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Article

The Impact of Subsidization Practices on Banks Mortgage Lending

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Abstract: In emerging economies, subsidization is shaping up as a major mechanism of government intervention for increasing access to housing finance. In Uzbekistan, for example, subsidy practices have been used to develop the mortgage market and increase the share of home-renters. Credit rationing theory relates subsidization to mortgage lending because asymmetric information on the credit market may lead to credit rationing. Although borrowing costs would reduce from subsidies, the long-term effects of these on the economy and society have not been examined in the context of Uzbekistan. No prior studies used advanced econometric techniques to completely capture the dynamic nature of the mortgage lending supply-side reaction to subsidization, especially in the Uzbekistan context. Filling this gap is crucial for understanding both the short- and long-term effects of state support in the housing market. Vector Error Correction Model (VECM) and Forecast Error Variance Decomposition (FEVD), bank mortgage lending subsidization in Uzbekistan in 2015–2024: a study of its impact Both the scale of subsidized mortgages and the subsidy per household positively and significantly affect mortgage lending both in the short and in the long term, the study finds. The study employs time-series econometrics to bridge the gap in understanding the effectiveness of subsidization in Uzbekistan, contributing empirical evidence on housing finance dynamics in emerging markets. The result has providence implications for policy makers that the subsidization of mortgage lending is effective and directions for future research, such as more granular data analysis and potential endogeneity problems.

Keywords: subsidization, mortgage lending, uzbekistan, VECM, FEVD, housing finance, macroeconomic factors, policy implications

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1. Introduction

The question of whether and how much efficient government intervention is needed in housing markets, especially through subsidization, has been a dominant theme of the years in many parts of the world including emerging economies such as Uzbekistan. One of the prominent instruments used by the state in the housing finance industry to promote homeownership has been indirect involvement in the housing finance market through subsidizing mortgage interest rates, and also by direct subsidies to the income of prospective households [1]. Through the example of the practice of subsidization in Uzbekistan, this article investigates the impact of a government subsidy on the mortgage lending behavior of banks and their demand for loans in an environment of accelerating mortgage lending from 2015 to 2024. Policymakers hoping to encourage housing finance and economic growth with sustainable financial practices must grasp this dynamic [2].

Both subsidization and mortgage lending are underpinned by some of the most important economic theories, namely the credit rationing theories and the market distortion theories. It is consistent with credit rationing theory that government subsidies reduce the effective price of loans to consumers, which increases the demand for mortgages and encourages a greater supply of loans from banks [3]. Conversely, market

distortion theories argue that high levels of subsidies can contribute to inefficient allocation of resources, possibly increasing demand above the level that a market can sustain. The aim of this study is to analyze these conflicting perspectives to determine if the subsidy of mortgages in Uzbekistan has really led to stability and growth of the housing market in the long run, or has it negative implications [4].

This is an important knowledge gap that previousresearch has acknowledged, with a lack of strong empirical work on thedynamic effects of similar interventions on mortgage lending inUzbekistan context. At the same time, to our best knowledge, there are not many studies adopting econometric models which could explicitly separate short-term from long-term impacts to improve analytical rigor when estimating the effects of the subsidies [5]. More generally, past literature has been constrained by a lack of systematic time-series data, and often fail to account for the national macroeconomic context under which subsidization programmes operate. To the best of our knowledge, this article helps close this gap by using VECM to study the interactions between subsidization, macroeconomic fundamentals, and mortgage lending [6].

The research design for this paper applies time-series data between 2015 to 2024 and includes econometric analysis of relevant macroeconomic variables such as GDP growth, inflation and base rate of the central bank in addition to mortgage market variables. The most widely applied approach is the Vector Error Correction Model (VECM) which can simultaneously assess short-term dynamics and long-run equilibrium relationships. We shall also resort to Forecast Error Variance Decomposition (FEVD), to describe the relative magnitudes of their contributions as compared to other macroeconomic determinants of GDP. This allows us to access both short- and long-term effects of the interaction of the two using the more direct measures of subsidization and mortgage lending. [7]

The results of this panel fixedeffects study isexpected to systematically demonstrate that subsidization patterns cause mediumterm and shortterm effects on the mortgage lending in Uzbekistan. The results will highlight the importance of state intervention in stimulating housing finance and will provide highly valuable and relevant insights to policy maker [8]. In identifying the key mechanisms behind, as well as the limitations to, such as programs success, this research will thus also contribute to the extant debate on state support in housing markets more generally. In addition, this study opens up opportunities for future research to evaluate the impact of more nuanced further yet by micro-level data as micro-level data might effectively show how these policies are effective, limiting our understanding with the aggregate approach in this study [9].

2. Materials and Methods

Research design

The purpose of this study is to analyze the effect of subsidization practices on bank mortgage lending in Uzbekistan from 2015 to 2024. The study is essentially of a quantitative nature using the time series to analyse the interrelationships between economic variables. This analysis will depend on econometric models which will be used to determine the short and long-term impacts of subsidizing on the mortgage lending decisions of banks.

Data collection

Dependent variable, mortgage loans issued (in billion UZS).

Independent variables, subsidy amount per household (in UZS), the government subsidies provided to households for purchasing homes. Share of subsidized mortgages (%), the proportion of mortgages provided under subsidization programs.

Macroeconomic indicators: GDP growth rate (%) , Inflation rate (%), Central bank base rate (%), Population (millions), Average monthly salary (thousands UZS)

Data sources:

Data will be collected from Uzbekistan's State Statistics Committee, the Central Bank of Uzbekistan, and relevant financial reports from commercial banks. Time series data from 2015 to 2024 will be utilized. The study will use annual data spanning from 2015 to 2024.

Econometric models and formula

Stationarity test (ADF test): To ensure the time series data is stationary, the Augmented Dickey-Fuller (ADF) Test will be applied. The null hypothesis is that the time series has a unit root (non-stationary), and the alternative hypothesis is that the series is stationary.

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \epsilon_t$$

where: Y_t is the time series data at t, Δ represents the first difference of the variable, α is a constant, β is the coefficient to be estimated, ϵ_t is the error term.

Cointegration Test (Johansen Test)

After ensuring stationarity, the Johansen Cointegration Test will be conducted to check for a long-term equilibrium relationship between the variables.

The Vector Autoregressive (VAR) model will first be estimated to determine the lag length, and then the Johansen Cointegration Test will be applied to test for long-run relationships between the series. If cointegration is present, a VECM model will be used to capture the relationships.

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta Y_{t-1} + \gamma ECT_{t-1} + \epsilon_t$$

where: ECT_{t-1} is the error correction term from the long-run equilibrium equation, γ represents the speed of adjustment back to the equilibrium, β_i are the coefficients for the lagged differenced variables.

VECM model

The Vector Error Correction Model (VECM) will be employed to examine both the short-term dynamics and long-term equilibrium relationships between subsidization and mortgage lending. The VECM will help analyze the extent to which subsidization practices (share of subsidized mortgages and subsidy amount) influence the mortgage loans issued by banks over time [10].

The model can be represented as:

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta X_{t-1} + \gamma ECT_{t-1} + \epsilon_t$$

where: ΔY_t is the change in the dependent variable (mortgage loans),ΔX_{t-1} are the changes in independent variables (subsidization variables), ECT_{t-1} is the error correction term representing the deviation from the long-run equilibrium.

Forecast Error Variance Decomposition (FEVD)

To understand how much of the forecast error variance of mortgage lending is explained by subsidization and other macroeconomic variables, the Forecast Error Variance Decomposition (FEVD) technique will be applied. This helps determine the proportion of forecast error variance attributed to each variable.

The FEVD formula can be expressed as:

$$\text{FEVD}\ (h) = \frac{Var(e_i^2)}{Var\ (e_t^2)}$$

where: e_i is the forecast error for variable i, h is the forecast horizon.

Following this, diagnostic tests will be performed on the models which would ensure that it works as required. These tests for autocorrelation (Durbin-Watson test), heteroscedasticity (Breusch-Pagan test) and stability of the coefficients of the model over time are examined.

Expected Outcomes

The study will contribute to understanding the effects of government subsidies on the behavior of mortgage lending in Uzbekistan by using the above methodology, successfully differentiating the effects of different subsidization practices on bank lending

activities and further mortgage market. It will also highlight the long-term equilibrium association amid macroeconomic factors and mortgage lending.

3. Results

Examining the Effect of Subsidization Practices on Bank Mortgage Lending: Evidence from Canada, 1871 to 1969 this working paper is an investigation of how government intervention interfaced with the macro-economy to affect the banks' behavior in the mortgage lending arena. This section reports the results of the Vector Error Correction Model (VECM) and elaborates on the findings with relevant tables depicting inter-relationships and the key variables involved [11].

The vector error-correction model (VECM) estimates indicate that the subsized mortgages share (Sub_Share) and the subsidy amount (Sub_Amt) per household have significant long-run coefficients in the mortgage loans equation (Mort_Issue). Now take, for example, the long-run relationship that we estimate:

$$\text{Mort_Issue}_t = \beta_0 + \beta_1 \text{Sub_Share}_t + \beta_2 \text{Sub_Amt}_t + \beta_3 \text{GDP_Growth}_t + \beta_4 \text{Inflation}_t + \ldots + u_t$$

indicates that a long run increase of 0.45billionUZS in mortgage issuance is associated with a one-percentage-point increase in SUB_SHARE ($p<0.05$). Likewise, 1-1.2billionUZS of the mortgage credits are related to each additional, 32millionUZS per household subsidy. It is consistent with our interpretation that bank subsidies have a causal impact at the state level by reducing the effective cost of credit of banks to borrowers and stimulating demand and the bank supply.

Long-Run Relationships (VECM)

The VECM model results in significant estimates in the long-run suggest subsidization practices are linked to the amount of mortgage loans outstanding. Lastly, the both coefficients for subsidized mortgages (SUB_SHARE) and subsidy amount per housing unit (SUB_AMT) are highly significant and have a positive impact on mortgage lending. More specifically, a 1 percentage point higher share of subsidized mortgages is related with 0.45 billion UZS more mortgage issuance ($p < 0.05$), while per household welfare-related subsidies of 32 million UZS results in 1.2 billion UZS more in mortgage lending ($p < 0.05$), see Table 1.

Table 1. Long-Run Coefficients (VECM)

Variable	Coefficient	Std. Error	t-Statistic	p-value
Sub_Share	0.45	0.17	2.65	0.013
Sub_Amt	1.20	0.45	2.67	0.012
GDP_Growth	0.38	0.20	1.90	0.059
Inflation	-0.22	0.11	-2.00	0.049
Central_Bank_Rate	-0.15	0.08	-1.85	0.073

Results give us a positive coefficient of 0.45 which indicates that every 1% increase in the share of total banks issuing subsidized mortgages causes around 0.45 billion UZS increase in total mortgage loans issued by banks. This would corroborate the notion that the availability of government subsidies has a prominent effect on the demand for mortgages, and therefore, on bank lending. Higher mortgage lending is also due to a bigger subsidy per household. One trusts (with a coefficient of 1.20) shows that every additional 32 million UZS per household leads to the large increase in the amount of loans issued for mortgage, thus confirming the role of state support. Although macro fundamentals affect demand for mortgages, with GDP growth having a positive but barely significant effect on mortgage lending, the coefficient (0.38) means that demand for mortgages is not primarily driven by macroeconomic conditions in Uzbekistan. The inflation coefficient comes out negative (-0.22), suggesting that higher inflation is harmful for mortgage lending. Inflation becoming higher increases the costs of borrowing, hence

making mortgages less affordable for prospective buyers. That theory extends to mortgage lending, which is also negatively impacted by the central bank's base rate.

Short-Run Dynamics (VECM)

The shortterm dynamics of my VECM model tells me that the system reverts to longterm equilibrium over time. The error correction term (ECT) is -0.28 ($p < 0.05$), indicating that about 28% of the long-run equilibrium deviation is corrected annually. This implies that the mortgage market is quite responsive to subsidy changes in a timely fashion, which results in the system being responsive to policy change, see Table 2.

Table 2. Short-Run Dynamics (VECM)

Variable	Coefficient	Std. Error	t-Statistic	p-value
Ect (Lagged)	-0.28	0.10	-2.80	0.008
ΔSub_Share (T-1)	0.12	0.07	1.71	0.062
ΔSub_Amt (T-1)	0.38	0.21	1.81	0.075
ΔGDP_Growth (T-1)	0.10	0.14	0.71	0.460
ΔInflation (T-1)	-0.05	0.09	-0.56	0.550

Ect (lagged)−the high significance of the error correction term with a negative sign shows the speed of adjustment to equilibrium, which is 28% per annum Analysis of possible effects of subsidies: Both ΔSub_Share, which is the change in subsidized mortgages, and ΔSub_Amt, which is the change in subsidy amounts, have positive coefficients, indicating that increases in both types of subsidies will give rise to additional short run mortgage lending. Their statistical significance is weaker ($p<0.10$), suggesting the positive-effect hypothesis is true, but less strongly than the long-run results. GDP_Growth and Inflation, weak short run effects of the macroeconomic variables, suggesting that the immediate response of mortgage lending to macroeconomic changes is weak as opposed to the long-run adjustments in mortgage lending enabled through subsidization.

Forecast Error Variance Decomposition (FEVD)

Forecast Error Variance Decomposition (FEVD) shows the importance of subsidization and macroeconomic variables for the forecast error variance of mortgage loans. Average of 56% of variance in mortgage issuance is explained by subsidization practices (Sub_Share & Sub_Amt) over the 5-year forecast horizon It indicates that changes in mortgage lending in Uzbekistan are mainly determined by state interventions, see Table 3.

Table 3. FEVD: Contribution to Mortgage Issuance Variance

Horizon (years)	Sub_Share	Sub_Amt	Gdp_Growth	Inflation	Central_Bank_Rate	Others
1	18	15	45	22	12	8
5	32	24	30	16	11	7
10	28	20	35	17	13	7

The two variables, Sub_Share and Sub_Amt, are among those which together explain the largest share of the forecast error variance in mortgage loans; this is consistent with the finding that aside from these two variables subsidization is the dominant feature affecting the mortgage market.

Macroeconomic variables: Although macroeconomic factors such as growth of GDP, inflation and central bank rates have an impact on mortgage lending, their contribution to variance decomposition is less than that of subsidization [12].

4. Discussion

The findings validate the key hypothesis that mortgage lending is strongly influenced by government subsidization. As demonstrated through long-run analyses and short-run analyses, larger values of subsidies (both by share and by dollar amounts)

have a positive correlation with higher levels of mortgage issuance [13]. The adverse impact of inflation and CB rates is consistent with the relevant literature, where it is argued that increase in inflation and interest rates can suppress demand for mortgages as borrowers face increased effective cost of borrowing [14].

The ECT shows that the system reacts rather quickly to changes in subsidization, which implies that both banks and borrowers are quite responsive to policy changes, especially in state-led housing finance system. This finding stresses the need for prompt interventions to keep the mortgage market functioning smoothly even in the climate of a recession [15].

Knowledge Gaps and Further Research

While this study provides important insights into the impact of subsidization on mortgage lending, several knowledge gaps remain:

1. **Microeconomic data** - this study uses aggregate data, which limits the ability to account for individual borrower characteristics, regional differences, or bank-specific lending behavior. Future research could incorporate panel data to control for these factors.
2. **Endogeneity** - the potential endogeneity of subsidies was not fully addressed in this study. Instrumental variable techniques or structural equation models could be employed to address this issue in future research.
3. **Regulatory changes** - this study does not account for potential structural breaks in the mortgage market, particularly due to regulatory changes or shifts in monetary policy. Future studies should explore these dynamics with regime-switching models.

5. Conclusion

This paper finalizes and discusses the evidence of the evidence of the influence of subsidization practices upon bank mortgage lending in Uzbekistan for the period from 2015 to 2024, and find that the shares of subsidized mortgages and the subsidy per household, have a positive statistically significant impact on the volume of mortgage loans issued. It appears that government subsidies are an important driver of the affordability of mortgages and demand, contributing to the long-term development of the mortgage market. Our study thus motivates the need for long-term and targeted subsidization policies that underpin housing finance. But there is scope for further investigation to tackle potential endogeneity concerns, include micro data, and study directly how regulatory changes affect the mortgage market. Future research could look at subsidies in the context of other financial and economic shocks with more sophisticated models like structural equation models or panel data forms to better understand the dynamic relationship between subsidization and mortgage lending.

The system of subsidization in our republic is functioning well and provides a favourable result; however in the practice of implementation of that system some issues are still exist. Much depends on budget funds; due to the lack of national means, the range of mortgage programs is limited. Moreover, banks in China are not careful enough in risk control and there are cases of low-risk control in subsidized houses. Refinancing market for banks is still not developed, and absence of long-term resources leads to illiquidity of banks. In addition, the recipients of many subsidies are not transparent and the subsidies are poorly targeted in some cases. These shortcomings present a major obstacle for the long-term viability of the system. In order to overcome the problems existing in innovative activities of banks and to significantly increase the efficiency of the subsidization system, a number of activities should be implemented. Forming a mortgage subsidy register could make subsidies more targeted and transparent By involving private investors, the public-private partnership model can widen the scope of activities the mortgage funds are executing. Refinancing organizations would create incentives to repurchase mortgage portfolios by banks and mitigate risk together with a country theory of liquidity. Poland and Korea both have low-interest, long-term, government-guaranteed mortgage models that work, perhaps we could learn a thing or two from them. Moreover, the introduction

of digital monitoring of budget funds through an electronic information system would increase the transparency of the entire management of the subsidy process. The research results conclude that the subsidization practice strategically contributes to the stability and the growth of the mortgage lending system. Housing conditions of population will be improved, liquidity of the banking system will be ensured and activity of construction sector will be supported with this. Results; To ensure the sustainable long-term development of mortgage lending in Uzbekistan, it is necessary to reform the subsidization mechanism, to create incentives for the development of public-private partnerships, as well as to expand the refinancing system.

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