INTERLINKAGE BETWEEN PROPERTY PRICE AND CREDIT: EMPIRICAL EVIDENCE FROM INDIA

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The paper investigates the two-way character of the link between asset prices (especially housing prices) and credit in India by examining quarterly data for fifteen Indian cities for a period of six years from 2007Q4 to 2013Q4. There may be many channels through which real estate and credit markets interact and causality may go in both directions, asset prices influencing credit through expectations formation and, credit in turn, impacting asset prices. Time series econometric tools of unit root, cointegration and causality tests are used to test for existence of long run relation and direction of causality for each city. The contribution of this paper is to provide evidence on causality between credit and housing price with respect to India and discuss the policy implications.

Keywords*: House Price, Credit, Granger Causality, Cointegration*

JEL classification: G21, G02, E44

1. Introduction

It is commonly recognized that it is excessive debt accumulation, whether by the corporations or consumers, that poses greater systemic risks during boom (Reinhart and Rogoff, 2009). Such debt buildups make an economy vulnerable to crises of confidence. We explore the role of asset prices, housing price in particular, in influencing debt buildups and vice-versa. A slump in housing prices might be more harmful than a stock market crash because real estate is the more important collateral underlying bank loans.

There may be many channels through which housing and credit market interact. House price may influence both credit demand and credit supply. Household's demand for credit increases with increase in house price as higher price of house increases the amount of credit required to finance the house leading to upward pressure on the demand for credit. Secondly, since housing loans are secured by mortgaging property, an increase in housing price feeds into greater net-worth for the household sector and hence, increasing their borrowing capacity. Similarly, due to financial market imperfections, firm's borrowing may be constrained. As a result, households and firms can only borrow when they offer collateral,

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so that their borrowing capacity is a function of their collateralisable networth. Since property is commonly used as collateral, property prices are, therefore, an important determinant of the private sector's borrowing capacity.

At the same time, higher property prices positively feed into credit supply by making bank's assets less risky by reducing the likelihood of defaults on existing loans, which may motivate the banks to expand their lending. Hence, property prices may affect bank lending via various wealth effects.

Increase in private sector borrowing may, in turn, put further upward pressure on housing price. Bank lending may affect housing prices via various liquidity effects. Property can be seen as a durable good in temporarily fixed supply. An increase in the availability of credit may increase the demand for property if households and firms are borrowing constrained. With supply temporarily fixed because of the time it takes to construct new units, this increase in demand will be reflected in higher property prices. Hence, theoretically, causality may go in both directions, asset prices influencing credit and credit, in turn, impacting asset prices.

Kindleberger (1978) points out that this potential two-way causality between bank lending and property prices may give rise to mutually reinforcing cycles in credit and property markets. A rise in property prices, caused by more optimistic expectations about future economic prospects, raises the borrowing capacity of firms and households by increasing the value of collateral. Part of the additional available credit may also be used to purchase property, pushing up property prices even further, so that a self-reinforcing process may evolve. Bordo and Jeanne (2002) find that banking crises tend to occur either at the peak of a boom in real housing prices or right after the bust for the advanced economies during 1970-2001.

Rienhart and Rogoff (2009) provide an evidence of decline in real housing prices around banking crises from peak to trough in both emerging and advanced economies. Credit booms seem too often coincide with house price increase. Rienhart and Rogoff (2009) argue that “the pattern that emerges is clear: A boom in real housing prices in the run up to a crisis is followed by a marked decline in the year of the crisis and subsequent years.” Gorton and Metrick (2012) point out that the causality is not clear by saying that “is it that financial intermediaries lower their lending standards and fuel house price increases? Or, are house prices going up (for some other reason) and intermediaries are willing to lend against collateral? This is an area for future research.”

It is argued that banking crises are more protracted if these episodes involve the real estate market's persistent cycle. It becomes imperative to know whether there exists long run relation between the two and if it exists, what the direction of causation between house price and bank's credit is. This paper makes a modest attempt to empirically identify the causality between bank credit and housing price in India by examining quarterly data on house price and credit for fifteen cities for a period ranging starting from 2007Q4 to 2013Q4. Time series econometric tools of unit root, cointegration and causality tests are used to test for existence of long run relation and direction of causality for each city.

Findings reveal that causality from house price to credit is more prominent in case of nine cities - Ahmedabad, Kolkata, Delhi, Lucknow, Kochi, Surat, Bangalore, Mumbai and Pune; and real estate prices influence the lending behavior of banks. They lend more during house price boom and vice- versa. Given the observation that financial intermediaries tend to become speculative when house price is booming, it is important to put a regulatory framework. Hence, it is important to remain watchful on the speculative tendencies of intermediaries when house price is in boom phase.

The paper is organized as follows: Section 2 discusses the existing literature on causality between property price and credit in both developing and developed economies. Section 3 explains the methodology used for the purpose. Section 4 presents data sources and some interesting observations from data on bank's credit and house price. The findings are presented in Section 5 and finally, Section 6 makes concluding observations and discusses policy implications.

2. Review of Literature

2.1 Literature for Developed Economies

Initially most studies relied on a single equation setup, focusing either on bank lending or property prices. Using annual data, Borio, Kennedyand Prowse (1994) investigate the relationship between credit to GDP ratios and aggregate asset prices for a large sample of industrialized countries over the period 1970-1992. Hypothesizing that the development of credit conditions as measured by the credit to GDP ratio can help to explain the evolution of aggregate asset prices, they focus on the determinants of aggregate asset price fluctuations. They find that adding the credit to GDP ratio to an asset pricing equation helps to improve the fit of this equation in most countries. They demonstrate that the boom bust cycle in asset markets of the late 1980s-ealy 1990s would have been much less pronounced or would not have occurred at all had credit ratios remained constant based on simulations. Goodhart (1995) finds that property prices significantly affect credit growth in the UK but not in the US.

Only recently - in the past decade - a literature on interconnections between house price (hp) and credit (c) have emerged. The results till now disagree about the direction of causality. Table 1 (cross-country) and Table 2 (individual country) provide the summary of the empirical findings on the long run interaction between housing prices and credit in developed countries.

Table 1: Cross-Country Literature Evidence on Long-Run Interaction between Housing Prices and Credit (Developed Countries)

Author	hp⟶c	hp⟵c	hp⟷c	Country
Goodhart & Hofmann (2003)	Yes			USA, Japan, Germany, France, Italy, UK, Canada, Sweden, Norway, Finland, Hong Kong Singapore
Hofmann (2004)	Yes			US, Japan, Germany, France, Italy, UK, Canada, Switzerland, Sweden, Norway, Finland, Denmark, Spain, Netherlands, Belgium, Ireland, Austr alia, New Zealand, Hong Kong , Singapore
David & Zhu (2011)	Yes			Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Spain, Sweden, Switzerland, UK, US

Table 2: Individual Country Literature Evidence on Long-Run Interaction between Housing Prices and Credit (Developed Countries)

Author	hp⟶c	hp⟵c	hp⟷c	Country
Gerlach and Peng (2005)	Yes			Hongkong
Brissimis and Vlassopoulos (2009)	Yes			Greece
Fitzpatrick and McQuinn (2007)			Yes	Ireland
Oikarinen (2009)			Yes	Finland
Gimeno and Carrascal (2010)			Yes	Spain
Anundsen and Jansen (2013)			Yes	Norway

Hofmann (2004) analyses the patterns of dynamic interaction between bank lending and property prices based on a sample of twenty developed countries using both time series and panel data techniques. Long-run causality appears to go from property prices to bank lending. This finding suggests that property price cycles, reflecting changing beliefs about future economic prospects, drive credit cycles, rather than excessive bank lending being the cause of property price bubbles. There is also evidence of short-run causality going in both directions, implying that a mutually reinforcing element in past boom bust cycles in credit and property markets cannot be ruled out.

Based on a simple VAR impulse response analysis for a sample of twelve countries, Goodhart and Hofmann (2003) assess the nature of the close empirical correlation between bank lending and asset prices. The results suggest that innovations to property prices have a significant effect on bank lending in the majority of countries. For most countries, the authors do not find evidence of a significant effect of credit on property prices or of significant dynamic interaction between share prices and credit in either direction.

David and Zhu (2011) investigate the determination of commercial property prices and the interaction between commercial property prices and bank lending. They develop a reduced-form theoretical model which suggests bank lending is closely related to commercial property prices and that commercial property can develop cycles given plausible assumptions, where the cycles are largely driven by the dynamic linkage between the commercial property sector, bank credit and the macro economy. Cross-country empirical analysis based on a sample of seventeen developed economies, using a unique dataset collected by the BIS, confirms the model's predictions. An investigation of determinants of commercial property prices shows particularly strong links of credit to commercial property in the countries that experienced banking crises linked to property losses in 1985-95. Further studies of dynamic interaction suggest that commercial property prices are rather “autonomous”, in that they tend to cause credit expansion, rather than excessive bank lending boosting property prices. In addition, GDP has an important influence on both commercial property prices and bank credit.

Brissimis and Vlassopoulos (2009) apply multivariate cointegration techniques in order to address this issue empirically for the Greek economy. Their results, based on a cointegration relationship that they identify as a mortgage loan demand equation, indicate that housing prices do not adjust to disequilibria in the market for housing loans. This suggests that in the long run the causation does not run from mortgage lending to housing prices. In the short run, they find evidence of a contemporaneous bi-directional dependence.

Employing time series econometrics, Oikarinen (2009) study shows that since the financial liberalization in the late 1980s, there has been a significant two-way interaction between housing prices and housing loan stock in Finland. Anundsen and Jansen (2013) examine the nexus of housing prices and credit in Norway within a structural vector equilibrium correcting model over the period 1986Q2 - 2008Q4. The results establish a two-way interaction in the long-run, so that higher housing prices lead to a credit expansion, which in turn puts an upward pressure on housing prices. Interest rates influence housing prices indirectly through the credit channel. Furthermore, households' expectations about future development in their own income as well as in the Norwegian economy have a significant impact on housing price growth.

Gimeno and Carrascal (2010) look at recent developments in house purchase loans and house prices in Spain and the linkages between them. The authors aim at identifying deviations of these variables from their equilibrium levels, and for this purpose, they estimate a vector error-correction model. The results show that both variables are interdependent in the long-run and that both variables were above their equilibrium level by the end of the sample period (2009:Q1).

2.2 Literature for Developing Economies

Using single equation setup focusing on asset prices, Collyns and Senhadji (2002) find that credit growth has a significant contemporaneous effect on residential property prices for a panel of four East Asian countries. These four countries are Hong Kong, Korea, Singapore and Thailand. Based on this finding, they conclude that bank lending contributed significantly to the real estate bubble in Asia prior to the 1997 East Asian crisis.

By exemplifying the cases of China's twenty financial cities, Che, Li *et al.* (2011) try to identify the linkages between property prices and bank lending in China's regional financial centers and find that long-run causality appears between property prices and bank lending for each financial center. Using time series techniques and dynamic panel data model, they conclude that bank lending plays an important role in pushing up property prices.

Although there exists some cross-country literature on causality between house price and credit for developed economies, there is almost no multi-country work for developing economies. The contribution of this paper is to provide evidence on causality between credit and housing price with respect to India.

3. Methodology

The data series on house price and credit used are seasonally adjusted using the census X-13 or X-12 procedure. Time series techniques of stationarity tests, cointegration and Granger causality tests in vector error correction mechanism (VECM) are used to find direction of causation between housing price and credit for Indian cities. Before testing for causality, the first econometric step is to test if the series is stationary or contain a unit root. A stationary series exhibits mean reversion, has a finite, time invariant variance and a finite covariance between two observations that depends only on their distance in time, not on their absolute location in time. If the series is non-stationary, then the characteristics of the stochastic process that generated the time series change overtime and it becomes difficult to represent it by a simple algebraic model. In this study, the augmented Dickey-Fuller test (ADF) (1979, 1981), Phillips Perron test (PP) (1988) and KPSS proposed by Kwiatrowski *et al*. (1992) have been used. ADF and PP tests share the same null hypothesis of a unit root. If two out of these three tests indicate non stationarity for any series, then we conclude that the series has a unit root.

To test if a sequence contains a unit root using ADF, three different regression equations are considered.

$$\Delta y_t = \alpha + \gamma y_{t-1} + \theta t + \sum_i^P \beta_i \Delta y_{t-i+1} + \varepsilon_t \tag{1}$$

$$\Delta y_t = \alpha + \gamma y_{t-1} + \sum_i^P \beta_i \Delta y_{t-i+1} + \varepsilon_t \tag{2}$$

$$\Delta y_t = \gamma y_{t-1} + \sum_i^P \beta_i \Delta y_{t-i+1} + \varepsilon_t \tag{3}$$

The first equation includes both a drift term and a deterministic trend; the second excludes the deterministic trend; and the third does not contain an intercept or a trend term. A sequential procedure is used to test for the presence of unit root when the form of the data-generating process is unknown. Details of the sequential procedure can be obtained from Dua, Raje and Sahu (2003).

To find the appropriate lag length, Akaike Information Criterion (AIC) and Schwarz Information criterion (STC) is used. Whenever the two lag length criterion gives contradictory results, appropriate lag length is chosen manually. In order to choose lag length manually, we use equation (1) to find appropriate lag length. To do this, we test for the serial correlation in the residuals and initially specifying a large value of p, such as 8 or 12. If the test does not reject the null hypothesis of no serial correlation up to order eight, we reduce the lags using Wald test unless the null hypothesis is rejected. If the test rejects the null hypothesis of no serial correlation, we choose to begin with a larger value of p, say, 12. We then check for the null hypothesis of no serial correlation and if the test does not reject the null hypothesis, we reduce the lags using Wald test unless the null hypothesis is rejected. We then estimate the model using appropriate reduced number of lags and again test for the presence of serial correlation in the residuals. If the test does not reject the null hypothesis of no serial correlation, we use that lag length for ADF test.

We also conduct the Phillips-Perron (1988) test for a unit root. This is because the Dickey-Fullfer tests require that the error term be serially uncorrelated while the Phillips-Perron test is valid even if the disturbances are serially correlated. The test statistics for the Phillips-Perron test are modifications of the t-statistics employed for the Dickey-Fuller tests but the critical values are precisely those used for the Dickey-Fuller tests.

In the ADF and the PP test, unit root is the null hypothesis. A problem with classical hypothesis testing is that it ensures that the null hypothesis is not rejected unless there is strong evidence against it. Therefore these tests tend to have low power, that is, these tests will often indicate that a series contains a unit root. Kwiatkowski *et al*. (1992), therefore, suggest that, based on classical methods, it may be useful to perform tests of the null hypothesis of stationarity in addition to tests of the null hypothesis of a unit root. Tests based on stationarity as the null hypothesis is used to confirm conclusions about unit roots.

One test of causality is whether the lags of one variable enter into the equation for another variable. If all variables in the VAR are stationary, the direct way to test causality is to use a standard F-test. This is popularly known as Granger causality. Appropriate lag length in VAR is chosen using sequential modified LR test statistic, final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn information criterion (HQ). Chosen lag length is the one given by majority of the criterion mentioned and also by examining lag exclusion tests.

In case the variables are cointegrated, it is not appropriate to use an F-statistic to test for Granger causality. The possibility of a cointegrating relationship between the variables is tested using the Johansen and Juselius (1990, 1992) methodology with the assumption of intercept and no trend in the cointegrating equation. If the presence of cointegration is established, the concept of Granger causality is tested in the Vector Error Correction Mechanism (VECM) framework. The econometric software packages such as EViews 8 and Stata 12 have been used for the analysis.

4. Data and Hypothesis

Quarterly data on house price is provided by National Housing Bank and on credit (given by scheduled commercial banks) is provided by Reserve Bank of India from 2007Q4 to 2013Q4 for Ahmedabad, Bangalore, Bhopal, Chennai, Delhi, Faridabad, Hyderabad, Jaipur, Kochi, Kolkata, Lucknow, Mumbai, Patna, Pune and Surat.

Intermediaries learn from the actual house price movements and form expectations for future movements in house price. The situation is similar to the adaptive expectations, where intermediaries adjust their expectation by some fraction of the error in expectation of the previous period. Thus, intermediaries revise their previous expectations of housing price change in each period in proportion to the difference between actual shock and what was previously expected.

There exists good amount of literature in psychology and behavioral economics that justify our choice of taking adaptive expectations in explaining causality from house price to credit. Kahneman and Riepe (1998) argue that

"there is a tendency to attribute causal significance to chance fluctuations that leads investors to overreact to any information to which their attention is drawn. In the context of finance, the same psychological quirk causes investors to perceive trends where none exist, and to take action on these erroneous impressions."

Hence, people perceive patterns where none exist and it is also explained by the authors that they have too much confidence in their judgments of uncertain events. Kahneman and Tversky (1973) explain that, in making predictions and judgments under uncertainty, people do not appear to follow the calculus of chance or the statistical theory of prediction. Instead, they rely on a limited number of heuristics which sometimes yield reasonable judgments and sometimes lead to severe and systematic errors.

The reliance on heuristics and the prevalence of biases are not restricted to laymen. Experienced researchers are also prone to the same biases when they think intuitively. For example, the tendency to predict the outcome that best represents the data, with insufficient regard for prior probability, has been observed in the intuitive judgments of individuals who have had extensive training in statistics (Tversky and Kahneman, 1974). The representative bias (i.e. the fact that people interpret short sequences of observations as representative for the population) is used by Barberis, Shleifer and Vishny (1998) to explain under and over-reaction in financial markets.

Housing prices tend to form a speculative bubble, beginning with continuous rise in prices and then decline at about the same rate it went up. Kindleberger (2000) discussed three different patterns of speculative bubbles. One is when price rises in an accelerating way and then crashes very sharply after reaching its peak. Another is when price rises and is followed by a similar decline after reaching its peak. The third is when price rises to a peak, which is then followed by a period of gradual decline known as the period of financial distress, to be followed by a much sharper crash at some later time.

The clear case for the second type of bubble at the time of US crisis was in real estate, particularly in housing. Shiller (2005, Chap. 2) presented the historical record on these measures, showing that by 2005 they had reached highs never previously observed in US history going back to the 1890s. Almost certainly this was a speculative bubble, and its rise and decline followed the second type of pattern, rising to 2006 and declining at about the same rate it went up to a bottom in 2009, with a mixed pattern thereafter.

We can see this pattern showing up in other real estate bubbles as well, with that in Japan in the 1980s and 1990s as an example. One reason why we may often fail to see a hard crash in real estate, particularly in single family homes, if not in other types, is that individuals become reluctant to sell when their homes fall in value. This fact is also established in this study, as we have shown that borrowers may not default even with negative equity, particularly for the initial range of negative equity.

When housing prices start rising, intermediaries revise their expectations about house price upwards. Hence, their expected return on lending to sub-prime borrowers rise, as the return is mostly based on high expected returns from property, even if borrowers default on their loan repayments. Hence, intermediaries divert their lending from productive investments to speculative investments.

Given the fact that, during housing price boom, lending shifts from prime borrowers (either households or firms) to sub-prime borrowers (either households or firms) due to speculative behavior of intermediaries, when the housing price starts to fall, it is the sub-prime borrowers who are more likely to default.

5. House Price and Credit in Indian Economy

There is good amount of evidence on linkages between house price and credit for Indian economy despite the limitation of data, as house price data is available only for fifteen cities, starting from 2007Q4 to 2013Q4, with 2007Q4 as base period.

5.1 Cross Correlogram Analysis

On looking at the cross correlogram between house price and credit for Indian cities, it is found that credit is positively correlated with 2 or 3 quarters lead values of house price (Table 4) and is also positively correlated with as many as 5 or 6 quarters lagged values of house price (Table 3). Hence, this indicates that causality is stronger and for longer duration, from house price to credit. The impact of credit on house price remains mostly for six to nine months. This may be because the supply of housing is fixed in short run and as the prices rise, more houses are constructed to meet the demand generated by more credit supply. On the other hand, impact of house price on credit remains for more than one and a half year, through its impact on lending behavior of intermediaries, as explained above. Also, there exists strong contemporaneous correlation between the two.

Table 3: Correlation between Credit and House Price (-i)

City/i	0	1	2	3	4	5	6	7
Ahmedabad	.847	.796	.721	.644	.554	.452		
Bangalore	.613	.570	.565	.521	.423			
Bhopal	.845	.759	.661	.5796	.498	.409		
Chennai	.924	.827	.743	.667	.587	.493		
Delhi	.901	.797	.678	.5335				
Faridabad	.817	.767	.739	.711	.671	.625	.569	.4897
Kolkata	.749	.717	.638	.562	.512	.428		
Lucknow	.952	.887	.799	.707	.616	.517	.413	
Mumbai	.869	.895	.795	.705	.602	.501	.429	
Patna	.738	.669	.609	.564	.503	.447	.437	.436
Pune	.969	.849	.756	.6505	.536	.436		
Surat	.775	.746	.693	.679	.654	.602	.566	.5335

Table 4: Correlation between Credit and House Price (+i)

City/i	0	1	2	3	4	5	6	7
Ahmedabad	.847	.689	.542	.424				
Bangalore	.613	.558	.474	.4737	.453	.417		
Bhopal	.845	.669	.568	.472				
Chennai	.924	.82	.712	.602	.473			
Delhi	.901	.798	.745	.68	.624	.562	.485	
Faridabad	.817	.657	.5015					
Kolkata	.749	.571	.416					
Lucknow	.952	.847	.7215	.598	.474			
Mumbai	.869	.749	.623	.492				
Patna	.738	.607	.514					
Pune	.969	.846	.724	.611	.486			
Surat	.775	.6497	.518					

First column of Table 3 and 4 are identical, as i = 0 signifies current value of house price. Hence, credit and house price are found to be contemporaneously correlated for 12 out of 15 cities considered for analysis. Thus, based on the cross correlogram analysis, we find that causality may exist in both directions and house price is having a longer term impact on credit market while the impact of credit on house price is for shorter duration (except for Delhi, where credit has longer term impact on house price).

It is also observed that the impact of house price on credit dies down over time. This can also be explained by the hypothesis of adaptive expectations. In each period (say every quarter) intermediaries adjust their expectations by some fraction of the error in expectations of the previous period. The error that is realized in period t is given by

$$\varepsilon_t^i = w_t - E_{t-1}(w_t^i) \text{ for i = 1, 2,……….N}$$

Given the error, intermediaries adjust their expectations on the basis of adaptive expectations rule.

$$E_t(w_{t+1}^i) = E_{t-1}(w_t^i) + \delta_i \varepsilon_t^i 0 < \delta_i \leq 1$$

where δ_i is a constant of proportionality called the coefficient of expectations.

Thus, intermediaries revise their previous expectations of housing price change in each period in proportion to the difference between actual shock and what was previously expected. The error adjustment mechanism can be applied to all previous periods so that current housing price expectations equal:

$$E_t\left(w_{t+1}^i\right) = \delta_i[\sum_{k=0}^{t}(1-\delta_i)^k w_{t-k}]$$

where $E_t\left(w_{t+1}^i\right)$ is expected house price change in the next period. Thus, current expected housing price change reflects a weighted average of all past housing price shocks, where the weights get smaller and smaller as we move further in the past. Hence, credit is also found to be strongly correlated with recent lagged values of house price and correlation sequentially falls, as we move to higher order of lags of house price data.

5.2 Stationarity Tests

The period considered includes the years of crisis in United States, but there does not exist any structural break in the data, although there is little fall in the credit in 2010 first quarter in almost all cities chosen. Except for Mumbai, where credit series is found to be stationary, data on credit for all other cities is non stationary. Similarly, except for Bhopal, Kolkata and Hyderabad, where house price series are found to be stationary, data on house price for all other cities is non stationary. Both these series are found to be stationary for all fifteen cities. These findings are confirmed by KPSS unit root tests. Hence, data on house price and credit is found to be integrated of order 1, i.e. I(1).

5.3 Tests for Cointegration and Granger Causality

On finding that both the variables under consideration are integrated of order 1, I(1), the next econometric step would be to test if there exists a long run relationship between credit and house price. There does not exist cointegrating relation between house price and credit in eleven cities (Ahmedabad, Bhopal, Delhi, Faridabad, Hyderabad, Jaipur, Kochi, Kolkatta, Lucknow, Patna, and Surat), whereas, in Bangalore, Chennai, Mumbai and Pune, there exists a cointegrating relation between the two variables.

Table 5 summarizes the findings. In seven out of fifteen cities (Ahmedabad, Delhi, Kolkata, Lucknow, Surat, Mumbai and Pune), causality runs from house price to credit. Hence, real estate prices influence lending behaviour of lenders in these cities. In two cities, i.e., in Kochi and Bangalore, causality runs in both directions. Thus, in these two cities also, wealth effect plays a role in lending decisions and credit further leads to upward movement in housing prices. In Patna and Chennai, causation is from credit to house price. We do not find evidence of causality between two variables in Bhopal, Faridabad, Hyderabad and Jaipur.

Table 5: Interaction between Housing Prices and Credit (Granger Causality) in Indian Cities

City	hp $\longrightarrow$ c	hp $\longleftarrow$ c	hp $\longleftrightarrow$ c
Ahmedabad	Yes		
Kolkata	Yes		
Delhi	Yes		
Lucknow	Yes		
Kochi			Yes
Patna		Yes	
Surat	Yes		
Bangalore			Yes
Chennai		Yes	
Mumbai	Yes		
Pune	Yes		

The study reveals that causality from house price to credit is more prominent in case of nine cities - Ahmedabad, Kolkata, Delhi, Lucknow, Kochi, Surat, Bangalore, Mumbai and Pune; and real estate prices do influence the lending behavior of banks. They lend more when house price is booming and vice- versa. In 4 cities, i.e., Kochi, Patna, Bangalore and Chennai, credit has impact on real estate price. This may be due to increased real estate demand coming from finance constrained firms or households.

6. Conclusions and Policy Implications

Given the fact that we can find many instances of banking crisis being preceded by housing price downturn suggests that causality is stronger from housing price to credit. Intermediaries learn from the actual house price movements and form expectations for future movement in house price. The situation is similar to the adaptive expectations, where intermediaries adjust their expectation by some fraction of the error in expectation of the previous period. Thus, intermediaries revise their previous expectations of housing price change in each period in proportion to the difference between actual shock and what was previously expected.

Housing prices tend to form a speculative bubble, beginning with continuous rise in prices and then decline at about the same rate it went up. When housing prices start rising, intermediaries revise their expectations about house price upwards. Hence, their expected return on lending to sub-prime borrowers rise, as the return is mostly based on high expected returns from property, even if borrowers default on their loan repayments. Hence, intermediaries divert their lending from productive investments to speculative investments.

Given the fact that, during housing price boom, lending shifts from prime borrowers (either households or firms) to sub-prime borrowers (either households or firms) due to speculative behavior of intermediaries, when the housing prices start to fall, it is the sub-prime borrowers who are more likely to default. Thus, the system becomes more prone to banking crisis and this explains the observation that banking crisis is preceded by a housing price downturn.

Given the result that financial intermediaries tend to become speculative during the house price boom in nine cities (Ahmedabad, Kolkata, Delhi, Lucknow, Kochi, Surat, Bangalore, Mumbai and Pune), it is important to put a regulatory framework particularly when housing prices are rising. It is imperative to regulate the behavior of financial institutions to restrict their exposure to speculative investments at the time of boom in real estate. It is only then house price bubble would not turn into speculative bubble followed by the defaults and decline in real activity. Hence, learning from the recent sub-prime crisis and the analysis of other crises that depict the connection between house price and credit in both emerging and advanced economies, it is important to remain watchful on the speculative tendencies of intermediaries when house price is booming.

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