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The Relationship between Oil Prices and Real Estate Loans and Mortgage Loans in Azerbaijan

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ABSTRACT

Azerbaijan is a major exporter of natural resources (oil). Improving the welfare of the population is a priority, as the driving force of the modern economy, including future economic progress, is the human factor, human capital, its science, knowledge, ability to use technology. Thus, at the current stage of Azerbaijan's economic development, the issue of social welfare, including housing, is one of the most important indicators of the sustainability of dynamic socio-economic development in the country in the long run. For this reason, the study of the issue of directing part of the oil capital to mortgage loans and real estate is urgent.Taking into account the dependence of oil revenues on world oil prices, the article examines the relationship between world oil prices in the Republic of Azerbaijan over the past 10 years (2010M01−2020M01) between mortgage loans and real estate loans. The ARDL model was used as a research model. In addition, stationary tests of variables (ADF, PP, KPSS) were performed and the Engle-Granger cointegration equation was evaluated using both FMOLS and DOLS, as well as CCR. The stability of the models was studied. EViews_9 econometric software was used for calculations and graphing.As a result of the analysis, it was theoretically determined that there is a certain positive correlation between world oil prices, mortgage loans and real estate loans. Our recommendation may be to accelerate the transfer of part of oil revenues to mortgage loans and real estate to improve housing.

Keywords: Oil Revenues, Oil Prices, Mortgages and Real Estate Loans, Housing Market, ARDL
JEL Classifications: E50, I39, P28, Q43, R21, R38

1. INTRODUCTION

Increasing housing opportunities for the Azerbaijani population will support economic development, further improve living standards, economic recovery and job creation, as well as further development of the mortgage and real estate markets. The formation and development of the mortgage market in modern times is the main direction of the social policy of each state. At the same time, the real estate market is one of the important indicators of the economy. In all countries, the construction sector is the most sensitive sector of the economy. For example, during the crisis, the negative situation first affects this area, and the real estate market begins to experience certain problems. However, the construction sector can show very good dynamics during the development period.

The economic conditions that have emerged in Azerbaijan since the early 2000s - the country's growing oil revenues, the macroeconomic and financial stability that has been formed and successfully maintained, have laid the groundwork for the development of the mortgage and real estate credit market. Thus, the rapid growth of incomes and purchasing power of the population, special funds in commercial banks have created opportunities for the issuance and use of mortgage and real estate loans. It is known that when oil prices fall, activity decreases in almost all sectors of the economy, and there is a serious stagnation in terms of supply and demand. This also applies to the real estate market (Hasanov et al., 2019). Thus, the construction boom in all oil-exporting countries usually occurs at a time when world market prices for "black gold" are always high. When the price of oil falls, construction works weaken and supply in this area immediately decreases. It is a fact that real estate markets around the world are inactive as economic activity related to oil declines. This situation is also specific to our country. It is known that the Azerbaijan Mortgage Fund (AMF) operating under the Central Bank of Azerbaijan (CBA) provdes ordinary mortgage loans with a maximum amount of 50,000 manat for a period of 25 years for 8 years, with an initial payment of 20 and a social (preferential) mortgage for 50,000 manat for 30 years. 4 per year for the term, and the initial payment is 15 percent. We are talking about a mortgage issued by the state. Concessional mortgage loans are financed from the state budget, while ordinary mortgages are repaid at the expense of the AMF, in other words, at the expense of funds raised through the issuance and placement of relevant bonds.

Mortgage lending in the country plays an important role in shaping prices in the housing market. In fact, the mortgage should serve the development of the construction sector and the state should control the real estate market through it. The construction sector in Azerbaijan is closely linked to the oil sector. Even the private construction sector worked at the expense of such budget money, and more funds diverted from investment projects were directed to construction. However, the peculiarity of the Azerbaijani economy is that it has no deep connection to the global financial and stock markets. In this sense, it is healthier and free from inflated price increases and "bubbles" (Mukhtarov et al., 2019).

Despite the threat of protectionism, the world is now returning to strict state control and economic planning. The Azerbaijani government, feeling that difficult times were about to begin, never let go of the steering wheel and tried to manually adjust macroeconomic balances from internal and external influences. In particular, whether at a time when export oil revenues are increasing, or when there are various restrictions on the distribution of budget funds within Azerbaijan, both between sectors of the economy and between regions. There is a certain correlation between rising oil revenues and sustainable economic growth (Muradov et al., 2019; Humbatova and Hajiyev, 2019). In general, in our opinion, although the current global financial and credit crisis has been analyzed in all cases, there is no denying that it will affect Azerbaijan. The most important proof of this is the report on the funds lost due to falling oil prices (Aliyev et al., 2019).

In modern times, the fall in oil prices due to the spread of the pandemic around the world and its impact on the economy has already begun to have its say in the market. In other words, there is a risk of repeating the scenarios that occurred during the economic crises of 2008 and 2014. The crisis of 2014 was marked by two sharp devaluations. However, the structure of the country's economy is different from 2008. At present, the role of the non-oil sector in the economy is greater, the volume of GDP, slightly different movements of oil prices and so on. Available (Humbatova et al., 2020). The special quarantine regime applied in the country has affected all areas, as well as the real estate market.

The decrease in oil prices in 2014-2015 had a negative impact on the macroeconomic performance of oil-exporting countries and their banking systems (Mukhtarov et al., 2019). Although the macroeconomic consequences of lower oil prices for oil-exporting countries have been well studied, the impact of oil prices on financial stability and the banking system has not received much attention (Jesus and Gabriel, 2006).

Since the 1970s, there has been a steady increase in oil prices: 1973/74 (Arab oil embargo), 1979/80s (Iranian revolution), 1990 (occupation of Kuwait), after 1999, Until the middle of 2003-2008 (Global Financial Crisis) and until 2009-2014. Steady declines in oil prices have been observed in recent years: in the early and mid-1980s, after the Asian financial crisis in 1991, and in late 2008 (Barsky and Kilian, 2002; 2004; Kilian, 2008).

2. LITERATURE REVIEW

2.1. Oil Prices and Key Macroeconomic Indicators

Oil is an important source of energy, important transport fuel and invaluable raw material in many industries. In addition, it has become the main object of international trade in the world (Bass, 2018). In general, there are three main reasons for changes in oil prices: oil demand, oil supply and speculation (Brevik and Kind, 2004).

Since the beginning of the twentieth century, the growth of demand for oil has been influenced by economic growth in the United States and the rapidly growing economies of Asian countries, especially China and India (Cleaver, 2007). Global shocks of aggregate demand in the global crude oil market have increased significantly in recent years (Kilian, 2009; Kilian et al., 2009; Kilian, 2010).

OPEC and contracts (OPEC +, OPEC ++) try to control energy supply and prices, manipulate resources and production. The diversity of stakeholders, such as oil companies, speculators and refineries, brings additional dynamics to the market. World events such as wars, revolutions and embargoes often affect crude oil prices. Based on these observations, it can be concluded that the price of crude oil has changed widely and chaotically (Alvarez-Ramirez et al., 2002).

At the same time, oil prices depend not only on supply and demand, but also on speculation and hedging, which lead to irrational changes in oil prices (Krichene, 2006; Federico et al., 2001; Eckaus, 2008).

The increase in the cost of raw materials by supply leads to inflation, especially in oil-importing countries (Özturk and Feridun, 2010; Habibullah, Mohamed et al., 2015; Al Rasasi and

Yilmaz, 2016). High levels of consumer prices (high inflation) lead to lower real incomes and domestic demand, higher unemployment (Hunt et al., 2001; Nordhaus, 2002; Abosedra and Baghestani, 2004), instability in the stock market, money market and foreign exchange market. causes (Krichene, 2008; Abhyankar et al., 2013; Agustiar, 2020).

2.2. Monetary Policy and Oil Prices

Monetary policy shocks do not necessarily occur in isolation from other shocks, and in some cases they respond to oil price shocks (Bernanke et al., 1997; Islam and Chowdhury, 2004; Islam and Watanapalachaikul, 2005; Hamilton and Herrera, 2004; Ozturk et al., 2008; Burakov, 2017; Omojolaibi, 2013; Kormilitsina, 2011). A decrease in the money supply can lead to a decrease in energy prices (Hammoudeh et al., 2015; Jawadi et al., 2016; Askari and Krichene, 2010; Hamilton, 2009; Ratti and Vespignani, 2014; Taghizadeh and Yoshino, 2013a; Taghizadeh and Yoshino, 2013b). Changes in monetary policy regimes were a major factor in the rise in oil prices in the 1970s (Barsky and Kilian, 2002; Kilian and Hicks, 2009). In 1960-2011 and 1980-2011, world demand for oil was severely affected by monetary policy regimes (Taghizadeh and Yoshino, 2014).

2.3. Monetary Policy and Property (Housing) Market

Although housing is generally one of the largest assets in a family's balance sheet, it has received limited attention (Emmons and Ricketts, 2017). However, there is little fundamental research. For example, Mian and Sufi (2009) attributed the rapid growth of credit in the United States in 2002-2007 compared to the last 25 years to a sharp rise in housing prices between 2002 and 2006 and the availability of soft mortgages. Granville and Mallick (2009), Mallick and Mohsin, (2016), Sousa (2010), Castro (2011) Arslan et al. (2015) showed the importance of monetary policy in financing housing construction and regulating housing prices. A number of regional, national, and international studies have examined the relationship between the dynamics of the housing sector and changes in various indicators of real economic activity (Ismail and Suhardjo, 2001; Leung, 2004; Tsatsaronis and Zhu, 2004; Ceron and Suarez, 2006; Dufrénot and Malik, 2012; Poghosyan, 2016; Hiebert and Rome, 2010; Gattini and Hiebert, 2010). Other studies have examined the relationship between the housing market and financial relations (Englund and Ioannides, 1997; Loungani, 2010, Igan et al., 2011, 2012; Anundsen et al., 2016; Rajan, 2005). Thus, monetary policy affects the profitability of the housing market (Chang et al., 2011) and a temporary decrease in risk-free interest rates may have a moderate or strong impact on housing prices (Arslan 2014, 2015). Sá and Wieladek (2015) also claim that lower interest rates and capital inflows are associated with higher housing prices. Thus, monetary policy measures can have a strong impact on housing prices. Thus, since the global financial crisis, the link between the housing market and macroeconomic variables has weakened, and the link between the housing sector and financial variables has strengthened (Leung and Ng, 2018).

A number of researchers, such as Lastrapes (2002), Aoki et al. (2002), and Elbourne (2008), have focused on assessing the impact of money shocks on the housing sector. In addition, the level of inflation to increase housing prices; cost and average rate of mortgage loan; The impact of labor force growth, investment, trends and the growth rate of oil prices were studied. The choice of these variables has been studied in a number of studies on the determinants of housing prices in developing and developed countries (Piazzesi and Schneider, 2009; Glindro et al., 2011; Adams and Fuss, 2010; Geraint and Hyclack, 1999; Islam and Watanapalachaikul, 2005).

Based on the discrete-time model, Veybulla, Agnello et al. (2018a, 2018b) showed that different phases of the housing market cycle are strongly dependent on real GDP growth.

Kannan et al. (2012) the potential interactions between monetary policy and housing finance regulation, Agnello et al. (2020), Carbó-Valverde and Rodriguez-Fernandez, (2010) the housing and mortgage market, Bernanke et al. (1997) a method of effective management of imbalances that create financial stability risks. Yoshino and Taghizadeh-Hesary (2016) examined how monetary policy affected crude oil prices after the mortgage crisis. Chen et al. (2014) showed that inflation and interest rates are the most reliable determinants of housing prices.

Balke et al. (2002), Dodson and Sipe (2008) concluded that the impact of oil shocks on monetary policy and, consequently, on housing prices and incomes.

In addition, Krichene (2006) shows that the relationship between oil prices and interest rates has two sides to supply shocks: rising oil prices lead to higher interest rates, whereas lower oil prices lead to lower interest rates as demand increases.

Previous research has shown that falling housing prices and jumping oil prices generally go hand in hand with the likelihood of an economic downturn. Hamilton (2011) also argues that the link between housing price regulation and energy price volatility is strengthened during the Great Recession. Leamer (2007) argues that although the housing sector is a relatively small part of GDP, it plays an important role in recession.

Boxall et al. (2005), Muehlenbachs et al. (2015), Larson and Zhao (2017), Kilian and Zhou (2018), Grossman et al. (2019), McCollum and Upton, (2018) focused on the impact of oil and gas on housing demand and housing supply (Grossman et al., 2017).

Torres et al. (2012), Pinno and Serletis (2013), Csereklyei et al. (2016), Kehrig and Ziebarth (2017), Savchina (2017), Gunarto et al. (2020) accept that oil prices and their uncertainty have a significant impact on overall economic activity. Jones (1999), Gentry (1994), Medlock and Soligo (2001), Liddle (2013) and Claudy and Michelsen (2016) argue that over time, oil prices and their uncertainty affect energy consumption and urbanization.

Researchers describe the impact of oil prices on housing prices as follows:

- Rising energy prices affect the income and expenditures (students) of the population, as it increases unemployment, reduces the purchasing power of oil-importing countries in the interests of oil exporters and reduces incomes. This can have a detrimental effect on housing demand. (Spencer et al., 2012; Kaufmann et al., 2011) also found a correlation between the population's energy expenditure and the level of overdue mortgage debt

- Rising energy prices can affect the production and operation of equipment, consumption of raw materials, construction costs, housing and communal services, the number and price of houses (Quigley, 1984; Swan and Ugursal, 2009)
- Rising energy prices affect the overall inflation rate and may lead to tightening monetary policy, reduced liquidity and housing demand (Edelstein and Kilian, 2009)
- Rising energy prices increase the attractiveness of oil and energy companies, which can lead to the withdrawal of capital from the housing market (Caballero et al., 2008; El-Gamal and Jaffe, 2010; Basu and Gavin, 2010)
- An increase in energy prices may affect the joint dynamics of housing prices with a significant increase in commodity prices (Batten et al., 2010; Belke et al., 2010; Frankel, 2014; Hammoudeh and Yuan, 2008; Ratti and Vespinyani, 2014)
- Rising energy prices can lead to the devaluation of the national currency and increased foreign demand for local property (Chiquier and Lea, 2009).

3. DATA AND METHODS

3.1. Data Descriptions

Lending to the construction of real estate and mortgage data are obtained from the Central Bank of Azerbaijan. Brent type oil prices are obtained from the U.S. Energy Information Administration data base. The data used in the analysis are in monthly frequency covering the period between January 2010-January 2020. Descriptive statistics are given in Table 1 (Table 1 and Figure 1). Descriptive statistics are given in Table 2.

3.2. Methodology

The econometric tools used are used to identify short-term and long-term dependencies in the assessments. Several evaluation methods were used to verify the reliability of the results. autoregressive distributed lags boundstesting approach (ARDLBT), Engel-Granger cointegration test, also ully modified ordinary least squares (FMOLS), Dynamic Ordinary Least Squares (DOLS) and canonical cointegrating regression (CCR) evaluated by applying.

3.3. Unit Root Test

Before evaluating regression equations, it is important to check the stationary nature of the variables using unit root tests. This is because the stability of time variables is necessary in estimating the relationship between two or more variables using regression analysis. In most methods, the existence and evaluation of a long-run or cointegration relationship requires that the variables be non-stationary, and that the first-order differences be stationary, ie, the variable I (1). Note that I (0) is considered to be stationary with the real values of any time sequence variable. If a variable is not I (0), its first difference is calculated and its stationary is checked. If it is stationary in this case, that variable is I (1). I (0) and I (1) indicate the extent to which the sequence variables are stationary when used and are determined by uniform root tests. The article uses three different single root tests for the reliability of stationary test results: Augmented Dickey Fuller (ADF) (Dickey and Fuller, 1981), Phillips-Perron (PP) (Phillips and Perron, 1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) (Kwiatkowski et al., 1992).

Table 1: Data and internet resource

OP	*INCOME_ OF_ PEOPLE_*	*www.eia.gov*
LCREM	*LENDİNG_TO_ THE_ CONSTRUCTİON_ OF REAL_ ESTATE_AND_ MORTGAGE_*	*www.cbar.az*

3.4. Auto Regressive Distributed Lags BoundsTesting

ARDLBT is a cointegration method developed by Pesaran et al. (2001). This approach has many advantages over previous alternative cointegration methods. First of all, in cases where the number of samples is relatively small, this approach gives more reliable results and can be easily evaluated using the ordinary least squares (OLS) method. The ARDLBT approach does not have the problem of endogenousness as one of the main problems to be considered in econometric modeling, and it is possible to evaluate both short-term and long-term coefficients within one model. In the ARDLBT cointegration approach, it is possible to perform calculations regardless of whether all the variables are I (0) or I (1) or a mixture of them. Evaluations using ARDLBT are carried out in the following stages:

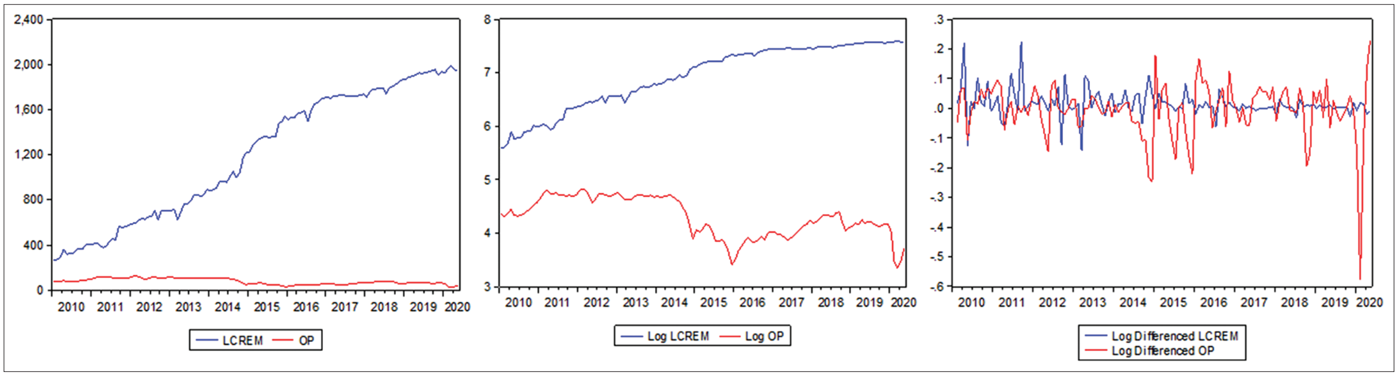
1. Unlimited error correction model (ECM) is structured:

$$\Delta \mathrm{y_t} = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta \mathrm{y_{t-i}} + \sum_{i=1}^{n} \mu_i \Delta \mathrm{x_{t-i}} + \theta_0 y_{t-1} + \theta_1 x_{t-1} + \epsilon_t \quad (1)$$

   Here are two *ECM* variable structures. Here *y* is a dependent variable, and *x* is independent or explanatory variable. β_0 represents the free limit of the model, and β_i and μ_i the white noise error. represents the long-run ratio, and short-term ratios. Selecting the most appropriate delay size and meeting the required conditions of the model *ECM* is one of the issues to be considered when setting up. One of the most important conditions in this case is the absence of autocorrelation or *ECM* sequential correlation problem, which will be used for the next stage. The optimal delay size is then determined according to the Akaike or Schvarz criteria from among the *ECM* ones that do not have this problem.

2. Among the variables after the establishment of the *ECM* in the *ARDLBT* approach whether there is a cointegration connection is checked. To do this, a Wald-test (or F-Test) is applied to the θ_i mentioned above as long–term coefficients, and the hypothesis H_0:θ_0=θ_1=0…θ_i=for the absence of cointegration is tested. An alternative hypothesis is that there is a cointegration relationship between the variables (opposite hypothesis: H_1:θ_0≠0,θ_1≠0,…θ_i≠0). If it is determined that there is a cointegration relationship between the variables, the stability of this relationship is checked. If the coefficient y_{t-1} of is statistically significant and negative, the cointegration relationship is said to be stable. This means that deviations

Figure 1: Dynamics of variable indicators



from the equilibrium (long–term relationship) that occur in the short term are temporary and are corrected over time to the long–term relationship. Note that is θ expected to be between –1 and 0. If the cointegration relationship between the variables is proved, the long–run coefficients can be estimated at the next stage. To do this, the long–run coefficients in equation 1 are equal to ($\beta_0+\theta_0\, y_{t-1}+\theta_1\, x_{t-1}=0$), this equation can be solved in relation to y, and the long–run coefficients can be calculated as follows:

$$y_t = -\frac{\beta_0}{\theta} - \frac{\theta_1}{\theta} x_t + \epsilon_t \qquad (2)$$

3. The long–run white noise error is (ect_t) calculated and included in the model instead of the part with long–run coefficients in Equation 1 ($\theta_0\, y_{t-1}$)+$\theta_1\, x_{t-1}$). $ect_{t-1} = y_t - \frac{\beta_0}{\theta} - \frac{\theta_1}{\theta} x_t$ The stability of the cointegration relationship is re–examined by re–evaluation:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta y_{t-i} + \sum_{i=1}^{n} \mu_i \Delta x_{t-i} + \delta ect_{t-1} + \epsilon_t \qquad (3)$$

Here, the fraction of the real values of the dependent variable y_t is the fitted value of the dependent variable ($-\frac{\beta_0}{\theta} - \frac{\theta_1}{\theta} x_t$) based on the long–run period equation (equation 1). In Equation 3, if it is between δ–1 and 0 and is statistically significant, this means that the cointegration relationship is stable. As mentioned above, this means that for the short run, the deviations will be corrected for the long run. If there is no serious calculation error, the δ coefficient gets the same or very close value to the θ in equation 1.

3.5. Engel–Granger Cointegration Test

One of the methods used to check the cointegration relationship between variables is the Engel–Granger (EG) cointegration test (Engle and Granger, 1987). This test can be used to check for a long–term connection. Through the EG cointegration test, it is also possible to determine the direction of the relationship between the variables and to investigate the short–term relationship. The EG co–integration test consists of the following steps:

1. The regression equation is evaluated for variables that are not stationary in the original case, but are stationary in the case of differentiation by the same degree (usually I (1)). So for the simplest case with two variables:

$$y_t = a_0 + a_1\, x_t + \varepsilon_t \qquad (4)$$

Here a_0və a_1 represent the regression coefficients to be evaluated, y and x represent the dependent and free variables, respectively, ε_t the white noise error, and t time.

2. The stationaryness of the white noise error is checked. If ε_t stationary, there is a cointegration relationship between these variables. Based on this, the estimated equation 4 is considered to be a long–run period equation.
3. The *ECM* is evaluated using stationary variables and a periodic delay white noise error (ε_{t-1}) to check the strength and direction of the cause–and–effect relationship between the variables, in other words, the dependence:

$$\Delta y_t = \rho_0 + \tau e_{t-1} + \sum_{i=1}^{q} \varphi_i \Delta y_{t-i} + \sum_{i=1}^{q} \sigma_i \Delta x_{t-i} + \omega_t \qquad (5)$$

Here ρ_0, τ, φ_i, σ_i represents the coefficients, q is optimal delay size, ω is the white noise error of the model. i=1,…q. To determine the optimal delay size, the relationship between the variables is first evaluated in the vector autoregressive (VAR) model. Equation 5 is then evaluated using the least square method (LSM), taking into account the optimal delay size. Engle and Granger (1987) show that if there is cointegration between variables, this dependence should also be evaluated through the . If the cointegration relationship is stable, the coefficient of the term Error Correction Term (*ECT*), ie (e_{t-1}), should be negative and statistically significant. Usually takes price in –1 and 0 range. Using Equation 5, the following cause–and–effect relationships can be tested.

3.5.1. Granger cause–and–effect relationship for the short term

For each free variable using statistical values of F or X_i squared statistical values are evaluated by checking all Δx_{t-1} delayed first–order differences (H_0:σ_1=σ_2=...=σ_i=0,H_1:σ_1≠0,σ_2≠0...σ_i≠0,i=1,…q). The rejection of the zero hypothesis indicates that x has an effect on y in the short run.

3.5.2. Granger cause–and–effect relationship for the long term

To test this relationship, the statistical significance of the t-test utilization factor e_{t-1} is checked. To do this, you need to test the hypothesis of zero (H_0: τ=0, H_1: τ≠0). If, as a result, the null hypothesis is rejected, this long–run period shows that deviations from the equilibrium state have an effect on the dependent variable and will return to the equilibrium state over time.

3.5.3. Strong cause–and–effect relationship

This relationship is, in fact, both a short–term and a long–term cause–and–effect relationship. In other words, the Wald test tests the hypothesis as a zero hypothesis for each variable taken using *F*-statistical or X_i squared statistical values. (H_0:σ_1=σ_2=...=σ_i=τ=0 ,H_1:σ_1≠0,σ_2≠0,...,σ_i≠0,τ≠0,i=1,…q).

3.6. FMOLS DOLS and CCR

The fully modified minimum squares method (FMOLS) proposed by Phillips and Hansen (1990) and the dynamic minimum squares method (DOLS) proposed by Stock and Watson (1993) are alternative cointegration methods developed by Park (1992). Note that the Philips–Ouliaris (1997) and Engel–Grange cointegration tests were used to test for cointegration in all regression equations evaluated using FMOLS, DOLS, and CCR.

3.7. Diagnostics

When conducting econometric analyzes, it is important to check whether the models have consistent correlation, heteroskedasticity, and normal distribution of white noise error. When performing assessments using the FMOLS, DOLS, and CCR methods, sequential correlation and heteroskedasticity problems are automatically corrected. However, for the ARDLBT co–integration approach, it is important to perform all tests when evaluating ECMs. Here, both the Breusch–Godfrey LM test (“no serial correlation”) to test a consistent correlation problem, and the Breusch–Pagan–Godfrey test (“no heteroskedasticity problem”) and the autoregressive conditional heteroskedasticity test (Automatic) are used to obtain a more reliable result. Hederoscedasticity test, ARCH, “no heteroskedasticity problem”), Ramsey RESET Test (statistic) are used. In all cases, it is desirable not to reject the zero hypothesis. The Jarque–Bera test will be used to check the normal distribution of white noise error. The null hypothesis tested by this test is the assumption that “there is a normal distribution in the white noise error.”

4. RESULTS AND DISCUSSION

The initial static expression of the econometric models to be evaluated is as follows:

$$Ln(LCREM)_t=\beta_0+\beta_1\ Ln(OP)_t+\epsilon_t \quad (6)$$

Table 2: Descriptive statistics of the variables

Indicators of variables	LCREM	OP
Mean	1194.194	78.10094
Median	1309.900	74.31000
Maximum	1989.000	124.9300
Minimum	265.8000	28.38000
Std. Dev.	573.5531	26.78217
Skewness	–0.146069	0.094218
Kurtosis	1.470823	1.670957
Jarque-Bera	12.62357	9.384704
Probability	0.001815	0.009165
Sum	149274.2	9762.617
Sum Sq. Dev.	40791426	88943.31
Observations	125	125

Here β regression coefficients, t expresses the time, ϵ_t is white noise error. $Ln(LCREM)_t$ is the amount of loans allocated for the construction and purchase of real estate, including mortgage loans. The key research factor here is the β_1 coffecent. Taking into account the important role of oil in the Azerbaijani economy, oil prices *Ln*(*OP*) were taken as the second variable.

4.1. Results of Unified Root Tests

As noted above, it is important to check the variability of the variables before conducting a model evaluation. Table 3 shows the results of the ADF, PP and KPSS single root tests obtained without trends and with the addition of trends.

The variable *LLCREM* is I (0) based on all three tests (ADF, PP and KPSS) in the case of “With Intercept only.” In the case of with intercept and trend and no intercept and no trend, I (1). The *LOP* variable is I (0) according to the KPSS test only with “With Intercept only.” In the case of with intercept and trend and no intercept and no trend, I (1). This result is suitable for subsequent assessments and all methods to be used. Based on the results of the ADF, PP, and KPSS tests, it is assumed that the variables here are I (0) and I (1). This means that all of the above methods can be applied. As mentioned above, one of the key issues in building a model when applying the ARDLBT cointegration method is to determine the optimal delay size.

4.2. VAR Lag Order Selection Criteria

The optimal lag is found using the VAR method (Table 4).

4.3. ARDL Bounds Test, Long Run and Short Run Results

Table 5 reports the results from the ARDL bounds test. Based on the results given in the table, it can be said that model 1 (5%), model 2 (5%), model 5 (1%), model 6 (1%), model 7 (5%), model 8 (1%), there is a long–term or cointegration relationship between the variables of appropriate significance in model 11 (1%) and model 12 (1%). There is no long–run or cointegration relationship between the variables in Model 3, Model 4, Model 9and Model 10.

The results obtained show that in the long run, a 1% increase or decrease in oil prices will decrease or increase the volume of mortgage loans, respectively, model 1 (0.51%), model 2 (0.52%), model 3 (0.36%), model 4 (0.37%), model 7 (0.51%), model 8 (0.33%), model 9 (0.46%) and model 10 (0.33%) show an decrease or increase. It is also not expected in theory that this will have a positive effect in the long run (Table 6) (model 5 (215%), model 6 (212%), model 11 (218%) and model 12 (206%) show an increase or decrease. It is also expected in theory that this will have a positive effect in the long run).

As can be seen, all the prerequisites required in the model are met. Thus, the coefficient of the lagged dependent variable entered into the model as a free variable with a period delay is model 1 (5%), model 2 (5%), model 3 (5%), model 4 (5%), model 5 (5%), model 6 (5%), model 11 (5%), model 12 (5%), model 7 (1%), model 8 (1%), model 9 (1%) and model 10 (1%) is negative and statistically significant. The same can be said about the results of

Table 3: Results of unified root tests

Model	Variable	ADF	PP	KPSS	Stationarity	Integrir I(0,1,2)
With intercept only	At level form					
	LLCREM	–3.369719**	–3.117820**	1.291484***	S	I(0)
	LOP	–1.875821	–1.160749	0.775602***	N/S	I(1)
	At first differencing					
	ΔLLCREM	–13.63387***	–13.73366***	0.825318***	S	I(0)
	D LSERIES02	–7.672364***	–6.955538***	0.126887*	S	I(0)
With intercept and trend	At level form					
	LLCREM	–1.447034	–1.354678	0.327965***	N/S	I(1)
	LOP	–2.977519	–2.209194	0.120922	N/S	I(1)
	At First differencing					
	D LSERIES01	–14.42799***	–15.12040***	0.018969	S	I(0)
	D LSERIES02	–7.665380***	–6.908027***	0.088318	S	I(0)
No intercept and no trend	At level form					
	LLCREM	3.476563	4.167070	N/A	N/S	I(1)
	LOP	–0.670182	–0.676932	N/A	N/S	I(1)
	At first differencing					
	D LSERIES01	–12.06620***	–12.14943***	N/A	S	I(0)
	D LSERIES02	–7.675700***	–7.016003***	N/A	S	I(0)

ADF denotes the Augmented Dickey–Fuller single root system respectively. PP Phillips–Perron is single root system. KPSS denotes Kwiatkowski–Phillips–Schmidt–Shin (Kwiatkowski et al., 1992) single root system. ***, ** and *indicate rejection of the null hypotheses at the 1%, 5% and 10% significance levels respectively. The critical values are taken from MacKinnon (Mackinnon, 1996). Assessment period: 2010M01−2020M01. S: Stationarity; N/S: No stationarity, N/A: Not applicable

Table 4: VAR lag order selection criteria

Dependent variable	Lag	LogL	LR	FPE	AIC	SC	HQ
LLCREM	0	–91.33506	NA	0.016903	1.595471	1.642688	1.614640
	1	319.9018	801.3846	1.60e–05	–5.365842	–5.224192	–5.308334
	2	332.8649	24.81820	1.37e–05	–5.519057	–5.282974*	–5.423210*
	3	338.4008	10.40945	1.34e–05*	–5.545313*	–5.214796	–5.411127
	4	341.0835	4.952745	1.37e–05	–5.522795	–5.097845	–5.350271
	5	341.5758	0.892046	1.46e–05	–5.462835	–4.943452	–5.251972
	6	347.0594	9.748503*	1.42e–05	–5.488194	–4.874378	–5.238992
	7	348.1731	1.941938	1.49e–05	–5.438857	–4.730607	–5.151316
	8	348.8935	1.231466	1.58e–05	–5.382795	–4.580112	–5.056916

*Indicates lag order selected by the criterion. LR: Sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan−Quinn information criterion

Table 5: ARDL Results from bound tests

№	Dependent variable	Significance										Significance
		F–statistic	I(0) Bound				I(1) Bound					
			10%	5%	2.5%	1%	10%	5%	2.5%	1%		
Model 1	ARDL(2, 0) (SIC) C lag, automatic	6.073999**	4.04	4.94	5.77	6.84	4.78	5.73	6.68	7.84	Cointegration
Model 2	ARDL(2, 2) (SIC) C lag, fixed	6.150443**	4.04	4.94	5.77	6.84	4.78	5.73	6.68	7.84	Cointegration
Model 3	ARDL(2, 0) (SIC) C @TREND lag, automatic	1.453132	5.59	6.56	7.46	8.74	6.26	7.3	8.27	9.63	No–cointegration
Model 4	ARDL(2, 2) (SIC) C @TREND lag, fixed	1.544662	5.59	6.56	7.46	8.74	6.26	7.3	8.27	9.63	No–cointegration
Model 5	ARDL(2, 0) (SIC) lag, automatic	13.03817***	2.44	3.15	3.88	4.81	3.28	4.11	4.92	6.02	Cointegration
Model 6	ARDL(2, 2) (SIC) lag, fixed	12.86947***	2.44	3.15	3.88	4.81	3.28	4.11	4.92	6.02	Cointegration
Model 7	ARDL(3, 0) (AIC) C lag, automatic	7.290435**	4.04	4.94	5.77	6.84	4.78	5.73	6.68	7.84	Cointegration
Model 8	ARDL(3, 3) (AIC) C lag, fixed	7.823509***	4.04	4.94	5.77	6.84	4.78	5.73	6.68	7.84	Cointegration
Model 9	ARDL(3, 0) (AIC) C @TREND lag, automatic	1.177619	5.59	6.56	7.46	8.74	6.26	7.3	8.27	9.63	No–cointegration
Model 10.	ARDL(3, 3) (AIC) C @TREND lag, fixed	0.767271	5.59	6.56	7.46	8.74	6.26	7.3	8.27	9.63	No–cointegration
Model 11	ARDL(3, 0) AIC) lag, automatic	14.34091***	2.44	3.15	3.88	4.81	3.28	4.11	4.92	6.02	Cointegration
Model 12	ARDL(3, 3) (AIC) lag, fixed	15.08259***	2.44	3.15	3.88	4.81	3.28	4.11	4.92	6.02	Cointegration

***, ** and *indicate rejection of the null hypotheses at the 1%, 5% and 10% significance levels respectively

the stability test in the evaluated cointegration equations. Stability here means the rate at which deviations from equilibrium in the short run are corrected to equilibrium in the long run and are determined on the basis of. Model 1 (5%), Model 2 (5%), Model 5 (10%), Model 6 (10%), Model 7 (1%), Model 8 (5%), Model 11 (10%) and Model The fact that all relevant coefficients are negative and statistically significant at 12 (5%) supports the idea that the cointegration relationship is stable in the models. In the short run, deviations are corrected over time and accumulated into a long–run equilibrium relationship.

4.4. Diagnostic Tests Results

The regression equations are also adequate, as all diagnostic tests for Serial Correlation (Durbin–Watson test and Breusch–Godfrey test), heteroskedasticity (ARCH – Heteroskedasticity test and Breusch − Pagan − Godfrey – Heteroskedasticity test)

Table 6: Long run and short run coefficients

Models	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
LOP	–0.514188	–0.521777	–0.360659	–0.368072	2.153787***	2.119620***	–0.513494	–0.327909	–0.463966	–0.333692	2.180923***	2.058236***
C	9.804923***	9.834622***	8.619519***	8.643758***			9.836772***	9.056151***	9.446743***	9.117686**		
@TREND			0.005170	0.005220					0.001698	–0.000347		
Cointeq=LLCREM–(–0.5142*LOP+9.8049)												
Cointeq=LLCREM–(–0.5218*LOP+9.8346)												
Cointeq=LLCREM–(–0.3607*LOP+8.6195+0.0052*@TREND)												
Cointeq=LLCREM–(–0.3681*LOP+8.6438+0.0052*@TREND)												
Cointeq=LLCREM–(2.1538*LOP)												
Cointeq=LLCREM–(2.1196*LOP)												
Cointeq=LLCREM–(–0.5135*LOP+9.8368)												
Cointeq=LLCREM–(–0.3279*LOP+9.0562)												
Cointeq=LLCREM–(–0.4640*LOP+9.4467+0.0017*@TREND)												
Cointeq=LLCREM–(–0.3337*LOP+9.1177–0.0003*@TREND)												
Cointeq=LLCREM–(2.1809*LOP)												
Cointeq=LLCREM–(2.0582*LOP)												
Short run coefficients (error correction estimates)												
$\Delta LLCREM_{-1}$	–0.262988**	–0.264965**	–0.254280**	–0.256120**	–0.240708**	–0.243528**	–0.316139***	–0.320128***	–0.313101***	–0.320654***	–0.279683**	–0.291901**
$\Delta LLCREM_{-2}$							–0.210929*	–0.206104*	–0.208752*	–0.206478*	–0.167422	–0.172284
ΔLOP	–0.015838	–0.028193	–0.015868	–0.028479	0.018474**	0.004681	–0.018222	–0.047416	–0.018271	–0.047438	0.020253**	–0.021278
ΔLOP_{-1}		0.009205		0.011057		–0.017121		0.114941		0.115026		0.120513
ΔLOP_{-2}								–0.084031		–0.084168		–0.105005*
Δ@TREND			0.000227	0.000233					0.000067	–0.000011		
ECM_{-1}	–0.030802**	–0.030998**	–0.043998	–0.044540	–0.008609*	–0.009123*	–0.035485***	–0.033671**	–0.039380	–0.032997	–0.009265*	–0.011609**

***, ** and *indicate rejection of the null hypotheses at the 1%, 5% and 10% significance levels respectively

and error normalization (Jarque–Bera test) have desireable results. According to the Ramsey RESET test, it can be indicated that the model is well defined. All results of these tests are given in the table (Table 7). Table 7 shows the results for CUSUM and CUSUMSQ tests. The results indicate that the some coefficients are instable, this is because the plot of the CUSUM and CUSUMSQ statistic is not located inside the critical bands of the 5% significant level of parameter stability. It should be noted that the required conditions in the models for testing the stability of the cointegration relationship were also tested. As you can see, the models meet all the conditions. Diagnostic testing of white noise error in all models gives a positive result. In other words, none of the models has a consistent correlation and heteroskedasticity problem, and the regression standard error is small.

4.5. Analysis of FMOLS, DOLS, CCR and Engle–Granger Analysis Results

Other evaluation methods used – FMOLS, DOLS and CCR cointegration methods and analysis of the results of Engle–Granger analysis are very useful in our study (Table 8). This is because the revision of the results obtained with the ARDLBT co–integration approach with the application of these methods allows for a more reliable analysis.

Another feature that indicates a cointegration relationship between the variables is that the white noise errors obtained from the estimates are stationary. Table 9 shows the results of the stationary test by applying single root tests ADF, PP and KPSS on the white noise error of each long-run equation evaluated by FMOLS, DOLS and CCR. In general, white noise errors are stationary, but it appears in the first 3 equations. Based on these results, the fact that white noise errors are stationary in all models and thus the existence of a cointegration relationship is once again confirmed. However, this result does not support the results of the Engle-Granger and Phillips-Ouliaris cointegration tests given above.

Short-term and long-term cause-and-effect relationships can be more clearly analyzed using the Granger cause-and-effect relationship using the Engle-Granger cointegration method. Table 9 presents the results of the analysis of the impact of oil prices on mortgages and real estate loans in the short and long term. It is known to have no significant effect on short-term analysis. To be more precise, the results obtained are statistically insignificant. However, it has been confirmed that there is a long-term relationship and a strong cause-and-effect relationship between the variables.

5. CONCLUSION AND POLICY IMPLICATIONS

The proposal is to use SOFAZ's funds to diversify AMF's financial sources and increase opportunities, to involve insurance funds in financing mortgage lending, and to ensure the inflow of private investment in this field by increasing activity in the securities market. In addition, construction savings banks should be established and in this way the passive savings of the population

Table 7: Diagnostic tests results (F/LM version)

Models	Ramsey RESET test (t–statistic)	Normality test (Jarque–Bera) JB	Heteroskedasticity test		Breusch–Godfrey serial correlation LM test		R^2	D_W	GUSUM/GUSUM of squares
			ARCH $\chi2$	Breusch–Pagan–Godfrey	$\chi2$	$\chi2$			
ARDL(2, 0) (SIC) C lag, automatic	0.141019 0.8881 0.019886 0.8881	155.4009 0.000000 N/A N/A	2.306266 0.1289 2.312167 0.1310	19.27351 0.0002 7.370498 0.0001	4.989251 0.0825 2.473259 0.0887	5.183113 0.2690 1.264798 0.2879	0.994039	2.108944	Stability/no–stability
ARDL(2, 2) (SIC) C lag, fixed	0.125247 0.9005 0.015687 0.9005	157.0903 0.000000 N/A N/A	2.439724 0.1183 2.448697 0.1203	20.63569 0.0009 4.717222 0.0006	4.796851 0.0909 2.333432 0.1015	4.923788 0.2952 1.178027 0.3243	0.994044	2.105668	No–stability/no–stability
ARDL(2, 0) (SIC) C @ TREND lag, automatic	1.046151 0.2976 1.094431 0.2976	144.4997 0.000000 N/A N/A	2.638341 0.1043 2.652451 0.1060	20.52673 0.0004 5.909233 0.0002	4.669164 0.0969 2.288596 0.1060	4.935322 0.2940 1.191353 0.3185	0.994054	2.101485	No–stability/no–stability
ARDL(2, 2) (SIC) C @ TREND lag, fixed	1.221037 0.2246 1.490930 0.2246	145.5402 0.000000 N/A N/A	2.803713 0.0940 2.822617 0.0955	22.12533 0.0011 4.240475 0.0007	4.354350 0.1134 2.091926 0.1282	4.567652 0.3346 1.079893 0.3700	0.994059	2.096966	No–stability/no–stability
ARDL(2, 0) (SIC) lag, automatic	2.444712 0.0160 5.976618 0.0160	206.4679 0.000000 N/A N/A	1.002742 0.3166 0.994477 0.3207	17.17538 0.0007 6.437917 0.0004	3.595991 0.1656 1.780084 0.1731	3.860581 0.4252 0.941304 0.4427	0.993736	2.077312	Stability/no–stability
ARDL(2, 2) (SIC) lag, fixed	2.370056 0.0194 5.617168 0.0194	216.4313 0.000000 N/A N/A	0.970153 0.3246 0.961898 0.3287	18.21177 0.0027 4.066824 0.0019	4.784832 0.0914 2.350485 0.0998	6.299066 0.1779 1.539763 0.1954	0.993753	2.090379	Stability/no–stability
ARDL(3, 0) (AIC)C lag, automatic	0.6160 0.6160 0.252847 0.6160	181.7545 0.000000 N/A N/A	2.284435 0.1307 2.289908 0.1329	20.28100 0.0005 5.831942 0.0003	6.262955 0.0437 3.111536 0.0138	23.46262 0.0001 6.726574 0.0001	0.994070	1.887134	Stability/no–stability
ARDL(3, 3) (AIC) C lag, fixed	0.291783 0.7710 0.085137 0.7710	164.6099 0.000000 N/A N/A	1.868899 0.1716 1.866842 0.1744	20.56157 0.0045 3.301115 0.0031	11.82135 0.0187 2.950545 0.0233	5.629520 0.0599 2.709047 0.0710	0.994227	1.930110	No–stability/no–stabilit
ARDL(3, 0) (AIC) C @ TREND lag, automatic	1.086391 0.2796 1.180244 0.2796	177.2148 0.000000 N/A N/A	2.381305 0.1228 2.388960 0.1249	21.42022 0.0007 4.940845 0.0004	6.197271 0.0451 3.050398 0.0512	23.82880 0.0001 6.796357 0.0001	0.994072	1.885514	No–stability/no–stability
ARDL(3, 3) (AIC) C @ TREND lag, fixed	0.598811 0.5505 0.358575 0.5505	165.3709 0.000000 N/A N/A	1.854080 0.1733 1.851809 0.1761	21.79876 0.0053 3.072891 0.0036	5.681182 0.0584 2.710702 0.0709	12.24959 0.0156 3.041459 0.0203	0.994227	1.930534	Stability/no–stability
ARDL(3, 0) AIC) lag, automatic	2.796907 0.0060 7.822688 0.0060	247.2559 0.000000 N/A N/A	0.977011 0.3229 0.968684 0.3270	17.45740 0.0016 4.884410 0.0011	16.02058 0.0003 8.771766 0.0003	29.27125 0.0000 8.998756 0.0000	0.993525	1.895516	No–stability/no–stability
ARDL(3, 3) (AIC) lag, fixed	2.316943 0.0223 5.368224 0.0223	218.9547 0.000000 N/A N/A	0.734061 0.3916 0.726334 0.3958	18.07351 0.0116 2.832195 0.0093	9.683912 0.0080 4.873953 0.0093	11.20514 0.0244 2.807722 0.0290	0.993958	1.945505	Stability/no–stability

N/A: Not applicable

Table 8: FMOLS, DOLS, CCR results

Variables	Coefficients	Fully modified least squares (FMOLS)							R²	J–B stat
		ect								
		ADF/PP/KPSS			Cointegration Test					
		Constant	Constant, Linear Trend	None	Engle–Granger		Phillips–Ouliaris			
					tau–statistic	z–statistic	tau–statistic	z–statistic		
ΔLOP	–1.166202***	–3.077466***/–	–2.995284/–	–3.052403***/–	–3.239345	–11.50139	–3.008875	–8.446309	0.463238	22.45400
C	11.94715***	3.206873**/0.682910**	2.599332/0.143793*	3.182680***/N/A	0.0705	0.2667	0.1156	0.4521		0.000013
Dynamic least squares (DOLS)										
ΔLOP	–1.160179***	–2.921490*/–	–1.949052/–	–2.918415***/–	–3.239345	–11.50139	–3.008875	–8.446309	0.512545	22.41181
C	11.93879***	2.908989**/0.704798**	1.987036/0.130393*	2.895204***/N/A	0.0705	0.2667	0.1156	0.4521		0.000014
Canonical cointegrating regression (CCR)										
ΔLOP	–1.167521***	–3.078190**/–	–2.995585/–	–3.054163***/–	–3.239345	–11.50139	–3.008875	–8.446309	0.463156	22.42544
C	11.95325***	3.206239**/0.681522**	2.599209/0.143704*	3.183459***/N/A	0.0705	0.2667	0.1156	0.4521		0.000014
Fully modified least squares (FMOLS)										
ΔLOP	–0.165945	–2.182573/–	–2.153992/–	–2.188010**/–	–1.952553	–6.591681	–1.795572	–5.307019	0.925990	17.46576
C	6.747607***	2.048092/0.326539	2.023024/0.326504	2.054676**/N/A	0.7950	0.8556	0.8506	0.9163		0.000161
@TREND	0.014549***									
Dynamic least squares (DOLS)										
ΔLOP	–0.206420	–0.894334/–	–1.152719/–	–0.905856/–	–1.952553	–6.591681	–1.795572	–5.307019	0.932721	15.56016
C	6.944434***	1.731347/0.316857	1.944254/0.316857***	1.74040/N/A	0.7950	0.8556	0.8506	0.9163		0.000418
@TREND	0.014324***									
Canonical cointegrating regression (CCR)										
ΔLOP	–0.164265	–2.173527/–	–2.150231/–	–2.178902**/–	–1.952553	–6.591681	–1.795572	–5.307019	0.926006	17.27490
C	6.739049***	2.037802/0.326723	2.037802/0.326655***	2.044301**/N/A	0.7950	0.8556	0.8506	0.9163		0.000177
@TREND	0.014569***									
Fully modified least squares (FMOLS)										
ΔLOP	1.593950***	–1.163998/– 0.725782/1.150707***	–2.375974/– 1.938306/0.166575**	–1.077511/– 0.677110/N/A	–1.027067 0.6920	–2.432771 0.7189	–0.744140 0.7966	–1.402956 0.8243	–2.424284	–2.424284 0.003260
Dynamic least squares (DOLS)										
ΔLOP	1.592871***	–0.856185/– 0.655015/1.108061***	–2.273440/– 2.114779/ 0.179752**	–0.770271/– 0.723525/ N/A	–1.027067 0.6920	–2.432771 0.7189	–0.744140 0.7966	–1.402956 0.8243	–2.251743	12.70864 0.001739
Canonical cointegrating regression (CCR)										
ΔLOP	1.591270***	–1.163600/– 0.726003/1.150945	–2.375052/– 1.937753/0.166656	–0.660763/– 1.063682/ N/A	–1.027067 0.6920	–2.432771 0.7189	–0.744140 0.7966	–1.402956 0.8243	–2.425743	

ADF denotes the Augmented Dickey–Fuller single root system respectively. PP Phillips–Perron is single root system. KPSS denotes Kwiatkowski–Phillips–Schmidt–Shin (Kwiatkowski et al., 1992) single root system. ***, ** and * indicate rejection of the null hypotheses at the 1%, 5% and 10% significance levels respectively. The critical values are taken from MacKinnon (Mackinnon, 1996). Assessment period: 2010M01−2020M01. Legend: S–Stationarity; N/S–No Stationarity N/A–Not Applicable

Table 9: Granger cause-and-effect analysis evaluation results. Wald test

Short-term period		long-term period		strong impact	
ΔLOP		$ECT_{(-1)}$		$ECT_{(-1)}$ ΔLOP	
Chi–square	F–statistic	t–statistic	F–statistic	Chi–square	F–statistic
0.474353 (0.4910)	0.474353 (0.4923)	–3.113207** (0.0023)	9.692059** (0.0023)	9.692994** (0.0079)	4.846497** (0.0095)
ADF unit root test					
–3.262966* */–3.134453/–2.907814**					

***, ** and * indicate rejection of the null hypotheses at the 1%, 5% and 10% significance levels respectively

should be attracted to the mortgage market. To create a standard of contracts concluded by construction companies during the purchase and sale in order to attract new buildings to the mortgage market.

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