House Price Dynamics under lower leverage

The case of Metropolitan Cities in India

Sudhanshu Pani

School of Business Management, NMIMS, Mumbai

Sketch of the Research

House price dynamics are important to stakeholders

- Urban planners and policy makers - the availability, affordability and equitable distribution of housing (Lennartz et al. (2019), Favilukis et al. (2019), Fuller et al. (2020), Coskun (2022))
- Local, state and federal governments – Costs of living, labour markets
- Central bankers – Transmission of monetary policies, Bubbles (Wang et al., 2018)
- Homeowners –Portfolio changes (Cerruti et al., 2017), Wealth change to consumer spending (Adelino et al., 2018) , (Berger et al., 2017)
- Investors and developers – Look for stability in prices to aid decision making

Research Challenges

- Research on house price dynamics Extensive – Primarily US, Europe
  - Starts with National aggregate based investigation
  - Then Cross-country studies
  - Now intra region / city studies
- Developing markets limited – challenge of appropriate data sets
- India
  - Availability of data improving
  - This paper uses a novel methodology and proxy datasets
  - Some recent excellent Indian papers are based on broker data
- This paper is the first to examine spatial heterogeneity in Indian housing prices

Research Questions

Related to the regional variation in house price dynamics.

1. How can we characterise the house price dynamics in metropolitan cities in an emerging economy using the long-run equilibrium prices and the short-run deviations from the equilibrium prices?
2. How do the house price elasticities compare with the literature from developed market studies?
3. To examine the spatial heterogeneity in housing price variation across these metropolitan cities.

- This paper is close to Oikarinen et al. (2018) and Cunha and Julio (2022) in objectives and partly in methodology.
- All the studies are multicity multivariate panel spatial analyses.
- Geographies – India , US and Iberian metropolitan areas

What causes variation in regional and city-level house price cycles?

- Only a few explanations that impact housing can apply to intra-country regional heterogeneity.
  - For example, there may not exist regional differences in financing rates or terms, tax treatment.
  - Changes in demand >>>Supply inelasticities >>> Influence on prices
  - Demand elasticity may depend on buyer wealth profile - For example, a lowering of interest rates or an increase in loan-to-value ratios can help low-income housing by shifting several marginal borrowers to affordability.
- Meen (2001) - disaggregation may be done spatially and thematically.
- Glaeser et al. (2005) - identifies lack of regulatory approval that can decrease the elasticity of housing supply, thereby increasing housing prices.
- Saiz (2010) in the US natural limitations exist from geography that limits the supply elasticity in many areas.

Studies of Regional Housing Price Dynamics – Methodology and Results

OECD Studies

Caldera and Johansson (2013), Cavalleri et al. (2019) , Betin and Ziemann (2019), Anundsen and Heeboll (2016)

- They estimate supply elasticities negatively correlated with population density, time to obtain building permits and the severity of land use restrictions.
- Long-run residential investment depends on lagged real house prices and construction costs
- Financial accelerator effect: Households and lenders increase credit volumes in strongly appreciating areas. Spatial heterogeneity enters the estimation only through the impact of variation in regulations.

Single Country Studies: Developed economies

- Matysiak and Olszewski (2019) - 16 polish cities. They find three groups of cities demonstrating similar long-term trends.
- Aastveit et al. (2020) study housing supply elasticities - 254 US metropolitan areas. They find policy permits and land-use regulations as drivers of regional variation in house price response.
- Oikarinen et al. (2018) study spatial heterogeneity in house price dynamics using a dataset of 70 US metropolitan areas and report considerable variation across the regions. The study reports spatial heterogeneity for the long-term elasticity of house prices, short-term momentum and reversion dynamics.
- Coskun et al. (2017) - Turkey
- Cunha and Julio (2022) - Spain and Portugal. In these markets the house prices are inelastic to income.

Single Country Studies: Emerging economies

- Wu et al. (2013) - developer pricing behaviour is important in nascent markets in China with predominantly new constructions.
- Wu et al. (2016) report substantial heterogeneity in housing price changes across different Chinese housing markets. The heterogeneity is traced to differences in housing supply conditions, amenities, perceived social status and land valuations.
- Dutta et al. (2021) study property price premium of ready properties versus under-construction properties using listing data of properties in 6 cities in India.

Methodologies used in similar studies

- Panel estimation methodologies
- In an intra-country context the estimates may get influenced due to cross-section dependence in data and slope heterogeneity.
- Mean group estimates that provide robust estimates given these challenges are preferred.
- Fully Modified Ordinary Least Square Augmented Mean Groups(FMOLS-AMG) - Oikarinen et al. (2018) and Cunha and Julio (2022).
- Dynamic Common Correlated Effects Mean Group (DCCEMG) for short-run estimation Cunha and Julio (2022).
- Coskun et al. (2017) employ dynamic OLS models, Kalman filter and ARIMA models to examine bubble formation.

Research gap

- Studies of housing price dynamics for India using multiple macroeconomic variables are limited due to the unavailability of key datasets in the past.
- Sahoo (2020) investigate the role of inflationary prices in creating house price bubbles in India, largely using the residex index.
- Dutta et al. (2021) and Tomar et al. (2021) are studies using broker level data.
- Naikoo et al.(2021) report that monetary policy has a modest impact on housing prices.
- Mahalik and Mallick (2011) examine at the country level in India causal relationship of house prices and five determinants such as income, interest rates, stock markets, exchange rate and bank credit. The study employs data from 1996-2007.
- This paper employs methodological improvement and new datasets to examine the house price dynamics of Indian cities.

Methodology

- A simple housing market stock-flow model

$$d^*_{i,t} = f(y_{i,t}, r_t, p_{i,t}) = \gamma_0 + \gamma_1 y_{i,t} - \gamma_2 r_t - \gamma_3 p_{i,t} \quad (1)$$

$$s^*_{i,t} = f(c_{i,t}, b_t, p_{i,t}) = \phi_0 - \phi_1 c_{i,t} + \phi_2 b_t + \phi_3 p_{i,t} \quad (2)$$

Long run stationary demand - *d** , Price (HPI) (*p*), Deposits Index (*y*), Average Mortgage Lending Rates of SCB (*r*),

Long run stationary supply - *S**, Price (HPI) (*p*), SCBlendingIndex (*b*), Construction Costs (*c*),

index subscripts- city (*i*), time (*t*)

In the long run, under market clearing equilibrium, $d^*=s^*$,

$$\gamma_0 + \gamma_1 y_{i,t} - \gamma_2 r_t - \gamma_3 p_{i,t} = \phi_0 - \phi_1 c_{i,t} + \phi_2 b_t + \phi_3 p_{i,t} \quad (3)$$

Reduced form of the long run equation derived from above

$$p^*_{i,t} = f\left(d_{i,t}, s_{i,t}\right) = \beta_0 + \beta_1 y_{i,t} - \beta_2 r_t + \beta_3 c_{i,t} - \beta_4 b_{i,t} \quad (4)$$

- In the short run, the equilibrium prices undergo transitory changes, i.e they are adjusting to shocks. House price movements can be presented in an error-correction form, where the lagged changes in fundamental variables and lagged price changes can explain short run deviations from equilibrium prices.

(5)

$$\Delta p_{i,t}$$

$$= \lambda_{0i} + \lambda_1 \Delta y_{i,t-1} - \lambda_2 r_{t-1} + \lambda_3 \Delta c_{i,t-1} - \lambda_4 \Delta b_{t-1} + \lambda_5 \Delta p_{i,t-1}$$

$$- \lambda_6 (p - p^*)_{i,t-1} + \varepsilon_{i,t}$$

Empirical examinations of house price dynamics in Oikarinen(2018), Harter-dreimen (2004) and Lamont and stein (1999) have used similar specifications.

Empirical Hypothesis

- The empirical hypothesis in this research is that there are significant differences across housing markets (large urban agglomerations) within a country with respect to housing market dynamics.
- We first introduce the city-specific elasticities and coefficients to capture these differences. This step will also help to identify spatial correlations if they exist.
- After this examination, we attempt to explain the differences in house price dynamics across cities based on other potential determinants.
- Specifically, can spatial differences in housing dynamics be explained using the difference in response to macro shocks or differences in political leadership or political events?

Datasets

Datasets	Source	Remarks
HPI (Housing Price Index) Quarterly Frequency.	RESIDEX, National Housing Bank, a subsidiary of RBI	Treated as an official housing price index. The assessment prices have the year 2017-18 as the base. It represents price changes in residential housing properties in 50 cities in India. The dataset is available from June 2013 to Sept 2021. Based on evaluated prices.
CCI (Construction cost indices) Quarterly Frequency	Construction Industry Development Council	Available for 78 cities. Only 35 overlap with Residex cities. At time of data collection available till Dec 2019.
Deposits Index, Quarterly Frequency	Reserve Bank of India (RBI): Distribution of deposits with scheduled commercial banks	Combination of current deposits, Savings deposits and Term Deposits. District level data. Deposits Index created by author.
Scheduled Commercial Bank (SCB) lending to Real estate. Annual data.	RBI: Exposure to sensitive sectors of SCBs	Annual data. Linearly extrapolated to quarterly. SCBLending Index created by author
Bank Lending Rate Quarterly frequency	RBI	Average lending rate of all SCBs.
VIIRS-DNB night-light dataset (Monthly frequency)	lighttrends lightpollutionmap ^^	Manually collected by author from the source

The final dataset consists of 35 cities and the observation period from June 2013 to Dec 2019.

Variable	Means across all Cities	Standard Deviation of City means	Smallest mean across cities	Largest Mean across cities	
Real house price growth (Δp)	0.011	0.021	-0.003	0.02	
Real growth in aggregate deposits (Wealth Proxy) (Δy)	0.021	0.036	0.004	0.0297	
Real growth in construction cost (Δc)	-0.003	0.036	-0.006	0.072	
Real interest rate change (Δr)	-0.001	0.002	-0.001	-0.001	
Real growth in bank lending to Real estate sector (Δb)	0.614	0.299	0.614	0.6.14	
Equality tests (p-values)	Equality of means	Equality of variances			
Δp	0.001***	0.001***			
Δy	1	1			
Δc	1	0.92			
Δr	1	1			
Δb	1	1			
Correlations of all data					
Δp	1				
Δy	0.1***	1			
Δc	0	-0.09***	1		
Δr	0.01	-0.07**	0.2***	1	
Δb	-0.07**	-0.16***	0.11	0.13***	1
N	1155	1155	1155	1155	1155
Correlations between Cities (only significance reported)					
Δp	***				
Δy	***				
Δc	***				
Δr	***				
Δb	***				

Empirical Analysis

- A preliminary check for stationarity and cross-sectional dependence.
- The analysis runs in two phases:
  1. Estimating the long-run equation (4) including the necessary tests.
  2. Estimating the short-term house price equation (5) and examining the significance of heterogeneity in dynamics across several cities.

Panel Unit Root Tests

Variable	Levin-Lin-Chu	Im-Pesaran-Shin	Maddala-Wu	Choi's modified P	Hadri	CIPS (with trend)	CIPS (without trend)
Δp	-15	-17	534	39	11	-2	-2
	(<0.00)	(<0.00)	(<0.00)	(<0.00)	(<0.00)	(0.01)	(0.01)
Δr	-21	-27	921	72	-0.9	-2	-1
	(<0.00)	(<0.00)	(<0.00)	(<0.00)	-0.8	(0.01)	(0.01)
Δc	-27	-26	922	72	-0.7	-2	-2
	(<0.00)	(<0.00)	(<0.00)	(<0.00)	-0.8	(0.01)	(0.06)
Δy	-21	-24	874	68	-0.1	-2	-1
	(<0.00)	(<0.00)	(<0.00)	(<0.00)	-0.9	(0.01)	(0.01)
Δb	-24	-16	487	68	121	2	-0.3
	(<0.00)	(<0.00)	(<0.00)	(<0.00)	(<0.00)	(0.01)	(0.01)
p	0.2	4	77	0.6	102	2	-0.3
	(0.06)	(1)	(0.03)	(0.03)	(<0.00)	(0.1)	(0.1)
r	-3	5	14	-5	114	-1	1
	(<0.00)	(1)	(1)	(1)	(<0.00)	(0.1)	(0.1)
c	-10	-11	282	18	15	-0.2	2
	(<0.00)	(<0.00)	(<0.00)	(<0.00)	(<0.00)	(0.1)	(0.1)
y	15	19	25	-4		-2	-1
	(1)	(1)	(1)	(1)	(1)	(0.1)	(0.1)
b	-5	4	16	-5	124	0.4	
	(0.02)	(1)	(1)	(1)	(<0.00)	(0.1)	(0.1)

Long Run Estimation

	MG	CCEMG
(Intercept)	3.273***	0.012
	(0.528)	(0.635)
y_{it}	0.154**	-0.101
	(0.059)	(0.099)
c_{it}	-0.085	0.033
	(0.1)	(0.153)
b_{it}	0.224	0.041
	(0.052)***	(0.057)
R-squared	0.896	0.933
CIPS unit root test statistics		
(4-lags, with trend), p-value		-2.45
		(0.1)
(4-lags, no trend), p-value		-2.305
		(0.01)
Avg. Cross correlation		
(Pesaran's CD test)	12.187	-2.506
p values	(< 2.2e-16)	(0.012)

Income elasticity of demand

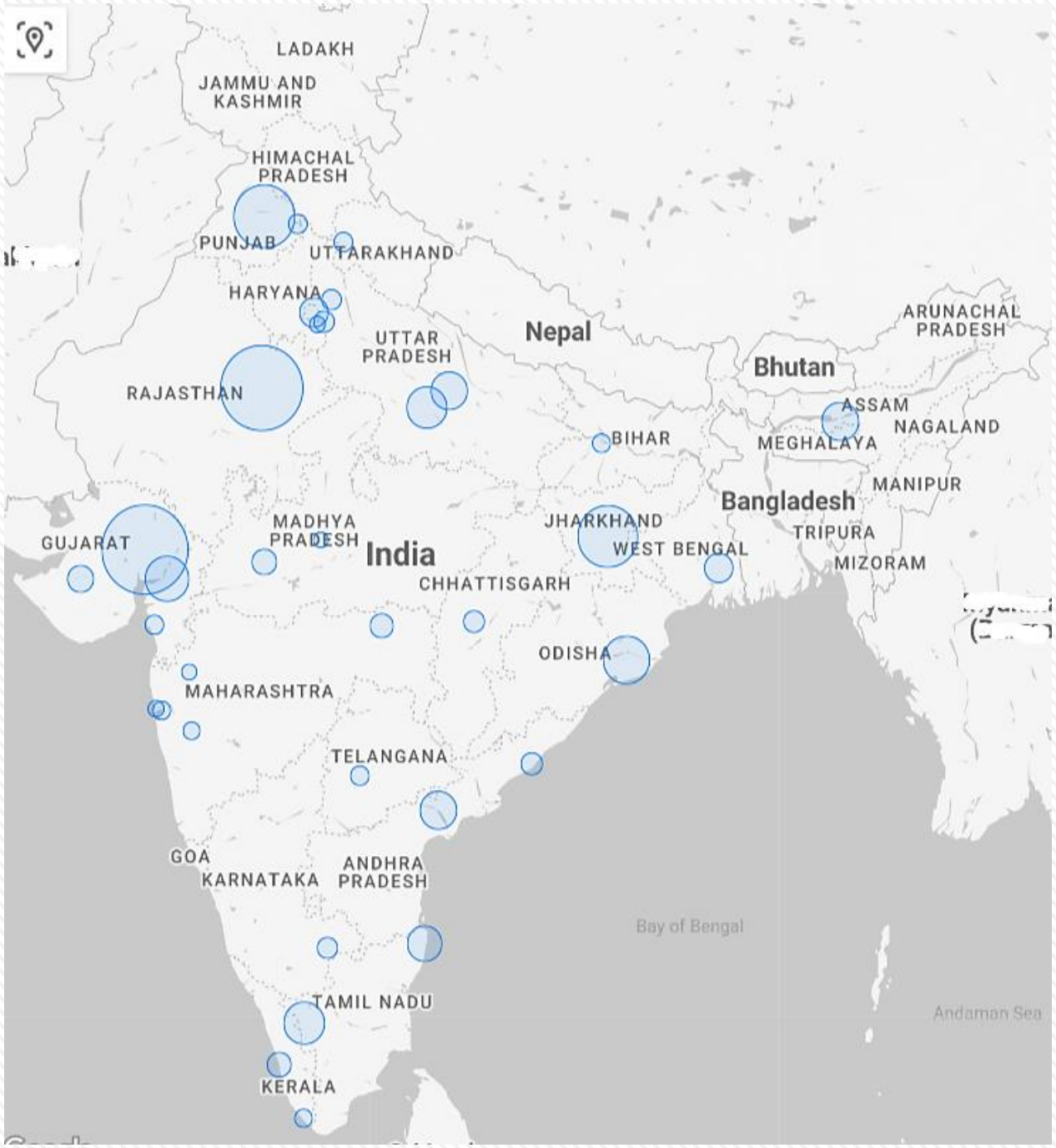
- This study India : 0.39
- Other studies :
  - US: Holly et al.(2010) (1.14), Oikarinen (2018) (0.81)
  - Warsaw market: Krzysztof et al. (2016) (-0.894),
  - Iberian Cities: Cunha and Lobao (2022) (0.227)

Interpretation of estimates

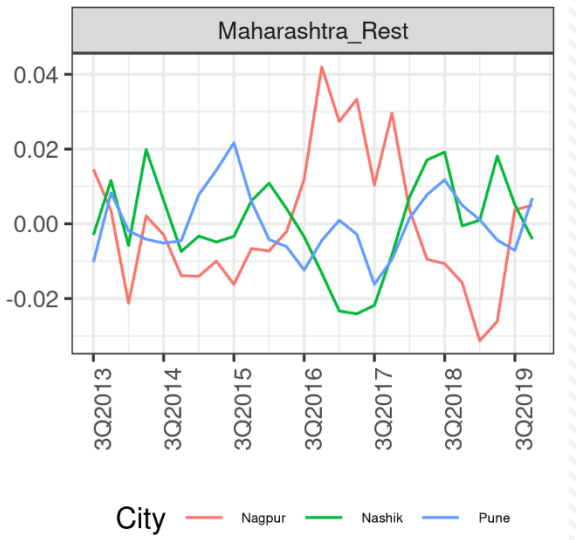
- While y is a proxy for wealth, its nature and effect on the demand for housing services are opposite to income. The general understanding of income is its role in providing income-eligibility to borrow using a mortgage loan. y, on the other hand, is the monetary stock deployed in a housing transaction. In the long run, an increase in housing prices provides confidence to buyers that they can expect similar growth in the asset in future. It offers a nudge to get on with transactions. When buyers enter transactions, deposits should go down..

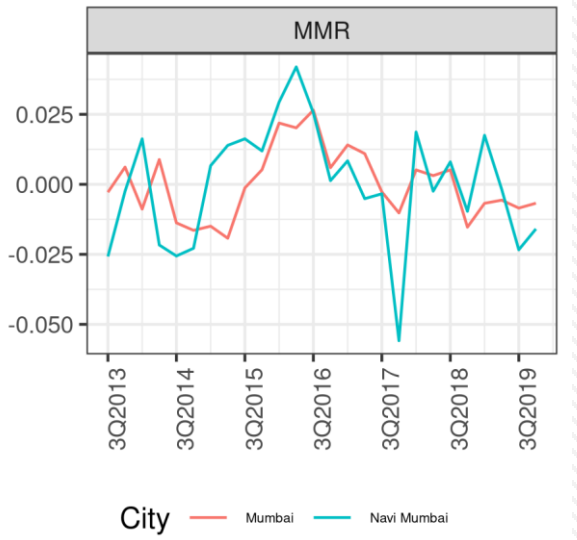
- In strong real estate markets, there is an incentive for the sellers to reinvest in residential housing to save on capital gains taxes. If prices go down in the long run, the deposits can increase from sale of housing prices for want of opportunities.

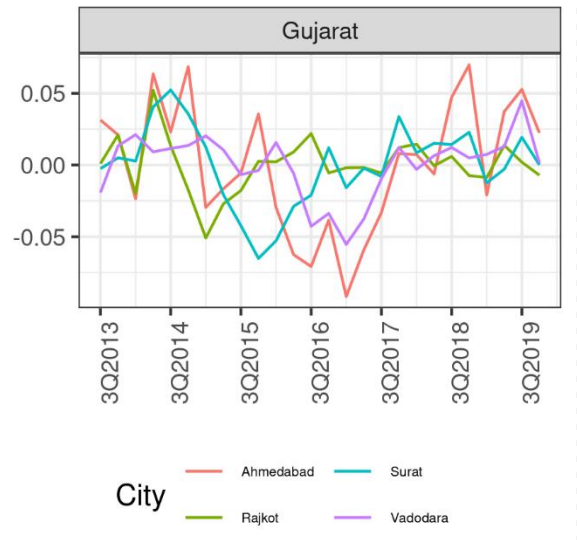
- The parameter signs for c is easily understood and in line with theory. Higher construction costs are expected to impact housing supply, leading to higher house price levels. The parameter sign for b is counter-intuitive. One of the controls for housing prices is that the developer needs to find the balance between liquidation of stock inventory to ensure required cash flow and price protection in line with perceived brand value. Bank financing is relatively cheaper, leading to enhanced holding power to extract higher prices in the market. The CCEMG estimator successfully controls for cross-sectional dependence. The average cross correlation is -2.5 as per the Pesaran's CD test, and a significant p-value.

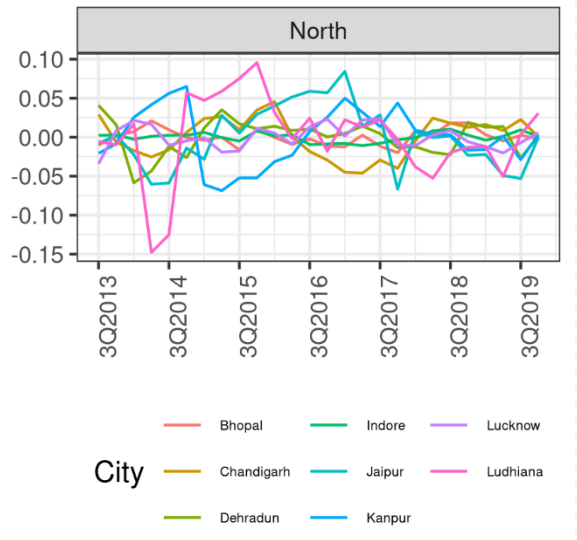

LADAKH
JAMMU AND KASHMIR
HIMACHAL PRADESH
PUNJAB
UTTARAKHAND
HARYANA
UTTAR PRADESH
Nepal
ARUNACHAL PRADESH
Bhutan
RAJASTHAN
ASSAM
NAGALAND
BIHAR
MEGHALAYA
MANIPUR
Bangladesh
MADHYA PRADESH
JHARKHAND
TRIPURA
GUJARAT
India
WEST BENGAL
MIZORAM
CHHATTISGARH
ODISHA
MAHARASHTRA
TELANGANA
GOA
KARNATAKA
ANDHRA PRADESH
Bay of Bengal
TAMIL NADU
Andaman Sea
KERALA

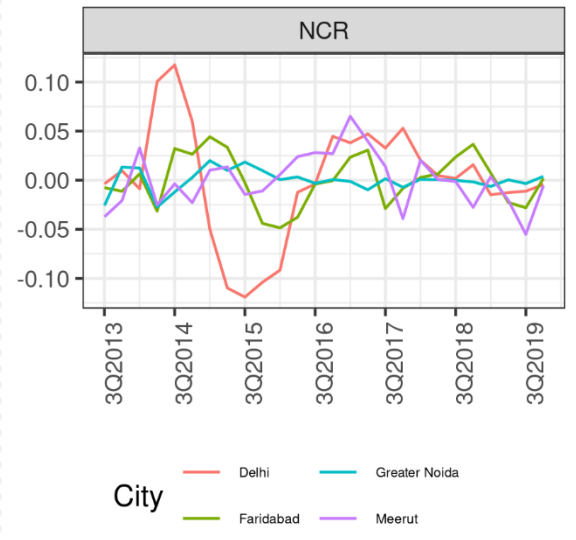
House Price Deviation from the Long-Term Fundamental Levels

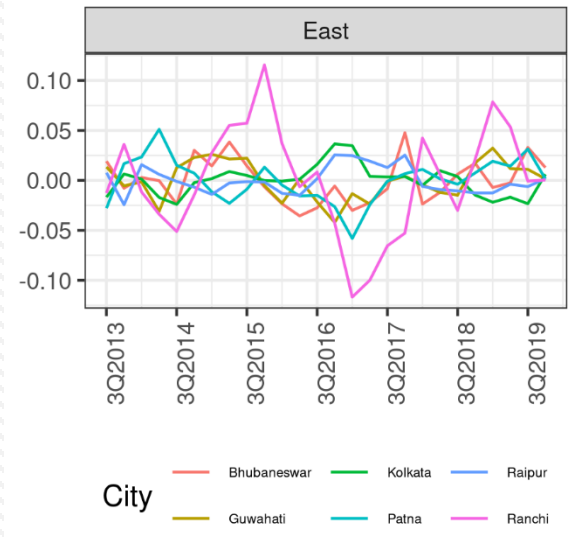


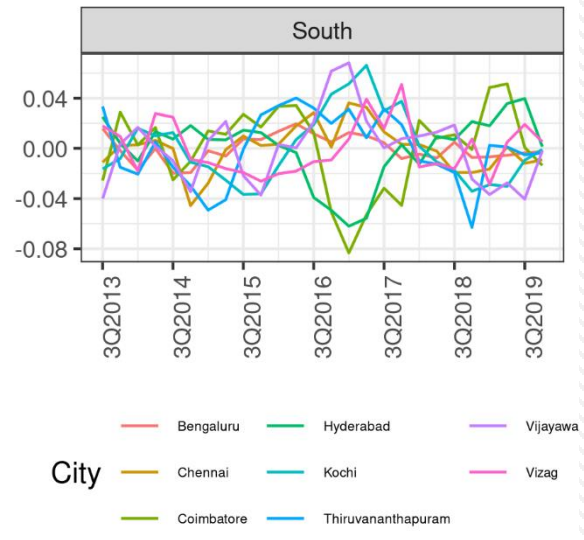












Price deviation from long term fundamentals

- In the Mumbai metropolitan area (MMR), the prices in satellite markets (Navi Mumbai) are more volatile than in the large metro area, even if one ignores the demonetisation-specific period. While there are no constraints around land supply and planning authority exists for Navi Mumbai, uncertainty around the upcoming airport at Panvel in Navi Mumbai formed the basis of price speculation in this market. This airport is the second airport to service the MMR. In the rest of Maharashtra, the Nagpur market has shown greater price volatility and price paths that are contrarian than other peer group cities. The price band of fluctuations is 2 - 2.5 per cent in MMR and rest of Maharashtra. This is in contrast to Gujarat where the range is between -5 to +5 per cent. All other markets have a similar price band around the equilibrium prices. Most markets in South India fluctuate between -4 to 4 percent.

- **Outliers**

- There are outliers in all regions with higher deviation from fundamentals: Delhi in National Capital Region (NCR), Ahmedabad (Gujarat), Ludhiana (North) and Ranchi (East).

- In the housing markets in the south, price deviation is observed pre- and post-demonetisation-period in opposite directions in different cities. For example, while Vijayawada and Vizag experience a rise in prices pre-demonetisation and a subsequent fall, Coimbatore and Hyderabad experience the opposite.

Housing sector reforms

- RERA: The Union Government passed the Real Estate Regulatory Authority Act (RERA), which enabled the respective State governments to set up the required RERA regulatory authority with features per their requirements.
- INDUSTRY STATUS: The Real Estate business was accorded Industry status during this period. An industry status allowed banks to offer formal lending capital to organised housing suppliers. This source of capital is expected to be the primary source of low cost capital for the Real-Estate developers.
- Given the low price deviation experienced during this period from fundamental values in most cities, the changes in policy regime have played an important role.

Estimation Results for Short Run Dynamics

	MG	CCEMG
(Intercept)	0.008	-0.0002
	(0.001)***	(0.002)
lag(Δy)	0.007	-0.015
	(0.017)	(0.045)
lag(Δc)	-0.032	-0.019
	(0.028)	(0.074)
lag(Δp)	0.285	0.307
	(0.038)***	(0.043)***
lag($p - p*$)	-0.044	-0.187
	(0.015)***	(0.031)***
R-squared	0.364	0.512
Average correlation coefficient	0.123	-0.019
Pesaran CD test	(< 2.2e-16)	(0.02)

Robustness Checks for Short Run Estimation

- categorise the cities based on similar development through this period.
- Employ the night-light data sourced from VIIRS for this purpose. This dataset is low-light imaging data collected by satellite and filtered to measure the quantity of human-generated light in an area.This is used as a proxy for development.
- The range of the change from the start to the end of the estimation period is a proxy for development.
- Using a ‘kmeans’ algorithm, the authors classify the cities into five clusters. Then the short run dynamics is estimated for each cluster

- Cluster 1: Bhopal, Chandigarh, Dehradun, Faridabad, Greater Noida Indore, Ludhiana, Meerut, Nagpur, Patna, Pune, Raipur, Ranchi, Vadodra, Vizag
- Cluster 2: Bhubaneswar, Coimbatore, Guwahati, Nashik, Navi Mumbai, Rajkot, Trivandrum, Vijayawada
- Cluster 3: Kochi, Lucknow
- Cluster 4: Bengaluru, Delhi, Hyderabad
- Cluster 5: Ahmedabad, Chennai, Jaipur, Kanpur, Kolkatta, Mumbai, Surat

	K1	K2	K3	K4	K5
(Intercept)	-0.003	-0.001	0.00	0.001	0.001
	(0.004)	(0.004)	(0.007)	(0.006)	(0.002)
lag(Δy)	0.047	-0.150	0.03	0.268	-0.005
	(0.047)	(0.072)*	(7.9e+13)	(0.042)***	(0.036)
lag(Δc)	0.023	-0.156	0.108	-6.695	-2.73
	(0.078)	(2.11)	’(0.00)***	(2.066)**	(1.21)*
lag(Δp)	0.33	0.24	0.213	0.599	0.42
	(0.066)***	(0.095)*	(0.000)***	(0.06)***	(0.078)***
lag($p - p*$)	-0.293	-0.112	-0.873	-0.103	-0.129
	(0.062)***	(0.03)***	(0.00)***	(0.023)***	(0.036)***
R-squared	0.61	0.66	0.88	0.86	0.75
Average correlation coefficient	-0.04	-0.12	-1	-0.45	-0.128
Pesaran CD test	0.02	0.001	0.000	0.000	0.003

City	(Intercept)	log(y)	log(c)	log(b)	Functional Classiciation
Ahmedabad	-5.732	-1.757	-1.223	-0.135	State Capital, Commerce
Bengaluru	-5.056	-0.143	0.598	-0.018	State Capital, IT, Service, Education
Bhopal	2.228	-0.008	0.026	0.193	State Capital
Bhubaneswar	3.792	0.778	-1.315	-0.369	State Capital, Education
Chandigarh	-1.547	-0.108	0.62	0.086	State Capital
Chennai	2.667	-0.490	0.172	0.027	State Capital, Service and IT
Coimbatore	-8.256	-0.645	0.814	-0.405	Industrial
Dehradun	1.339	0.104	0.558	-0.108	State Capital, Education
Delhi	1.969	0.347	0.705	-0.343	State Capital, Commerce
Faridabad	7.675	-0.033	-0.309	-0.461	Industrial, Satellite
Greater Noida	4.216	0.146	-0.212	0.101	Satellite
Guwahati	6.407	-0.551	-2.407	-0.592	State Capital
Hyderabad	-5.475	-0.103	-0.746	-0.375	State Capital, IT, Service
Indore	-1.892	-0.251	0.073	-0.075	Commerce, Education
Jaipur	1.318	-1.658	1.165	-0.090	State Capital, Tourism
Kanpur	0.082	0.629	-0.106	-0.053	Old City, Industrial
Kochi	2.151	0.231	-0.263	0.199	Old City, Commerce
Kolkata	0.308	0.341	0.227	0.109	State Capital, Commerce

City	(Intercept)	log(y)	log(c)	log(b)	Functional Classiciation
Lucknow	-3.352	0.538	0.145	0.166	State Capital
Ludhiana	4.50	1.14	-1.212	-0.261	Industrial
Meerut	1.038	0.126	1.125	0.209	Old City
Mumbai	-0.776	-0.037	0.580	0.502	State Capital, Commerce
Nagpur	1.007	0.215	0.004	0.233	Industrial
Nashik	-1.097	-0.018	0.49	0.214	Industrial
Navi Mumbai	-0.400	-0.085	1.65	0.181	Satellite
Patna	-2.471	-0.086	-0.454	0.129	State Capital
Pune	1.892	0.063	-0.034	0.413	Education, IT, Industrial
Raipur	-0.256	-0.157	-0.7	-0.34	State Capital, Commerce
Rajkot	0.213	0.284	0.477	0.427	Historical
Ranchi	-3.71	-1.108	1.020	0.534	State Capital
Surat	2.408	-0.102	-1.054	0.057	Commerce
Thiruvananthapuram	-8.78	-0.076	0.976	-0.087	State Capital
Vadodara	-1.41	-0.712	-0.983	-0.105	Commerce, Industrial
Vijayawada	1.487	-0.542	1.662	1.081	Old City
Vizag	3.937	0.171	-0.893	0.377	State Capital, industrial