

# The influence of macroeconomic factors on housing prices in India: an empirical study

Ms. Jaya G. Prabhu Parrikar

*Department of Commerce, Dnyanprassarak Mandal's College and Research Centre, Assagao Bardez,  
Goa- 403507, India  
jaya24@gmail.com*

## Abstract

**Objective:** The house prices in India have risen enormously in the recent past. Property buying has become unaffordable to a large section of population. Therefore, the study aims to identify the macroeconomic factors that can influence the House Price Index in India.

**Methods/ statistical analysis:** This study examines the macroeconomic determinants that can influence the House Price Index in India. The period of study is from 2010 Q1 to 2017 Q4. The study attempts to investigate the linkage between GDP, interest rates, housing credit, exchange rate and inflation with House Price Index. Hence, we employed correlation and multiple regression analysis, Johansen co integration test and VECM to identify the dynamic relationship in short run as well long run.

**Findings:** The study concluded that GDP, exchange rates, housing credit and inflation have strong positive correlation with house price index except for weak negative correlation with interest rates. The regression analysis has the adjusted r- squared 98.75% which indicates the model is strong. The Vector Error Correction Model which examines the dynamic relationship amongst variables in short run as well long run observed unstable long run association however there is presence of short run casual association of GDP, housing credit and interest rates with House price index. The study observed the absence of long run association of macroeconomic factors especially the GDP and House Price Index. Therefore, the study indicates the present rise in house prices may be supported irrational consumer expectations and not significantly influenced by incomes.

**Applications:** The study can guide the potential investors in real estate to revisit their investment plans. It is a clear indication for policy makers to that the rise in house prices is not in sync with the income rise.

**Keywords:** House prices, Real estate, Macroeconomic factors, Co-integration, VECM, Unsustainable prices.

## 1. Introduction

Food, clothing and shelter are the basic needs of every human existence. India, being the second most populated nation in the world there is always an ever growing demand for housing. To own a house it requires one to keep aside substantial household investment and for many households it is a lifetime dream. In the recent years, the housing prices in India have risen to enormously high levels making housing investment beyond the reach of common man.

The investment in housing serves a dual purpose. It is for consumption (i.e. for residential purpose) and for investment. The investment in housing comprises of rental yield and capital appreciation. In short, housing sector has a multiplier effect on the economy. As the housing prices increases, households borrowing increases and consequently household debt level increases which impacts consumer spending and reduces the purchasing power of households. Meanwhile as the housing market gains traction, speculative behavior and investment oriented buyers enter the market keeping the demand-supply gap out of equilibrium. The bank also tends to extend liberal credit facility as the value of the collateral rises. This behavior further propels investment in the housing market and the speculative buying behavior gains momentum.

The housing market crisis in Japan (1985-90) and USA (2006-08) also exhibited a similar trend. Favorable economic indicators in Japan and United States led to a massive rally in the housing prices causing a housing boom. However, as the price levels reached an unsustainable level the housing bubble burst causing severe economic distress, rising incidences of bad loans with the banks and financial instability in the nation. Following the housing bubble burst Japan passed through adverse economic condition which was characterized as the "lost decade". The United States also passed through housing market crisis. In both the economies housing crisis had preceded the financial crisis. In India, the real estate prices have shown a meteoric rise. The compelling question is: Are the housing prices in tune with the economic fundamentals? Are the housing prices sustainable in the long run? Unlike the stock market where the liquidity component is very high, the real estate investments are generally characterized as illiquid investment and the REIT is still in an infancy stage in India. The market for real estate in India is the interplay of multiple factors *viz.* demographic, political, social, economic etc. The present study attempts to analyze the effects of macroeconomic factors on housing prices in India. This study attempts to analyze the interaction between Indian House Price Index (HPI) and the macroeconomic factors. A lot of studies have explored the relationship between Housing prices and its macroeconomic variables in developed and emerging nations. In [1] examined the empirical relationship between housing prices with macroeconomic variables in Lithuania for the period 2001 to 2014 using Granger causality. The results of the study indicated no causality between inflation rates, interest rates and emigration with housing prices. However the GDP and unemployment rate has impact on the changes in housing prices.

A similar study carried out by [2] to analyze housing price in Malaysia during 2001 to 2010 using regression model. The study considers six dependent variables- population, GDP, labor force, interest rates, inflation rates and Real Property Gain Tax (RPGT). The study concluded that house prices were significantly linked with GDP, population and RPGT. Thus there exists positive relationship between income and housing prices. In [3] studies confirmed that there exists bi-directional causality between GDP growth and house prices. In [4] and [5] concluded that per capita disposable income greatly influenced the house prices [6] applied VAR model and variance decomposition to investigate the relation between house prices and macroeconomic variables in Turkey. The study concluded that influence of monetary aggregates namely GNP, prices and output has profound effect on housing investment. The study also reported a low influence of labor market (employment) on house prices. All the above studies have provided strong corollary to wage-price spiral theory. As the income levels grows household tends to increase spending and pushes prices levels up.

However, the study conducted by [7] concluded that there is an over valuation in housing prices in India for period 2001-05 and the housing prices are misaligned with the economic fundamentals. The study employed structural VAR models and variance decomposition to investigate for the presence of housing price bubble. The study examined the effects of interest rates, credit supply, inflation and GDP on house prices and concluded that income has significantly minor contribution to growth of housing price. The study conducted by [8] in the period 1996 to 2007 examined the influence of macroeconomic on housing prices using the co-integration test and VECM concluded that real income positively influenced house prices whereas the bank credit negatively influenced house prices, which suggests that credit availability has a significant bearing on house prices. Rapid rise in residential property prices have made home buying unaffordable to a large section of the population. As housing prices show an uptrend, people start investment in housing market with speculative motive. Banks lend money as the collateral value rises. The rationale of this study is to investigate the influence of macroeconomic factors on House Price Index in India. The macroeconomic factors selected for the study are namely- GDP, interest rates, inflation rates, exchange rates and housing credit. The study explores the significant relationship of macroeconomic variables with that of House Price Index in India.

## 2. Data and Methodology

### 2.1. Proposed empirical model

The main purpose of this study is to examine the association of macroeconomic factors on House Price Index. The dependent variable is the House Price Index (HPI) and the independent variables namely GDP, inflation rates (CPI), Interest Rates (INT), Exchange Rates (EXG) and Housing Credit (HSG CRD). The empirical model of this research specified below:

$$\lg HPI_t = \beta_0 + \beta_1 \lg GDP_t + \beta_2 CPI_t + \beta_3 \lg INT_t + \beta_4 \lg EXG_t + \beta_5 \lg HSG CRD_t + \mu_t$$

Where:

$\lg HPI_t$  = House Price Index (Index, 2010-11=100)

$GDP_t$  = Gross Domestic Product in India (used as proxy for income)

$CPI_t$  = Consumer Price Index (used as proxy for inflation)

$INT_t$  = Interest rates (weighted average call money rate is used as a proxy for domestic interest rates)

$EXG_t$  = Exchange rates (Rupees- USD used as proxy for India's foreign exchange)

$HSG CRD_t$  = Housing credit (used as a proxy for housing credit availability)

$\mu_t$  = error term

## 2.2. Source of data

The study uses secondary data and the research is based on quarterly time series data from the periods 2010-11 Q1 to 2017-18 Q4. The details of all independent and dependent variables are summarized in Table 1.

Table 1. Data measurement

Variables	Proxy	Unit measurement	Source
Dependent Variable			
1. House Price Index (dependent variable)	lgHPI	Index (2010-11= base year)( quarterly data)	Database on India Economy (RBI)
Independent Variables			
2. Gross Domestic Product	lgGDP	Amount in Rupees(quarterly data) (cumulative figures)	Database of Ministry of Planning and Statistics(MoPSI)
3. Inflation Rates	lgCPI	Index (2012-13= base year) (monthly data converted to quarterly) past values of inflations in data series is extrapolated	Database on India Economy (RBI)
4. Interest Rates	LgINT	Weighted average call money rates (daily rates then converted into quarterly average)	Database on India Economy (RBI)
4. Exchange Rates	lgEXG	Rupee=USD(daily rates then converted into quarterly average)	OCED database
5. Housing Credit	lgHSG CRD	Amount in Rupees (monthly data converted to quarterly) (cumulative figures)	Database on India Economy (RBI)

Source: Developed for the Research

## 2.3. Empirical testing procedure

Before running the stationary test, all the data series are converted into logarithmic series to maintain uniformity.

### 1. Unit root analysis

Augmented Dickey Fuller (ADF) test has been employed to examine the stationary in the time series data. When the variables are not stationary its mean, variance and covariance are not constant over time. Therefore, it is crucial to test data for stationary. If the data series appears to be non-stationary at level then the data is converted to it's the first difference. Mentioned that stationary time series maintain constant mean, variance and covariance across different periods. If the calculated ADF Statistic is less than the critical value, then the null Hypothesis is rejected; otherwise accepted.

Hypothesis statement:

H0: There is a unit root test (Non-stationary).

H1: There is no unit root test (Stationary).

### 2. Correlation and regression analysis

A correlation coefficient is a statistical tool to analyze linear relation among the two variables. The correlation coefficient "r" can range between -1 to +1, where 1 is total positive linear correlation, 0 is no linear correlation or spurious correlation, and -1 is total negative linear correlation.

Regression analysis is used to model the relationship between a dependent and independent variables.

### 3. Johansen co-integration

The Johansen co-integration tests (1988, 1991, and 1995) examine the presence of long term co-integration in the time series data. Johansen co-integration test in this study attempts to explore the relationship between macroeconomic variables and House Price Index in India. The prerequisite to run a Johansen co-integration test is the series are non-stationary at levels but stationary at first differenced. The trace statistics and Max Eigen test could be used to test number of co-integrating vectors.

### 4. Vector error correction model

When the variables are co-integrated, the Granger test is mis-specified and the Error Correction Mechanism (ECM) suggested by Engle and Granger (1987) should be used. As the variables are found to be co-integrated vector error correction model can be applied. VECM allows modeling of short-run as well as long-run dynamics involved in the model. It indicates the direction of causality. The VECM Granger causality test or the Block Exogeneity Wald test is tested to observe the short run causality available in the model.

### 3. Empirical results

Table 2 represents the unit root test. The analytical result reveals that all the variables are stationary at its first difference. The rejection of null hypothesis against the alternative hypothesis implies that the time series variables are stationary and integrated at the order of one i.e. I (1).

Table 2. Unit root test

Variables	Augmented Dickey Fuller Test (ADF Test)		
	Level	First difference (trend and intercept)	Order of integration
House price index (HPI)	-1.5065	-6.37356 (0.0001)	I(1)
GDP	-1.2288	-7.27034 (0.0000)	I(1)
Exchange rates	-3.5555	-5.50047 (0.0005)	I(1)
Housing credit	-0.1981	-3.0305 (0.0001)	I(1)
Inflation rates (CPI)	-1.8046	-4.79855 (0.0007)	I(1)
Interest rates	-2.0529	-5.41136 (0.0001)	I(1)

The interaction between house prices and its macroeconomic variables are examined through the Pearson's correlation tests. Table 3 represents the correlation analysis of House price index with other macroeconomic variables. The p-values are denotes in *italics* ( ). There exists strong positive correlation between house price index and GDP, exchange rates, housing credit and inflation except interest rates which showed weak negative correlation.

Table 3. Correlation matrix amongst variables

Variables	lgHPI	lg GDP	lgEXCHG	lgHG CRD	lgINFL	lgINT
lgHPI	1.00					
lg GDP	0.976 (0.000)	1.00				
lgEXCHG	0.957 (0.000)	0.919 (0.000)	1.00			
lgHG CRD	0.979 (0.000)	0.984 (0.000)	0.919	1.00		
lgINFL	0.987 (0.000)	0.970 (0.000)	0.966 (0.000)	0.977 (0.000)	1.00	
lgINT	-0.114 (0.0249)	-0.249 (0.0192)	0.001 (0.0995)	-0.266 (0.0239)	-0.147 (0.0250)	1.00

To further assess the relationship between house prices and macroeconomic factors, regression analysis is carried out. The results of regression analysis are presented in Table 4.

The coefficient of GDP, housing credit and interest rates seems to positively affect the house prices and the *p-value* returned indicates significance at 5% significance level. Exchange rates returned a *p-value* of 68.85% and the coefficient is also quite low meaning the effect of magnitude is also low.

The *F-statistic* shows that all the independent variables are jointly significant at 1% level of significance. The adjusted r squared at 0.98756, the model can explain 98.75% of the variations in the house prices. Moreover, 3 out of 5 independent variables return significance in the model which makes the model strong.

Table 4. Regression analysis

house price index	Coefficient	Std. Error	t-Statistic	Prob.
exch rates	0.087834	0.216641	0.405437	0.6885
GDP	0.290709	0.136613	2.12797	0.043
hsg credit	0.404579	0.135098	2.994712	0.006
Inflation	0.499623	0.294232	1.69806	0.1014
Interest	0.206875	0.051725	3.999512	0.0005
_cons	-6.19071	1.067993	-5.79658	0
R-squared	0.989567			
Adjusted R-squared	0.98756			
F-statistic	493.2105			
Prob(F-statistic)	0.0000			

Johansen co-integration test helps to determine the presence of long run association among variables. In order to accept the co-integrating relationship among variables, Trace and Max Eigen statistics should be higher than the critical values. Table 5 represents the test result and suggests there are a presence long run association and more than two co-integrating vectors with House Price Index.

Having established the co-integration of House Price Index with its macroeconomic variables, the fundamental question that arises regarding the nature of dynamic relationship between the variables in the short run can be answered by Vector Error Correction Model.

Table 5. Multivariate co-integration rank test (Trace and Maximum Eigen value) Johansen co-integration test

Hypothesized		Critical Value	Prob.**	Max-Eigen Statistic	Critical Value	Prob.**
No. of CE(s)	Trace Statistic					
None *	150.1091	95.75366	0	59.72833	40.07757	0.0001
At most 1 *	90.38073	69.81889	0.0005	48.62739	33.87687	0.0005
At most 2	41.75333	47.85613	0.1657	18.9424	27.58434	0.419
At most 3	22.81093	29.79707	0.2555	12.48151	21.13162	0.5009
At most 4	10.32942	15.49471	0.2562	8.351175	14.2646	0.3441
At most 5	1.978245	3.841466	0.1596	1.978245	3.841466	0.1596

### 1. Results of Vector Error Correction Model (VECM)

The vector error correction model is presented in Table 6 and 7. The results of Table 6 indicate absence of statistically significant association amongst macroeconomic variable and house price index in the long run. It means that in the long run macroeconomic factors do not have any causal relations with the House Price Index in India. To establish long run causality the coefficient has to be negative and the probability values statistically significant.

Table 6. Long run causality (Results of Vector Error Correction Model)

Dependent variables	Independent variables	Coefficient	Robust std. error	t-stat	P- values
House Price Index	Exchange rates	-0.1705	0.1152	-1.4798	0.1852
	GDP	-1.6134	0.1409	-11.469	0.1742
	Housing credit	0.5729	0.1055	5.4283	0.0087
	Inflation (CPI)	-0.5718	0.1111	-5.1452	0.1781
	Interest rates	0.0073	0.0380	0.1925	0.0127

The results of short run causality test among the variables based on VEC Granger causality test are presented in Table 7. The results indicate casual association of GDP, Housing Credit and Interest Rates on the House Price Index.

Table 7. Short run causality (VECM Granger causality/ Block Exogeneity Wald Tests)

Dependent variables	Independent variables	Chi-square	P- value	Implications
House Price Index	Exchange rates	2.1906	0.3344	No causality
	GDP	8.5670	0.0138	Existence of Causality
	Housing credit	9.8213	0.0074	Existence of Causality
	Inflation (CPI)	3.7312	0.1546	No causality
	Interest rates	8.0105	0.0182	Existence of Causality

Validity of the model gets proved by the tests applied on the residuals. The R-squared checks whether the data is good fitted. The model R- squared is 59%, which means 59% of the variation in house prices can be explained by the independent variables. The Durbin-Watson statistics is 1.37 indicates the absence of serial correlation in the results. The Bresuch-Pagan- Godfrey test proves absence of heteroskedasticity in the model. The observed R-squared probability is 16.45% which confirms no presence of heteroskedasticity. The Jarque-Bera statistics is 88% which proves the residuals are normally distributed [9-14].

#### 4. Conclusion

This study examined the linkages of macroeconomic variables with House Price Index as the property buying has become unaffordable in India. Based on the research findings, it can be concluded that there is a strong positive correlation of GDP, Housing Credit, Exchange Rates and Inflation with House Price Index except for the weak negative correlation of interest rates. This indicates that the economic variables of house prices move in the same direction. The regression result suggests 98.75% of the variation in house price can be explained by the independent variables considered. The Johansen co-integration test indicates the presence of long run association with more than two co integration equations. On the other hand, the Vector Error Correction Model (VECM) which examines the dynamic linkage of variables in the short run as well as long run observed unstable long run association of macro-economic variables with House Price Index. However, in the short run there is casual association of GDP, Housing Credit and Interest Rates with housing prices in India. This observation suggests that the rise in property prices in India is not in sync to the macroeconomic factors selected for the study.

The absence of linkage between income and housing prices in India, has become a concerning question for the policy makers. Are the housing prices driven by economic fundamental or by irrational consumer expectations? As GDP is not the main contributor to housing price rally, it shows that these high level house prices are unsustainable in the long run. Investors in real estate therefore should exercise caution at this juncture. Any adverse effects in the real estate prices can damage the financial stability in the nation, as housing loans still occupies the major segment of the total bank lending.

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