Analysis and Forecast of Prices of the Housing Market

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Abstract:

Instability in the real estate market in the Republic of Kazakhstan has exacerbated the need for short-and medium-term forecasts of housing prices.

Unfortunately, the results of the forecasts do not fully satisfy experts and consumers and therefore the further development of forecasting methods is an urgent and important task for real estate market analysts. The basis of the price forecast in the real estate market is usually the analysis of the dynamics of processes in the past periods of time. The author identifies stable trends that have been manifested in the past and for which there are grounds to assume that they will continue in the future. As the main tools for such forecasts are usually used methods of time series analysis, developed in the framework of the traditional methodology of random processes. But this analysis and the methods of forecasting based on it are usually used in a situation of calm market development and non-changing forecast background.

However, in the context of unstable economic processes such methods of forecasting real estate prices will not give accurate forecasts for the long term. In this regard this article proposes a new technique based on multivariate correlation and regression analysis to predict real estate prices.

Keywords: housing market; real estate; price; oil; exchange rate; mortgage lending; forecasting.

JEL Classification: C1; C4; C5.

Introduction

The strengthening of negative trends in the global economy and the increased risks in the real estate market have caused in recent years increased interest of market participants in the strategic and medium-term forecasting. At present the analysis and forecasting of the housing market dynamics is becoming increasingly popular among professional participants of the real estate market: domestic, foreign investors, valuation companies, banks and government agencies.

Increased interest in the housing market in Astana and Almaty is associated with the rapid development of these cities. According to our estimates currently a record volume of new housing is being built in Astana – only about 2.9 million square meters of housing in 102 residential complexes of which 90% of the declared terms of commissioning fall on 2018 year.

In addition to private developers the state is beginning to play an increasingly important role in the formation of the housing market. Every year within the framework of the regional development program (the old name – "Affordable housing – 2020") about 1.3 million square meters of housing are built in Kazakhstan which is 18% of the total housing construction in the country.

1. Research background

Within 10 years of implementation of the state program of development of housing construction ("Affordable housing" 2005-2007) in the country managed to increase construction volumes from 0.1 to 0.4 sqm per person a year. It earned a number of support programs for various categories of citizens, including gaining popularity among

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the population of Zhilstroysberbank. Despite the achievements the poor development of market regulation concepts based on the market forecast especially the regulatory and planned nature of the analysis lead to problems in the implementation of social housing. Thus in low-income regions large volumes of housing remain unclaimed due to the low solvency of the population and in fast – growing regions with high incomes there is a high deficit of social housing.

Therefore, the results of the development forecasts of the Kazakhstan real estate market taking into account all its parameters should become a mandatory reference point for all its professional participants.

When forecasting the performance of the Kazakhstan market there are difficulties that the observed crisis phenomena caused by the imbalance of supply and demand in various markets of goods and services, extend to other areas through the interconnection of the economic system (Gromov and Gromova 2016). From the point of view of the probability of obtaining accurate forecast values this period is characterized by increased uncertainty when it is difficult to predict the subsequent behaviour of certain market indicators and the conclusion is made on the basis of a comprehensive analysis of the variation of various factors affecting the value of the predicted indicator (Sihimbaev and Shatskaya 2016).

In addition to high macroeconomic instability the problems of modeling and forecasting of the real estate market in Kazakhstan are associated with high information closeness and imperfection of the legislative system (Sternik and Sternik 2014). That in turn leads to the widespread use of little formalized, intuitive forecasting methods based on heuristic analysis of experts on market trends (Sihimbaev and Kumisbekova 2015). In cases where the cost of housing is projected using quantitative methods it is often based on extrapolation and the determination of the projected values of real estate prices by extending the trend observed in the past (Sternik 2011).The practice of the authors of forecasting methods based on trend equations (for example linear or polynomial trend) has shown that these methods have a high prognostic ability only in the conditions of stable market processes but even with a small error of forecasts, have a high probability of error in the case of trend changes (Leifer and Grishin 2009). In addition, extrapolation methods in constantly changing economic conditions including the housing market, do not justify themselves also because the change in real estate prices is affected by other market indicators, both internal and external (Shatskaya and Yemelina 2015). As a result, to improve the quality of approximation of the model to the actual data of the period of retrospection the authors decided to include in the forecast model several explanatory factors in our opinion characterizing the housing market in Kazakhstan (Yemelina and Shatskaya 2016).

First of all, the demand in the housing market is due to the level of welfare of the population which in the course of 2017 in the Republic of Kazakhstan remains at a low level. The decline in effective demand in the housing market leads to a decline in real estate prices (Sihimbaev Tsyganov 2015).

The growth rate of per capita income is only in the first approximation characterized by the growth rate of effective demand of the population in the housing market. It is known that real estate is purchased not for current income but for savings however the increase in the growth rate of current income reduces the propensity of the population to save and the decline – increases and thus leads to a fall in the solvent demand in the housing market.

It is also clear that the effective demand depends on the volume of money supply in the country, the rate of inflation, on additional (above income) injection of money into the market through lending to the buyer (primarily mortgage), on factors such as the overflow of investment capital into the housing market and the transformation of real estate into an instrument for their preservation and multiplication as well as a variety of psychological, irrational factors (public statements and the actions of the representative and legislative authorities, public distrust of the public authorities financial policy, the aggravation of the situation before the elections at various levels and the expectation of changes in economic policy), *etc*. However, in the model adopted the value of nominal incomes since they are measured in monetary units. While real income is expressed in relative terms. In our opinion nominal incomes of the population are a direct factor of effective demand in the housing market.

Another important factor affecting the formation of prices in the housing market in Kazakhstan is the volume of mortgage lending (Apenova 2017). Mortgage lending in our conditions is highly correlated with real estate prices. Insufficient supply of credit resources from banks leads to a decrease in demand for housing which in turn can lead to a decrease in real estate prices. With the help of mortgage on the market is made about 45% of all transactions in the primary market more than 50% so this figure also strongly affects the dynamics of prices (Shatskaya 2017).

Despite the ban on the nomination of real estate prices in foreign currency, the pricing in the secondary market is still tied to the dollar equivalent (Shatskaya and Yemelina 2015). For this reason, the dynamics of housing prices both KZT and dollar strongly correlates with fluctuations in exchange rates. According to our calculations the correlation coefficient in the first case is 0.81, in the second – 0.54.

The real estate sector is one of the most sensitive sectors which clearly reflect the overall economic condition of the country as well as its residents. The positive change in the economy of Kazakhstan of course has continued to stabilize prices in the world commodity markets. That in turn will contribute to the stabilization of prices in the housing market in Kazakhstan. It is known that the share of raw material revenues in the country's GDP is more than 70%, because of this; the impact of this factor on economic growth is difficult to overestimate. For several years we have been monitoring the dynamics of real estate prices and oil prices on a regular basis. The results of this monitoring show that these indicators are closely linked; the correlation coefficient is about 0.7.

The relationship between the indicators is indirect and is expressed in an increase/decrease in the money supply in the country which in turn causes the volume of effective demand in the form of income and mortgage lending. It has also been observed that the rise/fall in oil prices is reflected in prices with a time lag (on average 6-8 months).

In addition, the price of oil affects the exchange rate of the national currency against the US dollar. There is a direct link between the indicators – the growth of oil prices leads to the strengthening of the national currency and the weakening of the dollar, and Vice versa. Since the Kazakh real estate market is still denominated in US dollars these factors are decisive in the medium - and long-term dynamics of prices.

2. Methodology

The forecasted model of housing prices is based on the multi-factor regression equation. At the first stage of forecasting we chose the most significant factors affecting the real estate market. It:

- nominal income (X_1, KZT);
- the volume of mortgage lending (X_2, million KZT);
- the world price of oil (X_3, USD/ Barr);
- US dollar rate to KZT (X_4, KZT/USD).

The resulting feature is the average price in the market of apartments (Y, KZT/1 m^2). We took the value of the price in the KZT equivalent because the correlation coefficient between the tenge prices and the exchange rate is higher.

According to the average monthly data for the period from January 2012 to December 2017a correlation analysis was performed and pair correlation coefficients were obtained which determine the close relationship between the variables. The following matrix of pair correlation coefficients was obtained (Table 1):

Table 1. Matrix of pair correlation coefficients

	Y	X_1	X_2	X_3	X_4
Y	1				
X_1	0,93	1			
X_2	0,86	0,67	1		
X_3	0,68	0,47	0,41	1	
X_4	0,81	0,62	0,70	0,18	1

Source: compiled by authors

Thus, of the considered factors the greatest influence on the formation of housing prices have nominal incomes (r_(yx_1)=0,93) and mortgage lending (r_(yx_2)=0,86), to a lesser extent, world oil prices (r_(yx_3)=0,64) and the dollar (r_(yx_4)=0,81).

Regression models describing the relationship between the features were constructed for the cities of Astana and Almaty. As a result of the approximation of the data by the least square method the following regression equations were obtained:

- for Astana city:

$$Y = 633979{,}2 - 0{,}774X_1 - 0{,}746X_2 - 4283{,}07X_3 + 551{,}996X_4 \quad (1)$$

That is, with an increase in the nominal income of Astana residents by 10 thousand tenge, the average price of apartments in Astana will fall by 7740 KZT/1 m^2. Increase in mortgage lending in Astana by 1 billion tenge will lead to a decrease in housing prices by 746 KZT/1 m^2. The growth of world oil prices by $ 1/ Barr may lead to a decrease in average prices in the housing market in Astana by 4283 KZT /1 m^2. The growth of the dollar by 1 tenge per dollar in Kazakhstan contributes to the increase in housing prices by an average of 552 KZT/1 m^2 with unchanged values of other factors.

- for Almaty city:

$$Y = 568872 - 2{,}711X_1 + 0{,}009X_2 - 523{,}6X_3 + 623{,}122X_4. \quad (2)$$

According to the presented model, with an increase in nominal incomes of Almaty residents by 10 thousand tenge the average price of apartments in Almaty will fall by 27110 KZT per m². Increase in mortgage lending in Almaty by 1 billion tenge will lead to an increase in housing prices by 9 KZT per m². The growth of world oil prices by $ 1 per Barr may lead to a decrease in average prices in the housing market in Almaty by 523.6 KZT per m². The growth of the dollar by 1 tenge per dollar in Kazakhstan contributes to an increase in the price of housing in Almaty by an average of 623 KZT /1 m² at constant values of other factors.

The regression equations are statistically significant since the observed values of the Fisher test significantly exceed its critical value at the significance level of 0.05 (for Astana $F_{obs} = 339{,}4 > F_{cr} = 2{,}78$ (3); for Almaty $F_{obs} = 12{,}86 > F_{cr} = 2{,}78$ (4)), therefore, the models adequately describe the relationship between the variables and can be used for further analysis.

The constructed models under the given conditions make it possible to predict with high accuracy the prices in the housing market in Astana and Almaty in future. To do this it is necessary to predict the values of the factors.

3. Forecasting of nominal income of residents of Astana and Almaty cities

The dynamics of changes in nominal incomes of the population shows a steady growth with a pronounced seasonality (Figure 1).

Taking into account the observed trend, an additive trend-seasonal model was used to predict this indicator:

$$Y = T + S + E \quad (5)$$

where: T – the trend component; S – seasonal component; E – random component.

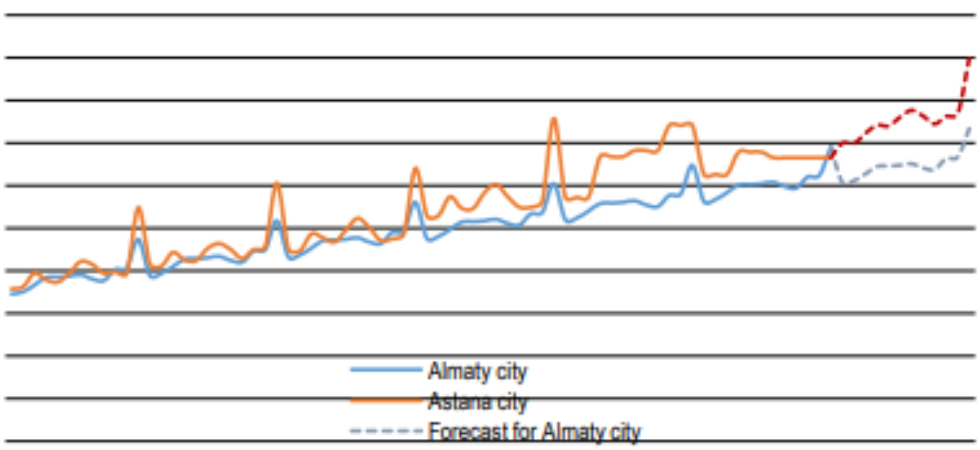
In the process of building a trend-seasonal model, the authors have done the following steps:

- alignment of the initial series by the moving average method for the time series of the monthly dynamics.
- calculation of seasonal component values *S* by the formula:

$$S_i = \overline{S}_i - k \quad (6)$$

where: $\overline{S}_i$ - average values of the seasonal component for each month for all years,

Figure 1. Dynamics and forecast of nominal income, January 2012 - December 2018, in KZT



Source: compiled by the authors according to the http://stat.gov.kz/

$$k = \frac{\sum \bar{S}_i}{12} \text{ – correcting coefficient} \quad (7)$$

- Removing the seasonal component from the series source levels and obtaining aligned data:

$$T + E = Y - S \quad (8)$$

- Analytical level alignment: $(T + E)$ and calculation of values T using the obtained trend equation.
- The construction of the forecast taking into account seasonal variations (Table 1).

Table 1. Forecast of nominal income of residents of Astana and Almaty for 2018

PERIOD	Nominal income of residents	
	Astana city	Almaty city
January 2018	139,793.8	121,147.7
February 2018	139,619.2	122,128.1
March 2018	144,443.1	125,325.9
April 2018	148,273.2	128,868.8
May 2018	147,878.5	129,065.0
June 2018	152,041.5	129,443.0
July 2018	155,262.9	130153.0
August 2018	152,544.3	128,183.7
September 2018	148,828.2	127,392.0
October 2018	152,467.4	132,673.4
November 2018	153,605.8	133,369.7
December 2018	179,650.5	146,726.8

Source: estimated and compiled by the authors

The calculation of the forecast showed that the average annual level of nominal income in Astana in 2018 will be 151,201 KZT, and the average monthly growth rate of nominal income of the population – 2.4% per month or 7.2% per year (December 2018 to December 2017). In Almaty the average annual level of nominal income in 2018 is projected at the level of 129,540 KZT, the forecast of the average monthly growth rate will be 1.8% per month or 6.3% per year. As the dynamics shows the average monthly growth rate of mortgage volumes in Kazakhstan in 2016 was 0.3% per month and 0.6% in 2017. On the basis of such rather restrained forecasts from banks it can be concluded that the current trends in the mortgage market.

4. Forecasting of nominal income of residents of Astana and Almaty cities

To find the forecast values of mortgage lending in Astana and Almaty until the end of 2018 the method of extrapolation was used that is the extension of the future trend observed in the past.

To describe the trend, we have built linear trends (Figure 2, Figure 3) and the method of least squares obtained the following equations:

- for Astana city

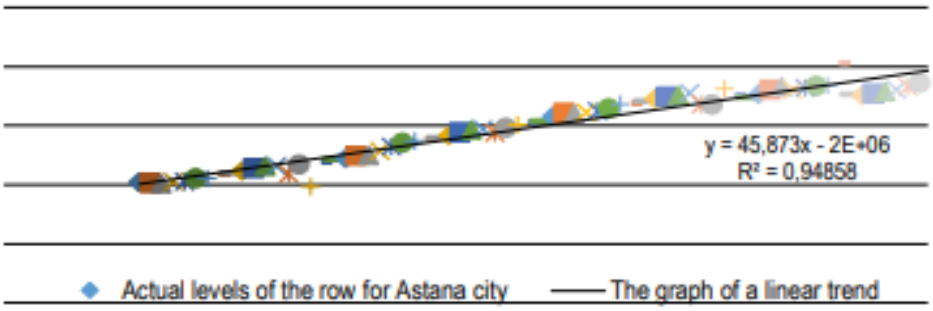
$$y_t = 99177{,}15 + 1396{,}208t, \quad R^2 = 0{,}95. \tag{10}$$

- for Almaty city

$$y_t = 242964{,}4 + 692{,}657t, \quad R^2 = 0{,}86. \tag{11}$$

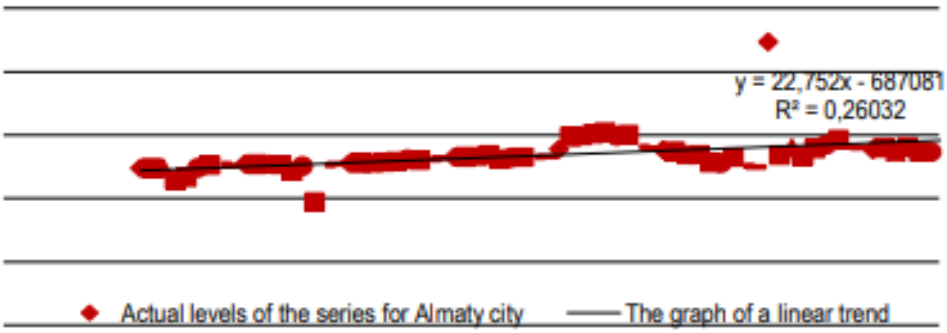
The coefficients of determination R^2 indicate the high accuracy of the models describing the dynamics of the time series.

Figure 2. Dynamics of volumes of mortgage lending in Astana, January 2012- December 2017, in million KZT



Source: compiled by the authors according to the National Bank of Kazakhstan

Figure 3. Dynamics of volumes of mortgage lending in Almaty, Kazakhstan, January 2012- December 2017, in million KZT



Source: compiled by the authors according to the National Bank of Kazakhstan

According to the trend equations we determine the forecast values of mortgage lending in the cities of Astana and Almaty by substituting the corresponding values of the time parameter into the equations (Table 2).

Table 2. Forecast of the volume of mortgage lending in Astana and Almaty in 2018

PERIOD	Nominal income of residents	
	Astana city	Almaty city
January 2018	201,100.4	293,528.4
February 2018	202,496.6	294,221.1
March 2018	203,892.8	294,913.7
April 2018	205,289.0	295,606.4
May 2018	206,685.2	296,299.0
June 2018	208,081.4	296,991.7
July 2018	209,477.6	297,684.4
August 2018	210,873.8	298,377.0
September 2018	212,270.0	299,069.7
October 2018	213,666.2	299,762.3
November 2018	215,062.4	300,455.0
December 2018	216,458.6	301,147.6

Source: estimated and compiled by the authors

Based on the calculation results we obtain the average monthly volume of mortgage lending in 2018 in Astana 208.78 billion KZT with a growth rate of 0.7% per month, in Almaty 297.34 billion KZT with a growth rate of 0.23% per month.

5. Forecasting of world oil price for 2018 year

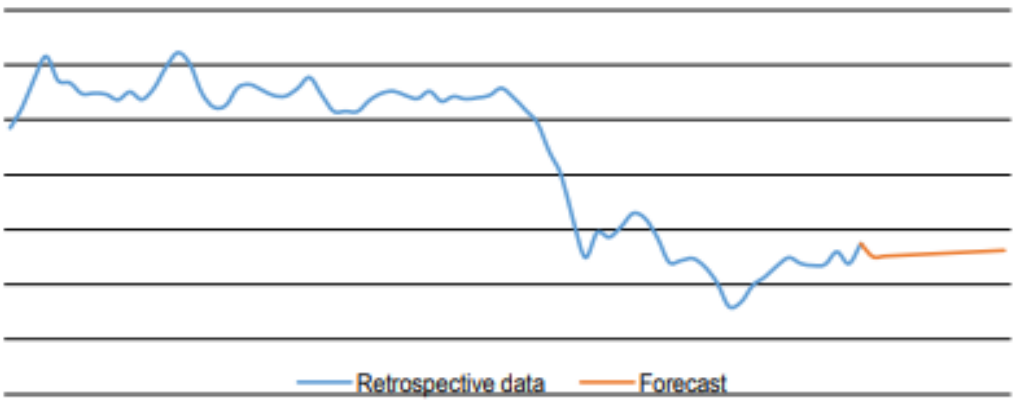
Since the dynamics of world oil prices does not have a trend (Figure 4) the basis for predicting oil prices was the linear adaptive model of R. Brown

$$y_t = \hat{a}_0 + \hat{a}_1 t \tag{12}$$

Using the first five points of the time series, we estimated the values of a_0 and a_1 parameters of the model using the least squares method for the linear model. Got the equation:

$$y_t = 109{,}46 + 0{,}0963t \tag{13}$$

Figure 4. Dynamics of world oil prices January 2012 - December 2017 (USD/Barr)



Source: Compiled by the authors according to the Information portal on personal investments and finance

The smoothing parameter was chosen equal toα=0,2 then the discount rate isβ=1-α=1-0,2=0,8. The initial conditions of exponential means are determined by the formulas:

$$S_0^{(1)} = a_{0(0)} - \frac{\beta}{\alpha} a_{1(0)} = 109{,}46 - \frac{0{,}8}{0{,}2} \cdot 0{,}0963 = 109{,}07 \quad (14)$$

$$S_0^{(2)} = a_{0(0)} - \frac{2\beta}{\alpha} a_{1(0)} = 109{,}46 - \frac{2 \cdot 0{,}8}{0{,}2} \cdot 0{,}0963 = 108{,}69 \quad (15)$$

Calculated the values of exponential averages for the following periods by formulas:

$$S_t^{(1)} = \alpha \cdot y_t + \beta \cdot S_{t-1}^{(1)} \quad (16)$$

$$S_t^{(2)} = \alpha \cdot S_t^{(1)} + \beta \cdot S_{t-1}^{(2)}. \quad (17)$$

Adjusted the parameters of the model:

$$a_{0(t)} = 2S_t^{(1)} - S_t^{(2)} \quad (18)$$

$$a_{1(t)} = \frac{\alpha}{\beta}\left(S_t^{(1)} - S_t^{(2)}\right) \quad (19)$$

Using the presented formulas, we obtained a model with adjusted parameters:

$$\hat{y} = 49{,}9 + 0{,}211\tau, \quad \tau = 1, 2, \quad (20)$$

Using this formula, we calculated the forecast values of world oil prices until December 2017 (Table 3). Thus the forecast of world oil prices by the end of 2018 according to our calculations will correspond to the value of $ 52/Barr. That is the increase will be 0.4%.

6. Forecasting of exchange rate of KZT to USD by 2018

The logarithmic trend equation obtained by the least squares method has the following form

$$y_t = 361{,}54 - 11{,}63 \ln t, \; R^2 = 0{,}71 \quad (21)$$

The model's forecast exchange rate values (Table 3) show a gradual decline to 325 KZT per USD by the end of 2018 which corresponds to 2.7% per year. However, it should be noted that the forecasts will be justified only if there are no sharp changes in the world economy in general and in Kazakhstan in particular.

Table 3. The forecast of world oil prices and the exchange rate of KZT to USD in Kazakhstan to 2018

Period	World oil prices	KZT to USD exchange rate
January 2018	50,1	332
February 2018	50,3	331
March 2018	50,5	330
April 2018	50,7	329
May 2018	50,9	329
June 2018	51,2	328
July 2018	51,4	327
August 2018	51,6	327
September 2018	51,8	326
October 2018	52,0	326
November 2018	52,2	325
December 2018	52,4	325

Source: estimated and compiled by the authors

Conclusion

As a result of applying our proposed prediction methods were obtained projected values for 2018 indicators characterizing changes in the real estate markets in the cities of Astana and Almaty: the nominal income of residents, the volume of mortgage lending, world oil prices and the exchange rate of the national currency against the USD. Based on the multivariate regression equations presented above we calculated predicted values of housing prices in KZT and USD terms (Table 4).

Table 4. Housing prices forecast in Astana and Almaty for 2018

Period	Astana city		Almaty city	
	KZT	USD	KZT	USD
January 2018	344.301	1.037	423.537	1.291
February 2018	342.014	1.033	420.238	1.284
March 2018	335.893	1.018	410.963	1.254
April 2018	330.570	1.006	400.785	1.221
May 2018	328.539	1.002	399.709	1.221
June 2018	323.006	988	398.166	1.219
July 2018	318.221	977	395.745	1.214
August 2018	318.048	977	400.608	1.236
September 2018	318.663	980	402.297	1.245
October 2018	313.603	967	387.536	1.194
November 2018	310.491	959	385.221	1.188
December 2018	288.125	901	348.593	1.054

Source: Estimated and compiled by the authors

Thus the situation in the real estate market will develop according to the scenario proposed by us if in Kazakhstan in 2018 the trends of 2017 will continue and there will be no significant changes in the economy of the country which is not excluded. That is the average KZT price for housing in Astana will fall by 17%, and will be 288125 KZT in December 2018, in Almaty the average KZT price will fall only by 6% and will be in December 2018, 397783 KZT. If talking about USD terms the decline in property prices by the end of 2018 Astana will occur at 13% compared to the same period in 2017 and will match $900 per 1 sq. m. In the city of Almaty is also observed negative dynamics, *i.e.* the decline will be 5% and by the end of 2018 for 1 sq. m of living space will offer just over $1,000.

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