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| RESEARCH ARTICLE

Analysis of Fluctuations between Housing Sector and Capital Market: Evidence from Iran

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| ABSTRACT
This study aims to examine fluctuations and the interconnections between the housing sector and the capital market in the Iranian economy, with the stock market serving as a proxy for the capital market. Many factors such as macroeconomic instability, sanctions, and exchange-rate fluctuations might cause connected asset prices to spillover portfolio reallocation channels. Conditional volatility is captured using ARCH and GARCH models, and the direction of influence between the two markets is evaluated using Granger causality tests. The findings demonstrate that stock market volatility is more robust and long-lasting than housing market volatility, suggesting a higher susceptibility to shocks. In order to represent asymmetric or long-memory behavior, more flexible models could be needed, as the housing market seems less responsive under the basic ARCH design. The Granger causality evidence shows a bidirectional, time-varying relationship between the two markets, with the direction of causality contingent upon the market conditions and lag structure. Overall, the results point to a nonlinear relationship between Iran's housing and capital markets that is influenced by more general macroeconomic factors. Investors and governments that are interested in asset allocation and market stability should take note of these findings.

| KEYWORDS

Housing market, capital market, stock market, Iran, conditional volatility

| ARTICLE INFORMATION

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1. Introduction

The housing sector is one of the leading sectors in any economy, which, in addition to its strong socio-cultural effects, is also economically important and acts as an engine of growth and development(Zhao & Liu, 2023)By creating economic growth and generating employment in the construction sector and related sectors, this sector strongly affects changes in GDP and economic fluctuations by influencing consumption and investment expenditures(Acolin et al., 2021),(Lunsford, 2016)Therefore, in conditions of economic crisis and the seriousness of the unemployment problem, countries seek help from this sector as a growth engine and employment generator(Acolin et al., 2021). In addition, the capital market plays a significant role in the financial support of firms and the allocation of monetary resources(Calza et al., 2013) The relationship between these two markets not only demonstrates current economic situations but also can predict future changes in the economy(Zhao & Liu, 2023). The housing sector, as one of the main kinds of assets for households and the capital market, as an environment for investment for investors, play a crucial role in economic welfare and financial security(Feng et al., 2016). Understanding the relationship between these two sectors is important and helpful for investors and policymakers in decision-making, because a change in one of these markets can affect the whole economy (Zhao & Liu, 2023). However, changes in one market could be reflected in another, and these changes have impacts on investors, households and policymakers.

This research illustrates how and through which mechanisms the housing sector and the capital market affect each other, and how and in which direction they influence one another. There are various studies on this topic, and each examines one or a few parallel sectors.

Current studies show that the main housing policy tools are monetary, tax, and macro-prudential policies, and housing prices and supply-demand conditions have transferred their effectiveness (Zhao & Liu, 2023). Systematic review testimonies illustrate tax instruments such as capital-gains-type measures to limit speculation; however, their impact is context-dependent and often partial (Zhao & Liu, 2023). Related empirical evidence from Canada and China suggests that taxes related to speculation and capital gains can be partially transmitted through buyers and even prices in non-taxed neighboring areas, sometimes suggesting spatial spillovers of housing policies (Rosiers et al., 2019). Studies in Australia demonstrate the strong response of investors to capital gains prospects, tax actions, and interest rates, authenticating the significance of these levers for investment and speculation in housing (Dixon, 2025)

International literature, using DCC and BEKK-type MGARCH models, shows fluctuation spillovers and transmissions between real estate and stock markets (Feng et al., 2016). Research in China shows strong two-way fluctuations and spillovers of the housing sector and banking or industrial indices, commonly positive and time-varying dynamic correlations (Cao, 2020). The narrative of the housing sector and stock markets illustrates through time-frequency connectedness analyses over longer horizons, stock markets acting as net senders to the housing sector across city tiers with uncertainty of economic policy (Sarma & Rajib, 2025; Yang et al., 2021). The financial or real estate sector can become an original spillover transmitter in sectorial networks, playing a crucial role in systemic risk during crises such as COVID-19 (Chang & Dasgupta, 2022; Feng et al., 2016; Mensi et al., 2023).

This study aims to analyze how the housing sector and the capital market affect each other and to better understand their interactions and responses across different situations. However, research explains the mechanisms of fluctuations between the housing sector and the stock market (Neri & Iacoviello, 2008). Substantial changes affected Iran's housing sector and stock market and these changes have narrative relationships to macroeconomic provisions, exchange rate fluctuations, inflation, ratification, and shifts in portfolio allocation across asset markets.

This research is important given the special features and structure of the Iranian economy and the changes during this period, as it examines fluctuations between the housing market and the capital market in Iran during 2016–2023. Studying the relationship between these two markets is policy-relevant because housing price changes spill into inflation, business investment, and financial-market performance, while stock-market behavior responds to housing and macroeconomic shocks (Calza et al., 2013). Developments in one of these markets can trigger reactions in the other, although the direction and size of the effect are not constant. Evidence for Iran shows co-integration between housing prices and stock-market variables, while broader Iranian asset-market evidence finds causality and spillovers among housing, stock, foreign-exchange, and gold markets (Roudari et al., 2023). A close study of these relationships can clarify how housing and capital markets jointly shape the wider economy. Rising housing prices in Iran have been associated with weaker investment in small and medium-sized industrial firms, suggesting that capital can be pulled away from productive activity toward real estate when housing becomes more attractive (Gholipour, 2020). Housing investment also appears to raise inflation across both recession and boom regimes. At the same time, exchange-rate depreciation and sanctions intensify market instability in Iran and strengthen co-movement across financial markets, making joint analysis of housing and capital markets especially important (Roudari et al., 2023). Econometric modeling is well suited to this topic because prior Iranian studies have used ARDL, NARDL, VAR, wavelet coherence, threshold SVAR, spatial panel, and Bayesian SVAR methods to estimate dynamic, asymmetric, and spillover relationships across housing and financial markets.

The findings from such a study can therefore help policymakers, analysts, and investors interpret spillovers, portfolio shifts, and macroeconomic transmission between Iran's housing and capital markets more effectively.

2. Literature Review

The housing sector and capital markets are strongly interconnected; the volatility of one of them often influences the other (Mohseni & Hashem, 2018). Real estate investment trust (REIT) equity returns are significantly affected by fluctuations in housing-sector variables in the U.S.(Alam, 2021) The housing sector significantly affects the non-stationary probabilities for business and interest rate cycles, with low-growth and high-growth periods both(Özdemir, 2020). A housing risk index based on factors derived from housing sector volatility plays a dominant role in predicting REIT returns and illustrates a remarkable segment of cross-sectional variation in sectorial REIT returns, also in the case after accounting for larger financial and macroeconomic factors. This introduces the volatility of the housing sector as a risk factor in capital markets (Chang & Dasgupta, 2022). Comparative studies in Poland reveal strong price volatilities in both the housing sector and capital markets and have direct impacts on both investment risk and financial decision-making(Chang & Dasgupta, 2022).The correlation of these two markets with each other and the fluctuations of their particular price indices advocate that awareness of these dynamics is necessary to apportion reasonable capital for both shelter needs and conjectural investors(Iacoviello & Neri, 2010).

Housing prices and the capital market have a more complicated relationship because of the capital channels mechanism (Fund, 2013). An increase in the capital of specific companies in China can be visible in local housing markets, which affects the prices of real estate remarkably in rich areas. The effect is different according to market conditions, as when there is a booming market, the growth of the stock market can replace the growth of housing prices. During market falls, the effect of wealth dominates, thus markets both fall in parallel (Calza et al., 2013). These capital streams increase local inequalities in housing prices and spotlight the significance of macro-level analysis to conceive these volatilities (Lunsford, 2016). Policies on the macro level, for instance, capital management have a dominant role to reconcile the interconnectedness of capital flows and housing prices; according to the evidence from a cross-country panel demonstrates that in the long run, policies of capital control inflow generally reduce housing prices and affect developed and emerging economies differently (Zhou, 2024). Before financial crises, macroeconomic policies are particularly noticeable; endogenous markets can be affected by them (Calza et al., 2013). Targeting the housing sector by loan-to-value ratios and shocks of countercyclical capital policies can lead the housing sector and capital market, according to the nature of economic buffers stabilize or destabilize (Calza et al., 2013). These instruments have different impacts; the effectiveness of loan-to-value ratio policies is bigger than the shocks of housing and technology, and sometimes capital shock policies might erode buffers of housing prices (An et al., 2016). For this reason, policymakers must adapt policies carefully for shocks which effect the economy. The models of dynamic stochastic general equilibrium (DSGE) illustrate that business cycles significantly influence fluctuations of the housing sector (وزیری‌زاده& حق‌شناس, 2023). The housing sector and residential investment show significant sensitivity to both monetary policy and demand buffers; the wealth impacts on consumption of housing have increased gradually. (DSGE) models are useful in the determination of housing expansion and in busting larger economic fluctuations (Calza et al., 2013).

The difference in the relationships between the housing sector and capital markets is significant from one region to another. By increasing capital into the housing sector, the level of prices in certain regions drives inequality up. Policy interventions to retain capital in less developed regions might be useful to ease these inequalities (Li et al., 2023). As the housing sector and fluctuations of its rising prices in Iran attracted the attention of investors and speculators in previous years, in this research, we analyze price volatilities and shocks and their impacts on each other in both the housing sector and the capital market. While in the last few years these shocks have become a big part of market behavior, analyzing these shocks is crucial for predictions and policymaking, and compared to other research, opens new doors.

According to the literature, there are different complex and interrelated factors that drive fluctuations between the housing sector and capital markets, such as volatility transmission, capital flows, macroprudential and capital controls, and regional dynamics.

This research aims to analyze the dynamics of relationships between the housing sector and the capital market in the Iranian economy according to the understanding of fluctuation coordination produced by expectations of investors.

3. Research Methodology

To investigate changes and volatility spillovers between the housing sector and the capital market, the study uses an econometric framework. The Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized ARCH (GARCH) models are used to model conditional heteroskedasticity and volatility clustering. The ARCH model encapsulates short-term volatility dynamics by linking the conditional variance to previous squared residuals, while the GARCH model enhances this framework by integrating both historical shocks and prior conditional variances, thus reflecting the persistence frequently seen in financial and housing market volatility. While real estate prices typically demonstrate more price inflexibility and prolonged memory compared to equity prices, this research aims to explore the short- and medium-term volatility transfer across the two markets instead of explicitly modeling long-memory behavior. Consequently, the conventional GARCH model is deemed suitable since it adeptly encapsulates volatility clustering and persistence, while offering a concise and broadly recognized framework for comparative assessments across various asset markets. Thus, more intricate long memory models, like EGARCH or FIGARCH, fall outside the purview of this investigation and will be reserved for subsequent studies.

Maximum Likelihood Estimation (MLE), assuming normally distributed errors, is employed for parameter estimation. Diagnostic tests, including ARCH-LM tests, are run to check the presence of conditional heteroskedasticity and to confirm the validity of the estimated volatility models. This methodological framework permits the investigation of dynamic interactions and volatility transmission between the housing and capital markets and provides data that can inform investment decisions and policy formation in the Iranian economy.

The stock market may be more volatile than the housing sector, according to the log-transformed changes in both variables. However, this comparison should be backed up by quantitative indicators, like the standard deviation or variance of returns, to confirm the relative riskiness of the capital market. This means there are more shocks and higher risk in the stock market, and models of uncertainty explain them in more detail.

4. Findings

4.1 Data

This study uses data related to two main sectors of the Iranian economy, such as the housing sector and the stock market, as an agent of capital market data covering the period from March 2016 to October 2023. The housing sector is illustrated by the monthly average price of residential apartments in Tehran per square meter helping as a proxy for housing returns. The USD/IRR exchange rate is a crucial variable in the Iranian context, even if it is not included in the baseline model. This is because currency swings can impact both asset markets through inflation, valuation, and portfolio reallocation. As a result, care should be used when interpreting the estimated causality between housing and stocks, and the exchange rate's omission should be acknowledged as a possible source of omitted-variable bias. An expanded model that incorporates the exchange rate would offer a more reliable assessment of the relationship between housing and stocks.

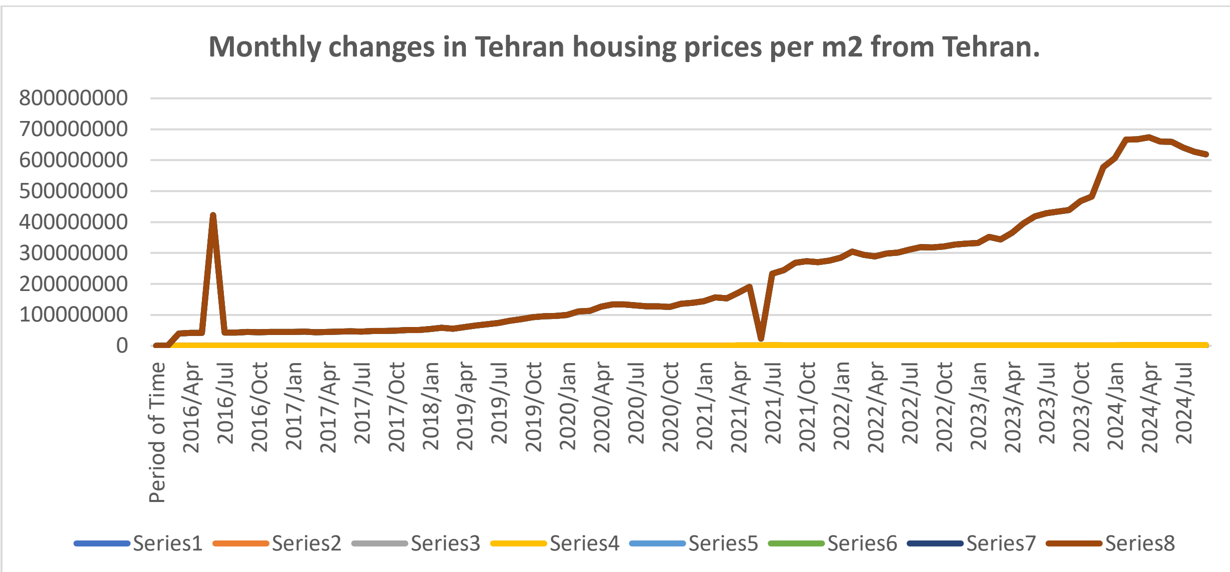


Table 1: Monthly changes in Tehran housing prices per m2 from Tehran.

From the capital market, the overall Tehran Stoke Market index monthly returns has taken as a factor of the capital market.

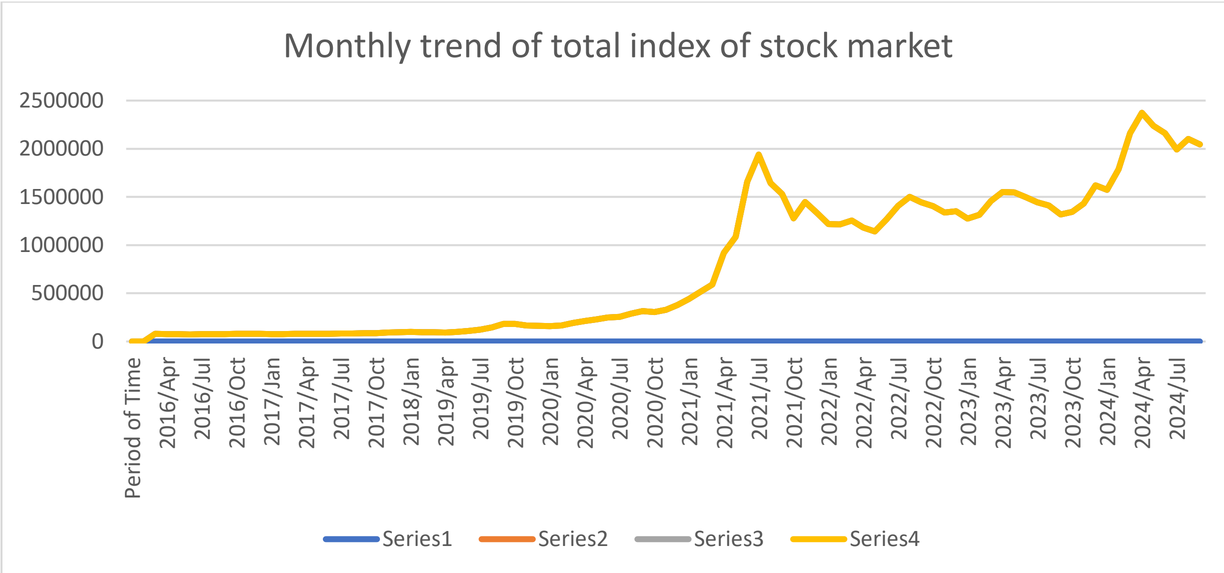


Table2: Monthly trend of total index of stock market for 2016 to 2023

To summarize the main characteristics of these two sector data sets, descriptive statistical examination was conducted before analysis. Time series stationarity is tested by the Augmented Dickey-Fuller (ADF) test to certify econometric modeling aptness. First differences and logarithmic transformations were crucial for variance stabilization and efficiency of return series analysis.

4.2 Stationarity and Trends of Variables

An essential stage in econometric and time-series modeling is analyzing unit roots and stationarity. However, given Iran's high inflation from 2016 to 2023, it is crucial to make clear whether the series are expressed in nominal or real terms because nominal price data could cause the results of the unit root test and causality analysis to reflect inflation rather than the underlying economic relationship. Both the Phillips-Perron and Augmented Dickey-Fuller tests indicate that the time series are dependent over time and have a trend. However, given Iran's substantial inflation from 2016 to 2023, it is crucial to indicate whether the price series are nominal or real because assessments based on nominal data may be significantly impacted by inflationary movements. Before time-series analysis, unit root tests are used to evaluate stationarity because non-stationary data can yield inaccurate and untrustworthy results. Therefore, before beginning the investigation, the stationarity of the data was evaluated by looking at its unit root attributes.

The unit root test using the generalized Dickey-Fuller and Phillips-Perron methods is shown in Table 3.

DLCAPINDX represents the first-differenced logarithmic series of the capital market index.
Exogenous: Constant and Linear Trend
Lag Length: (Automatic - based on SIC, (maximum lag set to 11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.721109	0.0000
Test critical values:	1% level	-4.064453	
	5% level	-3.461094	
	10% level	-3.156776	

*MacKinnon (1996) one-sided p-values.

Table 4. Stationarity tests for the logarithmic change in housing prices, reported using the Augmented Dickey-Fuller and Phillips-Perron tests.

Null Hypothesis: DLESTPRICE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.966046	0.0133
Test critical values:	1% level	-4.065702	
	5% level	-3.461686	
	10% level	-3.157121	

*MacKinnon (1996) one-sided p-values.

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were used to assess the stationarity characteristics of the variables. Both tests' findings show that the variables are stationary, demonstrating that they meet the stationarity criteria for further econometric analysis.

4.3 Building an average model based on the ARIMA model and the ARCH effect

A static ARIMA-GARCH framework would not adequately represent time-varying linkages in volatility and market connectedness given the study period of 2016–2023 and Iran's uncertain economic environment. Therefore, a time-varying specification like TVP-VAR may offer a more appropriate framework for capturing developing dynamics during times of policy shifts or crises, even though ARIMA model selection should be finished before testing for ARCH effects.In time series analysis, the ARIMA (Autoregressive Integrated Moving Average) model is one of the popular methods. This model is particularly useful for time series data predictions that have complex and non-linear patterns. The ARIMA model consists of three main components:

AR (Autoregressive): The autoregressive component of the model means that the current values of the time series are dependent on its previous values. An AR (p) model states that the current value of a time series is obtained from a linear combination of its p previous values. The component of autoregressive in this model indicates that the current value of the time series is dependent on its previous values. The AR (p) model defines the current value of a time series as a linear combination of its p previous values.

I (Integrated): The integrated part relates to the difference, subtraction of earlier values from the current values means integrated. Assuring the stationarity means ensuring that the mean and variance, or statistical properties of a time series, are constant over time.

MA (Moving Average): This part illustrates that prediction errors impact the current value of the time series by its previous value. A combination of the previous q prediction errors is considered as the current value of the time series in an MA (q) model. Because it is denoted by the character ARIMA (p, d, q), in an ARIMA model, the lag of periods of the AR section is represented by p, differencing operations for the I section are represented by I, and q shows the lag period number for the MA component. It is necessary to estimate a mean model for each series before examining ARCH effects. However, given the features of housing prices, EGARCH or FIGARCH might be a better fit for capturing asymmetric and persistent volatility than ARCH alone. The autocorrelation test is necessary for this purpose. This test rejects the null hypothesis of no autocorrelation. In the two tables below, we are noticing the partial correlation and autocorrelation of two variables of interest at the lags considered in the ARMA model.

Table5: Autocorrelation and Partial Autocorrelation Functions for [stock market returns / housing market returns / model residuals] (Sample: 1395M01–1402M12).

The following table reports the autocorrelation and partial autocorrelation functions for [the relevant series], using monthly observations from 1395M01 to 1402M12.

Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*** |	. |*** |	1	0.447	0.447	18.596	0.000
. |** |	. |* |	2	0.280	0.100	25.966	0.000
. |* |	.*|. |	3	0.081	-0.096	26.591	0.000
. |. |	.*|. |	4	-0.039	-0.087	26.737	0.000
. |. |	. |. |	5	-0.022	0.048	26.783	0.000
.*|. |	.*|. |	6	-0.169	-0.180	29.588	0.000
. |. |	. |* |	7	-0.014	0.145	29.608	0.000
. |. |	. |. |	8	0.016	0.043	29.633	0.000
. |. |	. |. |	9	0.031	-0.025	29.733	0.000
. |. |	. |. |	10	0.025	-0.033	29.797	0.001

Table: Housing Index Variable Results: Nominal and Real Returns

The Housing Index Variable Results are reported as [nominal/real] returns, and given the persistent and asymmetric nature of housing volatility, supplementary long-memory or asymmetric models such as FIGARCH or EGARCH should also be considered.

Sample: 1395M01 1402M12
Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |** |	. |** |	1	0.263	0.263	6.4185	0.011
. |** |	. |** |	2	0.335	0.286	16.972	0.000
. |* |	. |. |	3	0.140	0.002	18.835	0.000
. |. |	.*|. |	4	0.011	-0.131	18.846	0.001
. |. |	. |. |	5	0.018	-0.004	18.878	0.002
. |. |	. |. |	6	-0.030	0.004	18.969	0.004
. |. |	. |. |	7	-0.014	0.005	18.988	0.008
. |. |	. |. |	8	-0.006	0.007	18.991	0.015
.*|. |	.*|. |	9	-0.085	-0.095	19.735	0.020
.*|. |	. |. |	10	-0.075	-0.058	20.315	0.026
**|. |	**|. |	11	-0.323	-0.298	31.265	0.001
. |. |	. |** |	12	0.032	0.248	31.375	0.002

Table 6. Mean Equation Estimates for Stock Market Index Returns

Returns are calculated from the stock market index in [nominal/inflation-adjusted] terms to ensure correct interpretation in the context of high inflation.

Dependent Variable: DLCAPINDX
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 01/27/24 Time: 20:59
Sample: 1395M02 1402M07
Included observations: 90
Convergence achieved after 42 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.034826	0.020954	1.661967	0.1002
AR(1)	0.401048	0.119376	3.359547	0.0012
MA(2)	0.151915	0.069918	2.172760	0.0325
SIGMASQ	0.007466	0.000670	11.14280	0.0000

R-squared	0.217815	Mean dependent var	0.035994
Adjusted R-squared	0.190529	S.D. dependent var	0.098245
S.E. of regression	0.088391	Akaike info criterion	-1.967656
Sum squared resid	0.671920	Schwarz criterion	-1.856553
Log likelihood	92.54450	Hannan-Quinn criter.	-1.922852
F-statistic	7.982803	Durbin-Watson stat	1.972345
Prob(F-statistic)	0.000094		

Inverted AR Roots	.40	
Inverted MA Roots	-.00+.39i	-.00-.39i

This table shows a statistical result from an ARMA model (Autoregressive Moving Average model) and analyzes related time series data from the capital market. AR (1) value is 0.4010, showing a moderate positive autocorrelation on the previous value. This means there is a strong correlation between the stock market index return variable and its previous periods. MA(2) illustrates the reaction of variables to errors from two periods prior, although the coefficient is not very large. SIGMASQ (error variance), which indicates the stability of errors in the model.

Log likelihood, Akaike information criterion, Schwarz criterion, and Hannan-Quinn criterion indicate model fit. Both the Akaike and Schwarz criteria are negative, indicating a good model fit. The Durbin-Watson statistic is not entirely adequate for detecting autocorrelation because the specification contains lagged dependent variables; Durbin's h-test or the Breusch-Godfrey test would be more suited. F-statistic and Prob (F-statistic): A very low value indicates that the model is generally significant. Based on this model, This model investigates and validates the average ARCH impact using two lags. However, the analysis may be reinforced by estimating EGARCH or TARCH models in addition to the usual ARCH specification because volatility in developing market data can be persistent and asymmetric, particularly under penalty pressures.

Table 7. Mean Equation of the ARCH Model

Heteroskedasticity Test: ARCH

F-statistic	17.70254	Prob. F(2,85)	0.0000
Obs*R-squared	25.87638	Prob. Chi-Square(2)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/27/24 Time: 21:16
Sample (adjusted): 1395M04 1402M07
Included observations: 88 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	0.003667	0.001976	1.856187	0.0669
RESID^2(-1)	-0.021440	0.091188	-0.235114	0.8147
RESID^2(-2)	0.540562	0.091178	5.928618	0.0000

R-squared	0.294050	Mean dependent var	0.007582
Adjusted R-squared	0.277439	S.D. dependent var	0.018835
S.E. of regression	0.016011	Akaike info criterion	-5.397635
Sum squared resid	0.021789	Schwarz criterion	-5.313180
Log likelihood	240.4959	Hannan-Quinn criter.	-5.363610
F-statistic	17.70254	Durbin-Watson stat	2.076397
Prob(F-statistic)	0.000000		

ARCH model lags are related to the number of earlier periods used in estimating the current variance. For instance, AR CH (2) considers the two past time lags (such as RESID^2(-1) and RESID^2(-2)). ARCH models' lags represent the extent to which the variance of the current error is affected by shocks of past time. The current variance is affected by the fluctuations of the earlier two periods in two lags ARCH model. The coefficient of RESID^2(-1) is undersized and, of course, insignificant, while the coefficient of RESID^2(-2) is big and extremely significant. The t-statistic demonstrates that the second lag is statistically significant, showing that volatility from two months earlier influences current variance. While this indicates the presence of market memory, the sanction period beginning in 2018 may have generated structural breaks and separate volatility regimes, thus a static ARCH model may oversimplify the underlying dynamics. In this context, regime-switching models or time-varying parameter techniques would give a more flexible framework for assessing volatility transmission. The reality and overall significance of the model indicates with its very low Prob (F-statistic) (0.000000). Based on the above model, the ARCH equation with two lags is estimated so that we can interpret the coefficients.

Dependent Variable: DLCAPINDX
Method: ML ARCH - Normal distribution (OPG - BHHH / Marquardt steps)
Date: 01/29/24 Time: 12:33
Sample (adjusted): 1395M03 1402M07
Included observations: 89 after adjustments
Failure to improve likelihood (non-zero gradients) after 48 iterations
Coefficient covariance computed using the outer product of gradients
MA Backcast: 1395M01 1395M02
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(4) + C(5)*ABS(RESID(-1)/@SQRT(GARCH(-1))) +
C(6)*ABS(RESID(-2)/@SQRT(GARCH(-2))) + C(7)*RESID(-1)
/@SQRT(GARCH(-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.019789	0.007450	2.656112	0.0079
AR(1)	0.352197	0.089173	3.949578	0.0001
MA(2)	-0.257995	0.070817	-3.643111	0.0003
	Variance Equation			
C(4)	-7.258266	0.322421	-22.51178	0.0000
C(5)	0.647723	0.248770	2.603705	0.0092
C(6)	1.388975	0.219564	6.326061	0.0000
C(7)	0.245809	0.243695	1.008672	0.3131

R-squared	0.059214	Mean dependent var	0.036789
Adjusted R-squared	0.037336	S.D. dependent var	0.098510
S.E. of regression	0.096653	Akaike info criterion	-2.466552
Sum squared resid	0.803400	Schwarz criterion	-2.270817
Log likelihood	116.7616	Hannan-Quinn criter.	-2.387657
Durbin-Watson stat	1.766252		

Inverted AR Roots	.35	
Inverted MA Roots	.51	-.51

The ML-ARCH model results for the dependent variable DLCAPINDX are reported in Table X, where the variance equation coefficients C(4)–C(7) are presented (which represents the capital market index). Model results indicate that it's suitable and could describe the fluctuations of the capital market. In addition, as long as the values of AR (1) and MA (2) are significant, it illustrates that the capital market index is influenced by its previous information. From the other side, the components of the variance equation show conditional volatility in the data. ML ARCH model indicates that the index of capital market (DLCAPINDX) is significantly affected by its previous data and conditional volatility. The statistically significant AR (1) and MA (2) sections show autocorrelation and moving average effects. Over the course of 7.5 years, the model enforces a static parameter structure. Although this assumption makes estimate easier, it might be restrictive in the Iranian situation, where relationships may change over time due to sanctions, exchange-rate volatility, and policy changes. According to recent research on Iran, time-varying parameter models are more appropriate for capturing structural change and dynamic connection during times of crisis well with coefficients C (4) to C (7).Here, C(4) denotes the constant term in the variance equation, C(5) and C(6) correspond to the ARCH terms, and C(7) corresponds to the GARCH term. In other words, they show how the impact of past residuals (RESID (-1) and RESID (-2)) affects the current variance. Homoskedasticity is not always implied by the lack of a substantial ARCH effect under the conventional test. Supplementary volatility specifications like GARCH, EGARCH, or FIGARCH should be estimated to more thoroughly evaluate persistence and long-memory behavior given the known persistence and potential asymmetry of housing-market shocks. The mean model is estimated first. It is crucial to note that the two markets have completely distinct characteristics, and the stock market's cyclical swings have an impact on the average model and the calculation of delays. First, the mean model is estimated. As expected, the cyclical courses show their fluctuations in the ARMA model.

Table 8. Results of the ARMA Model

Dependent Variable: DLESTPRICE
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 01/29/24 Time: 13:52
Sample: 1395M02 1402M07
Included observations: 90
Convergence achieved after 18 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.031057	0.005021	6.184917	0.0000
AR(1)	0.240650	0.120594	1.995530	0.0492
AR(2)	0.242227	0.116337	2.082108	0.0403
MA(11)	-0.388425	0.136732	-2.840785	0.0056
SIGMASQ	0.001252	0.000159	7.874883	0.0000

R-squared	0.268827	Mean dependent var	0.030433
Adjusted R-squared	0.234419	S.D. dependent var	0.041607
S.E. of regression	0.036405	Akaike info criterion	-3.711786
Sum squared resid	0.112655	Schwarz criterion	-3.572908
Log likelihood	172.0304	Hannan-Quinn criter.	-3.655782
F-statistic	7.812891	Durbin-Watson stat	1.990215
Prob(F-statistic)	0.000021		

Inverted AR Roots	.63	-.39		
Inverted MA Roots	.92	.77-.50i	.77+.50i	.38-.83i
	.38+.83i	-.13-.91i	-.13+.91i	-.60-.69i
	-.60+.69i	-.88-.26i	-.88+.26i	

According to this model, we must assess the effect of the ARCH model. The logarithmic change in house prices does not show a substantial short-run volatility dependency according to the conventional ARCH test. However, as it does not rule out long-memory or asymmetric volatility dynamics, this result should be regarded with caution. A more thorough evaluation of volatility dependence would be possible with additional tests using FIGARCH or EGARCH-type models, given evidence from the Iranian housing market that macroeconomic shocks can have long-lasting and nonlinear consequences.

Heteroskedasticity Test: ARCH

F-statistic	0.485314	Prob. F(1,87)	0.4879
Obs*R-squared	0.493716	Prob. Chi-Square(1)	0.4823

This indicates that the logarithm of price changes is not significant statistically for (heteroscedasticity) in the Iranian housing market. The result of ARCH test with F-statistic and Prob. values. F, and their values are 0.485314 and 0.4879, respectively, show that housing sector fluctuations are not dependent on the past significantly. As a result, the data in this instance does not support the typical ARCH model, albeit this does not rule out other types of volatility dependency. Further specifications like FIGARCH or EGARCH would offer a more thorough evaluation of volatility dynamics given the potential for asymmetric or persistent shocks in housing markets. It could illustrate the particular nature and different dynamics of the housing market compared to other markets. The logarithm of housing price changes does not fit the ARCH model well. The test results proves this (the test for unequal variances, which illustrate the verification of the ARCH effect (with F-statistic and Prob. values). F, which are 0.485314 and 0.4879, respectively). The ARCH model is not fit with housing data, and the structural features of the housing market, such as lower liquidity, higher transaction costs, longer adjustment lags, and greater information asymmetry compared to the stock market, could be one explanation. These factors can all result in a volatility profile that is different from that of typical financial assets. The reaction of housing might be dissimilar against economic and political factors, and housing sector fluctuations might also differ from the stock market; the ordinary model as ARCH, cannot explain fluctuation in such a market completely.

We use a Granger-causality paradigm to investigate the relationship between housing and stock prices. However, a bivariate specification may confuse direct causality with shared exposure to USD/IRR movements since both markets may react to exchange-rate shocks in Iran. Future research should therefore use a multivariate VAR or VECM methodology that accounts for macroeconomic variables and exchange-rate dynamics. The correlation coefficient between the two variables is 0.354, indicating a positive but not very strong relationship between the two variables. Since both of these markets fall into the category of long-term investment markets, they can exhibit different causal relationships with each other at various intervals. As shown in the tables below, there is a one-month lag in the causal path from the stock market to the housing market, meaning changes in housing can Granger-cause changes in the capital market. As the time periods increase, the causal path changes. Meaning the capital market is the one that is affected by the housing market. In other words, over a longer period, such as 4 months, changes in capital market prices cannot Granger-cause changes in housing prices. Fluctuations in housing prices Granger-cause fluctuations in the stock market index over shorter time periods. This impact becomes weaker as the lag length increases, and at some higher-frequency horizons the direction may invert, with movements in the stock market also Granger-causing changes in housing prices. In other words, the first hypothesis of this research, which states that these two markets influence each other, is rejected.

For the correlation test between variables, we apply the Granger causality model and estimate the correlation relationship between two variables. Between these two variables, the correlation coefficient is 0.354, which indicates a positive connection between the two variables and also shows that the connection is not very strong. As long as these two markets are related to the class of long-term investment markets, there could be a variety of accidental connections between them at different points in time. We could notice in the table below that there is a one-month lag in the causal path from the stock market to the housing market, meaning changes in housing can Granger-cause changes in the capital market. As the time periods increase, the causal path changes. Meaning the capital market is the one that is affected by the housing market. In other words, over a longer period, such as 4 months, changes in capital market prices cannot Granger-cause changes in housing prices. At higher frequencies, although this causal relationship holds, it weakens, and changes in housing prices can Granger-cause changes in the stock market index. In other words, the first hypothesis of this research, which states that these two markets influence each other, is rejected.

Table 9. Results for Stock Market Index Changes

Pairwise Granger Causality Tests
Date: 01/29/24 Time: 14:41
Sample: 1395M01 1402M12
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.

DLESTPRICE does not Granger Cause DLCAPINDX	89	0.12428	0.7253
DLCAPINDX does not Granger Cause DLESTPRICE		4.27013	0.0418

Pairwise Granger Causality Tests
Date: 01/29/24 Time: 14:43
Sample: 1395M01 1402M12
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
DLESTPRICE does not Granger Cause DLCAPINDX	86	2.68617	0.0374
DLCAPINDX does not Granger Cause DLESTPRICE		2.05332	0.0952

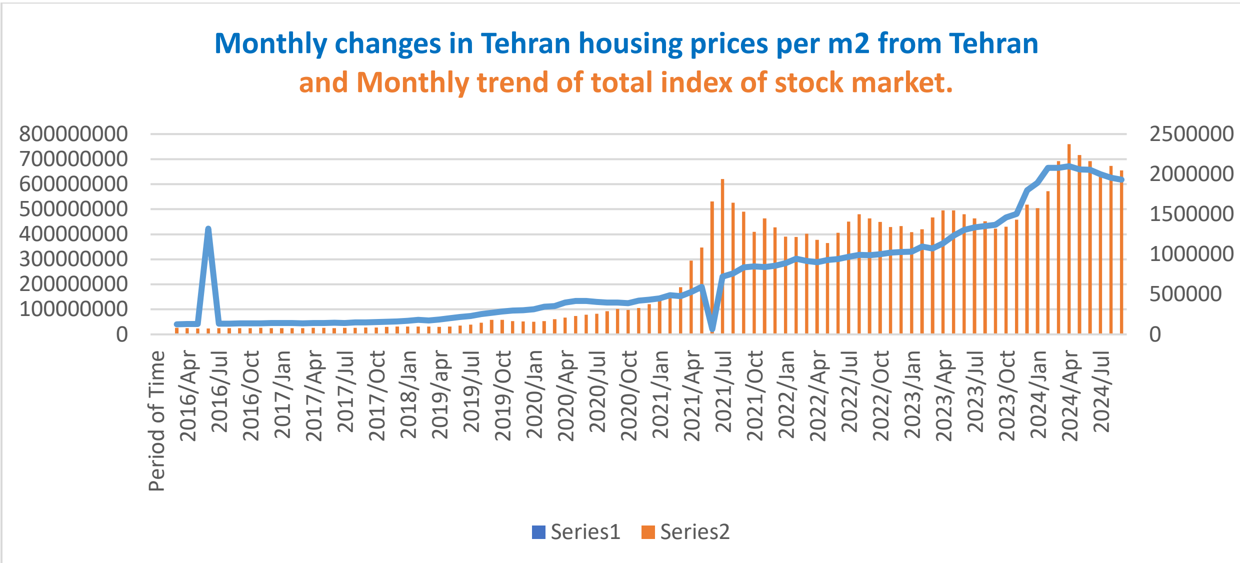
Pairwise Granger Causality Tests
Date: 01/29/24 Time: 14:46
Sample: 1395M01 1402M12
Lags: 6

Null Hypothesis:	Obs	F-Statistic	Prob.
DLESTPRICE does not Granger Cause DLCAPINDX	84	2.06229	0.0685
DLCAPINDX does not Granger Cause DLESTPRICE		1.56446	0.1703

Pairwise Granger Causality Tests
Date: 01/29/24 Time: 14:59
Sample: 1395M01 1402M12
Lags: 12

Null Hypothesis:	Obs	F-Statistic	Prob.
DLESTPRICE does not Granger Cause DLCAPINDX	78	1.75302	0.0814
DLCAPINDX does not Granger Cause DLESTPRICE		0.78523	0.6629

Based on Granger causality tests, the relationship between changes in housing prices and the capital market index at different lags has been examined. In the first lag, it was shown that the capital market index is a Granger cause for housing prices, but the reverse is not true. At lags 4 and 6, housing prices are the Granger cause of the capital market index, but at lag 12, neither variable could be identified as the Granger cause of the other. Despite the fact that the linear Granger-causality results indicate that the housing and stock market interaction fluctuates over time, these results should be regarded with caution since asymmetric responses to positive and negative shocks may not be captured by linear models. Nonlinear or frequency-domain techniques would offer a more reliable explanation of the transmission mechanism given the potential for housing-market rigidity and stock-market volatility clustering. The results obtained from models and causal relationships between the two variables indicate that the capital market risk in Iran is higher than that of the housing market, and its fluctuations affect subsequent periods. Here, we calculated the cumulative returns of both markets over the period under review to show we appreciate this suggestion. We agree that higher raw returns do not by themselves demonstrate compensation for higher risk. To make the comparison more rigorous, we will either report a risk-adjusted performance metric, such as the Sharpe ratio, or revise the claim to avoid implying risk-offsetting without such evidence. For this, we use cumulative returns. We note that these returns are on a monthly basis, and since housing has less monthly volatility, it has not experienced negative and positive returns with high variance, while the stock market has experienced these fluctuations on a monthly basis. As shown in chart (5), the cumulative percentage of monthly stock market returns has shown an increasing trend compared to housing since August 2018, and this trend has been maintained until today. In other words, over a period of 7 and a half years, investing in the stock market has yielded a higher return than real estate overall. According to these numbers, the cumulative nominal return on the capital market was 376.7 percent throughout this time, whereas the cumulative nominal return on housing was 286.1 percent. However, it is crucial to specify whether these returns are nominal or real (inflation-adjusted) because Iran had considerable inflation throughout this time. Since the stock market's apparent outperformance might not result in a true increase in purchasing power, reporting simply nominal returns could be deceptive.



In this chapter, the research modeling has been conducted. First, the effect of ARCH on the variables for the housing and stock markets has been examined, and the results are presented. Then, the stationarity and trend of the variables were examined for both markets, and the construction of the mean model based on the ARIMA model and the ARCH effect on both the housing market and the stock market were also investigated, and the results are presented.

In this study, monthly data from the period 2016 to 2023 were used. Housing price returns were used as a proxy for the housing market, and the total stock market index returns were used as a representative for the capital market. Considering the logarithmic changes in both variables, the random fluctuations and severe changes in the stock market are greater than the changes in housing prices, which have higher risk and volatility compared to the housing market. The test shows the trend of the variables, indicating that neither variable requires differencing and both are stationary. The results of the ARCH model show that past data influences the capital market index and exhibits autocorrelation. Logarithmic variations were also investigated for the housing price variable. The findings imply that the volatility dynamics in the housing market cannot be sufficiently captured by a straightforward ARCH design. This suggests that the conditional variance process may involve features like long memory, asymmetric responses, or structural breaks, which may be better modeled using specifications like FIGARCH or EGARCH, but it should not be taken as proof that previous shocks are unimportant. The full-sample test does not support the opposite direction, but the Granger causality results show a modest but statistically significant directional relationship between home prices and stock market returns. This full-sample result should be read with caution, though, as the larger research indicates that the housing-stock link may change with time; in certain windows or subsamples, the causality pattern may turn bidirectional.

5. Conclusion

This study investigates the relationship between Iran's housing and capital markets, using the stock market as a proxy for the capital market. Numerous internal and external factors, such as macroeconomic policy, sanctions, global shocks, pandemics, fiscal and monetary conditions, and social expectations, have an impact on the two markets. Households may distribute funds among bank deposits, foreign exchange, gold, stocks, coins, and real estate in an economy with little financial depth; hence, changes in one asset market may spread to others through portfolio reallocation and anticipation channels.

Return spillovers, volatility transmission, information asymmetry, and autocorrelation are frequently seen in parallel asset markets. High transaction costs, slower price adjustment, supply and demand dynamics, and a tight relationship with the larger macroeconomy all influence the housing market. Exchange-rate fluctuations may intensify these interactions in the Iranian context because shifts in the USD/IRR rate might impact stock and housing prices at the same time, raising the possibility of omitted-variable bias if the exchange rate is not taken into account in the empirical framework.

Both markets appear to have had significant volatility recently, particularly during times of macroeconomic hardship. In these situations, market reactions may vary throughout time periods, and volatility does not always suggest a straightforward linear trend. Because of this, the paper examines conditional volatility and return dynamics using ARCH and GARCH-type models, while acknowledging that more specifications would be required if the data show asymmetry, persistence, or long memory. The assertion that the financial market is "very shallow" ought to be made with greater caution unless it is backed up by a particular indication of market depth or liquidity. The Iranian financial system's limited ability to absorb significant liquidity flows in relation to the scope of monetary growth is a more convincing way to put it. This could put further strain on parallel asset markets like housing and stocks. Only after the methods section should the empirical results be presented; they should not be included in the introduction. The stationarity tests, ARCH/GARCH estimates, and Granger causality conclusions should be described in a more logical order. Additionally, the results of the housing market should be presented with greater caution. If a basic ARCH specification does not fit the log changes in housing prices, this should be interpreted as evidence that the volatility process is not well captured by a simple ARCH form rather than as proof that there is no volatility dependence in housing prices.

Compared to the housing market, the stock market exhibits stronger and more erratic volatility, suggesting a larger short-term risk and more susceptibility to shocks. The housing market, on the other hand, is less responsive in the basic ARCH framework, albeit this does not exclude out structural change, persistence, or asymmetry in its volatility process. In order to capture asymmetric or long-memory behavior, future research may require more adaptable models like EGARCH or FIGARCH, as shown by the lower ARCH performance for housing. The results of Granger causality should be expressed in a way that avoids contradiction and corresponds to the real lag structure. The proper interpretation is time-varying bidirectional causality rather than a single stable one-way link if a one-month lag indicates causality from stocks to housing and a longer lag indicates causality from housing to stocks. To ensure internal consistency throughout the manuscript, this should be made clear and reflected in the abstract.

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During the sample period, this study looked at the volatility and causal relationship between Iran's capital market and housing market. The data indicates that macroeconomic instability has an impact on both markets, although the stock market is more volatile than the housing market. The housing series may need more flexible specifications that allow for asymmetry or extended memory, but the ARCH-GARCH results show that basic volatility models capture stock-market dynamics better than housing-market dynamics. Further evidence that the direction of influence is time-dependent comes from the Granger causality data. Longer-term dynamics may change this tendency, but short-term causality seems to extend from the stock market to housing. These results should be interpreted cautiously, though, as both markets may be influenced by changes in exchange rates. Overall, the findings point to a connection between the housing and capital markets, albeit one that is nonlinear, reliant on time horizons, and sensitive to more general macroeconomic circumstances.

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