REAL ESTATE MARKET OF A BRAZILIAN METROPOLIS: SUSTAINED GROWTH OR SPECULATIVE BUBBLE?*

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ABSTRACT

Purpose: To analyze the real estate sector of a Brazilian metropolis in the recent period of great valuation of the asset in the country and to investigate if there are signs of a speculative bubble in this market.

Originality/gap/relevance/implications: This article presents a version of the Case-Shiller Index, which describes the evolution of the relationship between house prices and rental prices and uses models in order to identify if the rise in property prices rests on good economic fundamentals.

Key methodological aspects: The approach is quantitative and involves the construction of the price-rent index, unit root test with an instrument that allows structural break with trend (Innovation Outlier Model) and analysis of cointegration using estimates of a Vector Error Correction Model (VECM).

Summary of the results: The results do not favor the interpretation that the real estate market rests on solid economic fundamentals. On the contrary, the evolution of the price-rent index and the lack of causal relationship of rents to prices towards long-term equilibrium are suggestive of the existence of a speculative bubble.

Key considerations/conclusions: The results support authors who are critical to the efficient market hypothesis (EMH) and suggest that the relative increase in property prices stems only from the belief that their selling price will be higher in the future. It is therefore foreseeable a decrease of real prices of housings, with equity losses for the participants in that market.

KEYWORDS

1. INTRODUCTION

Studies carried out by the Civil Construction Industry Union (Sinduscon) of State of Minas Gerais and the Institute of Economic, Administrative and Accounting Research (IPEAD/UFMG) show that the real estate market in Belo Horizonte has experienced great increase in value since the beginning of the Real Plan of Stabilization (Sinduscon, 2010). The properties were valued in such a way that the builders were led to make large investments, represented by new real estate units and by diversification of the real estate offer, whether of luxury or intermediate standards, or those aimed at the low income class. This last market segment was further boosted by the federal government's housing development program called "My house, my life". Similar behavior was observed in the largest Brazilian cities, and the possibility of a real estate bubble in the country occupies the imagination of people and the topic has been raised by analysts and some academic studies (Oliveira & Almeida, 2014; Machado, Ceretta, & Vieira, 2014).

Market experiences with sharp appreciation, such as the Nasdaq Stock Exchange, for instance, related to the assets titled "dot com" in the year 2000, and real estate crisis in 2007/08, indicate that economic agents show a "herd behavior", creating bubbles that culminate in a major devaluation of assets and equity losses. Akerlof and Shiller (2010) even questioned the popular wisdom that real assets, as real estate, constitute a safe haven for securing family assets.

There are different interpretations about the existence or not of a real estate bubble in the country by market analysts, and in the case of Belo Horizonte the conjectures are formulated without methodological rigor, and there is no more solid study focused on the analysis of the evolution of the sector in the recent years.

If there is a speculative bubble it can be affirmed that the values of the real estate will not be sustained and this phenomenon could cause financial losses for the investors of this market and financial difficulties for construction companies, which could have a perverse effect on suppliers, clients, labor and the economy as a whole.

A more in-depth analysis of the subject is therefore relevant in a regional market which has not yet been the subject of any academic study and which has a good database. The article uses models capable of identifying the existence or not of a real estate bubble and is organized into five sections, including this brief introduction. It will be shown, in the following section, a review of the literature on economic and financial cycles, which

can shed light on the dynamics of real estate prices and on the possibilities for speculative bubble to burst. In the third section, the methodological procedures adopted in the study are described. The fourth section presents the results based on the evolution of the price-rent index of real estate and on time-series analysis to mark out the fundamentals of the housing market and the existence or not of a speculative bubble. Finally, in the fifth section, the final considerations are presented.

2. REVIEW OF THE LITERATURE

2.1. Financial crises and speculative bubbles

Financial crises have been a cause for concern and Minsky (1986) is the economist who conducted the most advanced analysis on speculative bubbles as an integral part of economic cycles. According to the author, the instability of an investment can be determined by expectations of future profits. As an investment in real estate translates a long-term conception of return, the decision of this type of investment is taken under uncertainty, as defined by Keynes (1936).

It is well known that most of the real estate is acquired through residential financing lines from financial institutions, whose offer also meets the economic and social development policies of the government. According to the Minsk typology, Shostak (2009) points out that three types of leveraged real estate investors can be identified. The first is entitled hedge borrowers for being able to repay all portions of their debt through their cash flow (the returns received from the leases). The second type is known as speculative borrowers for being able to pay interest, but needs to borrow new loans or constantly roll over the debt. These borrowers believe that in the long run the valuation of real estate plus rents exceeds interest payments and loan repayments. Finally, the third group is labeled as Ponzi borrowers who are unable to pay even the interests, depending on the appreciation of the value of their assets to be able to refinance the debts.

Minsky (1986) argued that during a prolonged period of good times capitalist economies tend to move out of a structure dominated by hedge financial units and go into a structure in which there is a large predominance of units involved in Ponzi and speculative finances. In the presence of a speculative bubble, these investors are forced to sell their assets because they can not honor their commitments. In this situation, there will be an unexpected decrease in prices caused by the increase in supply, creating a

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pernicious deflationary cycle in the economy. The fall in the price of assets will begin a process of reducing the supply of bank credit due to the associated risk of default. With the possible restriction of credit by the banks, borrowers will not be able to renegotiate all their debts and will be taken to a state of bankruptcy, thus leading to the financial crisis.

The emergence of a bubble is a recurring theme in finance, being accepted that its existence is proven from the moment the price of any asset deviates from its fundamental market price. According to the mainstream theory, this fact should not occur, since the definition of the fundamental price of an asset presupposes that the market is efficient (EMH) and that the agents correctly form their expectations (Fama, 1970).

Stiglitz (1990), a persistent critic of the market rationality hypothesis, points out that the increase in the price of an asset stems only from the belief that its selling price will be higher in the future: when the fundamentals do not seem to justify this fact, then there is a bubble. In this case, the basic cause of price movements is determined by the self-achieved expectation of price variation itself.

Kindleberger (2000), in a similar approach, defines a bubble as a sharp increase in the price of an asset or a range of assets in a continuous process, with the initial increase generating expectations of further increases and attracting new investors. The rise is usually accompanied by a reversal of expectations and a sharp drop in prices, often resulting in a financial crisis.

Garber's (2000) interpretation of bubbles is broader and covers aspects of finance, economics, and psychology, and is aligned with a new branch of economics entitled Behavioral Economics. Spolador and Melo (2010) adopt this new line of thought to describe the agents' decision-making during crises, emphasizing that in the real world investors, instead of cold and calculating beings, are subject to panic, irrationalities, exaggerated exuberance and "herd behavior".

Scheinkman and Xiong (2003) and Harrison and Kreps (1978) also emphasize behavioral aspects and work with unusual variables in economic analysis. The authors point out that negotiations only happen because of differences in belief among agents, so that the greater the overconfidence, the more difficult the negotiation becomes, which causes asset inflation and a speculative bubble.

2.2. Speculative bubble in the real estate market

Akerlof and Shiller (2010) point out that the formation of the recent bubble in the real estate market resulted from "the animal spirit" and the

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monetary illusion in relation to the sector, since the supposed superiority of the real estate market in terms of returns to investors does not find support in the historical series. According to them, individuals are led to believe that investing in real estate is always a safe option because it is a real estate and supposedly immune to losses. In this way, they conclude that the movements that placed the sector in the spotlight at the end of the last decade of the twentieth and early years of the twenty-first centuries are typical of speculative bubbles, since what really exists is a presumption that since land is scarce and, consequently, real estate properties are scarce too, the prices always tend to increase, providing great profits in this market.

Another important factor in explaining the real estate boom in the US was the 2000/2001 stock market crisis in the technology sector, also known as the "dot com" crisis, which caused a great loss for families, institutional investors and investment banks. In addition, accounting scandals involving big company (i.e. Enron) with losses to investors spread a sense of mistrust regarding the stock market and pushed people into a sector that was assumed to be safe.

Economic policies and loose prudential rules on credit also played a role in the boom as well as in the crisis of the sector. Specifically, the policy of encouraging credit for the acquisition of new housing, especially for the less favored classes, has led to a relaxation of the restrictions on credit approval in the US, which has led to speculation and the warming of the economy. The valuation of assets gave rise to the "wealth effect", providing greater indebtedness of the families and new acquisitions of real estate. However, following the spectacular growth phase, the bubble burst triggered the biggest financial crisis since the Great Depression of 1930, with catastrophic consequences for almost all sectors of the world economy.

According to Roubini and Mihm (2010), the origin of the real estate boom may have occurred when families failed to negotiate real estate in the traditional way, the buying (and selling) of a property as their home, and began working as financial market speculators as if the assets were shares traded on the stock market. However, most of the investments in real estate, as discussed, are not made with their own resources, being necessary the contracting of third-party resources and increasing the financial leverage. The growth of this market has given rise to new types of financial products, transformed into derivatives that investors did not understand very well and that became internationally traded. The global financial system was exposed to subprime mortgages and when home buyers became defaulters the panic spread.

Shiller (2005) sought to anticipate the foreclosure of mortgages by using real estate price-to-rent index information that, like the stock market price /

earnings index, allows for a breach of good economic fundamentals. Krugman (2009) was perhaps the economist who most propagated the results indicated by the Shiller index applied to the USA. The author pointed out that property prices in that country almost doubled from 1999 to 2006 and, insistently, anticipated the collapse of the market, which actually occurred in 2007, after the price-to-rent index peaked in the previous year (Graph 1).

(Graph 1)

INDEX PRICE-TO-RENT:
US REAL ESTATE MARKET

Source: Krugman (2009)

Later studies confirmed Shiller's analysis, and the presence of bubbles in the real estate market of metropolitan areas of that country, during the analyzed period, came to have wide acceptance (Mikhed & Zemchk, 2013; Escobari, Damianov, & Bell, 2013; Peláez, 2012; Mayer, 2011). However, persistent price-to-rent ratios and the lack of good market fundamentals did not constitute specific US phenomena. Strong price increases and bubbles

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were also observed in the OECD countries (André, Gil-Alana, & Gupta, 2014; Taipalus, 2006) and, in emerging economies, such as China, Hong Kong and Taiwan (Chen & Funke, 2013; Yiu, Yu, & Jin, 2013; Tsai & Peng, 2011; Hui & Yue, 2006).

2.3. Discussions about the real estate bubble in Brazil

Not many studies deal with the speculative bubble in the real estate market in Brazil and there is still controversy on the subject. Machado *et al.* (2014), through a multiple regression analysis, intended to explain the behavior of the amount of credit granted to the real estate sector in response to changes in macroeconomic variables. However, the explanatory power of the model was very low, at about 20%, which according to the authors may be the evidence of speculative actions in the sector, since the real estate market is not being explained by the economic fundamentals. In view of this evidence, the authors recommend the use of new methodologies for the analysis of time series.

A more recent study by Brando and Barbedo (2016) analyzes the evolution of the housing market in Rio de Janeiro and São Paulo, and uses regression to model the behavior of real estate prices in function of explanatory variables of demand and supply. Although the authors seek to assess to what extent behavioral and economic variables help to explain the pronounced evolution of the price of residential real estate between 2008 and April 2014, the article is hardly illuminating on the speculative bubble issue in the country.

The researches of Lima (2011), Mendonça and Sachsida (2012) and Oliveira and Almeida (2014) are directed precisely to verify the fundamentals of the real estate market, and the results derived from their estimates point to the possibility of a bubble in the market of real estate in Brazil.

Lima (2011, discusses that the existence of a bubble is due to the residential real state prices above its fair value. According to him, the fair price should cover production costs and should contain a margin to cover the uncertainties. He stresses that this is not the case, and that there is a no-ballast value being bought by the market, resulting in unbalanced rates of return for the attractiveness of real estate in the country.

Mendonça and Sachsida (2012) with a more comprehensive econometric work reached to the same conclusions and support the thesis that real estate prices have grown beyond what can be explained by their "fundamentals". The authors claim the existence of a housing bubble in this market and, objectively, elect the Federal Government, through its fiscal poli-

cies and stimulus to credit, as the main responsible for the emergence of this bubble.

Oliveira and Almeida (2014) are equally assertive and conclude that the evolution of prices of residential properties in the two most important cities of Brazil (São Paulo and Rio de Janeiro) shows the existence of a speculative bubble. According to the results found by the authors, based on time series analysis, the bubble would begin in mid-2009, as regards to São Paulo, and by the middle of 2010, as regards to Rio de Janeiro.

In short, the studies associate the possible existence of a housing bubble in Brazil with countercyclical government policies that would have overheated the real estate market, which may have led people to make systematic errors in assessing the potential for rising real estate prices. In addition, Mendonça and Sachsida (2012) warn that such policies generate inflationary pressure and a future increase in interest rates to hold prices would pose serious problems for the real estate market, since most of the financing agreements in Brazil are made having post-fixed interest. However, the authors comment on the relative impacts of a likely bubble burst, which they said may not be as acute as those that occurred in the US crisis.

Martone (2013) stresses that it is not an easy task to distinguish between the normal valuation of real estate and a valuation that represents a speculative process without economic fundamentals, but that there is no evidence of a speculative bubble, since this requires a high financial leverage with strong participation of the banking system. According to him, this situation is not seen in the country because there is no communication gap between the credit directed to the sector – Housing System that works with resources of savings account and is highly regulated – and the free segment of the credit market. In addition, mechanisms prevailing in other economies, based on securitization of real estate receivables and use of equity on mortgaged property as collateral for new loans, are incipient and not representative in the Brazilian financial system. Thus, according to Martone (2013), there is only a pronounced rise in prices as a result of a few years of exaggerated currency expansion, which will be corrected by raising the interest rate and reducing the amount of resources destined for the real estate market.

Semple and Marçal (2012), in a study based on the discounted cash flow model, are a little more cautious in the diagnosis and do not totally rule out the existence of a bubble. But they also admit that the increase in real estate prices has been generated by normal market factors, associated with the increase in demand driven by the fall in interest rates and facilities in credit

conditions, mainly due to the initiative of the Federal Government in the sector, with the launch of "My Home, My Life" program.

According to Semple and Marçal (2012), these facts allowed a strong increase in demand, and since the supply in the sector can not respond promptly to such demand, due to the time required to make new projects viable, the result was higher real estate prices. For the authors, in the near future, stabilization in real estate prices should occur in a new reality, free of continuous increases as recently seen or abrupt and intense falls as would be expected in the case of a classical bubble.

3. METHODOLOGY

According to the discussions presented in section 2 of this article, the presence of bubbles arises from the price dynamics detached from the economic fundamentals, and price variation is governed by the price variation in the previous period. In this situation, the basic cause of price movements is determined only by the self-fulfilling expectation of the price variation itself, with the initial increase generating expectations of further increases and attracting new investors, which confirms the strongly autocorrelated aspect of real estate prices. Therefore, at this juncture, the use of time series econometrics seems to be pertinent to capture the dynamics of prices.

3.1. Analysis models

The starting point for the quantitative analysis employed in this article is the construction of the price-to-rent index, as suggested by Shiller (2005), which gave rise to the S & P/Case-Shiller Home Price. This index is analogous to the financial market price/earnings indicator, known simply as P/E. In the case of the real estate market, the index (P/A) is the result of the division of the price of the property by the respective rent, and the higher the index, the more inflated the market is.

Graph 2 shows the evolution of prices and rent of homes in the City of Belo Horizonte (State of Minas Gerais, Brazil), used to construct this index, revealing that from 2010 there is a distancing of the series for an extended period, and this is the first indication of disrespect to good economic fundamentals in this market. But it is rash to conclude whether or not a bubble is present merely by graphical analysis and that it can be confirmed or rejected, for example, by unit root tests of the price-to-rent index and cointegration between these two variables, and these instruments will be used in this article.

Graph 2

PRICE INDICES OF REAL ESTATE (PR) AND RESIDENTIAL RENTAL (AL) BELO HORIZONTE - DECEMBER 2008 TO MARCH 2016
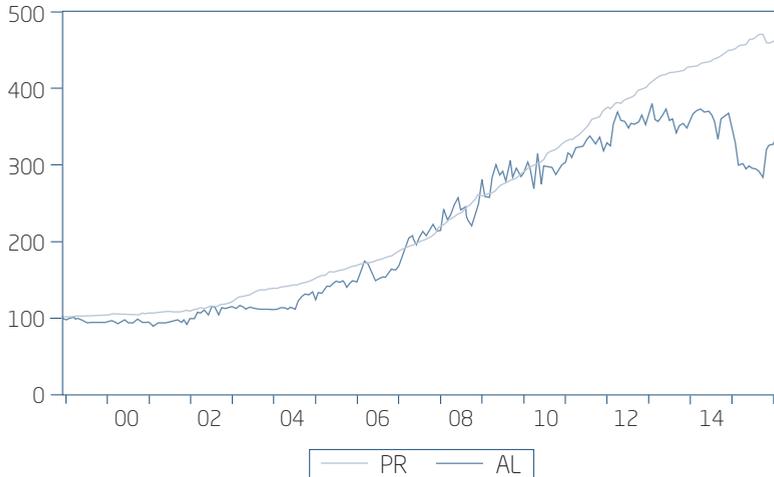
Note: Base December 1998 = 100.

Source: Elaborated by the authors.

The Unit Root Test allows to identify whether the series is stationary or not. The Dickley-Fuller ADF Test (Dickey & Fuller, 1979) is usually used for this purpose. However, as pointed out by Perron (1989), structural change and unit root are closely related, such that conventional unit root tests are biased in favor of the null hypothesis of unit root when the data show a steady trend with structural break.

There are different ways of dealing with this issue, and the innovational outlier (IO) model is used, which presupposes that the break occurs gradually following a dynamic pattern such as innovations. The test adopts as null hypothesis the assumption that the series follows a unit root process, possibly with a break, against the alternative hypothesis of stationary trend with breakage.

In an IO model with data with trend and possibility of break of intercept and trend, it is added in the standard equation:

- a break variable (0 for dates before the break, and 1 later)

$$DU_t(T_b) = 1(t \geq T_b)$$

- a trend-breaking variable (for dates before the break)

$$DT_t(T_b) = 1(t \geq T_b) \cdot (t - T_b + 1)$$

- a dummy breaking variable (assumes value 1 only on the date of the break and zero for the others)

$$D_t(T_b) = 1(t = T_b)$$

The equation for the test assumes the following form:

$$y_t = t + DU_t(T_b) + DT_t(T_b) + D_t(T_b) + y_{t-1} + \sum_{i=1}^{k} c_i\, y_{t-1} + \varepsilon_t \qquad (1)$$

Eviews 9.4 software presents several ways of testing the presence of unit root by looking at this alternative formulation. In this study, the lags structure was selected using the F test and the break date minimizing the Dickey-Fuller t-statistic.

Another instrument capable of providing indications of violation of market fundamentals is the Cointegration Test. Akerlof and Shiller (2010), for example, by questioning the common sense that investing in real estate is always safe and a good deal, emphasize that the existence of a bubble can be ruled out if the driving force for real estate price increases comes from the increase in rents. In this case, a situation of excess demand in the market makes it possible to increase prices until the market finds its equilibrium, which does not imply, according to them, a speculative move.

Although the authors do not indicate how to test this proposition, it is known that analysts generally use the Granger Causality Test to verify causality in two time series, but the method demands that the series do not exhibit unit root. The existence of a unit root implies that the series is non-stationary, so that it must be differentiated to make it stationary, and thus the long-term information originally contained in the series is lost (Carneiro, 1997).

However, a vector error correction model (VECM) proposed by Engle and Granger (1987) allows us to identify possible causal relations between two variables originating from the same long-term trend. VECM modifies Granger's causality pattern by incorporating possible long-term effects into a short-run analysis, which is the essence of cointegration analysis (Hendry, 1995; Nogueira, 2001).

In the specific case, tests performed (ADF) by the authors show that the price and rental series of real estate used in this study are not stationary, but differentiated of order 1. Therefore, in this study, in addition to analyzing the

dynamic behavior of the price-rent index of Belo Horizonte, using the unit root test, used a vector error correction model (VECM) to estimate the relationship between these variables and to identify the possible influence of rental increases in the determination of real estate prices in the short and long term horizon.

In the estimation of VECM the following steps were observed:

1. Identification of the most appropriate lag structure to establish the relationship between the series, by means of estimation of a vector autoregressive (VAR) model;
2. Johansen's test (1988) to verify if the series are cointegrated;
3. VECM estimates to verify the dynamic relationship of the variables and the correction mechanism.

In order to identify the appropriate lag structure, considering that the data used are monthly, a VAR with 12 lags was initially defined, and the 6-period lag, as defined by the Akaike Information Criterion (AIC), was selected. Once the cointegration of the series was confirmed by the Johansen test (1988), the VECM was used, and whose estimates allow the evaluation of the causality and the mechanism of correction of errors in the long term and the influence of one variable over the other in the short term horizon, according to the lag structure of the model. The model was estimated with the following specification:

$$\Delta X_t = {}_o + EC_{t-1} + i\ \Delta X_{t-i} + j\ \Delta Y_{t-j} + {}_{1t} \tag{2}$$

Where Δ is the first difference operator, EC_{t-1} is the error correction term lagged over a period; is the short-term coefficient of the error correction term $(-1 < \ < o)$, and is the error term. The coefficient indicates the rate of adjustment of the short-run model for the long run, and the error correction term shows the long-term relationship between the variables. A negative and significant coefficient of the error correction term indicates the existence of a long-term causal relation of Y (rents) to X (price of the residences), in such a way that Y takes X towards the long-term equilibrium.

3.2. Analysis unit and data source

One of the problems faced by the researchers who propose is to analyze the presence of bubble is the lack of a sufficient long base of real estate prices and of the rents that cover the different regions of the country. The studies reviewed address the Fipe-Zap data for São Paulo and Rio de Janeiro,

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whose series begin only in 2008. However, in the case of Belo Horizonte, this gap is partially remedied since the Institute for Economic and Administrative Research (IPEAD/UFMG) reports consistent data since 1994 regarding real estate prices and, as of December 1998, with respect to rental values. Therefore, there are 17 years of comparable data for the monthly series of prices and rent that have not yet been explored in academic studies.

Thus, Belo Horizonte is chosen as the object of analysis. The choice is justified because it is the capital of the third most economically important state in Brazil and because it provides access to a database with information on the evolution of the real estate market, which may be the most complete in the sector. Moreover, the evidence presented in this study may reflect what is happening at the national level, since according to Oliveira and Almeida (2014) there is some similarity between the behaviors of the real estate market in the largest Brazilian cities in recent years.

The sales price data of the properties (apartments) employed in this study are those announced, when the most appropriate variable should be the transaction price of the property. However, in the absence of this information, it is accepted, as in other studies that work with the price rent ratio in the country, that both measures follow the same trend of growth over time.

4 RESULTS

4.1 The price-to-rent index

According to the literature presented in section 2, there is a speculative bubble from the moment the price of any asset deviates from its "correct" market price for a reasonably long period. This seems to be the case in the real estate market of Belo Horizonte, since the price-to-rent index of residential properties reveals a clear upward trend (Graph 3).

Three periods of elevation of the index can be distinguished, the first covering the years 1999-2001 of acute crisis of the Brazilian economy and coinciding with the international economic retraction caused by the "dot com" crisis and the terrorist attacks on the Towers Of the World Trade Center in New York. In this period, there was a rush to real estate with a considerable increase in the price-to-rent index observed in both developed countries (Graph 1, section 2.3) and in the domestic market (Graph 3). In the real estate market of Belo Horizonte, the increase reached 19 percentage points in the period considered (Table 1). Contrary to what happened in developed countries that reacted with fiscal and monetary stimulus policies

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to face the mistrust crisis, the Brazilian government was obliged to correct fiscal and external imbalances from the first phase of the stabilization effort (Oliveira & Turolla, 2003). The country implemented a triple regime change, involving exchange, monetary and fiscal areas, which resulted in lower economic growth and lower demand for real estate, reflecting the retreat of the price-to-rent ratio of Belo Horizonte.

(Graph 3)

INDEX PRICE-TO-RENT OF THE REAL ESTATE RESIDENTIAL MARKET BELO HORIZONTE - DECEMBER 1998 TO MARCH 2016

PREAL

Note: Price-to-rent index in December 1998 = 100.

Source: Elaborated by the authors.

The second period of warming of the real estate market in Belo Horizonte occurred in the second half of 2003, and reveals the distrust and uncertainties of the economic agents resulting from the election of Luís Inácio Lula da Silva as president of Brazil. However, with the maintenance of the tripod fiscal responsibility-floating exchange rate-inflation targets and the new president's commitment to stability, which was supported by a policy of high interest rates, there was no room for real estate inflation, and the index decreased round 20 percentage points between December 2003 (index = 124) and April 2006 (index = 100). Thus, an austere monetary policy prevented any bubble in the domestic real estate market during this period, contrary to what happened internationally.

The third period is the longest and originates in the inflection of macroeconomic policy and little commitment to the balance of the public budget in the country. Monetary policy becomes expansionary as of 2009/10, with very low real interest rates. In addition, sectorial programs and cheap credit for the construction sector gave new impetus to this segment, which translated into a large increase in the price-rent index of Belo Horizonte (Table 1).

(Table 1)

PRICE-TO-RENT INDEX: RESIDENTIAL PROPERTIES IN BELO HORIZONTE

Month/Year	Price of the Real Estate	Rent of the Real Estate	Price-to-Rent Index
Dec/98	100.00	100.00	100.00
Dec/99	103.52	95.03	108.93
Dec/00	105.47	95.46	110.48
Dec/01	109.70	92.45	118.65
Dec/02	120.40	114.23	105.43
Dec/03	138.10	111.71	123.62
Dec/04	149.36	134.53	111.02
Dec/05	168.27	149.05	112.41
Dec/06	184.02	161.78	113.75
Dec/07	214.14	211.50	101.25
Dec/08	261.65	249.11	105.03
Dec/09	286.35	283.39	100.83
Dec/10	326.33	299.91	108.81
Dec/11	370.62	318.54	116.35
Dec/12	401.21	350.84	114.36
Dec/13	426.57	347.15	122.88
Dec/14	449.09	369.02	121.70
Dec/15	458.71	326.59	140.46
Jan/16	460.51	326.80	140.91
Feb/16	459.35	339.90	135.14
Mar/16	458.45	321.11	142.77

Source: Elaborated by the authors.

Graph 3 also shows index swings around a mean in the first nine years of the series, and from that there is a strong upward trend. According to the

unit root test, the null hypothesis (H0) can not be rejected, since the absolute value obtained from t is 4.3455, which is lower than the absolute values tabulated, corresponding to a probability value (P-value) of 0.31 (Table 2).

Table 2

UNIT ROOT TEST: PRICE-TO-RENT INDEX[1]

Breaking Date: March 2007

Break Type: Innovational Outlier

Automatic lag selected = 1 period

		Statistic t	Prob.[2]
Teste Dickey Fuller increased		-4.345549	0.3131
Critical Values	1% Level	-5.719131	
	5% Level	-5.175710	
	10% Level	-4.893950	

Note: [1] H0 the series has unit root. Includes trend and intercept

[2] Vogelsang asymptotic one-sided p-values.

Source: Elaborated by the authors.

In addition to being non-stationary, the IO model (equation 1) allows to identify that the series exhibits a structural break which probably occurred in March 2007, a behavior that is suggestive of bubble formation in this market (Graph 4). This result of the beginning of the bubble in 2007 for Belo Horizonte is slightly different from those reported by Oliveira and Almeida (2014) for São Paulo and Rio de Janeiro, for which the bubble would start in mid-2009 and in the middle of 2010 respectively. It should be noted, however, that the time series used in Oliveira and Almeida (2014) is shorter, covering 2008-2014, which may influence the initial breaking point.

At this point, it is interesting to contrast the information of the US real estate market, shown in Graph 1, and the market data of Belo Horizonte shown in Graph 3. It can be observed that in the former the price-rent index (P/A) increased by 60 points in seven years (from 2000 to 2007), and in Belo Horizonte, the index increased by around 50 points in a little more than five years, considering the observed index average in the first six months of 2015 (P/A = 155) in relation to the December 2009 index (P/A = 101). After these periods of high rise the index fell back, but the fall of the index of Belo Horizonteis still not very pronounced. In the US, the aggregate index fell by 40 points in two years, and domestically there was a drop of around 15 points, considering the average index in the first three months of 2016 (P/A = 140) in relation to the average observed in the first half of

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2015 (P/A = 155). Therefore, we can expect new falls in the price-to-rent ratio for Belo Horizonte, since the market is very much inflated. It is noted that this situation has led to residential real estate business in Belo Horizonte with substantial discounts (20-30%) at current offer prices, and these transactions are perfectly compatible with the results presented here.

(Graph 4)

STRUCTURAL BREAK: PRICE-TO-RENT INDEX
Statistics t Dickey-Fuller

Source: Elaborated by the authors.

4.2. Analysis of causality between rents and real estate prices: the lack of good fundamentals in the real estate market

According to the hypotheses formulated in section 3, good economic fundamentals demand that the rise of rents promote increase in real estate prices. In order to test the hypothesis, the VECM was estimated, with equation (3) incorporating the rent (AL) and real estate prices (PR) variables, in level and its first difference (D), with 06 lags, as discussed in section 3.1, and results are described in Table 3.

$$D(PR) = C(1)*(AL(-1) - 0.706479282465*PR(-1) - 0.444194922727) + C(2)*D(AL(-1)) + C(3)*D(AL(-2)) + C(4)*D(AL(-3)) + C(5)*D(AL(-4)) + C(6)*D(AL(-5)) + C(7)*D(AL(-6)) + C(8)*D(PR(-1)) + C(9)*D(PR(-2)) + C(10)*D(PR(-3)) + C(11)*D(PR(-4)) + C(12)*D(PR(-5)) + C(13)*D(PR(-6)) + C(14) \quad (3)$$

The coefficient of cointegration C(1) depicts the adjustment speediness towards the long-term equilibrium, and for transmission of one variable over another this coefficient must be negative and present statistical significance. It can be seen in Table 3 that these conditions are not met, since C(1) has an inverted signal. Therefore, the possibility that increases in rents directs prices to a situation of long-term equilibrium is not confirmed.

(Table 3)

RELATIONSHIP BETWEEN REAL ESTATE AND RENTAL PRICES:
Variable Dependent Real Estate Prices in First Difference

	Coefficient	Standard Error	Statistics t	Prob.
C(1)	0.032387	0.006426	5.040030	0.0000
C(2)	-0.023100	0.012055	-1.916282	0.0569
C(3)	-0.031461	0.012359	-2.545580	0.0117
C(4)	-0.036681	0.012406	-2.956707	0.0035
C(5)	-0.021845	0.012505	-1.746891	0.0823
C(6)	-0.026936	0.012848	-2.096494	0.0374
C(7)	0.003553	0.011863	0.299552	0.7649
C(8)	0.029062	0.070780	0.410597	0.6818
C(9)	-0.014564	0.069414	-0.209811	0.8340
C(10)	0.133772	0.069372	1.928321	0.0553
C(11)	0.080168	0.067810	1.182239	0.2386
C(12)	-0.167808	0.074972	-2.238257	0.0264
C(13)	0.153296	0.076010	2.016801	0.0452
C(14)	0.015492	0.003004	5.157169	0.0000

R^2 = 0,3563 R^2 adjusted = 0,3113   Statistic F = 7,9184   Prob (Stat. F = 0,0000)
Durbin-Watson = 2,0447

Source: Elaborated by the authors.

In relation to the short-term impacts of rents on prices, the estimated coefficients [C(2), C(3), C(4), C(5), C(6)] are statistically significant, but the signals are negative! Only the coefficient with a lag of 06 months [C(7)] shows the correct signal but is not statistically significant.

The results of the estimates leave no doubt about the lack of good fundamentals in the real estate market in recent years. Thus, the results support

the perceptions of Machado *et al.* (2014) and the findings in the researches of Oliveira and Almeida (2014), Mendonça and Sachsida (2012) and Lima (2011), which highlight the presence of a speculative bubble in state capitals of Brazil. It should also be noted that the results are in line with the studies presented in the theoretical framework and are consistent with the irrationality in decision-making by economic agents, in which the families/investors suffer from monetary illusion.

Although the study has identified the presence of a speculative bubble, it is believed that it should be deflated without an overflow in the international molding, given the striking differences in the banking industry. The Brazilian government adopted a more cautious and prudent policy, with greater shareholders' capital requirements and stricter rules on lending (Souza, 2014). These policies have made the Brazilian banking system less leveraged and the forms of real estate credit that exposes investors to greater risks are incipient and not very representative in the country (Martone, 2013). The most important segment is that of regulated credit that has funding backed by the savings accounts, which is protected by the Credit Guarantee Fund and avoids abrupt withdrawals and bank runs. In addition, banks, on their turn, besides income requirement of borrowers, compatible with the volume financed, require an entry of at least 20% of the value of the property for the granting of financing, which helps inhibit acquisitions of impulse-driven investors.

5. FINAL CONSIDERATIONS

The study was based on a version of the Case-Shiller Index that describes the evolution of home and rental prices to support analyzes of the real estate market dynamics of a large Brazilian city. It was possible to identify different cycles in the last 15 years, and in the period 1999-2001, of acute crisis of the Brazilian economy and of uncertainties in the world, there was also a race for real estate market in the city of Belo Horizonte, and considerable price-to-rent index increase. However, fiscal and external accounts problems forced the country to adopt a rigorous macroeconomic program, which resulted in lower economic growth and little room for a sharp rise in property prices.

The second period of warming of the real estate market occurred in the period 2003-2006, and reveals the distrust of the economic agents in relation to the election of Luis Inácio Lula da Silva as president of Brazil. The commitment of the new president's towards stability and a high interest rate monetary policy prevented any bubble in the domestic real estate market in the following years, unlike the international one.

However, in recent years a significant increase in property prices has been detected, being the result of the "new macroeconomic matrix" and little commitment to the balance of the public budget in the country. Decrease in interest rates, rent transfers, real wage increases, and cheap credit programs for the construction sector gave new impetus to this segment, which translated into a large increase in Belo Horizonte's price-to-rent index.

The structural breakdown of the series in March 2007 and the presence of a unit root in the series of the price-to-rent index, as well as the lack of a causal relationship of rents to prices in the direction of long-term equilibrium, revealed that the housing market in Belo Horizonte and, why not, in Brazil, is inflated and are suggestive of a speculative bubble. The results support authors who are critical to the efficient market hypothesis (EMH) and argue that the relative increase in property prices stems only from the belief that their selling price will be higher in the future. It is therefore foreseeable a decrease of real prices of housings, with equity losses for investors/households who acquired real estate during the boom.

Thus, it is advisable that future studies investigate the reasons that led people to buy real estate in this inflated market. It can not be ruled out that the search for this real assets in the country responds to other variables, besides those traditionally considered in this type of study (income, prices, interest, credit facility, etc.), being motivated, for example, by personal fulfillment criteria or even for the sake of patrimonial protection, the latter being an attempt to avoid the economic turbulence caused by the fragility of the government and the poor conduct of public policies in the country. In addition, although there are elements that allow us to make considerations that should not be a bubble burst, but an accommodation of nominal prices with a gradual reduction of real estate prices in the face of high inflation rates, it is relevant to investigate how the situation of this inflated market should be resolved.

MERCADO IMOBILIÁRIO DE UMA METRÓPOLE BRASILEIRA: CRESCIMENTO SUSTENTADO OU BOLHA ESPECULATIVA?

RESUMO

Objetivo: Analisar o setor imobiliário de uma metrópole brasileira no período recente de grande valorização do ativo no país e investigar se há indícios de bolha especulativa neste mercado.

Originalidade/lacuna/relevância/implicações: O artigo apresenta uma versão do Índice Case-Shiller que retrata a evolução da relação entre os preços das residências e dos alugueis e utiliza modelos visando identificar se a alta dos preços dos imóveis repousa em bons fundamentos econômicos.

Principais aspectos metodológicos: A abordagem é quantitativa envolvendo a construção do índice preço-aluguel, teste de raiz unitária com um instrumental que permite quebra estrutural com tendência (Innovation Outlier Model) e análise de cointegração mediante estimativas de um modelo de vetor de correção de erros (VECM).

Síntese dos principais resultados: Os resultados não favorecem a interpretação de que o mercado imobiliário repousa em sólidos fundamentos econômicos. Ao contrário, a evolução do índice preço-aluguel e a falta de relação causal de aluguéis para preços em direção de equilíbrio de longo prazo são sugestivos da existência de uma bolha especulativa.

Principais considerações/conclusões: Os resultados dão suporte aos autores que são críticos à hipótese do mercado eficiente (EMH) e sugerem que o aumento relativo do preço do imóvel decorre apenas da crença de que seu preço de venda será maior no futuro. É, portanto, previsível a redução dos preços reais dos imóveis, com perdas patrimoniais para os participantes desse mercado.

PALAVRAS-CHAVE

Mercado imobiliário. Bolha especulativa. Crise financeira. Índice Preço--Aluguel. VECM.

¿EL MERCADO DE BIENES INMUEBLES DE UNA METRÓPOLI BRASILEÑA: CRECIMIENTO SOSTENIDO O BURBUJA ESPECULATIVA?

RESUMEN

Objetivo: Analizar los bienes inmuebles de una metrópoli brasileña en el reciente periodo de gran apreciación de los activos en el país e investigar si hay evidencias de la burbuja especulativa en este mercado.

Originalidad/laguna/relevancia/implicaciones: El artículo presenta una versión del índice Case-Shiller, que describe la evolución de la relación

entre los precios de las viviendas y de los alquileres y emplea modelos para identificar si el aumento de los precios de las propiedades se basa en los buenos fundamentos económicos.

Aspectos metodológicos principales: El enfoque es cuantitativo, consistente en la construcción del índice de precios-alquiler, prueba de raíz unitaria con un instrumento que permite ruptura estructural con tendencia (Innovation Outlier Model) y el análisis de cointegración en base a estimaciones de un modelo de corrección del error (VECM).

Síntesis de los principales resultados: Los resultados no favorecen la interpretación que el mercado de la vivienda se basa en fundamentos económicos sólidos. Por el contrario, la evolución de la relación precio - renta y la falta de relaciones causales de alquileres a precios de dirección de equilibrio de largo plazo son indicativos de la existencia de una burbuja especulativa.

Principales consideraciones/conclusiones: Los resultados apoyan los autores que son críticos para la hipótesis del mercado eficiente (EMH) y sugieren que el aumento relativo de los precios de los inmuebles se deriva sólo de la creencia de que el precio de venta será mayor en el futuro. Por tanto, es previsible la reducción de los precios reales de bienes inmuebles, con pérdidas para los participantes en este mercado.

PALABRAS CLAVE

Mercado de bienes inmuebles. Burbuja especulativa. Crisis financiera. Modelo del Índice de Precio de Alquiler. VECM.

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