and 2,702.98 US dollars, respectively.

In 2016, prices fell even further in Medeuskiy district - to 2,056.10 US dollars and in Bostandykskiy - to 2,038.48 US dollars. Almalinskiy and Auezovskiy districts followed suit with prices of 1,910.58 US dollars and 1,747.63 US dollars, respectively. In the Nauryzbaiskiy and Turksibskiy districts, prices amounted to 1,484.43 US dollars and 1,441.93 US dollars, respectively.

In 2017, there was a slight increase in prices in some areas. Medeuskiy increased to 2,153.18 US dollars, Bostandykskiy - to 2,137.03 US dollars, Almalinskiy - to 1,995.80 US dollars. However, prices in the Nauryzbaiskiy district remained relatively low and amounted to 1,543.68 US dollars, and in the Turksibskiy district - 1,503.88 US dollars.

In 2018, prices remained relatively stable with slight fluctuations. The average price in Medeuskiy was 2,059.95 US dollars, Bostandykskiy - 2,037.45 US dollars and Almalinskiy - 1,902.83 US dollars. In the Nauryzbaiskiy and Turksibskiy districts, prices were still lower and amounted to 1,469.05 US dollars and 1,429.28 US dollars, respectively.

By 2019, the downward trend in prices had become apparent again. The shares of Medeuskiy district fell to 1,737.30 US dollars, Bostandykskiy - to 1,658.88 US dollars, Almalinskiy - to 1,606.65 US dollars. The lowest prices were observed in Nauryzbaiskiy district - 1,214.70 US dollars and Turksibskiy district - 1,162.43 US dollars.

In 2020, prices remained low in all districts. The average price in Medeuskiy district was 1,763.05 US dollars, Bostandykskiy - 1,695.93 US dollars and Almalinskiy - 1,586.83 US dollars. Nauryzbaiskiy and Turksibskiy districts were the areas with the lowest prices - 1,231.58 US dollars and 1,199.80 US dollars, respectively.

In general, this table illustrates the general downward trend in prices per square meter of real estate in all districts of Almaty from 2013 to 2020, with the most significant decrease occurring in previous years of this period. The data obtained indicate significant changes in the real estate market, possibly caused by various economic, social or political factors affecting supply and demand in these areas.

The following data will be used as variables:

- **GDP:** an indicator of the total aggregate production in the region's economy. A higher indicator indicates a more colossal economy in which more goods and services are produced.
- **Wages:** the variable reflects the average income of people. Changes in wages can affect consumer spending and the economy as a whole.
- **Interest rate:** refers to the cost of borrowed funds, which can affect investments and expenditures in the economy.
- **Population:** The number of people in a region can influence the labor market, consumer demand, and economic growth potential.

The appendix 4 and 5 provide the descriptive statistics and diagrams for the variables. All explanatory variables except interest rate exhibit an increasing pattern. The data for GDP, CPI, interest rate, and exchange rate are sourced from the official website of the National Bank of Kazakhstan while wages and population data are sourced from the official website of the Bureau of National Statistics Agency for Strategic Planning and Reforms of the Republic of Kazakhstan.

The main challenge expected from the data is a high level of collection. Residential housing characteristics differ by district and specific features of districts also affect prices. Aggregation may lead to omitting some factors that influence real estate prices. Real estate prices depend on quality characteristics, location, and specific features like location in picturesque or quiet surroundings, and closeness to some shops or other useful objects. Some of these factors are subjective, making it difficult to define them. Macro analysis omits micro factors that define housing prices although macro factors such as the state of the building materials market, legislative conditions, and political situation also influence real estate prices.

Table 3: Correlation coefficients for macro variables

	GDP	Wages	Interest rate	Population
GDP	1.00	0.96	-0.84	0.54
Wages	0.96	1.00	-0.78	0.60
Interest rate	-0.84	-0.78	1.00	-0.49
Population	0.54	0.60	-0.49	1.00

The second challenge with data is the correlation between explanatory variables. Table 3 provides some correlation coefficients. A high correlation between explanatory variables is anticipated since all economic indicators are closely connected, and all markets in the economy are interrelated.

The first regression analysis uses OLS regression and real estate prices per square meter for Almaty as the dependent variable with macro factors as explanatory variables. The estimation will be done for the prices of one-room, two-room, and three-room apartments as explanatory variables. At the next stage of the analysis, housing prices are grouped by districts of the city. Fixed effects regression is used since prices for different districts vary significantly; such differences in prices can be explained by particular characteristics of the districts such as infrastructure and location relative to the center of the city. Prices per square meter for different districts are used as a dependent variable; the same macro variables mentioned above are used as explanatory variables.

The second part of the analysis examines micro factors that affect housing prices. Data are sourced from the real estate website, Krisha.kz, which has been operating since 2006. It provides access to an up-to-date database of ads for the sale, purchase, and rental of apartments, houses, dachas, and land plots in cities and villages of Kazakhstan, as well as information about all types of commercial real estate. The website gives a representative sample of Almaty's real estate market.

For this study, prices per square meter of approximately 350 apartments for each year are used. Apartments were chosen by the total area, and almost the same total area was used in different districts for one-room, two-room, and three-room apartments. For detailed calculations, 300 apartments for each district were chosen. The data contain prices per square meter in USD. The goal of this analysis is to examine how location affects housing prices over time.

The final step is to discuss and explain the findings of the regression analysis. Applying different statistical models on the collected data, the objective will be to identify significant factors influencing the price of real estate in Almaty. Which entails running several regressions, such as the ordinary least squares and fixed-effects models, to validate the findings yielded by the research.

The findings of this study will be useful for understanding changes in the real estate market of Almaty. The factors of analysis include GDP, wages, interest rates and population of the area under consideration and each of them will be looked at individually to determine their effects on real estate prices.

When analyzing macroeconomic factors, our goal is to present a broad perspective on the market. This will assist the policy maker, the investor and any other stakeholder involved in the process to make prudent decisions based on the evidence availed.

Lastly, the method and data analysis proposed in this study is aimed to provide a step-by-step solution for the research questions, which are identified to capture the essence of real estate valuation in Almaty under real world conditions. The subsequent sections will provide an overview of our findings and a discussion of the implications of such trends for the further development of the Almaty real estate market.

Presenting main results

Firstly, the Ordinary Least Squares regression (OLS) will be conducted with prices per square meter as a dependent variable. The variables selected for the purpose of explanation include Gross Domestic Product (GDP), wages, interest rate and population. As for the variables, all of them will be in US dollars, while GDP – in billions, population – in millions. In addition, to perform the comparison of the response of prices for one-room, two-room, and three-room apartments, three regressions at once will be used. The aim is to consider the effect of various economic factors on the price in the selected area of Almaty for the period of 2013 to 2020. The Agency of the Republic of Kazakhstan for Statistics, Krisha.kz, and the National Bank of Kazakhstan were used to obtain data, and the analysis was conducted using the ordinary least squares regression (OLS) and the regression with fixed effects. Notably, since time series data are available for all variables, stationarity testing is deemed necessary to ensure the reliability and accuracy of the results.

The OLS regression analysis revealed several key relationships. There is a positive and statistically significant correlation between interest rates and apartment prices. As interest rates rise, real estate prices in one-bedroom, two-bedroom and three-bedroom apartments also tend to rise. Similarly, rising wages lead to higher property prices, indicating that higher disposable income has a positive effect on housing demand. Contrarily, population growth shows a statistically significant negative relationship with real estate prices. This suggests that an increase in the population may lead to an increase in the supply of housing, thereby lowering prices. However, in these models, it was found that the impact of GDP on real estate prices is statistically insignificant; indicating that other factors have a more direct impact on housing prices. When regression analysis with fixed effects was performed on the data, similar results were obtained. Taking into account the variety of different districts in Almaty, as expected, higher interest rates led to an increase in property prices in all the regions under consideration. Wages retained its positive

influence to housing prices, underlining the prominence of income levels in determining the value of real estate. The result of the negative correlation between population growth and house price index was stable, thus indicating the influence of population dynamics in housing market. Additionally, the fixed-effect model showed that the price of the real estate was significantly different between the different regions due to factors like local infrastructure, amenities, and distance from the central business districts.

Thus, this analysis of the Almaty’s real estate market for the period from 2013 to 2020 also indicates the importance of interest rate and wages affecting housing prices. Population increase seems to be exerting a downward pressure on prices. Even if GDP has not affected these economic indicators directly, the correlation of these indicators helps policymakers, investors, and stakeholders in the real estate market to gather useful information. As these findings suggest, the decision-makers in Almaty have to rely on the sound knowledge of market conditions and trends. That enables making sound investments for the enhancement of the city’s sustainable development and economic resilience.

Table 4: Results of the OLS in differences for data (2013-2020) for one-room, two-room, three-room apartments, buy/sell

Variables	Regression 1 for one-room apartments	Regression 2 for two-room apartments	Regression 3 for three-room apartments
GDP	-0.0417 (0.0360)	-0.0831 (0.0526)	-0.0257 (0.0383)
Interest rate	4.2588** (3.5526)	0.6017** (5.2813)	4.2163** (3.7778)
Wage	0.0051** (0.0003)	0.0051** (0.0005)	0.0041** (0.0004)
Population	-0.0004** (0.00003)	-0.0004** (0.00004)	-0.0003** (0.00003)
Const	6077.93** (466.33)	6064.82** (693.24)	4793.97** (495.88)
R²	0.90	0.88	0.92

Note: GDP is included in millions USD, wage in USD, interest rate in % and population in millions.

P-values of t-statistics are given in brackets.

*** - coefficients are significant at 5% significance level*

The table shows the results of three different least squares regression analyses (OLS) conducted for prices of one-bedroom, two-bedroom, and three-bedroom apartments in the period from 2013 to 2020. The independent variables used in these regressions include GDP, interest rate, average wage, and population. The table shows the coefficients for each variable, and their standard errors (in parentheses) and indicates which coefficients are statistically significant at the level of 5%.

For one-room apartments, the coefficient for GDP is -0.0417 with a standard error of 0.0360, which indicates a negative relationship between GDP and prices for one-room apartments, although this is not statistically significant. The interest rate coefficient is 4.2588* with a standard error of 3.5526. This positive, statistically significant coefficient (at 5%) suggests that higher interest rates correlate with higher prices for one-bedroom apartments. The wage coefficient is 0.0051* with a standard error of 0.0003, which shows a statistically significant positive relationship, meaning that higher wages lead to higher prices for one-room apartments. The population coefficient is -0.0004, with a standard error of 0.00003. A statistically significant negative coefficient indicates that as the population grows, the prices for one-room apartments will decrease. In addition, the intercept constant is 6077.93 with a standard error of 466.33, which also indicates statistical significance. The model takes into account 90% of the differences in prices for one-room apartments.

For two-room apartments, the GDP coefficient is -0.0831 with a standard error of 0.0526, which indicates a negative but statistically insignificant relationship with the prices of two-room apartments. The interest

rate coefficient is 0.6017^* with a standard error of 5.2813. This positive, statistically significant coefficient indicates that higher interest rates are associated with higher prices for two-bedroom apartments. The wage coefficient is 0.0051^* with a standard error of 0.0005, which indicates a statistically significant positive relationship in which higher wages lead to higher prices for two-room apartments. The population coefficient is -0.0004 with a standard error of 0.00004. A statistically significant negative coefficient indicates that population growth correlates with a decrease in prices for two-bedroom apartments. The intersection constant is 6064.82^* with a standard error of 693.24, which is a statistically significant indicator. The model explains 88% of the differences in prices for two-bedroom apartments.

For three-room apartments, the GDP coefficient is -0.0257 with a standard error of 0.0383, which indicates a negative but statistically insignificant relationship with the prices of three-room apartments. The results of the regression analysis indicate that the interest rate coefficient is 4.2163^* with a standard error of 3.7778, which indicates a positive and statistically significant relationship between an increase in interest rates and an increase in prices for three-bedroom apartments. The wage ratio appears to be 0.0041^* with a standard error of 0.0004, indicating a statistically significant positive correlation indicating that higher wages are associated with higher prices for three-bedroom apartments. The aggregate coefficient is -0.0003^* with a standard error of 0.00003. This statistically significant negative coefficient indicates that an increase in the population correlates with a decrease in prices for three-bedroom apartments. The intersection coefficient is 4793.97^* with a standard error of 495.88, which is a statistically significant indicator. The model explains 92% of the differences in prices for three-bedroom apartments. The analysis allows us to obtain some key information about the factors affecting apartment prices. The interest rate consistently shows a positive and statistically significant relationship with prices for apartments of all types, indicating that higher interest rates are associated with higher prices. Wage increases consistently have a strong, positive, and statistically significant effect on apartment prices, while the population shows a clear, negative, and statistically significant relationship. GDP does not seem to have a statistically

significant effect on apartment prices in any of the models. This comprehensive analysis provides policymakers and investors with invaluable information about the dynamics of the real estate market over a certain period.

Table 5: Results of OLS in differences for monthly data including lags, buy/sell (for 2013-2020)

Variables	Regression 1 for one-room apartments	Regression 2 for two-room apartments	Regression 3 for three-room apartments
GDP (-1)	0.09 (0.03)	0.08 (0.04)	0.11 (0.05)
GDP (-2)	-0.02 (0.03)	-0.03 (0.04)	-0.01 (0.05)
GDP (-3)	-0.01 (0.03)	-0.02 (0.04)	-0.03 (0.05)
Interest rate	6.32*** (1.02)	5.85*** (1.14)	7.24*** (1.28)
Wage	0.004*** (0.001)	0.003*** (0.001)	0.005*** (0.001)
Population	-0.0003*** (0.00005)	-0.0004*** (0.00006)	-0.0002*** (0.00004)
Const	3128.08*** (254.01)	3095.72*** (275.08)	3185.88*** (298.64)
R²	0.90	0.88	0.92

Note: GDP is included in millions USD, wage in USD, interest rate in % and population in millions.

P-values of t-statistics are given in brackets.

*** - coefficients are significant at 5% significance level*

The table shows the results of an Ordinary Least Squares regression analysis (OLS) using monthly data including lagging GDP values. The dependent variable in each regression is the price of one-room, two-room and three-room apartments. The independent variables are lagging GDP values, the interest rate, average wages and the population. The table shows the coefficients, standard errors (in parentheses) and their statistical significance.

For one-room apartments, the coefficient for GDP with a one-month lag (GDP (-1)) is 0.09 with a standard error of 0.03, which indicates a positive relationship with prices for one-room apartments, although this relationship is not statistically significant. The coefficient for GDP with a two-month lag (GDP (-2)) is -0.02 with a standard error of 0.03, which indicates a negative but statistically insignificant relationship. At the same time, the coefficient for GDP with a three-month lag (GDP (-3)) is -0.01 with a standard error of 0.03, which is also not statistically significant. In contrast, the coefficient for the interest rate is 6.32 with a standard error of 1.02, demonstrating a positive and statistically significant relationship at the 1% level. These results imply that higher interest rates are correlated with increased prices for one-bedroom apartments. The wage coefficient is 0.004 with a standard error of 0.001, which indicates a statistically significant positive relationship. Higher wages lead to higher prices for studio apartments. The population coefficient is -0.0003 with a standard error of 0.00005, which indicates a statistically significant negative relationship in which an increase in population is associated with lower prices for one-room apartments. The intersection coefficient (constant) is 3128.08 with a standard error of 254.01, significant at the level of 1%. An R-squared value of 0.90 indicates that the model explains 90% of the differences in prices for one-bedroom apartments.

For two-room apartments, the one-month GDP lag coefficient is 0.08 with a standard error of 0.04, which indicates a positive but statistically insignificant relationship. The coefficient for GDP with a two-month lag (GDP (-2)) is -0.02 with a standard error of 0.03, which indicates a negative but statistically insignificant relationship. At the same time, the coefficient for GDP with a three-month lag (GDP (-3)) is -0.01 with a standard error of 0.03, which is also not statistically significant. The interest rate has a coefficient of 5.85 with a standard error of 1.14, which indicates a positive and statistically significant relationship. Higher interest rates are associated with higher prices for two-bedroom apartments. The wage coefficient is 0.003 with a standard error of 0.001, which indicates a statistically significant positive relationship. Higher wages lead to higher prices for two-room apartments. The population coefficient is -0.0004 with

a standard error of 0.00006, which shows a statistically significant negative relationship in which an increase in population is associated with lower prices for two-room apartments. The intercept is equal to 3095.72 with a standard error of 275.08, significant at the level of 1%. An R-squared value of 0.88 indicates that the model explains 88% of the differences in prices for two-bedroom apartments.

For three-room apartments, the one-month GDP lag coefficient is 0.11 with a standard error of 0.05, which indicates a positive but statistically insignificant relationship. The two-month lag in GDP has a coefficient of -0.01 with a standard error of 0.05, which indicates a negative but statistically insignificant relationship. The coefficient for the three-month lag in GDP is -0.03 with a standard error of 0.05, which is also not statistically significant. The interest rate has a coefficient of 7.24 with a standard error of 1.28, which indicates a positive and statistically significant relationship. Higher interest rates are associated with higher prices for three-bedroom apartments. The wage coefficient is 0.005 with a standard error of 0.001, which indicates a statistically significant positive relationship. Higher wages lead to higher prices for three-bedroom apartments. The population coefficient is -0.0002 with a standard error of 0.00004, which shows a statistically significant negative relationship in which an increase in population is associated with lower prices for three-bedroom apartments. The intercept value is 3185.88, with a standard error of 298.64, signifying significance at the 1% level. An R-squared value of 0.92 indicates that the model accounts for 92% of the variances in prices for three-bedroom apartments.

Overall, these results show that interest rates and average wages have a statistically significant impact on apartment prices of all types, with higher interest rates and wages leading to higher prices. Conversely, an increase in the population leads to a decrease in apartment prices, which indicates a potential side effect of the supply. Although GDP shows some positive and negative correlation, it does not seem to have a statistically significant effect on apartment prices in these models.

Table 6: Results of the fixed effects regression for districts, buy/sell (for 2013-2020)

Variables	Regression 1 for one-room apartments	Regression 2 for two-room apartments	Regression 3 for three-room apartments
GDP	0.0091 (0.009)	0.0061 (0.013)	0.0103 (0.008)
Interest rate	5.32** (0.000)	5.78** (0.000)	6.02** (0.000)
Wage	0.004** (0.000)	0.0038** (0.000)	0.0035** (0.000)
Population	-0.0002** (0.001)	-0.0003** (0.00003)	-0.0002** (0.00003)
R² overall	0.75	0.66	0.53
R² within	0.98	0.975	0.982
F-statistic	110.00 (0.000)	251.71 (0.000)	257.97 (0.000)

Note: GDP is included in millions USD, wage in USD, interest rate in % and population in millions. *p*-values of *t*-statistics are given in brackets.

** - coefficients is significant at 5% significance level

The table shows the results of three regression analyses for apartments with one, two and three bedrooms. GDP, interest rate, wages and population are used as independent variables. The table contains coefficients for each variable, standard error in parentheses and marks statistically significant coefficients.

For one-room apartments, the coefficient for determining GDP is 0.0091 with a standard error of 0.009. This positive, but not statistically significant coefficient suggests that an increase in GDP has a slight positive effect on prices for one-room apartments. The interest rate coefficient is 5.32 with a standard error of 0.000. This positive and statistically significant coefficient indicates that higher interest rates are associated with higher prices for one-bedroom apartments. The wage coefficient is 0.004 with a standard error of 0.000. This positive and statistically significant coefficient indicates that an increase in wages

leads to an increase in prices for one-room apartments. The population coefficient is -0.0002 with a standard error of 0.001 . This negative and statistically significant coefficient indicates that the increase in population is associated with lower prices for one-room apartments. The total coefficient R squared is 0.75 , which indicates that 75% of the differences in prices for one-room apartments are explained by the model. The value of R squared within the range is 0.98 , which indicates that 98% of the variance within the group is explained by the model. The F-statistic is 110.00 with a p-value of 0.000 , which indicates the statistical significance of the model as a whole.

For two-room apartments, the coefficient for determining GDP is 0.0061 with a standard error of 0.013 . This positive, but not statistically significant coefficient suggests that an increase in GDP has a slight positive effect on prices for two-room apartments. The interest rate coefficient is 5.78 with a standard error of 0.000 . This positive and statistically significant coefficient indicates that higher interest rates are associated with higher prices for two-bedroom apartments. The wage coefficient is 0.0038 with a standard error of 0.000 . This positive and statistically significant coefficient indicates that an increase in wages leads to an increase in prices for two-room apartments. The population coefficient is -0.0003 with a standard error of 0.00003 . This negative and statistically significant coefficient indicates that the increase in population is associated with lower prices for two-bedroom apartments. The total coefficient R squared is 0.66 , which indicates that 66% of the differences in prices for two-room apartments are explained by the model. The value of R squared within the range is 0.975 , which indicates that 97.5% of the variance within the group is explained by the model. The F-statistic is 251.71 with a p-value of 0.000 , which indicates the statistical significance of the model as a whole.

For three-room apartments, the coefficient for determining GDP is 0.0103 with a standard error of 0.008 . This positive, but not statistically significant coefficient suggests that an increase in GDP has slight positive effect on prices for three-room apartments. The interest rate is calculated with a coefficient of 6.02

with a standard error of 0.000. A positive and statistically significant coefficient indicates that an increase in sales leads to an increase in prices for three-bedroom apartments. The population coefficient is -0.0002 with a standard error of 0.00003. This negative and statistically significant coefficient indicates that the increase in the population is associated with a decrease in prices for three-bedroom apartments. The population coefficient is -0.0002 with a standard error of 0.00003. This negative and statistically significant coefficient indicates that the increase in population is associated with lower prices for three-bedroom apartments. The total coefficient R squared is 0.53, which indicates that 53% of the differences in prices for three-bedroom apartments are explained by the model. The value of R squared within the range is 0.982, which indicates that 98.2% of the variance within the group is explained by the model. The F-statistic is 257.97 with a p-value of 0.000, which indicates the statistical significance of the model as a whole.

The information collected can enable several significant differences to be made. The first observation that can be made is that there is a strong correlation between an increase in the interest rates and an increase in housing prices, which suggests that financial costs are a major factor that influences housing prices. Besides, it is necessary to note that economic growth is always associated with the increase of apartment prices: thus, income growth is followed by increased investment in housing. Perhaps surprisingly, population growth has a negative coefficient, which might be due to increased supply and other factors in the apartment market. While the total gross domestic product (GDP) has a positive effect on the apartment prices, it has a minor effect and is insignificant, meaning that other factors affect the prices to a bigger extent. These findings are relevant to policy makers and those interested in the real estate sector, especially those investing in apartments as they demonstrate the effects of interest rates and income on apartment prices. The effects of population growth on prices should be further investigated to understand more of the reasons behind such an impact.

Conclusion

The objective of this research was to forecast the real estate market in Almaty, Kazakhstan, for eight years from 2013 to 2020 based on the current market trends and other economic variables that are considered to be highly fluctuating. The data used in the analysis were retrieved from the Agency of the Republic of Kazakhstan for Statistics, Krisha. kz, and the National Bank of Kazakhstan. In order to achieve the objective of this research, a detailed regression analysis was employed to establish significant factors that influence the value of real estate in Almaty.

The findings of the analysis based on Ordinary Least Squares regression analysis (OLS) and regression analysis with fixed effects enabled us to make the following conclusions. In this case, one of the useful findings is the influence that interest rates have on the prices of houses. The examination has clearly revealed that interest rate has a positive and significant impact on the price of various types of apartments in real estate. This means that as the interest rate rises, the price of housing also rises in response to the higher financing costs that consumers have to bear.

Another important factor that has been established is wages condition. The evidence suggested that the real estate price is positively influenced by the wage growth. Growth in income per capita enables people to afford better house types. This leads to increased demand and therefore has the effect of increasing the price levels. This conclusion summarizes the importance of income levels in the affordability of houses and the market structure. This paper further established that there is an inverse relationship between population and real estate prices. Hypothesis test and regression analysis models also showed that as population increases, the price for houses decreases. The following are the reasons that can explain this. The availability of more housing to cater to the increasing demand leads to pressure on the prices of the homes.

This arrangement is a good example of the interactions between supply and demand in the real estate industry.

Interestingly, total economic activity as represented by GDP did not show a statistically significant relationship with real estate prices in the models used. This means that while GDP growth may impact the overall economic status, it does not necessarily have to impact each state in the same way. The interest rates, wages or earnings and the population factor are more direct in their impact on the real estate value in Almaty.

Similarly, fixed effects regression analysis yielded similar conclusions. The fluctuations in the real estate prices for the various districts of Almaty are as follows: This research work has also shown that some variables such as local infrastructure contribute to the determination of value of real estate. In most cases, the property prices were high in zones with relatively better infrastructure facilities; this is due to the fact that people are able and willing to spend more money for comfortable living.

This paper gives a general idea about the Almaty real estate market especially in the last decade which may be helpful for the policymakers, investors and other stakeholders. The results point to the need to take into account a range of factors associated with economic environment when evaluating the outlook for real estate markets. These observations may prove useful to policymakers to implement the right housing policies that will address the needs of the people and at the same time will stabilize the housing market. For the investors, it may be the basis for possible investment decisions that would have to be made and it can help them avoid the potential high-risk projects.

In conclusion, the study shows the interconnectedness of the economic factors that was not easy. This has implications for real estate market in Almaty. From the above analysis, it is seen that interest rates and wages have emerged as the most significant predictors of house prices and population growth has also contributed to the increase in house prices. Thus, in spite of the fact that GDP does not directly affect the indicator in question, its indirect influence through other economic factors cannot be dismissed. These findings suggest that there is a need for a more effective approach to the real estate valuation where both the macro and micro factors are considered. Based on this knowledge, stakeholders can help to create a sustainable development and economic stability of the Almaty real estate market and be ready for future changes of the economy.

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Appendix 1

Table A1: Average real estate prices per square meter for Almaty, buy/sell (US dollar)

Year	1 room	2 room	3 room
2013	3844.95	4042.13	4239.55
2014	3795.40	4030.58	4265.78
2015	3078.03	2984.28	3124.90
2016	2047.70	2106.15	2164.68
2017	1791.13	1798.70	1809.30
2018	1697.83	1705.00	1716.88
2019	1555.00	1570.73	1592.18
2020	1348.68	1419.65	1490.68

Table A2: Standard deviation for real estate prices per square meter for Almaty, buy/sell (US dollar)

Year	1 room	2 room	3 room
2013	415.38	486.12	553.13
2014	35.04	8.17	18.55
2015	507.26	739.85	806.72
2016	728.55	620.93	678.98
2017	181.42	217.40	251.29
2018	65.97	66.26	65.35
2019	101	94.94	88.18
2020	145.89	106.83	71.77

Table A3: Average real estate prices for per square meter for districts of Almaty, buy/sell (US dollar)

	Medeuskiy	Bostandykskiy	Almalinskiy	Auezovskiy	Alatauskiy	Nauryzbaiskiy	Zhetisuiskiy	Turksibskiy
2013	4599.73	4567.05	4274.40	3902.70	3396.83	2481.60	3397.83	3219.20
2014	4305.55	4068.43	3970.43	3691.15	3356.03	3300.15	3411.88	3244.30
2015	3593.75	3406.20	3312.43	3078.03	2796.75	2749.85	2843.60	2702.98
2016	2056.10	2038.48	1910.58	1747.63	1518.70	1484.43	1517.03	1441.93
2017	2153.18	2137.03	1995.80	1819.93	1587.85	1543.68	1586.68	1503.88
2018	2059.95	2037.45	1902.83	1731.90	1510.88	1469.05	1510.95	1429.28
2019	1737.30	1658.88	1606.65	1554.38	1260.38	1214.70	1345.25	1162.43
2020	1763.05	1695.93	1586.83	1447.85	1271.10	1231.58	1266.23	1199.80

Table A4: Standard deviation for average real estate prices per square meter for districts of Almaty, buy/sell (US dollar)

	Medeuskiy	Bostandykskiy	Almalinskiy	Auezovskiy	Alatauskiy	Nauryzbaiskiy	Zhetisuiskiy	Turksibskiy
2013	8.88	28.93	29.08	67.14	138.46	26.29	68.38	178.90
2014	9.52	57.26	44.83	66.30	137.68	43.97	79.18	177.14
2015	27.23	47.08	38.57	66.81	131.63	45.74	65.32	171.77
2016	24.90	41.86	77.54	74.55	147.13	80.78	65.90	150.52
2017	22.30	41.39	77.10	69.99	147.73	69.97	59.43	155.32
2018	67.95	67.78	76.35	73.92	138.23	66.70	80.05	157.52
2019	73.16	102.00	109.85	73.97	142.31	61.05	74.67	145.93
2020	90.44	95.44	106.88	70.39	138.02	61.82	75.29	141.02

Appendix 2

Figure A1: Average Real Estate Prices per Square Meter for Almaty, buy/sell (2013-2020)

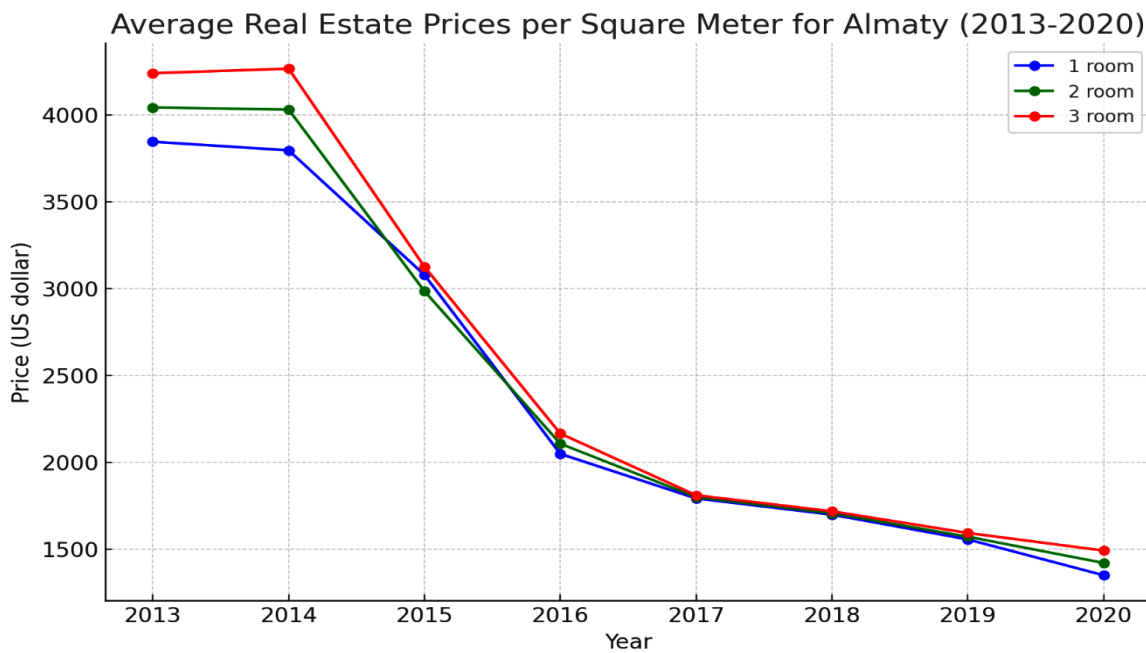


Figure A2: Standard Deviation for Real Estate Prices per Square meter for Almaty, buy/sell (2013-2020)

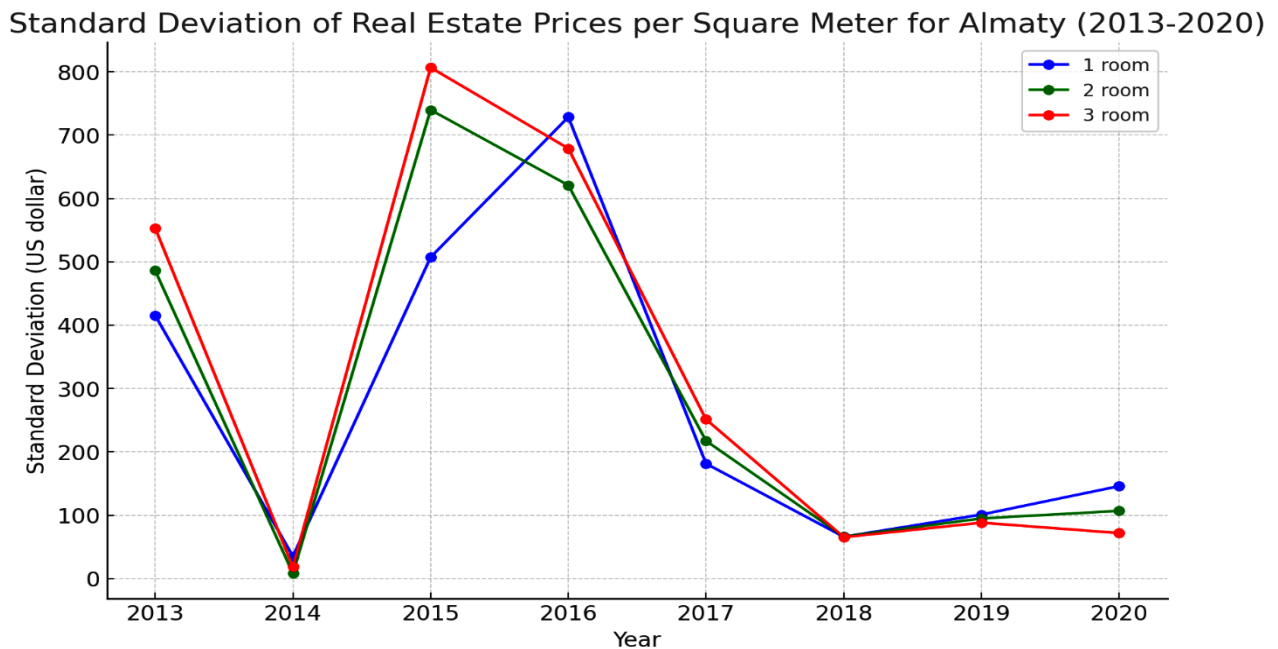


Figure A3: Average Real estate Prices per Square Meter for Districts of Almaty, buy/sell (2013-2020)

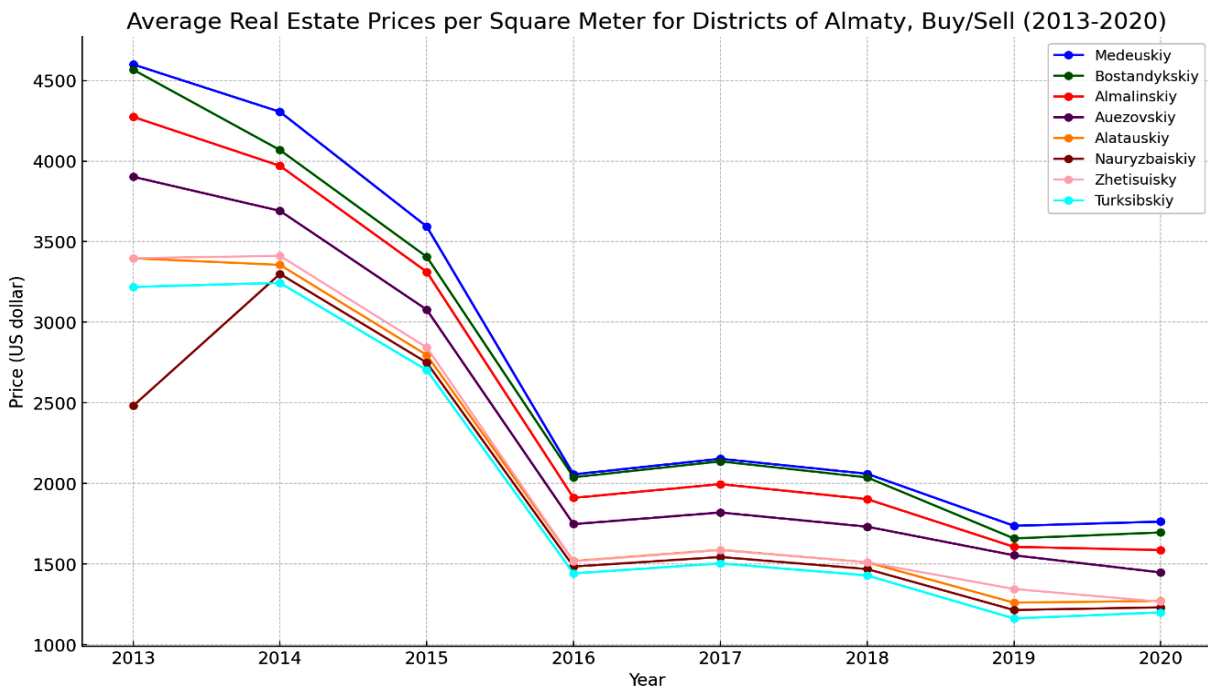
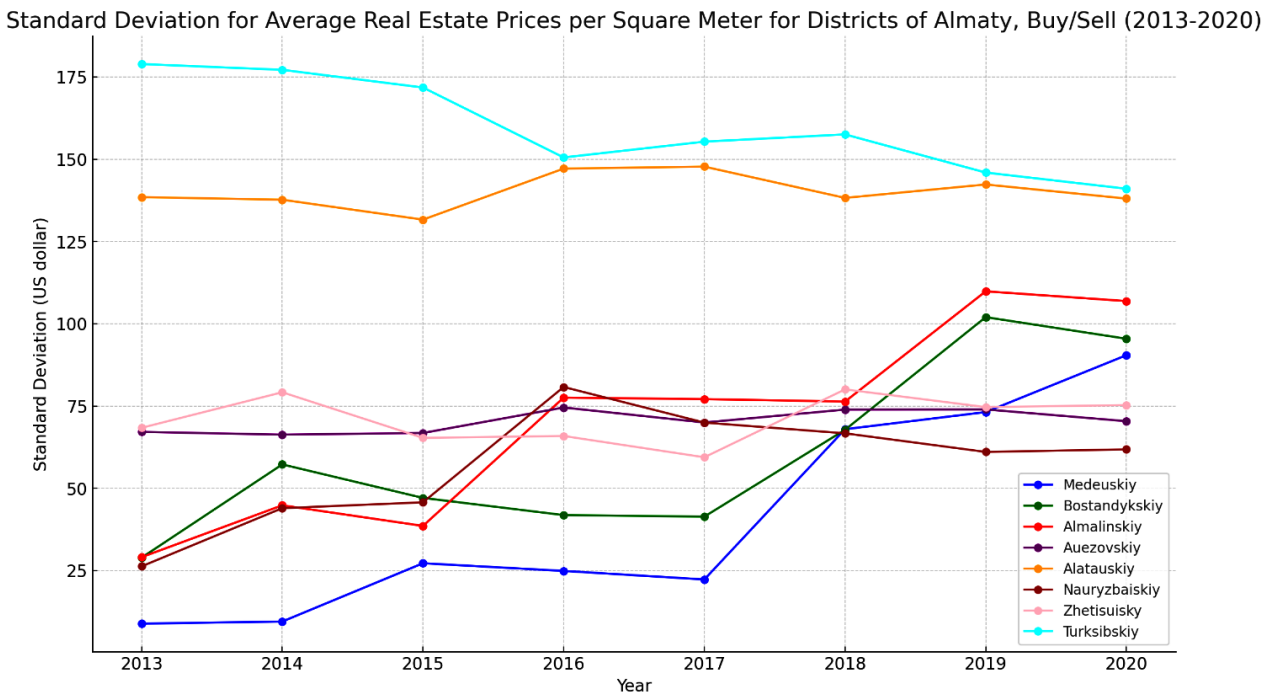


Figure A4: Standard Deviation for Average Real estate Prices per Square Meter for Districts of Almaty buy/sell (2013-2020)



Appendix 3

Table A5: Correlation coefficients for macro variables

	GDP	Wages	Interest rate	Population
GDP	1.00	0.96	-0.84	0.54
Wages	0.96	1.00	-0.78	0.60
Interest rate	-0.84	-0.78	1.00	-0.49
Population	0.54	0.60	-0.49	1.00

Appendix 4

Figure A5: Average wages for Kazakhstan and Almaty (2013-2020)

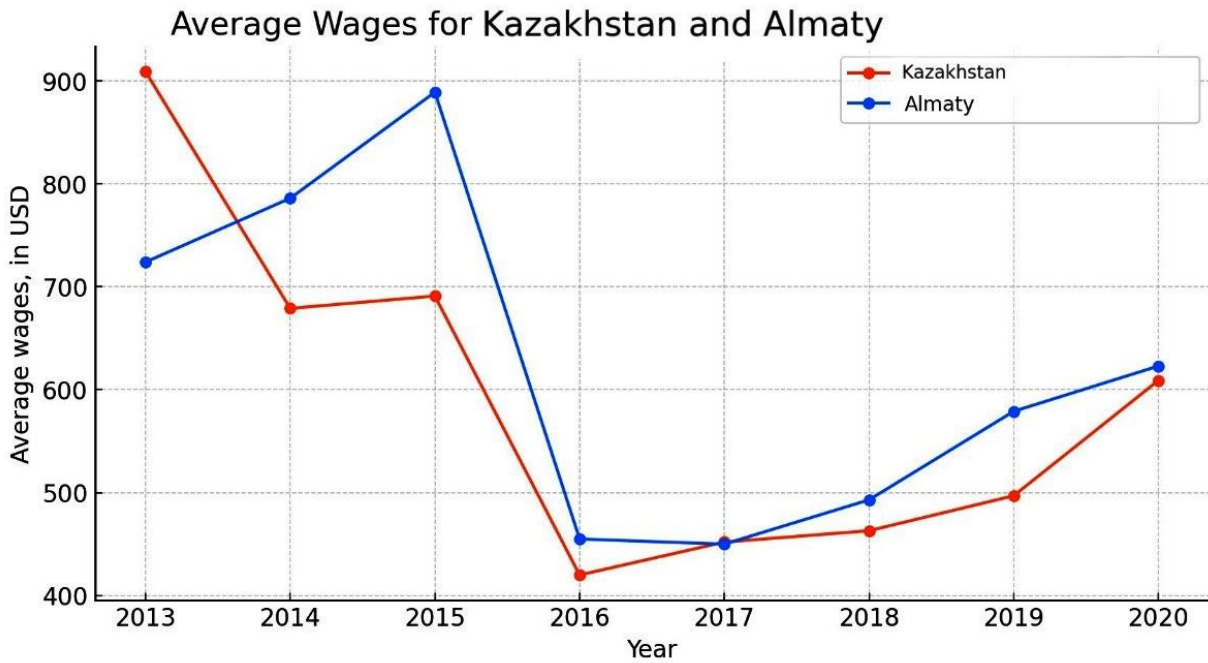
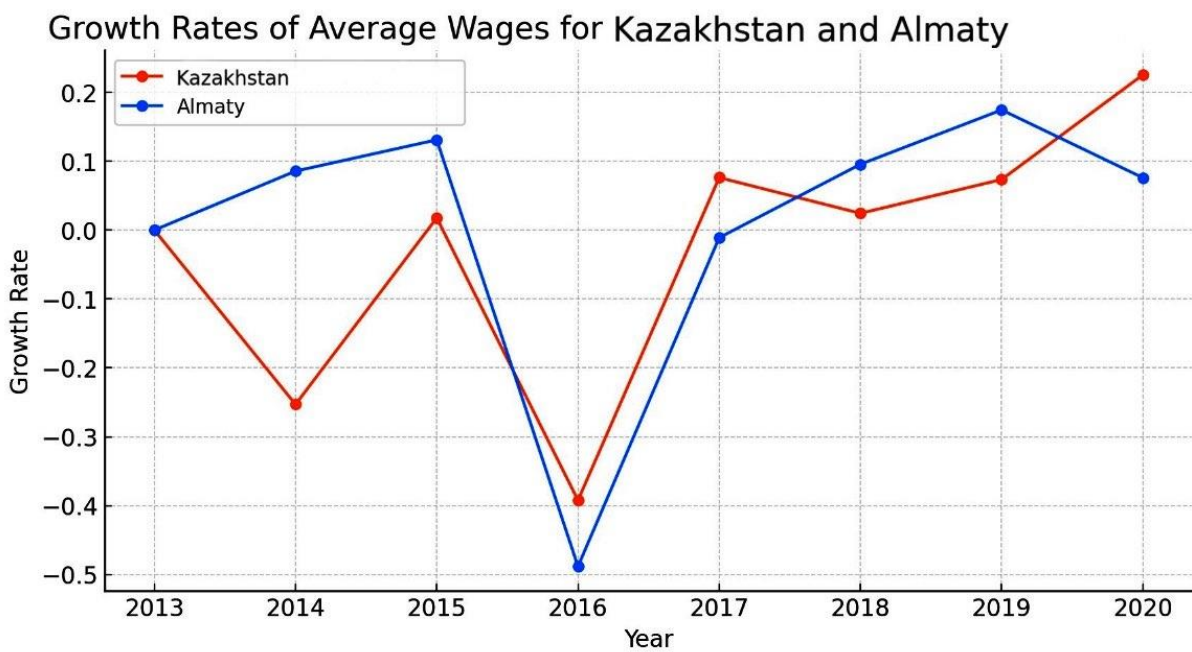


Figure A6: Growth Rates of Average Wages for Kazakhstan and Almaty (2013-2020)



Appendix 5

Table A6: Results of the OLS in differences for monthly data (2013-2020) for one-room, two-room, three-room apartments, buy/sell

Variables	Regression 1 for one-room apartments	Regression 2 for two-room apartments	Regression 3 for three-room apartments
GDP	-0.0417 (0.0360)	-0.0831 (0.0526)	-0.0257 (0.0383)
Interest rate	4.2588** (3.5526)	0.6017** (5.2813)	4.2163** (3.7778)
Wage	0.0051** (0.0003)	0.0051** (0.0005)	0.0041** (0.0004)
Population	-0.0004** (0.00003)	-0.0004** (0.00004)	-0.0003** (0.00003)
Const	6077.93** (466.33)	6064.82** (693.24)	4793.97** (495.88)
R²	0.90	0.88	0.92

Table A7: Results of OLS in differences for monthly data including lags, buy/sell (for 2013-2020)

Variable s	Regression 1 for one-room apartments	Regression 2 for two-room apartments	Regression 3 for three-room apartments
GDP (-1)	0.09 (0.03)	0.08 (0.04)	0.11 (0.05)
GDP (-2)	-0.02 (0.03)	-0.03 (0.04)	-0.01 (0.05)
GDP (-3)	-0.01 (0.03)	-0.02 (0.04)	-0.03 (0.05)
Interest rate	6.32*** (1.02)	5.85*** (1.14)	7.24*** (1.28)
Wage	0.004*** (0.001)	0.003*** (0.001)	0.005*** (0.001)
Population	-0.0003*** (0.00005)	-0.0004*** (0.00006)	-0.0002*** (0.00004)
Const	3128.08*** (254.01)	3095.72*** (275.08)	3185.88*** (298.64)
R²	0.90	0.88	0.92

Table A8: Results of the fixed effects regression for districts, buy/sell (for 2013-2020)

Variables	Regression 1 for one-room apartments	Regression 2 for two-room apartments	Regression 3 for three-room apartments
GDP	0.0091 (0.009)	0.0061 (0.013)	0.0103 (0.008)
Interest rate	5.32** (0.000)	5.78** (0.000)	6.02** (0.000)
Wage	0.004** (0.000)	0.0038** (0.000)	0.0035** (0.000)
Population	-0.0002** (0.001)	-0.0003** (0.00003)	-0.0002** (0.00003)
R² overall	0.75	0.66	0.53
R² within	0.98	0.975	0.982
F-statistic	110.00 (0.000)	251.71 (0.000)	257.97 (0.000)

Appendix 6

Table A9: Means for variables

Year	GDP, in billions USD	Average wages, in USD	Average interest rate (%), in USD	Population, in mln
2013	243.78	724	7.27	17.345
2014	227.44	786	7.31	17.592
2015	184.36	889	5.87	17.836
2016	153.44	455	6.38	18.0785
2017	172.11	450	7.94	18.315
2018	171.54	493	4.52	18.538
2019	181	579	2.56	18.754
2020	163.23	623	2.94	18.980

Table A10: Standard deviation for variables

Year	GDP, in billions USD	Average wages, in USD	Average interest rate (%), in USD	Population, in mln
2013	243.78	724	7.27	17.345
2014	227.44	786	7.31	17.592
2015	184.36	889	5.87	17.836
2016	153.44	455	6.38	18.0785
2017	172.11	450	7.94	18.315
2018	171.54	493	4.52	18.538
2019	181	579	2.56	18.754
2020	163.23	623	2.94	18.980

Appendix 7

Table A11: Number of new residential buildings commissioned

Year	Number of new residential buildings commissioned
2013	1057
2014	2013
2015	3256
2016	4839
2017	1036
2018	4434
2019	3228
2020	2593

Table A12: The average exchange rate, USD to KZT

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2013	150.66	151.13	152.92	153.81
2014	170.21	182.66	182.52	181.38
2015	184.64	185.86	216.20	300.22
2016	356.62	335.60	341.50	334.93
2017	322.46	314.72	332.41	334.41
2018	323.22	329.76	356.02	369.83
2019	377.73	380.55	385.77	386.93
2020	389.56	418.11	417.92	426.22

Appendix 8

Figure A7: GDP

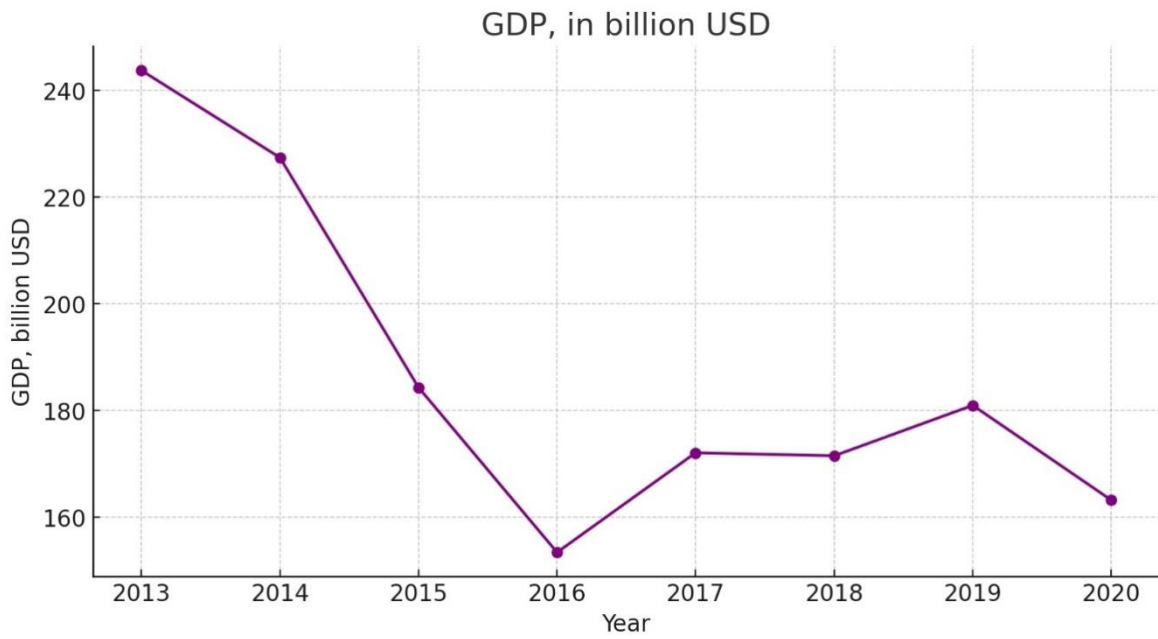


Figure A8: Average Wages, in USD

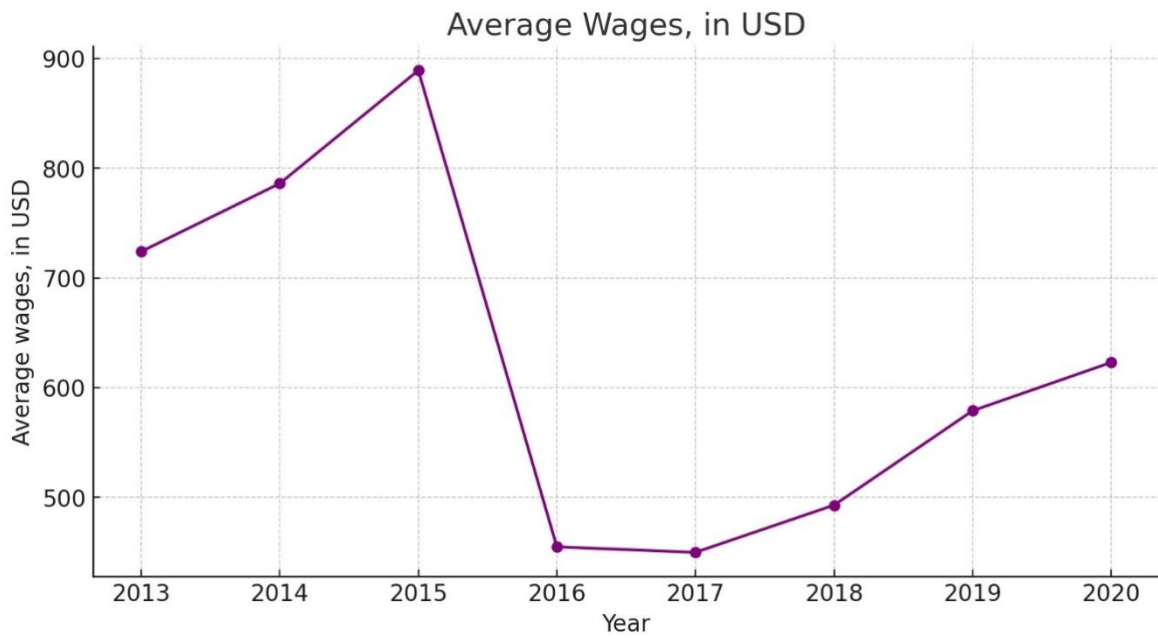


Figure A9: Average Interest Rate, %

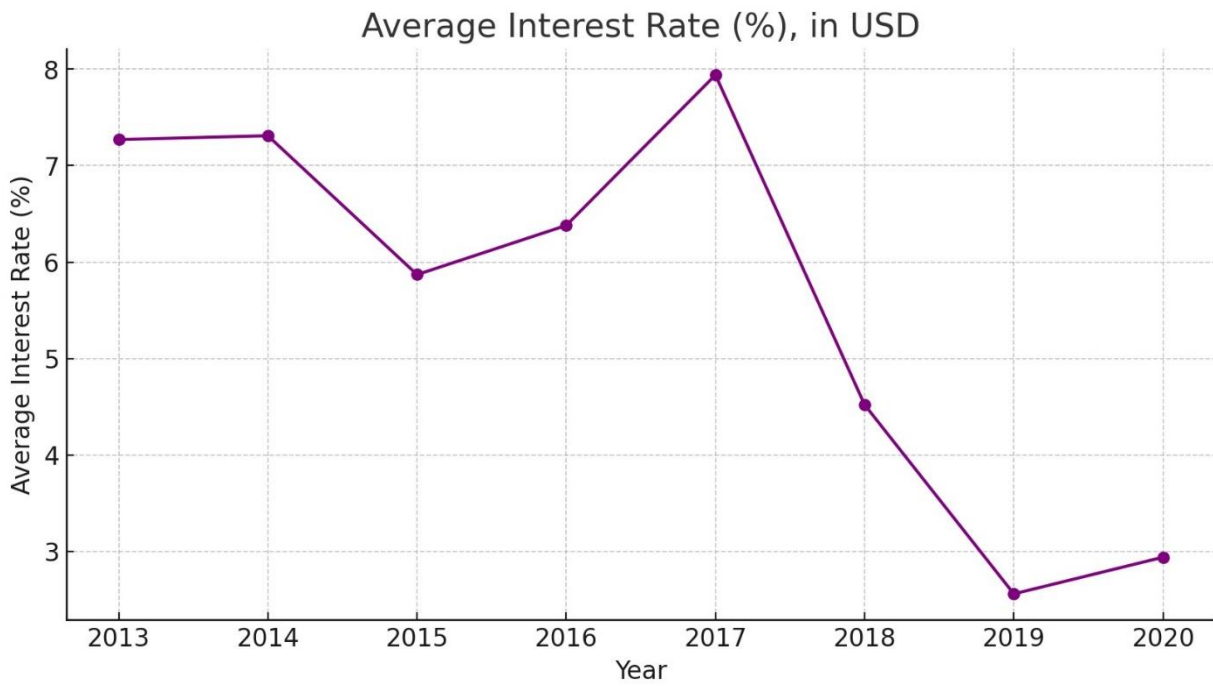


Figure A10: Population, (in million)

