MACROECONOMIC DETERMINANTS OF HOUSE PRICE IN ARMENIA

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ABSTRACT

The housing sector's role in the economy is gradually growing, and many researchers examine the major macroeconomic drivers of housing prices in various countries. House prices in Armenia are regarded as seriously unaffordable, with the median all-house price being significantly higher than the annual median income. Despite the fact that the issue of house prices is widespread in the country, few studies have been conducted to determine the factors that influence its movement. As a result, the current paper attempts to investigate the causal relationship between macroeconomic variables and house prices in Armenia while accounting for the variables' structural break.

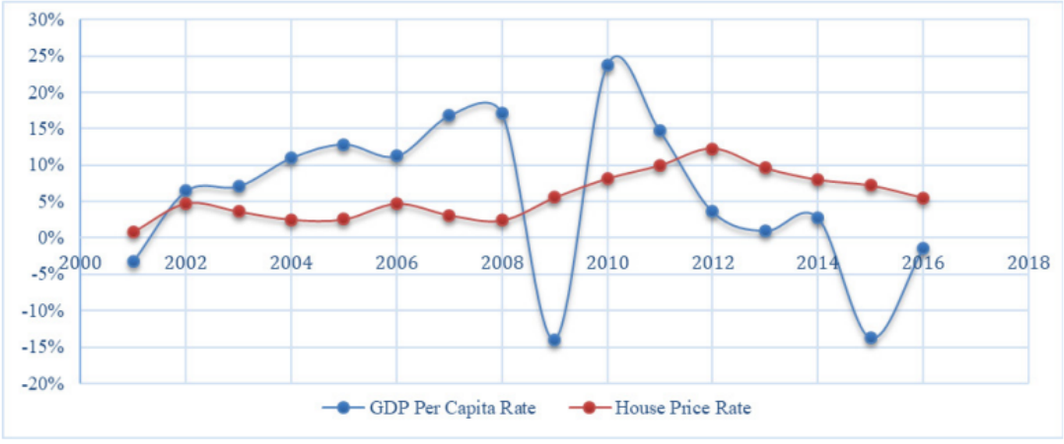
It has been determined that, in the long run, macroeconomic variables are collectively significant in influencing house price movement, whereas the individual impact of macroeconomic variables varies. House prices will fall as interest rates, housing supply, and inflation rise, while GDP and local currency appreciation cause prices to rise. It was discovered that stock prices have no significant influence on house prices. Exchange rate fluctuations appear to be the most important in explaining the movement of house prices among all macroeconomic factors studied. All macroeconomic factors are individually significant in influencing house prices in the short run, and it has also been identified that house prices tend to move back into their long-run state after temporary macroeconomic shocks, with a quarterly adjustment speed of around 5.2 percent. It is recommended that policymakers constantly monitor the movement of macroeconomic factors and take necessary actions to mitigate the negative impact of the country's house price movement.

INTRODUCTION

The house is a necessary asset that people require for shelter and social activities. According to Maslow's Hierarchy of Needs, home ownership is related to all five tiers of needs, from basic physiological to advanced self-actualization. It is also an appealing asset for those who are financially capable of purchasing multiple houses because it can be used to generate wealth through rental and property sales.

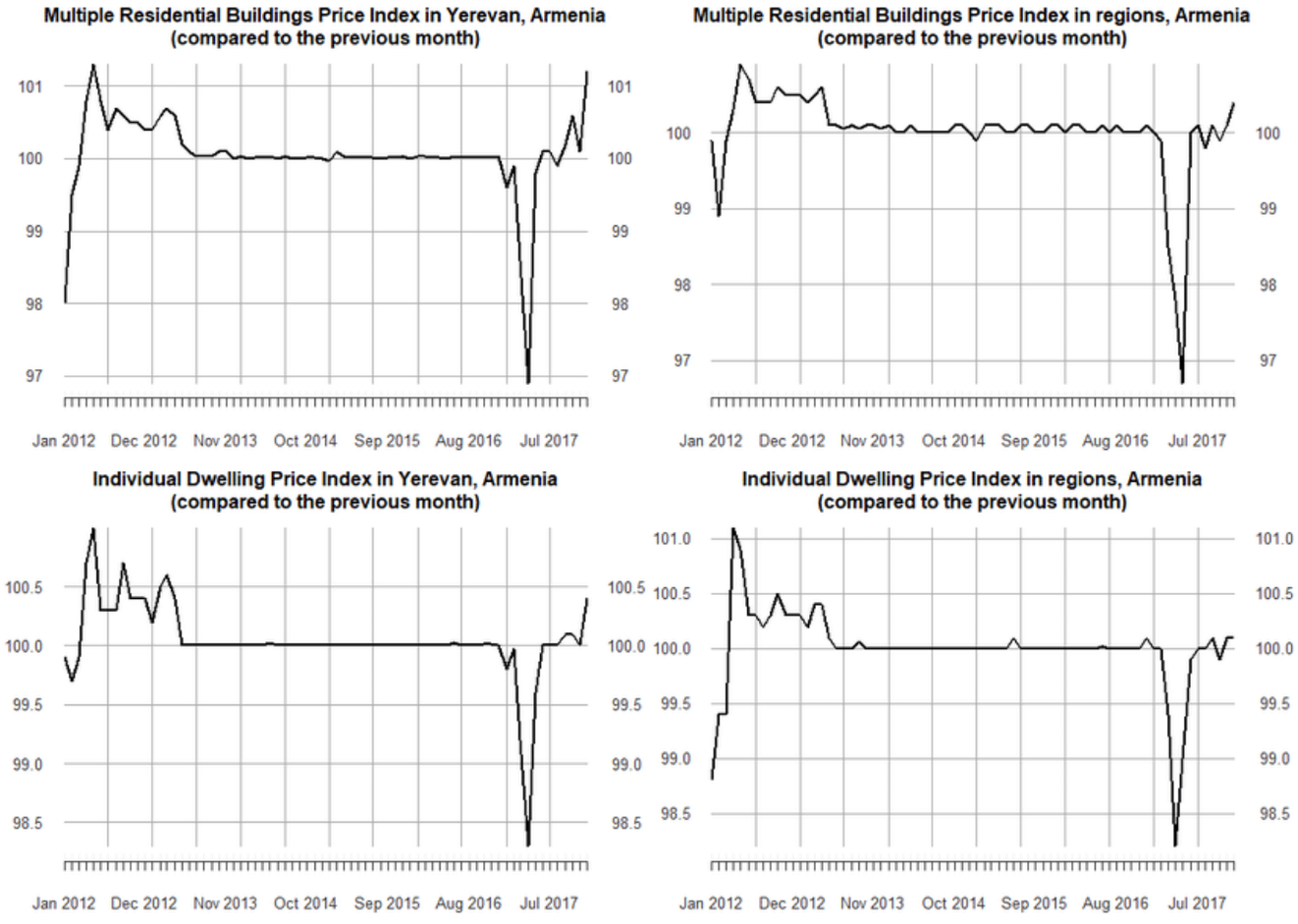
Many papers discuss the main factors that influence house prices. According to Kalili (2008), housing expenses comprise the second largest portion of household expenditure in Namibia, and higher inflation decreases the purchasing power of people, which consequently reduces housing spending. Tsatsaronis and Zhu’s (2004) paper suggests that economic growth impact household consumption and firms’ production, which lead to demand fluctuations in the housing market, and eventually, the demand for housing is negatively related to housing prices. Panagiotidis and Printzis (2015) argue that interest rate is the most important factor because the majority of houses are purchased through mortgage bonds, which is sensitive to the interest rate. Higher interest rate increases the cost of borrowing, and consequently, potential buyers become discouraged. Hence, economic growth, inflation, and interest rate are key determinants of housing demand and price

FIGURE 1. Comparison between gross domestic per capita growth and house price change rate



The research documented in this paper has two goals. The first is to determine the impact of selected macroeconomic factors on house prices in Armenia in the long and short run. Furthermore, this paper attempts to determine how long it takes for house prices to return to their long-run equilibrium as a result of temporary macroeconomic movements.

FIGURE 2.The price indices of the housing market of Armenia



LITERATURE REVIEW

According to Nakajima (2011), it is possible to have three groups of theories that attempt to explain the movement of house prices. The first group of literature focuses on the inflexible nature of housing supply that is associated with a longer period to build houses and the scarcity of land, particularly in urban areas. Based on the study conducted by Glaesar et al. (2002) who investigated the supply-side restrictions, it is identified that tightened housing supply regulations contribute to the increase of house prices. This is similar to the findings of Hilber and Vermeulen (2013) who discovered that the English planning system is an important determining factor towards the issue of housing affordability, particularly in urban areas. Another factor that can be linked to the housing supply side is the role of a

limited supply of land and this is agreed by Ho and Ganesan (1998). Based on their findings, Ho and Ganesan (1998) identified that an increase in land supply will bring forth a decrease in housing prices.

Iacoviello and Neri (2008) found a strong short-term relationship between economic growth and housing prices, and an increase in the growth rate (GDP) causes housing demand and prices to increase through the channel of changing the household's income and firm's revenue. Charles Goodhart and Boris Hof□mann (2008) discuss that increase in CPI declines the overall purchasing power in the economy, which eventually decreases demand for housing when households adjust their spending patterns. Kalili (2008) suggests that higher CPI and lower purchasing power would considerably impact housing spending because housing expenses comprise the second largest household expense in Namibia. Economic growth and price level are crucial macroeconomic determinants for housing demand and price.

DATA AND METHODOLOGY

The analysis covers 17 years of housing prices and macroeconomic quarterly data from 2000 until 2016. In the study, key macroeconomic indicators include

- **base lending rate**
- **real gross domestic product**
- **housing stock (to represent the level of housing supply)**
- **consumer price index (to represent inflation)**
- **real effective exchange rate**
- **stock prices**

The housing price and macroeconomic variables are transformed into natural logarithms. The long-run and short-run relationship between macroeconomic factors and house prices in Armenia are analyzed using cointegration and error correction modeling.

The major sources of data collection are the Central bank of Armenia (CBA) and the Cadastre Committee of the Republic of Armenia.

UNIT ROOT TEST WITH STRUCTURAL BREAK

The unit root test is used as the first step in analyzing the relationship between macroeconomic determinants and house prices. Based on the literature the existence of structural breaks on data that is trend stationary causes conventional unit root tests to become biased towards a false null hypothesis of a unit root. In this regard, the current paper used a unit root test that allows for a one-time break, with the breaking point date determined by the minimum Dickey-Fuller t-statistics. This model also assumes that the data is not trending and that the break occurs gradually. The number of lags is chosen using the Schwarz info criterion.

AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) MODEL FOR LONG–RUN RELATIONSHIP

The cointegration test that is used in this research is based on the Autoregressive Distributed Lag Model (ARDL). The estimation of the long-run relationship between variables by using the basic ARDL (p,q) model is shown below

$$y_t = \alpha + \sum_{i=1}^{p} \theta_i y_{t-i} + \sum_{i=0}^{q} \beta_i x'_{t-i} + \lambda_1 y_{t-1} + \lambda_2 x'_{t-1} + \varepsilon_t$$

- ε_t – error term
- α, θ, β and λ – coefficents that need to be estimated
- Y – house price
- X' – set of macroeconomic variables selected (interest rate, real gross domestic product, housing stock, inflation, exchange rate and stock price)

The Akaike Info Criterion (AIC) determines optimal lags in the ARDL model for this analysis, where a model with a certain number of lags in the right hand side of the variable that produces the lowest value of AIC is considered optimal. The current paper limits the maximum number of lags to four, which is one year.

A dummy variable that accounts for the breakpoint periods of macroeconomic factors and housing price, as well as the intercept, are treated as fixed regressors to test the significance of breaking point in explaining the level of housing price. To identify the existence of a long-run relationship, bounds test of is conducted to test the following hypotheses:

1. H_0: $\lambda_1 = \lambda_2 = 0$, indicating the non-existence of a long-run relationship among variables.
2. H_1: $\lambda_1 \neq \lambda_2 \neq 0$, indicating the existence of a long-run relationship among variables.

The null hypothesis is rejected when the value of F-statistics is higher than the upper critical bound and the rejection of the null hypothesis indicates there is a long-run relationship between the housing price and macroeconomic factors.

SHORT-RUN RELATIONSHIP AND SPEED OF ADJUSTMENT

The short-run relationship is obtained from an Error Correction Model (ECM) with Error Correction Terms (ECT) representing the speed of adjustment for the model to reach equilibrium or long-run relationship.

$$\Delta y_t = \alpha + \sum_{i=1}^{p} \theta_i \Delta y_{t-i} + \sum_{i=0}^{q} \beta_i \Delta x'_{t-i} + \lambda_1 ECT_{t-1} + \varepsilon_t$$

Where $ECT_{t-1} = \varepsilon_{t-1} = y_{t-1} - \alpha - \beta x'_{t-1}$

A least square estimation is carried out to analyze the ECM model and the number of lags in the model is determined based on the lowest Akaike Info Criterion values.

RESULT ANALYSIS

This study employs a unit root test, which allows for a one-time structural break and determines the number of lags using the Schwarz criterion. According to the results in Table 1, the level of stationarity is mixed with the interest rate, real GDP, housing supply, inflation, stock price, and the exchange rate is stationary at the first difference or I(1), while the house price is stationary at level I(0).

Table 1.Unit root test with breakpoin

Variable	Breakpoint Period	ADF Test Statistics	
		At level	At 1st difference
House price	2008 Q3	-5.7851***	-9.4780***
Interest rate	2008 Q3	-3.8703	-10.1512***
Real gross domestic product	2011 Q1	-4.4585	-8.9448***
Housing supply	2015 Q4	-4.3809	-10.9010***

Inflation	2004 Q3	-4.0847	-8.2179***
Stock price	2013 Q1	-4.3932	-6.4839***
Exchange rate	2009 Q4	-3.1154	-8.4020***

Minimum Dickey-Fuller t-statistics are used to determine the period of the structural break for each variable, and it appears that the breakpoint period for the interest rate and house price occurs around the same time, in 2008 Q3. The real GDP breakpoint period occurred in 2011 Q1, while housing supply experienced a similar phenomenon in a more recent period. The level of inflation in the fourth quarter of 2004 represents the earliest breaking point. The breakpoint period for stock prices is shown in the first quarter of 2013, whereas the breakpoint period for the exchange rate is shown in 2009 Q4. The presence of a structural break in the unit roots demonstrates the importance of including the element in examining the impact of macroeconomic determinants on house prices.

The optimal ARDL lags in the analysis are (4, 3, 4, 3, 3, 4, 4) as the model produces the lowest value of AIC. As demonstrated in Figure 3, the house price, real gross domestic product, exchange rate, and stock price are set to 4 lags while the interest rate, house stock, and inflation contain 3 lags.

Figure 3. ARDL lag selection criteria

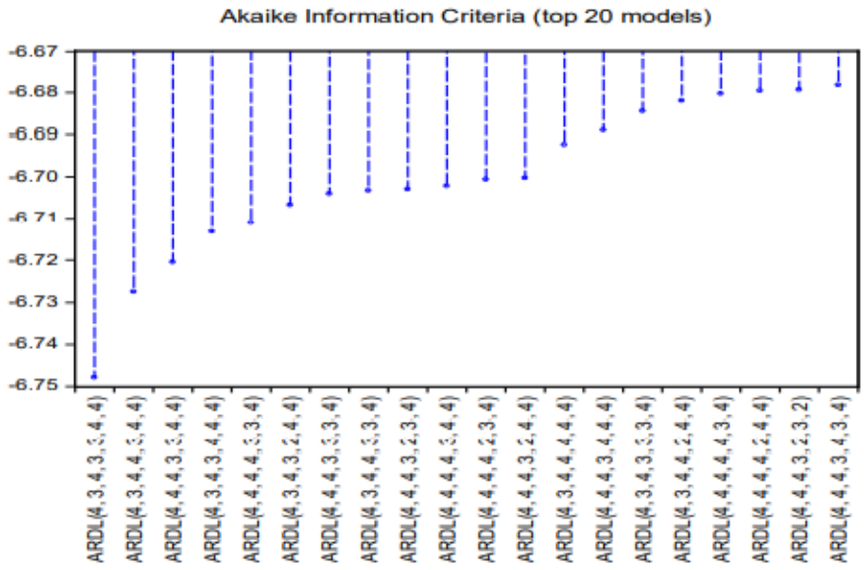


Table 2 illustrates the bounds test based on the ARDL model, which is used to examine the joint significance of the regressors in explaining Armenian housing prices in the long run. The F-statistics are found to be greater than the upper critical bound at all significance levels, implying that the null hypothesis of no cointegration between variables in the model is rejected. This implies that the macroeconomic variables have a combined influence on the country's house prices.

Table 2. Long-run relationship between housing price and macroeconomic movement

ARDL Model: (4,3,4,3,3,4,4) F-Statistic: 6.8202		
Critical Value	Lower Critical Bound	Upper Critical Bound
10% Significance	2.12	3.23
5% Significance	2.45	3.61
1% Significance	3.15	4.43
Breusch-Pagan Serial Correlation LM Test	F-statistic Prob. Chi-Square(2)	0.8284 0.1488
Breusch-Pagan-Godfrey Heteroskedasticity	F-statistic Prob. Chi-Square(32)	0.8178 0.5888
Ramsey RESET Test	F-statistic Probability	1.8567 0.1852

Using the diagnostic tests, it is clear that the model does not exhibit serial correlation and is also free of heteroskedasticity, as demonstrated by the Breusch-Pagan-Godfrey test. In contrast, the Ramsey RESET test indicates that the cointegration model is correctly specified.

The majority of macroeconomic factors are significant in determining the level of housing price, according to the long-run coefficients of the independent variables in Table 3. The interest rate is found to have a negative relationship with housing prices and is significant at a 10% level, where a 1% increase in interest rates causes a 1.7 percent decrease in housing prices. The demand side of house price theories explains why an increase in interest rates causes house prices to fall by increasing the cost of financing and negatively impacting the level of demand for houses. With fewer housing demand in the economy, house prices will tend to fall.

The real gross domestic product and housing prices have a positive relationship. Based on the coefficient value, a 1% increase in the variable causes a 2.4 percent increase in housing prices at a 1% significance level. At the 5% level, the level of housing supply and price exhibits a significant negative relationship. Because of the wealth effect, an increase in the level of inflation reduces the purchasing power of households, resulting in a decrease in demand for houses. In the long run, the negative impact of inflation on housing demand causes house prices to fall. The negative relationship between inflation and house prices demonstrates the severity of housing unaffordability in the country, where an increase in inflation prevents individuals from buying a house. According to the analysis, a 1% increase in inflation causes a 0.25 percent drop in house prices, and this relationship is significant at the 1% level.

Because the unit root tests show that the variables have structural breaks, the factor is included as a fixed regressor. While structural breaks show positive signs on its coefficient, implying a negative impact on house prices, the impact is determined to be insignificant in the long run. This implies that, while macroeconomic variables may experience structural breaks as a result of certain factors, these effects fail to translate into changes in house prices.

Table 4 shows the Wald test results for determining the significance of individual macroeconomic movements on short-run house prices. The null hypothesis, which assumes no causal relationship between house prices and macroeconomic factors, is rejected at a 5% significance level or lower by referring to the probability value of the F-Statistics. This suggests that changes in individual macroeconomic determinants have a significant short-run impact on house prices.

Table4.Short-run relationship between house price and individual macroeconomic movement

Macroeconomic Factor	Wald Test F-statistics (Probability)
Base Lending Rate	4.1895 (0.0131)
Gross Domestic Product	12.4953 (0.0000)
House Stock	17.1222 (0.0000)
CPI	2.5921 (0.0698)
Exchange Rate	6.1198 (0.0009)
Stock Price	4.6804 (0.0044)

According to Table 5, the error correction term is significant at a 1% level of significance. The negative sign on its coefficient indicates that short-run macroeconomic movements significantly corrected the model into a long-run equilibrium. The value of coefficient indicates that the 5.3 percent difference between the actual and equilibrium prices is closed within a quarter year. This rate of correction is rather slow, indicating a slow price reaction, because disequilibrium caused by a short-term deviation in macroeconomic factors is fully corrected only after 19 quarters, or 4 years and 3 quarters.

Table 5. Short-run adjustment

Variable	Coefficient
Error Correction Term	-0.052607***

Table 6 shows that the Breusch-Godfrey LM test indicates that the model is free of serial correlation up to two orders, whereas the Breusch-Pagan test indicates that the model does not exhibit heteroskedasticity. Meanwhile, the CUSUM stability test shows that all models are stable against a 5 percent significance level critical bound. The Ramsey RESET test, on the other hand, implies that the model in a linear model is well specified because the null hypothesis's correctly specified model fails to be rejected even at a 10% significance level.

Table 6. Residual and stability diagnostics

Test	F-Statistics	Probability
Breusch-Godfrey Serial Correlation LM Test	0.969557	Chi-Square: 0.1761
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.805930	Chi-Square: 0.6145
Ramsey RESET Test	0.026494	0.8717
Cusum Stability Test	Stabile at 5%	
Cusum of Squares Test	Stabile at 5%	

CONCLUSION

The current study looks at the relationship between macroeconomic determinants and house prices in Armenia from 2000 to 2016. The relationship between the variables, based on the findings, is consistent with the demand and supply sides of house price theories.Paper used the ARDL model to analyze the long-run relationship, and it was found that the joint movement of macroeconomic factors is significant in explaining housing prices in Armenia. Interest rates are identified to have an inverse relationship with house prices where an increase in the said macroeconomic factor causes house prices to fall. Sharing the same effect as the interest rate, an increase in housing supply and inflation rate causes house prices to fall. On the other hand, the exchange rate exhibits a positive relationship with house prices. The relationship between stock prices and house prices meanwhile is identified to be insignificant in the long-run and happens due to the contradicting effect of wealth and substitution effects. Although the structural break is present on the macroeconomic variables as demonstrated based on the unit root tests, it is shown to be insignificant in explaining the movement of house prices in the long-run. In analysing the short-run relationship based on the error correction modeling, it is identified that all macroeconomic variables are individually significant in explaining housing price growth. In terms of the speed of adjustment to equilibrium or long-run relationship, short-run shocks in the macroeconomic factors are identified to be corrected within 4 years and 3 quarters.