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# Macroeconomic Determinants of Housing Price Index: An Empirical Analysis of India

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## Abstract

Investment in real estate is treated as one of the most rewarding portfolio choices and many driving forces are aligned with the planning for it. The study attempts to measure the influence of select macroeconomic factors on housing price Index (HPI) for Indian economy. Reserve Bank of India and St. Louis Federal Reserve economic databases have been used to obtain the quarterly frequency data of House price index, real GDP, inflation and real effective exchange rate from 2010-11 Q1 to 2023-24 Q2 and analysed by using ARDL Bound test approach. The results of the study exhibit that the HPI in India is significantly affected by select macroeconomic variables, viz., Gross Domestic Product, inflation rate and real effective exchange rate. Findings of the study has positive inferences for the potential investors and government policies with respect to the housing sector.

**Keywords:** Real effective exchange rate (REER), GDP, inflation, Housing Price Index (HPI)

## 1. Introduction

The housing market is a vital indicator of economic health representing broader impact of macro-economic conditions. The increase in the volume of aggregate production gives a boost to aggregate revenue, disposable income and thereby a push to aggregate consumption and purchasing power. Moreover, owning a piece of land is the most desirable and significant portfolio component of most Indian households. Primarily people invest their money either in equities or in land in order to get increased returns in the near future. Therefore, the policy makers frame suitable legal protocols in the form of registration fee, site approval, stamp charges, rent and tax rates etc., to attain market stability. Price variations in real estate business can be measured with Housing Price Index (HPI). It is evident that macro-economic variables are associated with HPI. Real estate businesses focus on construction, buying and selling of commercial lands, plots, buildings, properties and all other infrastructure activities. The expansion of real estate industry supports a nation in multiple ways. Mass utilization of human capital in this industry contributes positively in relieving the unemployment obstacle in the growth of a country. Rural development, uplifting living standard, educational progress, money circulation and increased purchasing power, rise in GDP are positive aspects of real estate business. At the same time inflation, interest and exchange rate volatility, financial crises, political and legal changes force to oscillations in this market and disturb the economy of the country or region entirely. (Jaya & Prabhu Parrikar, 2019) <sup>[9]</sup> observed the interaction between HPI and macro-economic variables was not stable in the long run and the find causal relationship with GDP, housing credit and interest rates in short period.

Economists and financial advisors consider the revenue from real estate industry as one of the major sources for the steady progress of a nation. Academicians and researchers are therefore interested in analysing the core effect of basic factors to derive meaningful perspectives and framing new policies. According to (Naikoo *et al.*, 2021) <sup>[15]</sup> the effect of monetary policy on housing prices in India is uncertain and updated monetary policy is required for the problems in real estate sector. Interest rate is a crucial factor affecting the HPI. Masses are able to invest money in land and property when credit rates are low. On the other hand, when the supply for house increases, people tend to take loans from banks and financial institutions at a higher rate of interest. The non-payment of interest and loan amount leads to financial crises. When the demand for houses increase, the price also go very high due to market assumptions may even create 'property bubble' and inflate the HPI to certain level.

The upward movement of price can drop significantly after a point in case of economic downturn. (Salisu *et al.*, 2024)<sup>[19]</sup> studied the dynamic relationship between exchange rates and housing affordability and find that rise in exchange rate stimulates the cost of homes positively in short run and this link tends to scatter in the long run. Moreover, inflation can badly affect the house prices in both the short and long run. Analysis of the dynamics between exchange rates in HPI is essential to predict the future status of this sector, particularly for the country which expects foreign investment in real estate industry. The changes in exchange rate have impact on sale value of the asset in foreign currencies. Hence the role of macro-economic variables on HPI postulates the significance on financial matters and economic improvement in a region or country. This paper aims to scrutinize the interaction of macroeconomic variables on HPI. In this article, Section 1 introduces the topic and is further extended to Section 2 covering review of literature. Data and methodology comprise the third section followed by Section 4 explaining empirical results and discussion. Finally, the last Section 5 concludes the topic.

## 2. Review of Literature

Numerous researches have explored this subject with various aspects of relationship of various macro-economic variables and HPI in developed and emerging economies. Nature and purpose of the study, variables, statistical techniques applied, and period of the study have deduced multiple results and implications. Reviewing some previous studies and their approach enable the current paper to identify the gap areas aimed to study the behaviour of housing markets and their influence on the economy and suggested that standardised system should be followed for data collection and calculation of indices in India. An intermittently, seasonally and provincially adjusted National index is required for an extremely varied demand factors of housing prices in the country. (Ceritoğlu *et al.*, 2019)<sup>[4]</sup> examined “the exuberance in regional house prices in Turkey using the data of 26 geographic regions from 2010 – 2019 and found excitement incidents in house prices in different period”. They found exuberance episodes in housing prices in Istanbul housing market and few other regions. In the HPI literature many studies have discussed the association between macro-economic variables and house price changes. (Li, 2020)<sup>[12]</sup> used the annual data from 2010-2018 to find the effects of gross domestic product index, consumer price index, and fixed asset investment price index on housing prices in China through multivariate linear regression equation and revealed the positive association between macro-economic variables and housing price index. (Cohen & Karpavičiūtė, 2017)<sup>[5]</sup> discussed how the GDP, unemployment, inflation, interest rate, emigration and the means of macroprudential policy impact on house prices and found significant impact of changes in housing prices upon GDP, unemployment. The means of macroprudential policy and other variables did not influence housing prices in Lithuania. (Xu & Chen, 2012)<sup>[23]</sup> studied the influence of long-term bank loan rate, money supply growth and mortgage credit policy indicator on the real estate price growth changing aspects in China and find the growth of real estate price significantly affected by the movements in monetary policy. (Jaya & Prabhu Parrikar, 2019)<sup>[9]</sup> reported a strong positive correlation between

house price index, and explanatory variables, GDP, exchange rates, housing credit and inflation. However, HPI was adversely linked with interest rates. (Balqis & Purwono, 2021)<sup>[3]</sup> explores the drivers of the Residential Property Price Index (RPPI) in five emerging Asian countries using demand and supply indicators after the global crisis. The result shows the significant association with RPPI and positive link with the economic growth but negative with number of workers and real interest rate. (Olatunji *et al.*, 2017)<sup>[17]</sup> investigated the information gap in the influence of macro-economic factors on residential property returns in Abuja with the data of sales transaction and lettings for the time span 2001-2015 and concluded the existence of long-term relationship between both the variables. By employing the vector error correction model to predict the relationship between major macroeconomic fundamentals with real house prices in South Africa, (Lekhuleni & Ndlovu, 2023)<sup>[11]</sup> have found existence of strong correlation in short and long-run time period.

The effect of exchange rate has been examined by the researchers and results have been varied. (Sumer & Ozorohn, 2020)<sup>[21]</sup> applied VAR technique to investigate the effect of exchange rates (USD/TL) on the real estate investment trust return rates and housing sales price indices and reported that exchange rate has negative impression on housing sales price return rates. For the same purpose, using the same test (Yang & Zhiqiang, 2012)<sup>[24]</sup> analysed the connection on the monthly data from 2007-2010 and derived the positive stimulus between them in the long run however housing price increase would cause the depression of RMB exchange rate in the short run in China.

The role of monetary policies in fixing property price was focussed in some researches. (Evgenidis & Malliaris, 2023)<sup>[7]</sup> examines the influence of expansionary monetary policies and the global saving glut on housing price bubbles in the United States by VAR and time-varying models and concluded both factors are motives for rising house prices in US. The connection between monetary policy and housing prices in India was investigated by (Naikoo *et al.*, 2021)<sup>[15]</sup> through Autoregressive Distributive Lag model applied on the monthly data of HPI, Real Effective Exchange Rate, Gross Domestic Price, and interest rate for the time span 2009-2018 and revealed monetary policy has insignificant impact on housing prices.

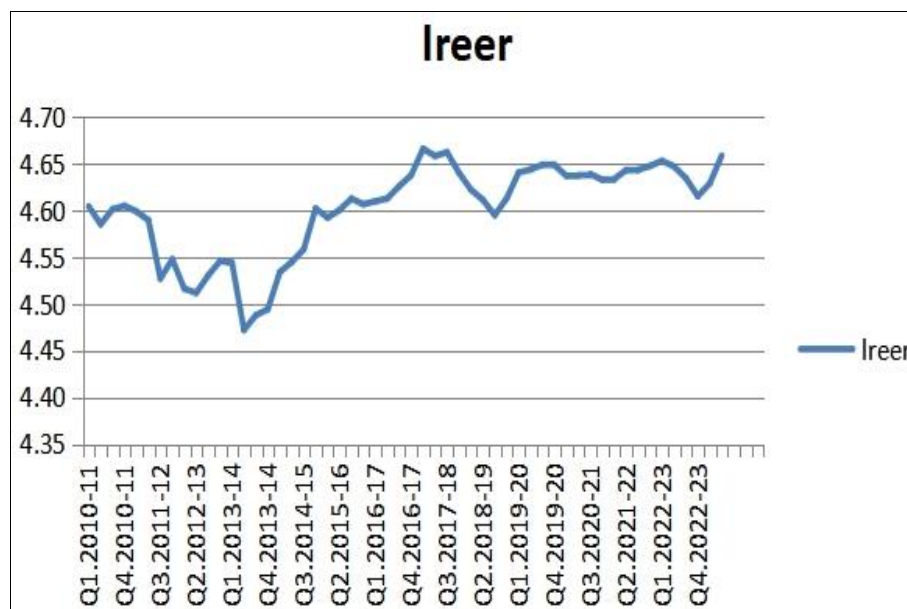
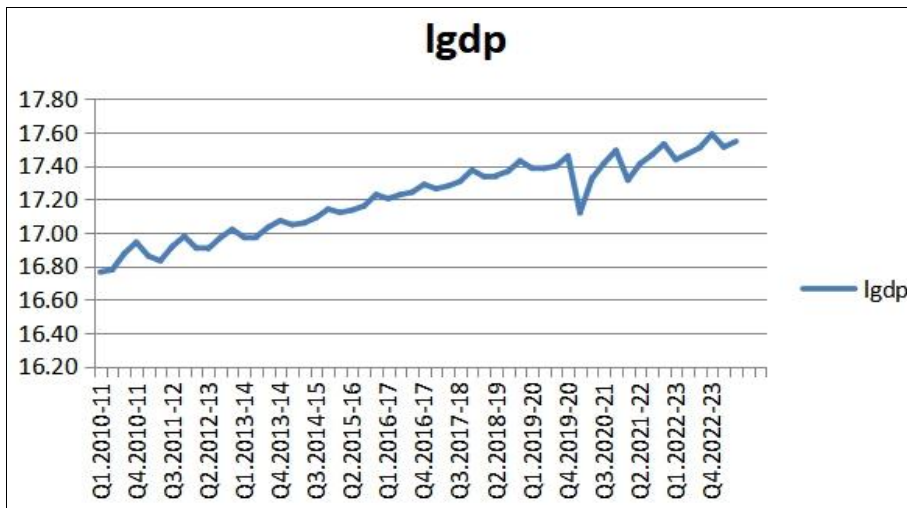
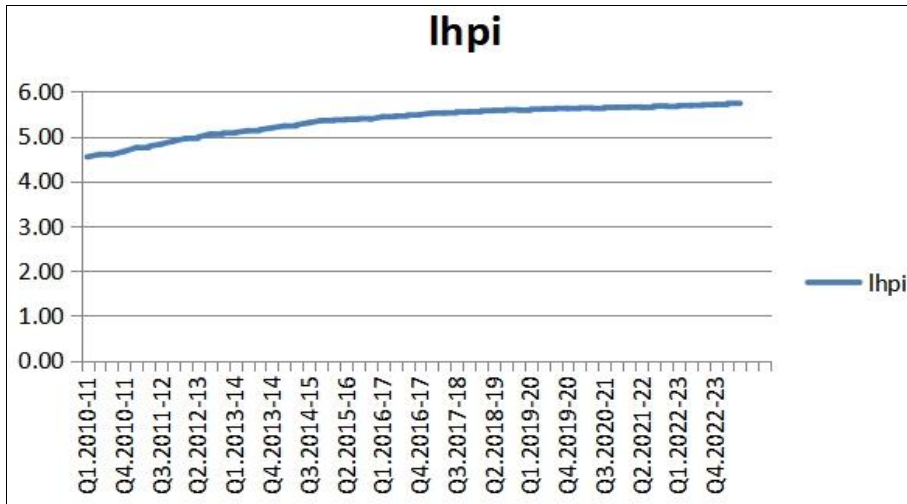
## 3. Data and Methodology

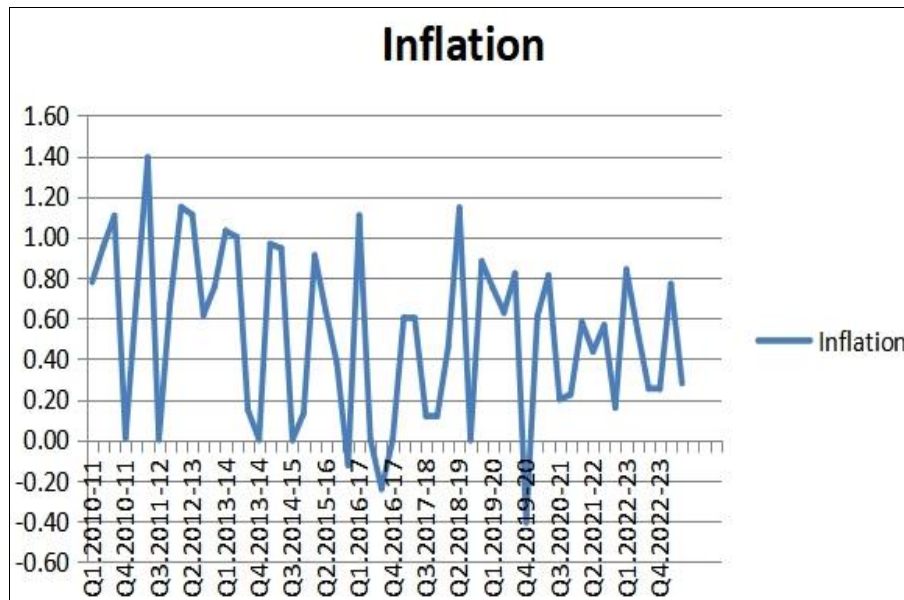
This study utilises secondary data at quarterly frequency, from 2010-11 Q1 to 2023-24 Q2. The data for HPI (base year 2010-11) is obtained from Database on Indian Economy, R.B.I and the data for real GDP, inflation and real effective exchange rate for India is taken from St. Louis Federal Reserve economic database. This study uses natural logarithms of all these variables (denoted as IHPI, I GDP, IREER) except inflation. Table 1 shows the unconditional pairwise correlations between IHPI, I GDP, inflation and IREER. It may be noted from Table 1 that while there is high positive correlation between IHPI and I GDP, and IHPI and IREER, IHPI and inflation are moderately negatively correlated. Further, the table shows absence of multicollinearity between the explanatory variables. Figure 1 shows trend in IHPI, I GDP, inflation and IREER respectively.

**Table 1:** Correlation Matrix amongst Variables

	IHPI	I GDP	IREER	Inflation
IHPI	1			
I GDP	0.9395	1		
IREER	0.6106	0.6888	1	
Inflation	-0.3014	-0.3595	-0.2349	1

Source: Authors' own estimation





Source: Authors' own elaboration

Fig 1: Trend in logarithm of HPI, GDP, REER and Inflation during 2010-11 Q1 to 2023-24 Q2

### 3.1 Econometric Methodology and Empirical Model

As followed in every time series analysis, we begin with the test for the non-stationarity in our variables using Dickey-Fuller generalized least squares (DF-GLS) test suggested by (Elliott *et al.*, 1996) [6]. The next step involves examination of the longrun relationship between IHPI, 1 GDP, IREER and Inflation. For this purpose, this study utilizes 'ARDL Bounds test' developed by (Pesaran *et al.*, 2001) [18] that has

$$lHPI_t = a_0 + a_1 lGDP_t + a_2 lREER_t + a_3 Inflation_t + e_t \tag{1}$$

Where  $lHPI_t$ ,  $lGDP_t$ , and  $lREER_t$  are natural logs of HPI, GDP and REER respectively.

$$lHPI_t = b_0 + b_1 \sum_{i=1}^p b_{1i} lHPI_{t-i} + b_{2i} \sum_{i=0}^q lGDP_{t-i} + b_{3i} \sum_{i=0}^r lREER_{t-i} + b_{4i} \sum_{i=0}^s Inflation_{t-i} + e_t \tag{2}$$

The corresponding EC parameterization of the above model is given below:

$$\Delta lHPI_t = c_0 + \sum_{i=1}^{p-1} c_{1i} \Delta lHPI_{t-i} + \sum_{i=0}^{q-1} c_{2i} \Delta lGDP_{t-i} + \sum_{i=0}^{r-1} c_{3i} \Delta lREER_{t-i} + \sum_{i=0}^{s-1} c_{4i} \Delta Inflation_{t-i} + yecm_{t-1} + \epsilon_t \tag{3}$$

where  $ecm_{t-1} = lHPI_{t-1} - a_1 lGDP_t - a_2 lREER_t - a_3 Inflation_t$ .  $\gamma$  is the coefficient of ECM (error correction term). If there is cointegration between IHPI, 1GDP, IREER and Inflation,  $\gamma$  is negative and significant. The long run coefficients are denoted by  $a_i$ ,  $i=1, 2, 3$  and the short run coefficients are indicated by  $c_{ji}$ ,  $j=1,2,3,4$ .

(Pesaran *et al.*, 2001) [18] suggests test for the long run relationship between IHPI and the explanatory variables by testing the joint hypothesis:  $H_0^F: \gamma = 0 \cap \sum_{j=0}^q b_j = 0$ . "If  $H_0^F$  is rejected, compute the t-statistic for the single null hypothesis  $H_0^t: \gamma = 0$  and compare it to the critical values"(Nnyanzi, 2018). In the final step, long run and short run coefficients can be obtained by re-estimating a

several benefits over the conventional cointegration tests. According to (Pesaran *et al.*, 2001) [18] this test can be used regardless of whether variable series are I (0) or I (1), accounts for endogeneity and can be applied in small sample size.

We consider the following relationship between IHPI and explanatory variables:

The conditional ARDL (p, q, r, s) model can be written as

parsimonious version of the ARDL model.

### 4. Empirical Results and Discussion

The results of the DF-GLS test are given in Table 2 below:

Table 2: Unit Root test results

DF-GLS statistic			
Variable	Level	First Difference	Order of Integration
IHPI	-1.242	-4.697	I(1)
1 GDP	-1.237	-11.328	I(1)
IREER	-2.057	-4.137	I(1)
Inflation	-7.273	-	I(0)

Source: Authors' own estimation

As shown in the above table, while the null hypothesis of non-stationarity is not rejected for the level variables IHPI, 1 GDP, IREER, it is rejected for the first difference of these variables. For the inflation variable, the null hypothesis of non-stationarity is rejected. Thus, we find that while the

variables IHPI, I GDP, IREER are I(1), inflation is I(0). As we have a mix of I(1) and I(0) variables in our sample, we use ARDL Bound test approach developed by (Pesaran

*et al.*, 2001) [18]. The result of this test for the sample considered in this study is given in Table 3.

**Table 3:** Results for Bounds Test for cointegration

Country	Computed F Statistic	10% Critical		5% Critical		1% Critical		ARDL Specification	Conclusion (the hypo-thesis of no co-integration)
		I (0)	I (1)	I (0)	I (1)	I (0)	I (1)		
India	12.411	2.76	4.041	3.361	4.816	4.775	6.621	3,3,4,2	Reject

Source: Authors' own estimation

As the computed F statistic exceed “the critical values at 1%, 5% and 10% level of significance (LoS), the null hypothesis of no cointegration if rejected”. Thus, we find the existence of cointegration between the IHPI, Inflation, IREER and I GDP in our sample. The results of the long run ARDL model and its EC parameterization (equations 3 and 4) are given in following two tables.

**Table 4:** Long-run ARDL Model results (3,3,4,2) for India

Variable	Coeff (T-stat)
I GDP	.765*** (4.68)
IREER	-1.112** (-2.40)
Inflation	-0.299*** (-3.20)

Source: Authors' own estimation

**Table 5:** ECM Results (3,3,4,2) for India

Variable	Coefficient (t-statistic)
ECM {1}	-.172*** (-4.49)
dIHPI {1}	-.367** (-2.56)
dIHPI {2}	-.223** (-1.84)
dI GDP	-.005** (-0.16)
dI GDP {1}	-.034** (-0.79)
dI GDP {2}	-.007** (-1.89)
dInflation	-.001** (-0.30)
dInflation {1}	.038** (2.68)
dInflation {2}	0.023** (2.4)
dInflation {3}	0.01** (1.69)
dIREER	0.035** (0.29)
dIREER {1}	0.14** (1.24)

Note: d indicates the first difference of the variable.

\*\*\* and \*\*indicates 1% and 5% LoS respectively.

Source: Authors' own estimation

As shown in Table 4, we find that while the long run coefficient of I GDP is positive and significant at 1% LoS, the long run coefficient of inflation is negative and significant at 5% significance level and the coefficient of IREER is negative and significant at 1% LoS. Thus, the estimates of the ARDL long run model (equation 2) indicate that while an increase (decrease) in I GDP causes a significant increase (decrease) in IHPI, an increase (decrease) in inflation and IREER cause a significant decline (rise) in the IHPI for India. The signs of all the long run coefficients are consistent with the economic theory and the trend in time series as shown in Figure 1.

As shown in Table 5, the coefficient of ECM is negative, less than one and significant at 1% LoS. This indicates existence of stable long run relationship between IHPI, I GDP, inflation and IREER. The short run coefficients depict a complicated dynamic between the variables considered in this study. The signs of the short run coefficients of I GDP and IREER at the chosen lags are different from the signs of their respective long run coefficients. The sign of short run coefficient of inflation is negative at lag 0 and positive at

lags 1, 2 and 3. Further, all the short run coefficients are significant at 5% LoS.

The results of ARDL bound test for our sample suggest that the HPI in India is cointegrated with the macroeconomic variables considered, viz. Real GDP, Inflation and REER. The regression result of the long run ARDL model indicates the positive and significant effect of GDP on HPI which is similar to the findings of several other studies such (Kok *et al.*, 2018; Li, 2020; Li *et al.*, 2018; Vogiazas & Alexiou, 2017) [10, 12,13, 22]. An increase (decrease) in real GDP causes an increase (decrease) in the person's disposable income that results in an increase (decrease) in their purchasing power and standard of living. Along with these increases (decreases), there is an impact on housing demand and demand for space. As the supply of houses is predominantly inflexible in the near term, this causes housing price to increase (decrease).

Further, we find negative and significant effect of inflation on HPI which is similar to the findings of (Fang *et al.*, 2016) [8]. However, several empirical studies (such (Jaya & Prabhu Parrikar, 2019; Li, 2020) [9], find positive impact of inflation on HPI. Theoretically, the effect of inflation on HPI is ambiguous. On the demand side, a high (low) inflation rate decreases (increases) a person's purchasing power and increases (decreases) the rate of interest on loans causing demand for houses and subsequently, the price of houses to fall. On the supply side, a higher inflation causes increase in the construction cost that leads to an increase in HPI.

Our finding that REER has a negative and significant effect on HPI is similar to the finding of many other studies such as (Asal, 2019; Bahmani-Oskooee & Wu, 2018) [1, 2]. A rise (fall) in the REER indicates appreciation (depreciation) of INR that causes imports of construction goods to become cheap (costly). This pushes the input costs down (up) resulting in a decrease (increase) in the price of houses. The estimates of the short run EC parametrization of ARDL model confirms the long run stable relationship between HPI, Real GDP, Inflation and REER. The estimates of the short run coefficients indicate complex intricate relationship between these variables.

**5. Conclusion**

This study analyzes a complex and ever-intriguing topic of the “relationship between the macroeconomic variables” (Miaw *et al.*, 2017) [14] and HPI for India. For this purpose, we use quarterly data from 2010-11 Q1 to 2023-24 Q2 and ARDL Bound test approach developed by (Pesaran *et al.*, 2001) [18]. Our findings lend considerable support the hypothesis that changes in HPI of India are largely driven by the changes in macroeconomic variables, viz., the changes in GDP, changes in inflation rate and changes in REER. These findings have implications for the potential investors, government, other regulatory and policy making

agencies with respect to the housing sector. Housing prices are affected by multiple factors however, in this study we have included three macro-economic variables that affect HPI due to the data constraints. The research can be extended further by including other important demand side and supply side variables affecting HPI such as rate of interest and credit availability. Furthermore, with the increasing presence of REITs (Real Estate Investment Trusts) in India, these results can yield meaningful strategies for fund houses going forward. This can lead to monetization of arbitrage opportunities in the housing sector and a jump in commercial property prices as these trusts offer lucrative benefits of earning returns on commercial properties without investing gigantic sums.

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