

ANALYSIS OF THE RELATIONSHIP OF MORTGAGE LENDING AND REAL ESTATE MARKETS IN RA

Arevik ALEKSANYAN

Ph.D., Senior Lecturer, Department of Finance and Accounting, ArSU

Key words: mortgage lending market, real estate market, regression equation, correlation coefficients, standard error

Introduction . The real estate and mortgage markets are considered to be one of the driving forces behind the economy of every country. There is a close relationship between these markets and with other sectors of the economy, as well as with the financial system,. The development of the real estate market leads to an increase in the volume of construction, sale and purchase, rental transactions, and the development of the mortgage lending market also leads to the development of the financial system, because mortgage lending models are widely used, they involve the expansion and growth of the infrastructure of financial markets.

Literature review. The mortgage lending market is a segment of the financial market in which real estate is collateralized by redistributed borrowed capital [Razumova, 2009, p. 53]. The real estate market is an extremely important economic player. Real estate, in addition to meeting one of the most important needs of society, is one of the main "stores" of wealth in the economy. The real estate market is a combination of such systems, through which property rights and other rights to real estate are transferred, which are regulated by such market mechanisms as price, supply, demand, competitive conditions [Ozerov, 2007, 64].

Methodology. The scientific basis of the study was the scientific works and analyzes of Armenian and foreign experts in the real estate and mortgage lending markets, and the information basis was the reports of the Central Bank of the Republic of Armenia, statistical data and analyzes of the real estate markets of the RA Cadastre Committee. On the basis of correlation-regression analysis, econometric relationships between the real estate and mortgage lending markets were revealed. The analysis was carried out using programs on the site "<https://math.semestr.ru>" and the tool "Analysis MS Excel".

Scientific novelty. The article provides a systematic analysis of the mortgage lending and real estate markets of the Republic of Armenia. As a result of applying economic and mathematical models, a significant impact of interest rates on mortgage lending and the average market price of 1 square meter in Yerevan on the volume of the mortgage lending market was revealed.

Analysis . In 2021, 23.3 thousand transactions were made in the real estate market of the Republic of Armenia, the percentage distribution of which by the city of Yerevan

and the regions of the Republic of Armenia is shown in Figure 1 (most transactions were made in Yerevan, the least in Vayots Dzor region).

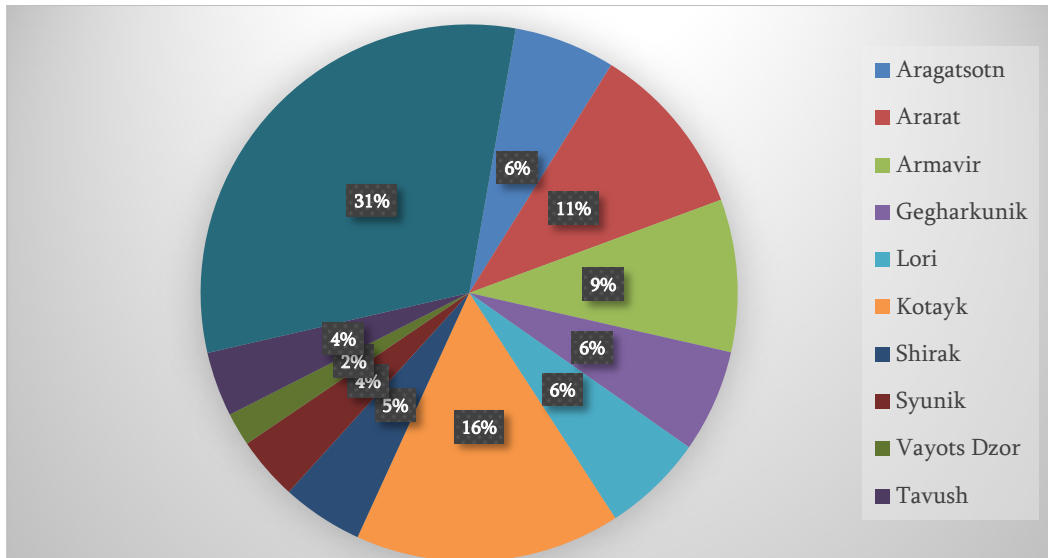


Figure 1. The share of transactions made in real estate market by region, 2021 (%)

The dynamics of transactions of general pledge and mortgage pledges carried out in the real estate market of Armenia, and their percentage are presented in Figure 2.

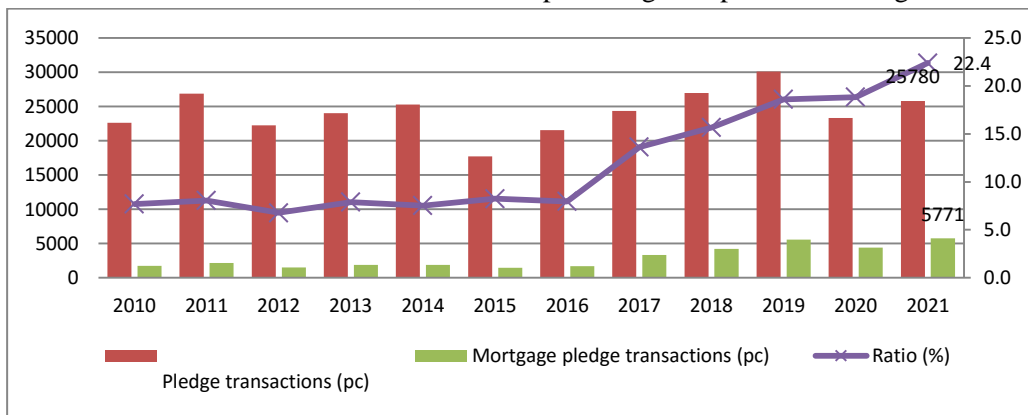


Figure 2. General pledge and mortgage pledge transactions carried out in the real estate market of the Republic of Armenia in 2010-2021 [4]

Figure 2 shows that the dynamics of general and mortgage mortgage transactions is unstable, the ratio of the latter increased by 3.6 p.p. compared to the previous year. The structure of collateral mortgage transactions by regions of the Republic of Armenia is shown in Figure 3 as most of the mortgage transactions (64.8%) were carried out in the city of Yerevan, and 10.3% - in the Kotayk region, which is due to the proximity of this region to the city of Yerevan and the development of the Tsaghkadzor community in recent years.

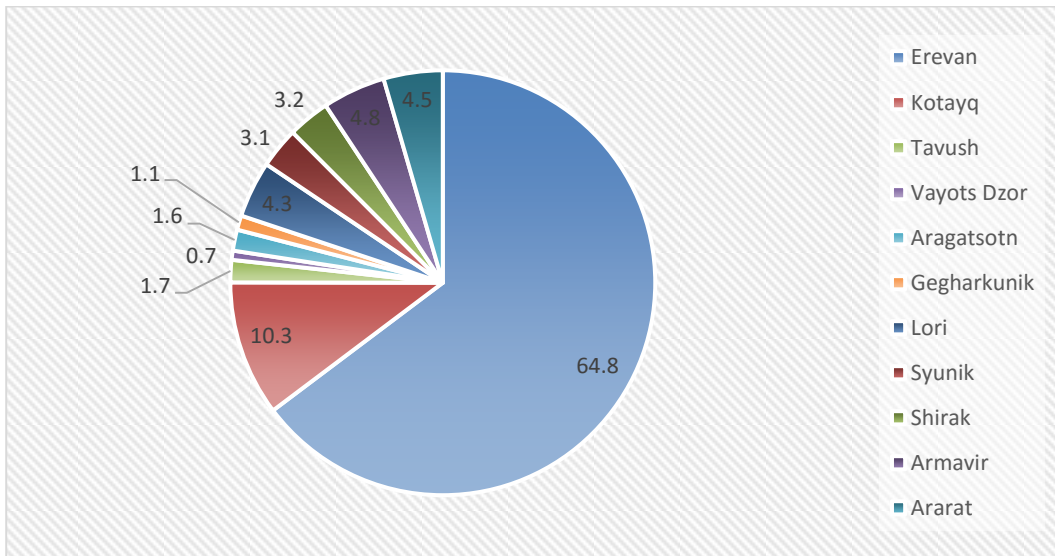


Figure 3. 2021 Structure of pledged mortgage transactions by RA regions (%) [3, p. 68]

Mortgage lending as a financial instrument was introduced in Armenia by the Decree of the Government of the Republic of Armenia in 2004. Currently, mortgage loans in the Republic of Armenia are provided by 17 commercial organizations and more than a dozen credit organizations. Mortgage loans are provided in AMD and foreign currency to residents and non-residents. Now let's present the average interest rates on mortgage loans in AMD and foreign currency in the Republic of Armenia (Figure 4).

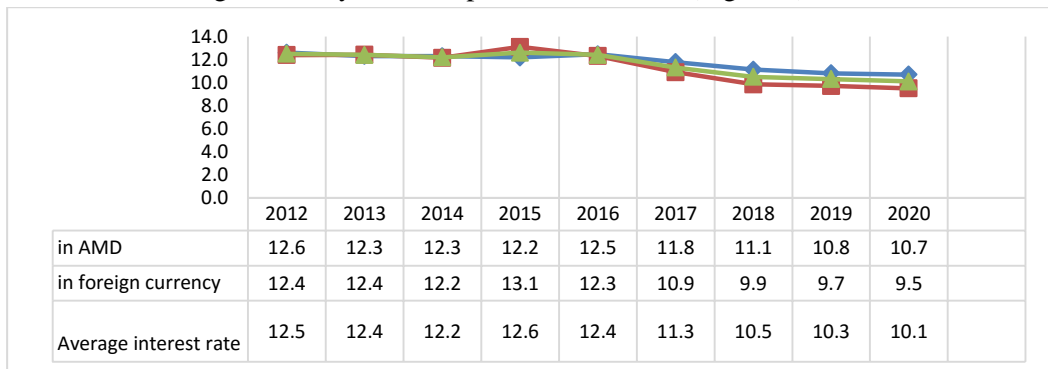


Figure 4. Average interest rates on mortgage loans issued to individuals in the Republic of Armenia in 2012-2021 (%) [5]

Interest rates on mortgage loans in the Republic of Armenia have been constantly decreasing in recent years, but in 2021, compared to the previous year, the average interest rates increased by 0.2 percentage points, but this circumstance is associated with an increase in average interest rates on mortgage loans provided in foreign countries. currency (0.2 percentage points), while the average interest rates on mortgage loans issued in AMD decreased (0.05 percentage points). To identify the economic and mathematical relationships bet-

ween the indicators of the mortgage lending and real estate markets of Armenia, a regression analysis was carried out and the following system of indicators was chosen:

y- resulting variable: mortgage loans (logarithmic);

x₁-independent variable: mortgage amount logarithmized by previous lag (t-1)

x₂ -independent variable: average mortgage interest rate

x₃-independent variable: average market price per 1 square meter in the city of Yerevan (logarithmic).

The initial data for regression analysis are presented in Appendix 1. As a result of calculations, the correlation coefficients between the variables are presented in Table 1.

Table 1. Correlation Coefficients for Regression Analysis

Variables	Correlation coefficient	Comment
y l x ₁	0,997	The connection is direct and very strong.
y l x ₂	-0,862	The relationship is strong and reciprocal
y l x ₃	0,944	The connection is direct and very strong.
x ₁ l x ₂	-0,848	The relationship is strong and reciprocal
x ₁ l x ₃	0,936	The connection is direct and very strong.
x ₂ l x ₃	0,838	The connection is direct and strong

Descriptive statistics of regression analysis indicators are presented in Table. 2.

Table 2. Descriptive statistics of regression analysis results

Index	Y	x ₁	x ₂	x ₃
average cost	839,4049	837,3888497	11,42410	247,1311
standard error	3,2802	3,181876047	0,1695	0,8661
Median	831,7709883	831,5381945	12	243,8700
Standard deviation	20,4849	19,87080954	1,0586	5,4088
Asymmetry	0,6782	0,614719109	-0,1287	0,7828
Interval	75,5372	74,10146703	2,87	17,31206
Minimum:	808,1627	805,0712851	10,03	240,6199
Maximum	883,7	879,1727522	12,9	257,932
Number of observations	39	39	39	39

As a result of the calculations, the following equation of multiple regression of a linear dependence was obtained:

$$Y = 14,328 + 0,917x_1 - 0,913x_2 + 0,275x_3 \quad (1)$$

The weighting effects of regression coefficients in the regression equation are as follows:

1. $a_1 = 0,917$, this is the coefficient of the previous lag,
2. $a_2 = -0,913$, which means that an increase in interest rate on mortgage loans by 1% leads to an increase in mortgage loans by 0.913%,
3. $a_3 = 0,275$, which means 1 m² of real estate in Yerevan An increase in the meter by 1% leads to an increase in the mortgage loan by 0.275%.

First, we need to calculate the average approximation error using the following formula:

$$A = \frac{\sum \epsilon Y}{n} * 100\% = 0,11\% \quad (2)$$

The variance estimate is:

$$s_e^2 = (Y - Y(X))^T * (Y - Y(X)) = 69,754 \quad (3)$$

The unbiased estimate of the variance is then computed:

$$s^2 = \frac{1}{n-m-1} * s_e^2 = \frac{1}{40-1-1} * 69,754 = 1,993 \quad (4)$$

The standard deviation will be:

$$S = \sqrt{s^2} = 1,412 \quad (5)$$

The quality of the above regression equation was tested on the basis of Fisher's statistics (F-test), according to which, if $F > F_{stat}$, the coefficient of determination is statistically significant, and the regression equation is statistically reliable.

In the resulting model, the coefficient of determination was first calculated. (in the considered model $F_{stat}=2,84$),

$$R^2 = 1 - \frac{s_e^2}{\sum(y-\bar{y})^2} = 0,9956 \quad (6)$$

Then was calculated F:

$$F = \frac{R^2}{1-R^2} * \frac{n-m-1}{m} = \frac{0,9956}{1-0,9956} * \frac{39-3-1}{3} = 2655,323 \quad (7)$$

where n is the number of combination units, m is the number of factors in the regression equation. The number of freedom degrees will be: $df = n - m = 36$.

Since $F > F_{stat}$, so the coefficient of determination of statistics is significant, the regression equation is statistically reliable.

The statistical significance of the regression model was also tested by excluding the presence of autocorrelation between variables. We conducted it in two ways: by calculating the autocorrelation coefficient and using the Durbin-Watson test.

If the autocorrelation coefficient is $r_{ei} < 0,5$, then there is a reason to assert that there is no autocorrelation. Now we shall use Student's t-statistics and find intersection point $\alpha = 0,05$, (95% probability) and $df = 36$: $t_{tab} = 2,329$ ($\alpha = 0,05$, $df = 36$).

According to t-Student criterion, if the first-order autocorrelation coefficient r_1 is in the following range, then it can be assumed that there is no autocorrelation:

$$-t_{tab} * S_{eY} < r_1 < +t_{tab} * S_{eY} \quad (8)$$

where S_{eY} is the standard error criterion.

The standard error criterion is determined by the following formula:

$$S_{eY} = \frac{1}{\sqrt{n}} = \frac{1}{\sqrt{39}} = 0,16 \quad (9)$$

$$r_1 = 0,178$$

As in our example « $-2,329 * 0,16 < 0,178 < 2,329 * 0,16$ » there is no autocorrelation.

Based on the Durbin-Watson criterion, is first calculated DW_{stat} .

$$DW = \frac{\sum(e_i - e_{i-1})^2}{e_i^2} = 2,29 \quad (10)$$

Then the critical values d_1 и d_2 are calculated based on the Durbin-Watson tabular data ($\alpha = 0,05$, $n = 39$, $m = 3$ $df = 36$). According to this criterion, there is no

autocorrelation if the following conditions are simultaneously satisfied: $d_1 < DW$ и $d_2 < DW < 4 - d_2$.

Critical tabular data values for this model $d_1 = 1,33$ and $d_2 = 1,66$.

Since " $1.33 < 2.29$ and $1.66 < 2.29 < 4 - 1.66$ ", we have reason to believe that there is no autocorrelation. The coefficient of determination in the constructed model is 0.9956, that is, the change in the volume of mortgage loans by 99.56% is due to changes in independent variables. In the resulting model, the average value of the approximation is also quite small: $A=0.11\%$:

We have summarized the main results of the constructed model in the form of Table 3.

Table 3. The main results of the correlation-regression analysis equation

Multiple correlation coefficient	-0.998
Relationship between features	Very strong
Number of views:	39
Multiple determination adjusted index (\hat{R}^2)	0,995
Multiple determination factor (R^2)	0,996
Multiple linear regression equation	$Y = 14,328 + 0,917x_1 - 0,913x_2 + 0,275x_3$
Mean approximation error (\bar{A})	0,11%
Standard Error Criterion (S_{ey})	0,16
Auto correlation coefficient	is absent

Thus the regression equation is estimated as good.

Conclusion. We revealed that there is a close relationship between the mortgage lending and real estate markets, in particular, the correlation coefficient between the average market price per 1 square meter in the city of Yerevan and the volume of mortgage lending is direct and very strong, and between average rates and volumes of mortgage lending is the opposite and very strong. The regression coefficients are also significant, which means that the average interest rates of mortgage lending and the market prices of the Yerevan real estate market per 1 sq.m have a significant impact on the volume of mortgage lending.

Arevik ALEKSANYAN

Analysis of the relationship of mortgage lending and real estate markets in RA

Key words: mortgage lending market, real estate market, regression equation, correlation coefficients, standard error

At the same time, real estate and mortgage lending markets are particularly sensitive to external shocks, especially currency market fluctuations, military conditions, political instability, etc. The real estate and mortgage lending markets have been and remain the subject of study by Armenian and foreign specialists and experts. Mortgage is one of the oldest institutions of civil law, which has been transformed and improved over a long period of historical development. Currently, the mortgage has reached the highest level of development, retaining its original name, that is, being one of the most reliable forms of loan security.

References:

1. Razumova I. A, "Mortgage lending", Teaching manual, 2nd edition, SP. 2009, p. 206
2. Ozerov E.S. "Economic analysis and assessment of real estate", S.Petersburg. 2007, p. 535
3. RA Cadastre Committee, 2021 real estate market analysis, www.cadastre.am,
4. RA Cadastre Committee, 2010-2021. real estate market analysis, www.cadastre.am,
5. Central Bank of RA, Monetary and Financial Statistics, <https://www.cba.am>

Attachment 1. Input data for regression analysis

Term / quarter	Mortgage loan volume (1000 AMD) logarithm	Mortgage loan volume: t-1 (1000 AMD) logarithm	Average mortgage rate (%)	Average market rates per 1 m ² real estate Yerevan (1000 AMD) logarithm
	Y	X1	X2	X3
2012/2	808,2	805,1	12,34	240,6199424
2012/3	809,1	808,2	12,59	241,4973348
2012/4	816,1	809,1	12,56	242,1932813
2013/1	817,7	816,1	12,17	242,8296814
2013/2	817,7	817,7	12,4	243,4249452
2013/3	819,8	817,7	12,46	243,5366507
2013/4	821,3	819,8	12,39	243,63217
2014/1	821,8	821,3	12,14	243,679851
2014/2	822,9	821,8	12,46	243,7116093
2014/3	823,8	822,9	12,13	243,7274797
2014/4	828,2	823,8	12,15	243,7433444
2015/1	827,4	828,2	12,33	243,7750563
2015/2	828,0	827,4	12,9	243,806745
2015/3	828,8	828,0	12,69	243,8225808
2015/4	830,0	828,8	12,61	243,8542349
2016/1	829,8	830,0	12,74	243,8700533
2016/2	830,2	829,8	12,55	243,9016728
2016/3	831,0	830,2	12,18	243,9253724
2016/4	831,8	831,0	12,06	243,949059
2017/1	831,5	831,8	12	243,5844366
2017/2	832,6	831,5	11,54	241,763774
2017/3	833,8	832,6	11,25	241,8135498
2017/4	837,6	833,8	10,63	242,3245874
2018/1	838,6	837,6	10,68	246,0747542
2018/2	839,5	838,6	10,48	246,686762
2018/3	841,5	839,5	10,58	247,7265995
2018/4	845,5	841,5	10,2	249,2900011
2019/1	847,8	845,5	10,38	250,1880494
2019/2	851,4	847,8	10,21	251,6403148
2019/3	854,9	851,4	10,17	252,9943402
2019/4	859,2	854,9	10,37	255,1071655
2020/1	863,0	859,2	10,15	256,5588108
2020/2	864,1	863,0	10,1	256,6201719
2020/3	867,6	864,1	10,11	255,0534087
2020/4	871,1	867,6	10,07	254,3695632
2021/1	874,0	871,1	10,03	254,0454614
2021/2	876,6	874,0	10,17	254,7282308
2021/3	879,2	876,6	10,4	256,1101384
2021/4	883,7	879,2	10,17	257,932