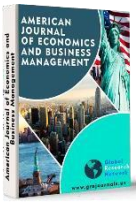

American Journal of Economics and Business Management

Vol. 8 Issue 1 | **pp.** 23-32 | **ISSN:** 2576-5973
Available online @ https://www.globalresearchnetwork.us/index.php/ajebm

Article

The Implementation of Mortgage-Backed Securities in Uzbekistan by Means of the Tashkent Stock Exchange Based on Econometric Analysis

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Abstract: The securitization of mortgage loans is one the most lucrative sources of fixed-income assets in the financial world, albeit current financial instabilities making investment decisions extremely difficult for both institutional as well as retail investors around the globe. Consequently, a rise of mortgage loans in emerging markets like Uzbekistan does provide a stable, or even growing investment return. The aim of this investigation is to econometrically analyze the impact of interest rates variation and population growth on the mortgage loans allocation in Uzbekistan for last 20 years between 2004-2024. A researcher opted for Ordinary least squares (OLS), Correlation matrix (CM), Scatter graphic matrix (SGM), and last but not least Graphical histogram as well as matrix, to carry out this research, all models developed in Stata software. The outcome of this study points out that a placement of mortgage-backed securities could boost capital market liquidity in Uzbekistan. According to econometrical analyses, only two factors, in particular interest rate and population growth would influence the growth of mortgage loans which are underlying assets for mortgage-backed securities.

Keywords: Mortgage-Backed Securities, Securitization, Population Growth, Interest Rates, Regulatory Sandbox, The Tashkent Stock Exchange

Citation: Abdulaziz, A. The Implementation of Mortgage-Backed Securities in Uzbekistan by Means of the Tashkent Stock Exchange Based on Econometric Analysis. American Journal of Economics and Business Management 2024, 8(1), 23-32.

Received: 10th Oct 2024
Revised: 11th Nov 2024
Accepted: 24th Dec 2024
Published: 27th Jan 2025

1. Introduction

Nowadays, a demand on mortgage loans is rocketing in Uzbekistan that is due to a stable population growth causing a high bid on housing market since as long as population increases the number of real estate construction would also follow an upward trend within economy, in other words, the allocation of mortgage loans would be in high demand by people in a country experiencing a stable population growth. Consequently, there would be promising opportunities for securitizing assets backed by mortgage loans, and of course commercial banks or other financial institutions in emerging markets, is unlikely to run securitization process on their own, needless to say, by means of the Tashkent Stock Exchange, necessary measures could be taken to convert mortgage loans into securities like mortgage-backed securities.

In Uzbekistan, there have been made many contributions to advance capital market infrastructure for the purpose of improving the structure of the Tashkent Stock Exchange resulted in facilitating securities issuance by private and state-owned companies in Uzbekistan [1]. As the main topic of this article is to highlight future prosperity of

transforming banking loans such as mortgages into stable fixed-income sources. As a consequence, mortgage loans considered as a dependent variable (y), variation of this heavily relies on the movement of independent variables (x_1) interest rates, and (x_2) population growth. To be more precise, the research objectives are to identify the true relationship between dependent variable and independent variables, in accordance with the scope of the study two hypotheses developed: 1) Null Hypothesis (H_0) meaning there is no statistically significant relationship between mortgage loans (y) and interest rates (x_1), population growth (x_2) for last 20 years between 2004-2024; 2) Alternative Hypothesis (H_A) showing vice versa, there is a statistically significant relationship between mortgage loans (y) and interest rates (x_1), as well as population growth (x_2).

The research paper does consist of the following structures: introduction, literature review, research methodology, results and analyses, discussion, and last but not least conclusion.

Literature Review

First and foremost, it is important to disclose the crux of a securitization process to grasp the essence of its structure. Andreas Jobst (2008) securitization is the process in which certain types of assets are pooled so that they can be repackaged into interest-bearing securities. The interest and principal payments from the assets are passed through to the purchasers of the securities [2]. A mortgage-backed security is a type of investment that is backed by a pool of underlying mortgages. As homeowners make their monthly mortgage payments, those payments are passed on to holders of mortgage-backed securities [3]. The mortgage-backed securities (MBS) market emerged as a way to decouple mortgage lending from mortgage investing. Securitization today allows these mortgages to be held and traded by investors all over the world, and the US MBS market is one of the largest and most liquid global fixed-income markets, with more than $11 trillion of securities outstanding and nearly $300 billion in average daily trading volume [4]. Maggio et al. (2017) the market for mortgage rates is often influenced by variations in interest rate, a decline in interest rates leads to lower mortgage rates especially for adjustable-rate mortgages [5]. Payne (2006) there is a causality between the federal funds rate and fixed mortgage rate which is unidirectional [6]. There is a great concern about the impact of prepayment and default risk on mortgage rates in three different interest rate environments: (a) low current interest rates which are expected to go up in the future; (b) high current interest rates which are expected to decrease in the future, and; (c) interest rates at the long term mean level [7].

Moreover, Becker et al. (2012) the pass-through of the official interest rate to the money market rate and then another pass-through from the market rate to the mortgage rate. Thus, the investigation of interest rate shocks, induced by monetary policy, which are transmitted to the mortgage rate and use the series measured at the end of month from the period 1995 to 2008. The analysis used a model with single equation and weak exogeneity as an assumption. Official interest rate is proxied by LIBOR whereas mortgage rate is also taken account of in the analysis [8]. Tashkent State University of Economics (2023) It should be noted that, although there was an increase in mortgages in 2021, as a result of structural changes, the demand for mortgages remains high, primarily due to the following factors: a robust growth of economic indicators (compared to the corresponding period of the previous year, there was an increase in GDP by 7.4 %, GDP per capita by 5.3 % and fixed asset investments by 5.2 %); robust growth of the population (as of January 1, 2022, the population was 35.2 million people, which is equal to 102.1 % compared to the same period of the previous year); increase in the proportion of entities engaged in construction activities in economic sectors as a result of increased investment activity in the country [9]. The relationship between population and housing is two-sided. On the one hand, population change leads to a changing demand for housing. Population growth, and particularly a growth in the number of households, leads to a growth in housing demand [10]. The advancement in the Tashkent Stock Exchange infrastructure by

active government support initiatives, in particular, launching regulatory sandbox to run innovations and new financial securities by means of tax incentives for investors which facilitate placing mortgage-backed securities [11].

2. Materials and Methods

Research Design and Research Approach

The research design is longitudinal due to covering 20 years of observations in three variables since the research object is to identify the true relationship between dependent and independent variables. The research variables are the followings:

- Interest rates variation for the last 20 years (2004-2024) = (X_1)
- Population growth for the last 20 years (2004-2024) = (X_2)
- Allocated mortgage loans for the last 20 years (2004-2024) = (Y)

Data collection method

Mainly primary sources of data collection method have been applied, such as the results of analyses, and some secondary sources of information gathered from the Central Bank of Uzbekistan (www.cbu.uz) a change in interest rate for the last 20 years.

Statistical software and statistical models

The statistical software of Stata used to develop the outcome of statistical models such as Ordinary least squares (OLS), Correlation matrix (CM), Scatter graphic matrix (SGM), and last but not least Graphical histogram as well as matrix.

3. Result

First and foremost is the Linear Regression used to predict the value of variable based on the value another variable, the relationship between Y and X_1, X_2

Source	SS	df	MS	Number of obs	=	14
				F(2, 11)	=	57.64
Model	485.796285	2	242.898143	Prob > F	=	0.0000
Residual	46.3522362	11	4.21383966	R-squared	=	0.9129
				Adj R-squared	=	0.8971
Total	532.148521	13	40.9345016	Root MSE	=	2.0528

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
x1	.2679006	.2278001	1.18	0.264	-.2334841	.7692853
x2	2.379383	.2288033	10.40	0.000	1.87579	2.882976
_cons	-75.05947	7.773388	-9.66	0.000	-92.16858	-57.95035

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

Where:

- y = Mortgage loans;
- x_1 = Interest rates;
- x_2 = Population growth

Interpretation of Linear Regression Model Output

As it is visible from the linear regression model indicating relationship between response variable (y) as well as explanatory variables (x_1; x_2). In general, there are four the most significant components that should be disclosed so that to grasp the correlation between the movements of dependent variable (y) and independent variables (x_1; x_2). Firstly, it is Coefficient of Determination (Coef.) that shows the portion of the total variation in the response variable (y) explained by covariates (x_1; x_2), in simple terms, one unit change in (x_1; x_2) causes with x unit change in (y). According to model, it is obvious that if x_2 increases to 1%, then y would rise to 2.4 %, but regarding a growth of x_1 to 1% would result in 0.3% rise in y. In other words, there is a strong correlation between y (mortgage loans) and x_2 (population growth) thus if population grows to 1%, and that would cause 2.4% increase of mortgage loans allocation, while the observation depicts that there is a weak correlation between y (mortgage loans) as well as x_1 (interest rate) consequently as long as interest rate reaches 1% it would lead to the allocation of mortgage loans rise by 0.3%.

Second is a standard error (Std.Err.) does play key role in determining whether there is a true relationship between y and x in the population. In this work, it is certain that there is a positive relationship between (y) and (x_1; x_2) accounting for .2278001 and .2288033 respectively. In greater detail, there is an alternative hypothesis (H_A) between (y) mortgage loans as well as (x_1) interest rates, (x_2) population growth in turn. Meanwhile, regarding t-value component, it can be seen that there is an alternative hypothesis (H_A) or a statistically significant relationship between (y) mortgage loans and (x_2) population growth being 10.4 which is considerably higher than 1.96 to prove 95% confidence. On the other hand, the result for (y) and (x_1) shows a null hypothesis (H_0), to put it another way, there is no statistically significant relationship between (y) mortgage loans as well as (x_1) interest rates made up 1.18 which is less than 1.96, briefly the outcome disproves 95% confidence.

Last but not least, there is one more component that makes pay attention to which is probability value or $P > |t|$ two tailed p-values that test the hypothesis that each coefficient is different from zero 0. Based on the theory, we need to have p-value less than 0.05 in order to prove a statistically significant relationship or an alternative hypothesis (H_A) between x (independent variable) and y (dependent variable). However, the outcome of p-value does unveil that there is a null hypothesis (H_0) between (y) mortgage loans as well as (x_1) interest rates since relied on data p-value of (y) and (x_1) is 0.264 which is greater than 0.05 coefficient. On the other hand, it is visible that a dependent variable (y) and independent variable (x_2) do appear to have an alternative hypothesis (H_A) or a statistically significant relationship exists among them constituted 0.000 which implies high significance.

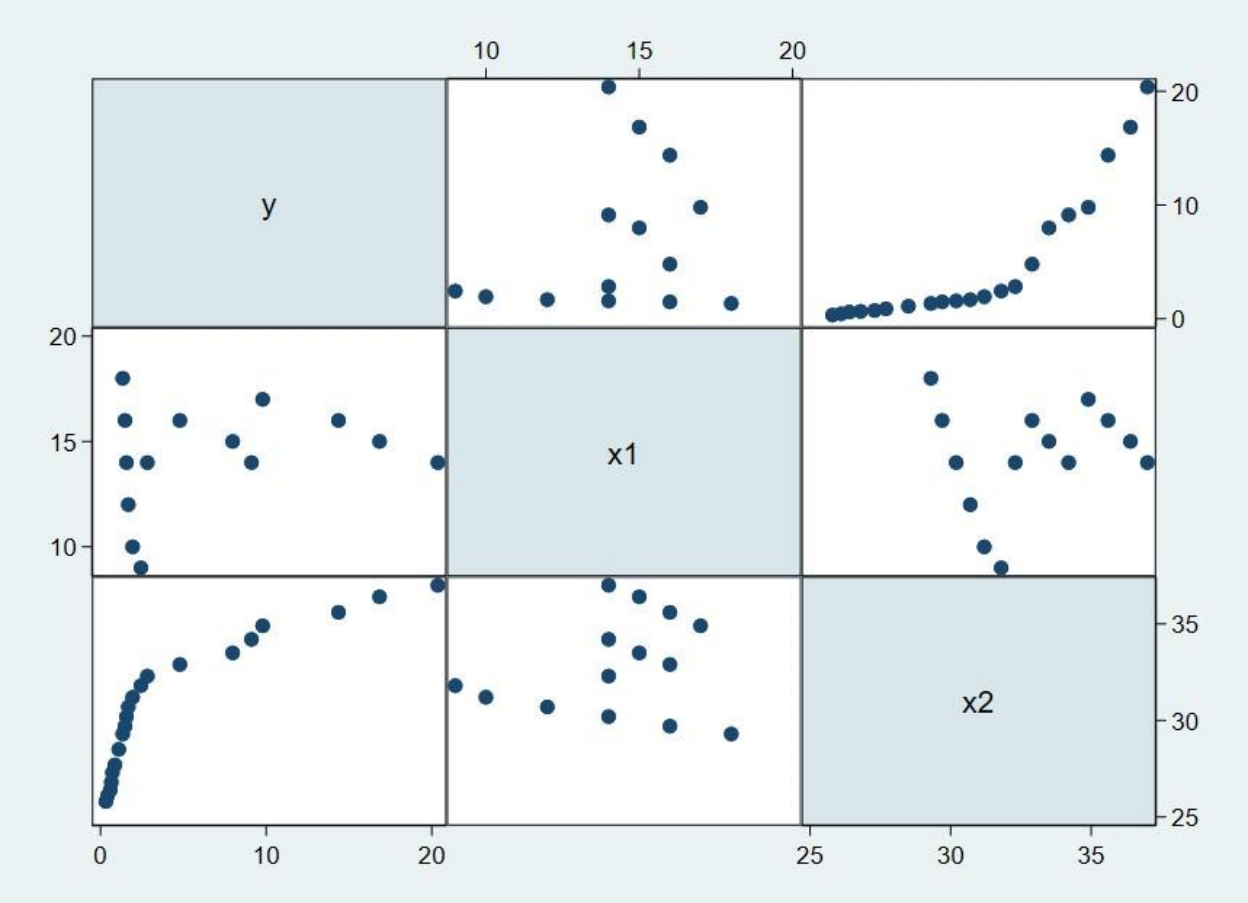
In conclusion, four components of linear regression model demonstrate an alternative hypothesis (H_A) between (y) dependent variable and (x_2) independent variable meaning population growth highly influence mortgage loans allocation rather than interest rates variation.

Next is the correlation matrix showing the correlation coefficients between two variables to measure how strong and in which direction they (variables) are linked in a straight line.

	y	x1	x2
y	1.0000		
x1	0.2378	1.0000	
x2	0.8797	0.1413	1.0000

In the correlation matrix analysis, it is clear to note that there is no correlation at all between (y) dependent variable as well as (x_1; x_2) independent variables. However, a correlation between dependent variable (y) and independent variable (x_2), amounting to 0.8797 ≈ 0.9, which is more than the coefficient of correlation between (y) and (x_1) made up 0.2378 ≈ 0.2. That is to say, there is more probable true relationship between (y) mortgage loans as well as (x_2) population growth rather than the correlation between (y) mortgage loans and (x_1) interest rates.

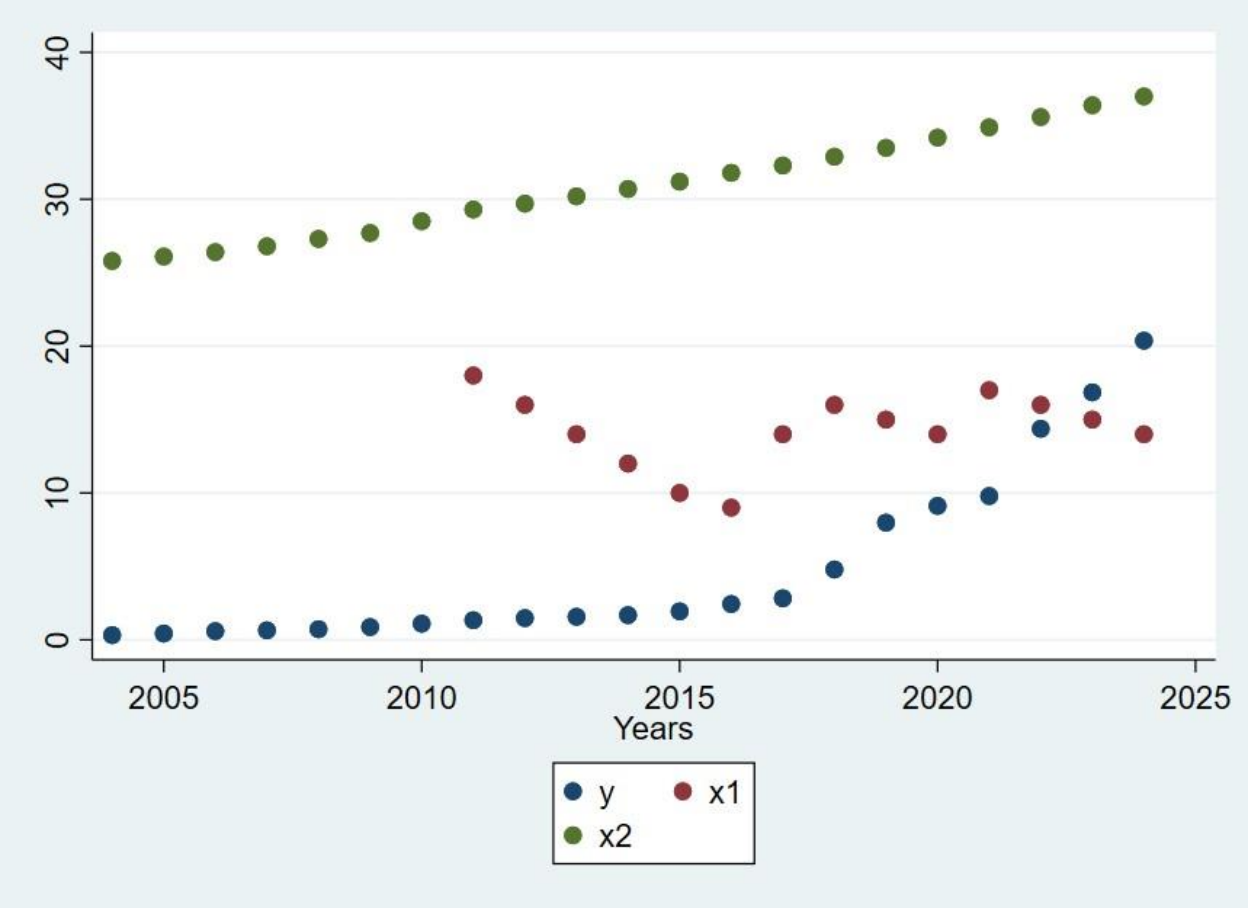
The third is a scatter plot matrix used to visualize bivariate relationships between combinations of variables. This graphic, in essence, explores cross- correlations among response variable (y) and explanatory variables (x_1; x_2). As mentioned above, dependent variable (y) is mortgage loans; independent variable (x_1) is interest rates; and a second independent variable (x_2) remained population growth. There is a below illustrated scatter plot matrix with detailed interpretation.



The interpretation of the scatter plot matrix

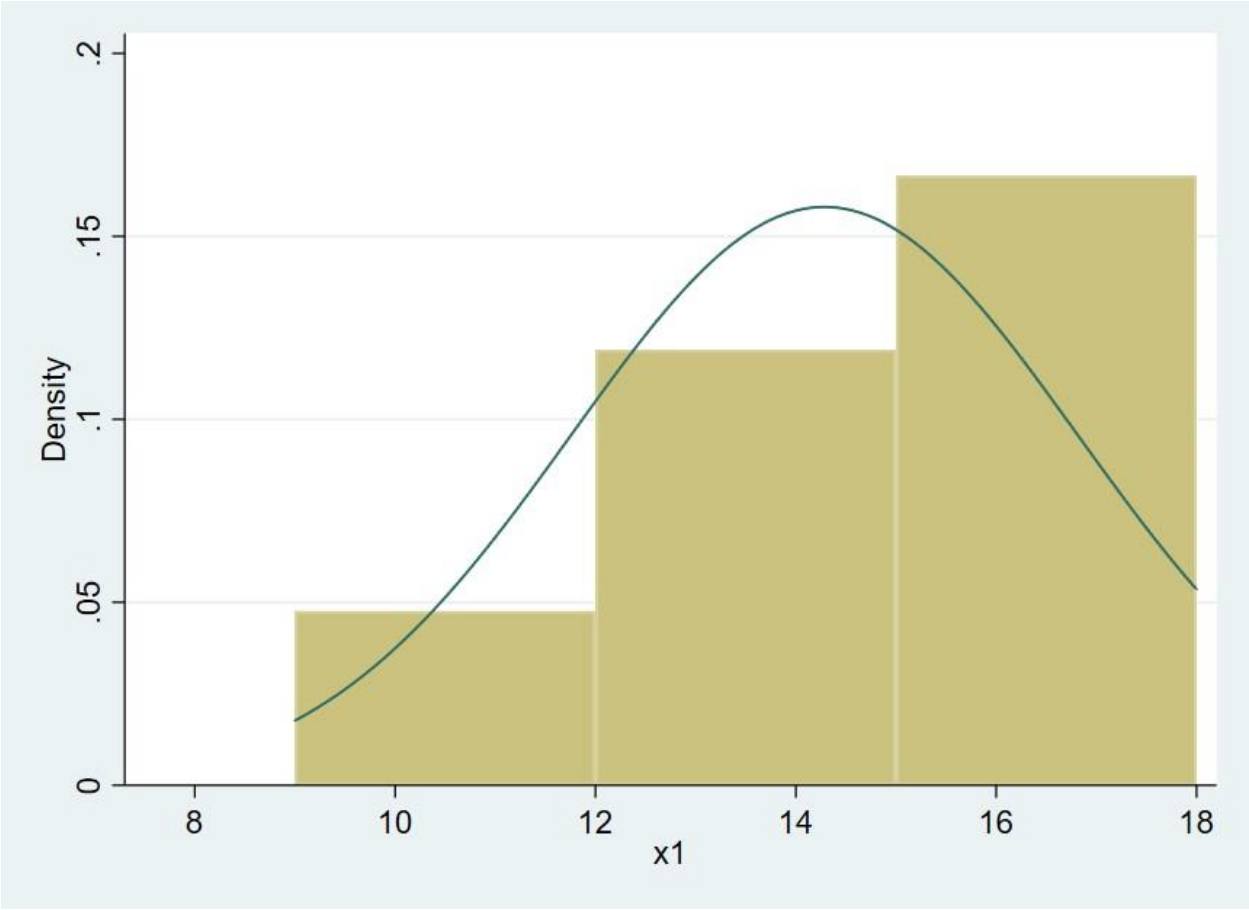
In the first column (y) dependent variable mortgage loans is x-axis, in the second column (x1 or x_1) independent variable interest rates is x-axis and in the last third column (x2 or x_2) population growth is x-axis. Overall, it can be seen that there is a cross-correlation between (y) which is mortgage loans, as well as (x_2) population growth. In other words, in the first column, it is clear that an increase of mortgage loans (y) causes a growth of population (x_2), simultaneously there is a similar trend in the third column where population growth (x_2), results in hiking mortgage loans allocation (y). However, cross-correlation does not exist among mortgage loans (y) and interest rates (x_1), even it is obvious from matrix that no matter how far independent variable (x_1) varies, there would be less effect on mortgage loans allocation (y) being dependent variable. The same is true for (y) mortgage loans in the first column, it is less likely correlated with (x_1) interest rates. In all, based on the scatter plot matrix, there is a cross-correlation between (y) and (x_2). To be more precise, an alternative hypothesis (H_A) exists between mortgage loans and population growth.

The fourth is the Two-way (scatter by years) representing how each variable has changed within 20 years from 2004 to 2024.

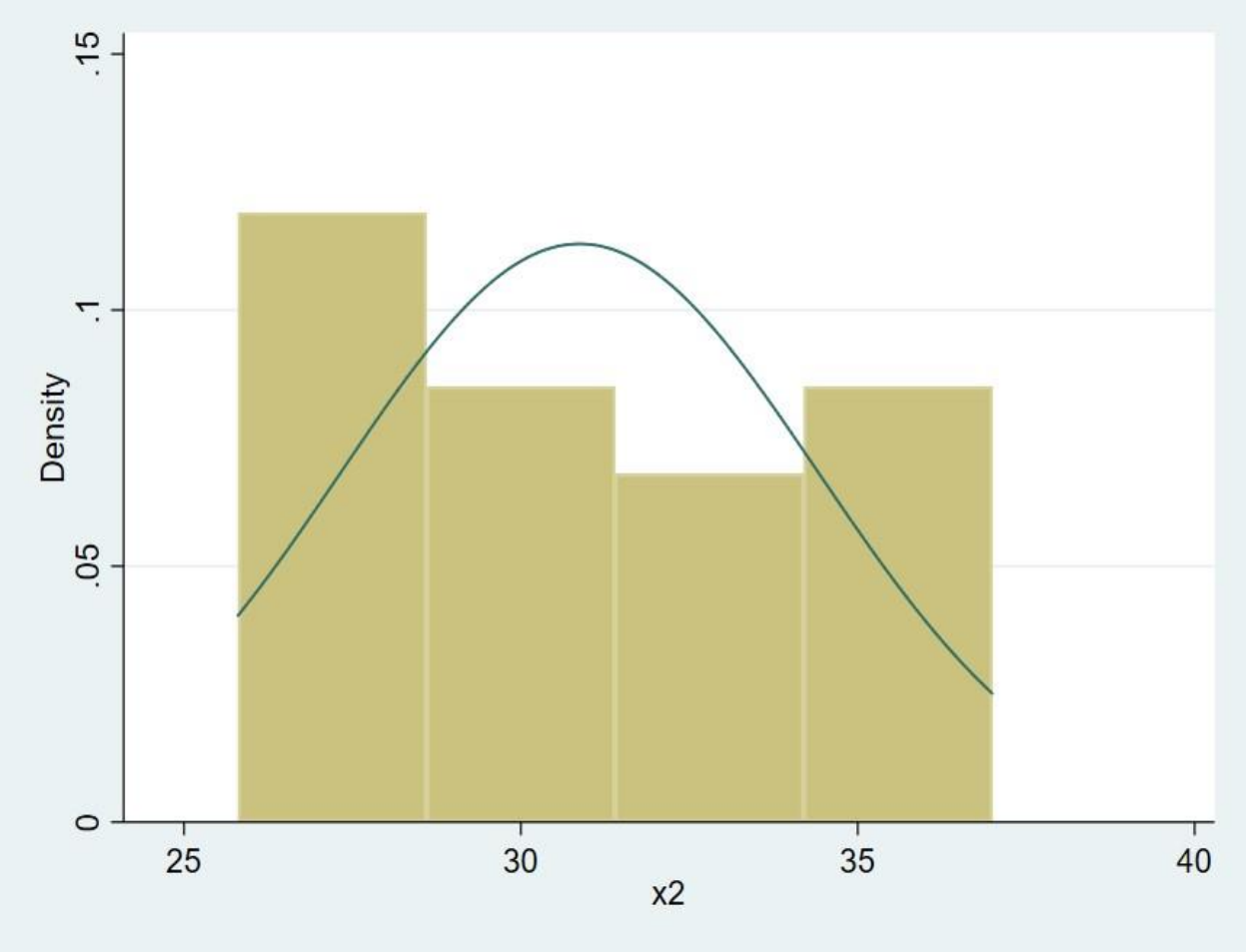


According to the graph above, a dependent variable (y) which is mortgage loans, has commenced to grow remarkably since 2017 made up 2,83 trillion sums of allocated mortgage loans, by the first half of 2024, this amount rocketed exactly 10 times accounting for 20,37 trillion sums of allocated mortgage loans in Uzbekistan and this upward trend is expected to continue in 2025, regardless of volatility in the interest rates (x_1). Meanwhile, the population growth does appear to have risen gradually indicating similar positive move as a dependent variable (y) does, in addition, independent variable (x_2) is anticipated to climb in 2025, which means that it would result in an alternative hypothesis (H_A) in dependent variable (y) or would lead to lift mortgage loans allocation in Uzbekistan.

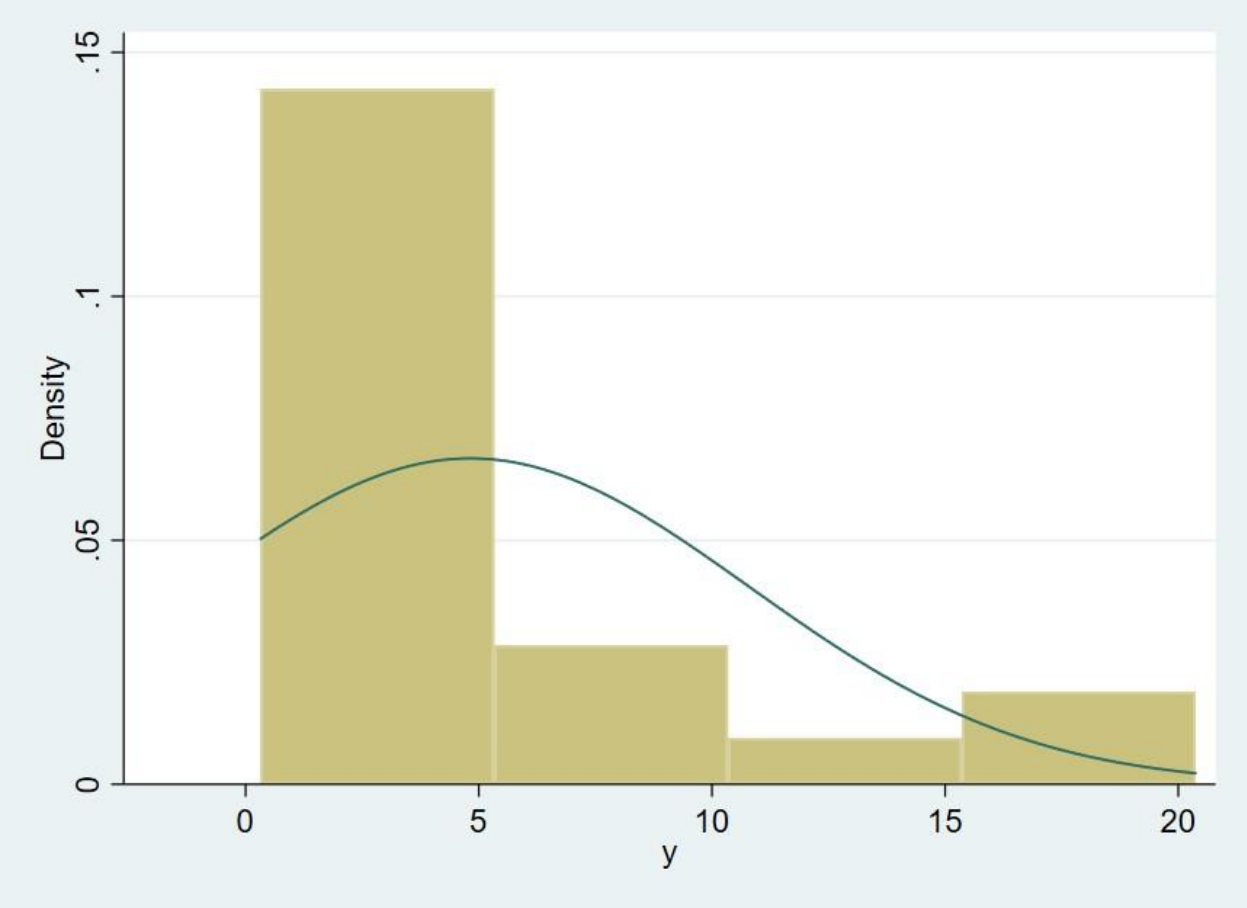
Last but not least, there is one more tool being used in order to analyze density of each variable separately in the given PhD thesis, and it is a graphical histogram bar which does visualize a representation of the distribution of data, to be more precise, higher bars in the histogram signify a greater concentration of data points within that interval, whereas lower bars indicate a lower density of data points in that range.



First and foremost, there is a graphical histogram bar of the independent variable (x_1) which is the interest rates within last 20 years (2004-2024). As it can be seen that there is the highest level of density in 14% translating into above [12]. 15 percentage or (0.15%). In other words, interest rates have been adjusted to 140 basis points more frequently than the rest of basis points within last 20 years between 2004-2024, whereas, the least prevalent fixed rates were 90 basis points and 180 basis points, making up 0.02% of density level as well as 0.06% of density level respectively. In greater detail, for last 20 years interest rates reached only once 9%, and 18% in turn, forecasting a less probability of the interest rates variation toward being mentioned basis points in the near future. Briefly, it does depict a stability in monthly payments of financial products adjusted by interest rates such as mortgages [13].



The second is a population growth which is an independent variable (x_2), consequently this histogram represents a density level in covariate (x_2) resulting in the highest level of density between 30 million as well as 32 million by reaching .12 density level being 0.12%. As it was mentioned in previous graphs, there is a true positive relationship or an alternative hypothesis between regressor (x_2) and regressand (y). While, according to the histogram above, approximately 37 million appears to have the lowest density level recording .05 density units or 0.05%, following there could be seen a similar pattern in 26 million that accounts for nearly [14]. 04 density units which is equal to 0.04%. In general, based on the histogram, a stable pace of population growth is expected to slow down in the near future, which would adversely affect (y) dependent variable mortgage loans' growth, but it does not connote the outcome of this prediction would occur surely [15].



Finally, there is a graphical histogram of dependent variable (y) which is mortgage loans. Overall, it is obvious that a 5 trillion sum mortgage loan allocation reaches the highest density level substituting more than .05 units or 0.05%, whereas the lowest unit of density level found in a 20 trillion sum mortgage loan allocation being nearly 0 unit. However, as this research method (graphical histogram) conducted apart, in other words, all variables have been visualized separately, the research outcome would not prove that a response variable (y = mortgage loans) is anticipated to experience with downward trend in the near future [16].

4. Discussion

According to the study, it is evident that one unit change in (x_1; x_2) causes with x unit change in (y). If x_2 increases to 1%, then y would rise to 2.4 %, but regarding a growth of x_1 to 1% would result in 0.3% rise in y [17]. In other words, there is a strong correlation between y (mortgage loans) and x_2 (population growth) thus if population grows to 1%, and that would cause 2.4% increase of mortgage loans allocation, while the observation depicts that there is a weak correlation between y (mortgage loans) as well as x_1 (interest rate) consequently as long as interest rate reaches 1% it would lead to the allocation of mortgage loans rise by 0.3% [18].

5. Conclusion

In conclusion, two out of three econometric tools do represent true relationship between independent variable (x_2) and dependent variable (y), in greater detail [19], there is an alternative hypothesis (H_A) between population growth (x_2), as well as mortgage loans (y) since as long as number of population is growing, the similar upward trend would be seen in the allocation of mortgage loans regardless of the interest rates variation

in Uzbekistan translating into a high potential of securitization process, in simple terms, now based on the econometric analyses, it is noteworthy that a creation of mortgage-backed securities could open new ways of fund raising for commercial banks to finance mortgage loans [20].

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