CYCLICITY OF HOUSING MARKETS UNDER THE SPECIFIC CONDITION OF THE EXISTENCE OF A BUBBLE IN THE REAL ESTATE MARKET

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Abstract

In recent years, real estate bubbles have been commonplace in housing markets all over the world. That's why we examine the relation between housing prices during bubbles in 101 cities located in ten different countries, aiming to explain the housing market cycle during a housing bubble, using economic and housing indicators. We obtained data on eight variables used in market cycle analysis which may be able to explain the existence of speculation and the ideal market cycle. The obtained results show that many of economic and housing indicators begin to decrease while housing prices peak. Only the quantity of transactions peaks during the following year. We also observed that a housing bubble can follow three different scenarios, i.e.: the bubble does not burst, or can burst with a slow decline or sudden and rapid collapse. Finally, it is possible to determine that the same variables can provide clear insight into a bubble in the real estate cycle.

Key words: *housing bubble, housing market, cyclicity.*

JEL Classification: R31, R10, O57, E32.

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1. Introduction

Modern real estate speculation had its beginning in the 1970s and early 1980s in the south-eastern United States and Southern California (MELLO, SPOLADOR 2004). The effect of the resultant bubble collapse was felt all over the USA and Mexico. The Japanese bubble, which occurred between 1986 and 1990, was one of the best-known of this crisis period. At its peak, prices reached \$1.5 million per square meter in Tokyo (DEHESH, PUGH 1999). However, in 2004, one square meter in the financial districts cost just one hundredth of the price of one square meter in the residential districts and only

one tenth of what it was worth in 1990. For the Japanese economy, this crisis was very difficult, causing the bankruptcy of many companies (SHIRATSUKA 2003). By the end of the real estate crisis, the country had lost 41% of the wealth of its population (ZEIT 2005).

Between 1991 and 1996, there was a case of real estate speculation in the former East Germany, as a consequence of the reunification of Germany and the influx of capital from West Germany into the market. When the bubble burst, many banks and companies, such as the entrepreneur Schneider, one of the most famous speculators in East Germany of this time, had serious financial problems. Schneider operated in the market through developers, brokers, real estate agents, etc., speculating with real estate prices and rent prices. He filed for bankruptcy with a total loss of 1.4 billion euros (LEIPZIGER VOLKSZEITUNG 1998). Since 2000, the list of cases of bubbles has become extensive. Such cases include: Brazil, 2000 to present; the U.S.A., between 2002 and 2007 (CLARK, COGGIN 2010; KIVEDAL 2013); Russia, between 2004 and 2006 (IRN 2007); China, from 2002 to 2010 (SHEN 2012); Spain, between 1997 and 2007 (MÜLLER 2007); and Poland, 2004 to 2011 (ZUZAŃSKA-ŻYŚKO 2014). Between June 2006 and June 2007, the growth of real estate values in Poland was over 50% (BELEJ, KULESZA 2014; SIEMIŃSKA, RYMARZAK 2014).

Lin and Lin (2011) explain that real estate is the most important and expensive asset to acquire. As the major capital asset in the world, its capitalization is larger than the common stock or bond markets (SHI and XU, 2013). Real estate has the respective peculiar characteristics: heterogeneity, high investments, low liquidity and fixed locations (COZZMEI, ONOFREI 2012). Complementarily, the real estate market includes: the securitized market, the commercial market and the residential market (BOUCHOUICHA, FTITI 2012). The residential market is classified according to its structure and characteristics (SCHULTE, HUPACH 2000; LING, HUI 2013). Another important aspect of real estate classification is that investments can be ordered into two groups, i.e.: direct and indirect investments. Direct investments can be carried out through purchase of property, and indirect investment - through acquisition of shares or units of entities that hold real estate (HEANEY, SRINANTHAKUMAR 2012).

The real estate market is a dynamic and interconnected structure, which includes the creation, financing, management and transfer of real property (GEIPELE, KAUSKALE 2013). The real estate sector had been a key factor in the world financial instability in 2008 (AMONHAEMANON et al. 2013; BOUCHOUICHA, FTITI 2012; DRIESSEN, VAN HEMERT 2012).

Werneck and Rottke (2006) explain in a simple way how the cycle of the real estate market works, particularly in relation to highs (booms) and lows (busts), which has been a subject of attention for policy makers. On the other hand, positive and negative real estate asset price bubbles are also commonly associated with the cycles of the readiness of investors to take risks (KAKLAUSKAS et al. 2011).

The cycle is an important factor for companies in this industry; however, PHYRR *et al.* (2003) drew attention to the fact that, until now, there has been no common knowledge, but only common terminology and methodologies used by researchers and academia. However, these authors only speak about the cycles in general, without discussing speculation. BOUCHOUICHA and FTITI (2012) explain that "the booms and busts in real estate markets have been an issue of concern for policy makers." A different point of view is represented by GLAESER, GYOURKO and SAIZ (2008), viewing the housing market cycle from the perspective of adjustment by the supply side, blaming the elasticity of housing supply for high prices. Some researchers, like TSAI, LEE and CHIANG (2012), studied the relation between the real estate market and the stock market. Others investigated the implications for investors and policymakers in the world market (HATEMI-J, ROCA, AL-SHAYEB 2014), more specifically, that a contagion risk exists amongst real estate markets. NNEJI, BROOKS and WARD (2013) found two types of bubbles in the residential real estate market in the United States between 1960 and 2011: intrinsic bubbles and rational speculative bubbles. A different selection is given by CAMERER (1989), which classified these into rational growing bubbles, fads, and information bubbles. ARTIS (2003) didn't find a particular European cycle in his research. On the other hand, CANOVA, CICCARELLI and ORTEGA (2007), KOSE, OTROK and WHITEMAN (2008), LUMSDAINE and PRASAD (2003) and NADAL DE SIMONE (2002), found a European cycle together with evidence of a world cycle for a group of OECD countries. Del NEGRO and OTROK (2008) discovered a strong correlation between the EU and the US cycles.

Based on these facts, hypotheses were defined:

1. Cyclicity of housing markets is the same in different countries,
2. variables can indicate the burst of housing bubbles, and

3. during a bubble, cyclicity reacts in the same way.

This paper aims to explain the normal cycle of the housing market during a real estate bubble. It is an empirical, exploratory and descriptive study, which uses variables of 101 cities in ten countries, such as Germany, USA, Brazil and Australia. The selection of these cities was based on Gross Domestic Product (GDP) and the number of inhabitants, as well as using indices, e.g. the "housing price to income ratio", according to CASE (2000), JUD and WINKLER (2002) and NING and HOON (2012). This discussion is needed in order to clarify which variables are useful in determining the actual situation on real estate markets, especially during a bubble phase. The variables used were: building permits, land price, quantity of transactions, housing market volume, house price, rent, GDP and population. The selected period of research was from 1990 to 2005, using annual data.

The results of this paper should not be generalized for other cities and countries because the housing market depends on supply and demand, as well as the behavior of owners and speculators. It also does not confirm that all the variables have the same development and percentage rates at every stage. The selected indicators can be insufficient in explaining the cycle of the real estate market in light of the speculative bubble. Psychological aspects (e.g. herd behaviors) may have to be considered (BRZEZICKA, WISNIEWSKI 2014).

Within this study, only housing speculation in urban areas (cities) was analyzed because rural housing data, as in the case of Brazil, are not present in all countries.

2. Cycle of the real estate market

The Royal Institution of Chartered Surveyors (1994, p.9) defined the property cycle as "... recurrent but irregular fluctuations in the rate of all property total return, which are also apparent in many other indicators of property activity, but with varying leads and lags against the all-property cycle." But finding a time series which does not show this pattern might be difficult. Empirical time differs by the size of the uneven irregular amplitude and the period of oscillation, e.g. there is a deviation from the basic value and it presents a lack of symmetry with respect to the demonstration of the cosine function (Figure 1).

The length of the cycle varies by real estate type. WHEATON (1987) discovered that the cycle of offices is approximately 10 years. Basically, cycles, from the viewpoint of macroeconomics, can be differentiated between the Kondratjew cycle, lasting 48-60 years (KONDRATJEW 1926); Kusnetz cycle, 18-25 years (BALL, WOOD 1999; BALL, MORRISON, WOOD 1996); Judging cycle, 7-11 years (DIETRICH 1999); and Kitchin cycle, 3-5 years (GAIDOSCH 2007). From the microeconomic point of view, differences in the real estate market lie in the four markets, i.e.: the land, investment, new construction and capital market (ROTTKE 2008). An alternative is to describe real estate cycles by the phases in their lapse of time. In this case, the life cycle of the real estate market can be divided into four parts: recession, recovery, expansion and oversupply.

2.1. Recession

During recession (also called market adjustment) sales activity is very slow, while prices and rents continue to decline at a high rate (ROTTKE, WERNECKE 2006). The peak of this decrease varies by property type and location. The demand for space is very low and vacancy increases.

2.2. Recovery

The second phase is called recovery, where the market stabilizes by beginning price recovery, and absorbs excess space. That means that the vacancy rate begins to approach equilibrium, where supply equals demand. According to ROTTKE and WERNECKE (2006), recovery is usually caused by factors including the passage of time and external factors such as revision of tax laws. In a normal passage of time, the real estate cycle continues its course. After a recession, the level of new building permits and construction works is low. Eventually, this phase of the real estate market is often characterized by the introduction of a new technology or product. At this stage, it is difficult to predict the companies and products that will emerge as leaders in the industry (LYNCH, ROTHCHILD 2000). Some companies will be extremely successful, while others will not survive, but the market, nevertheless, starts to recover.

2.3. Expansion

After recovery, prices continue to increase, vacancy rates fall, and, therefore, space becomes difficult to find. This causes rents to rise rapidly, which spawns new construction motivated by possibilities of

high profits. In consequence, construction activity increases dramatically (GEIPELE, KAUSKALE 2013). Despite this, at the sectorial level, sales and profits grow rapidly, as the market for new products has not yet become saturated (BODIE et al. 2002). An example of this process, from the market within the Brazilian states (GORAYEB 2008), is in closed condominiums and houses or apartments that offer quality, security, leisure and attractive terms of payment.

Usually, prices during expansion start to increase due to market forces or the speculation of higher prices. Increased investment, seeking higher profits and with expectations of indefinite prosperity, are the common components of a price increase (LYNCH, ROTHCHILD 2000; KINDELBERGER 1989). This factor could exacerbate price increases, causing a boom and possibly a bubble. AGNELLO and SCHUKNECHT (2011, p. 171) define booms "as price rises of major duration and amplitude". ZHOU and SORNETTE (2007) point out that the term "bubble" is widely used but rarely clearly defined. One explanation was given by CASE and SHILLER (2003) and ENGSTED (2006), who defined a bubble as a situation where excessive expectations of future housing price increases cause prices that are evaluated in a temporary moment.

If housing prices continue to rise beyond market reality, this can form a bubble that might end in a burst. Clearly, a bubble is closely linked with speculation. However, the behavior of real estate is more complex. Nneji, Brooks and Ward (2013) are in line with this, stating that, including periods that have no indicator of intrinsic bubbles, rational speculative bubbles may be influenced by the dynamics of the residential property market, and through others exogenous causes independent of rents.

2.4. Oversupply

If the market becomes overbuilt, it will enter into a phase of oversupply. Because of the lack of information, investors may not perceive that the market is saturated (PHYRR et al. 2003). They continue to pump capital and new buildings into the market. In this phase, prices begin to drop and vacancies begin to increase (ROTTKE, WERNECKE 2006). As a result of these changes, prices and sales activity begin to slow even more. New construction continues for a while because investors do not detect the change occurring in the market or some real estate projects in development cannot be stopped (HEEG, 2008). At this phase, the real estate market can grow more slowly than the economy or, more typically, it can decline.

3. Housing cycle with speculation

Based on the theory in Section 2 (cycle of the real estate market) and the data from the cities, the cycle of speculation will be explained, describing the four stages - initial, growth of the bubble, peak of the bubble and the bubble burst. The same form of data processing used in Figure 2 was also used for the distribution of transaction prices from all cities. The maximum prices were aligned in column 33 (33 MP - maximum point) in Figure 1 to verify the development of prices before and after the peak. Subsequently, Figure 1 shows the distribution of prices (cycle of absolute price per city). Thirty years' worth of data was selected for the research represented on the x-axis. In Figure 1, semi-annual data were used, though this does not necessarily mean that only a speculative cycle exists within this period.

Many cities only provide data up to a year or two after the price caps. This happened because real estate speculation also occurred in several cities, as in Brazil, or the cities did not provide data for 2007 and 2008 to protect their own market. Moreover, in some cities, such as ones in Brazil, it is not clear if real estate speculation has just begun, if it exists, or if it has already reached maximum prices. The curves vary with the city real estate cycle, but they are at a similar level with some outliers. There are different maximum prices, different behaviors of growth and different behaviors of falling prices, as can be seen in Figure 1. However, the curves are similar in all cities. Therefore, an average house price was created for all cities, as in Figure 2. The average house price is based on the real value.

At the beginning of the data records, the price levels are different within the same country, starting with prices from less than 100 to more than 1,200 currency units (Euro, US\$, R\$) per square meter. These variations are dependent on local and regional real estate markets, the economy, etc., and influence the following phases: initial, consolidation and maturity. Figures 3 and 4 show that price growth increases as the peak approaches. Some cities like Ostrava (The Czech Republic) have two price peaks, the second of which is ten years after the first. Others, like London (Great Britain), have a very sharp decline after the initial price decrease. This will be discussed in Chapter 3.4 (The Bursting of the Bubble).

Fig. 1. Cycles of absolute house price of individual cities. Source: data-based research.

Fig. 2. Average value of cities. Source: data-based research.

Fig. 3. Growth of prices for cities in accumulated percentage points. *Source:* data-based research.

A simple analysis of prices is insufficient for the proper analysis of speculation; however, an annual review (represented in percentage points) of the development of land and construction prices, the real estate price, the quantity traded, and the total housing market volume during the four phases of the cycle, allows for more robust analysis.

Fig. 4. Growth of house prices for cities in percentage points. *Source:* data-based research.

In Figures 3 and 4, you can see the phases of the cycle with real estate speculation based on prices and the growth rate of prices. We can see that high volatility shortly before the peak in year 33 varies significantly—that is, initially we see an average growth of 17%, and later, an average drop of 17%. This indicates that the profits of one year are the losses of the following. However, it is important that the whole cycle of speculation is analyzed.

3.1. Initial point

The specific causes of the beginning of a growth cycle in real estate can include new products, new technologies and/or the general growth of the economy. Some causes of speculative growth are foreign investments, subsidies or cheap financing. The beginning of the growth cycle appears to be normal, and the growth rate varies between 3% and 6%. However, there may be some annual

increases above these values, as seen in Figure 4. At this stage, prices are still at a low level, depending on the location, the size of the city, economic power, etc.

3.2. Growth of the bubble

After the initial phase, the market enters the growth phase of the bubble, assuming that there is real estate speculation. At this point, the growth in real estate prices starts to accelerate. The survey results show an increase of 10% to 17% in real estate prices.

Table 1

Data for the city of San Francisco (USA)					
	2001	2002	2003	2004	2005
Building Permits	23,727	23,031	14,828	15,239	14,883
Land value	976.43	1,046.54	1,105.77	1,283.8	1,514.89
Quantity [un]	63,145	76,182	77,745	93,641	91,047
Market volume [millions]	2,936	3,633	3,954	4,317	6,506
Population	778,258	768,156	759,056	752,347	751,461
GDP [billions]	230.36	229.7	235.76	251.73	272.88
Income	47,717	46,346	46,800	50,209	54,191
Construction costs	142.8	144	147.1	161.5	169.6
Rent	1,613.2	1,931.4	2,145.2	2,219.4	1,702.8
Real Estate price	500,000	521,642	550,000	618,642	734,000

Source: data research.

In this phase, cities can be divided into two groups that define the behavior and the growth rate of real estate prices (REP). The first group has the highest growth rate a year before the peak, such as in San Francisco, USA (Table 1). During the year before the peak, the average growth rate in this group was 16%. The second group consists of cities where the formation of the bubble was also the year of the peak (e.g. Bern, Switzerland), with an average growth rate of up to 14%. Regardless of these groups of speculation, this phase usually lasts for two years.

Fig. 5. Levels of increase during the growth of the bubble. Source: data-based research.

In the growth phase of the larger bubble, the growth rates are:

- Building permits (BP), between 3% and 78% a year, with an average of 24%.
- Land value (LV), between 13% and 71% a year, with an average of 14%.
- Market volume (MV), ranging from 13% to 138%, with an average of 30%.
- Rent (R), with variations between 0% and 24%, and an average of 8%.

- GDP, ranging from 0% to 30%, with an average of 9%.
- Population (P), increasing between -0.3 and 4.5% per year, with an average of 0.9%.

Figure 5 shows the growth levels of the variables during the growth of the bubble in different countries.

From the analyzed data, only the quantity of transactions (QT) does not achieve the maximum growth in this phase, with rates falling between 11% and 25%. This variable has its maximum growth only during the peak of the bubble. All variables in Figure 5 show growth only during this stage. The other variables show contradictory behavior, which means that the growth and decline during the same phase of speculation do not allow for proper representation of the results.

3.3. Maximum point of the speculation

The maximum point of a real estate bubble is exactly the point when real estate prices reach their maximum before the decrease. In this period, growth stops and prices start falling (negative growth rate). As the data is collected annually, half of the countries have their highest growth rate at this stage, with the annual percentage increasing between 8% and 40%. This is because the cities exhibit strong growth caused by real estate speculation at the beginning of the year, which decreases to 0% during the course of the year. This phenomenon could possibly be explained by the available cash increase from end-of-the-year bonuses and profit share, typically distributed from January to March. This phase lasts up to one year.

During the peak, the total percentage of growth in relation to the maximum price (since the beginning of speculation) is determined. This can result in more than 1650%, as seen in the cases of San José (USA) and Curitiba (Brazil). At this moment, the traded quantity also shows the largest growth, between 1% and 143% (Table 2). The other real estate variables, such as building permits, land value, market volume and rent, revealed the largest growth in the previous year. The characteristics of these factors are shown in the table below.

Table 2

Growth rate of real estate data

	BP	LV	REP	QT	VM	R	GDP	P
Total	2.5342	10.0183	13.7226	20.5164	19.7362	1.8653	1.0460	0.7760
Germany	16.2785	38.4279	24.4522	3.2310	26.2864	1.3607	2.8348	-1.1104
Australia	143.6782	-1.3410	8.0000	13.8530	-	1.3907	8.7546	2.5130
Austria	4.7433	8.8533	9.7512	-	-	2.0486	1.3596	0.0915
Brazil	18.7532	10.6476	11.8882	21.3661	33.9914	-5.5254	-2.5834	-0.9559
Canada	-12.5016	-	16.2638	0.3656	0.9880	7.5346	6.8735	1.4025
USA	-2.9013	5.2888	9.6281	3.3542	23.1813	1.6250	1.4503	1.2477
Hong Kong	-10.5248	-4.1488	39.5210	0.9654	9.2006	-3.4431	-16.2825	0.8360
Czech								
Republic	-10.6718	3.1532	7.8416	-0.9926	-0.9909	27.3059	0.1000	-0.3629
Singapore	-	34.3474	-	-	-	-	-	4.1481
Switzerland	19.6502	-15.7869	20.5231	143.5071	6.5799	-1.9140	-3.3768	0.3571

Source: data-based research.

A study on how long the maximum point lasts does not yet exist, and is not the objective of this study.

3.4. The bursting of the bubble

All cycles show that, after a boom, real estate prices start to decline or remain stagnant. The burst of the real estate bubble usually causes a recession in the local economy. In general, there are three possibilities of how a bubble burst can occur. In the first case, the growth rates of other economic variables cause the bubble to not exist. The second option is the slow decline of the bubble, and the third one is a sudden and very rapid decline. The last two possibilities have the negative effects of decreasing real estate prices and the impact on the general economy, which also leads to losses resulting from lower government revenues from taxes. The more common case of a recession in the local economy is also included in both of these cases.

3.4.1. Economic variables that make the bubbles disappear

This phase does not consist of a decrease in real estate prices. In many countries that are in this development process, one can see an annual increase of all economic indicators that are useful in controlling inflation. Increasing wages, among other factors, can cause the common indices to show that the bubble has dissolved and will eventually disappear. During this research it was not possible to collect sufficient data for one single city to prove this hypothesis. Perhaps government incentives may also create new demand, and ultimately result in the bubble not bursting. At the very least, this could postpone the burst, so that no one in the economy and the government (no individual or juristic person) would incur losses.

3.4.2. The slow decline of the bubble

The second possibility of a burst is through the slow decline of real estate prices. Cities that had this type of burst were state capitals and major economic centers, such as Winterthur (Switzerland) as presented in Table 3. The decline in Winterthur lasted until the end of the survey data. The period of decline in Munich (Germany) and Salzburg (Austria), however, lasted for four years. After this point the real estate prices, once again, increased. The building permits do not show typical development. Salzburg did not provide any data. Munich provided a scenario that showed two years of decline in the number of permits, while in Winterthur (Switzerland), one can see a large amount of permits one year after the decrease. An explanation for this adverse behavior could not be found.

Table 3

Data for the city of Winterthur (Switzerland)								
	2000	2001	2002	2003	2004	2005	2006	2007
Building Permits	801	735	820	901	872	886	857	794
Land value	560.00	549.00	536.00	649.00	616.00	618.00	569.00	559.00
Quantity [un]	60	31	51	90	81	68	52	65
Market volume [millions]	336.00	170.19	273.36	584.10	498.96	420.24	295.88	363.35
Population	91,243	92,041	92,875	94,081	95,482	96,144	97,732	99,307
GDP [billions]	26.54	27.34	26.78	26.84	27.13	27.91		
Income	71,201.75	73,094.15	68,126.59	71,911.40	69,782.44	73,803.81	72,147.95	
Vacancy rate (%)	2.66	1.05	0.70	0.41	1.20	0.59		
Construction costs	541.71	566.38	566.79	549.64	555.98	569.68	538.75	563.64
Inflation	183.80	185.60	186.80	188.00	189.50	191.70	193.70	195.10
Rent	1,133.33	1,166.67	1,200.00	1,233.33	1,200.00	1,266.67	1,300.00	1,333.33
Real Estate price	487,000.00	522,000.00	483,000.00	567,000.00	575,000.00	534,000.00	523,000.00	517,000.00

Source: data-based research.

While in Winterthur the value of land started to increase again one year after the peak, this took about 4 to 5 years in Munich and Salzburg. It was not possible to determine a timeline for the decrease because of the quantity of transactions. Market volume starts to increase, once again, between 2 and 3 years after the peak. The same three cities reveal increasing rent prices only one year after the peak of real estate prices.

3.4.3. The sudden and fast decline of the bubble

The worst and best-known scenario that may occur is the rapid burst of the bubble, with high percentages of decrease. If this happens, there is no possibility to prevent it or for governmental interventions or actions by individuals or companies to successfully take place. The fast decrease is observed in smaller cities, like Rostock (Germany), in Table 4 (Note: Rostock is not a large metropolitan area). The data from Rostock (Table 4) show that from 1997 onwards, real estate prices started to fall, and in that year alone, fell by almost 20%. This decrease in prices continued until the

end of the data records (2006), except for 2004 when there was a small growth, which means a total decrease of almost 40%. The average value of land fell from 1997 to 2003, similarly to the real estate prices. The quantity of traded real estate reached its maximum value of 431 in 1998. At the same time, the volume of the housing market reached its maximum of €1,396.45 million, commencing the decrease of the total market. The lowest volume, i.e. €208.64 million, was recorded in 2006. The market volume fell by a total of 85% compared to its highest value.

Table 4

Data for the city of Rostock (Germany)

	1992	1993	1994	1995	1996	1997	1998	1999
Building Permits	102	159	187	233	791	631	459	452
Land value	38.54	123.91	61.88	41.55	115.50	94.08	88.16	84.92
Quantity [un]	145	97	106	155	185	136	431	336
Market volume [millions]	1,192.04	957.20	877.15	747.28	1,327.10	537.67	1,396.45	766.83
Population				227,535	221,029	212,715	207,431	203,279
GDP [billions]	2.68	3.25	4.10	4.46	4.62	4.46	4.43	4.78
Income				11,287.00	11,929.00	12,091.00	12,444.00	13,087.00
Construction costs	1,159	1,207	1,243	1,279	1,282	1,261	1,246	1,236
Rent	346.20	367.57	382.53	391.08	400.34	408.17	418.86	425.27
Real Estate price	37,446.00	48,651.00	60,123.00	80,370.00	112,221.00	91,409.00	85,657.00	82,509.00
	2000	2001	2002	2003	2004	2005	2006	
Building Permits	445	399	381	421	443	323	325	
Land value	83.62	80.96	63.45	83.44	85.26	89.33	69.20	
Quantity [un]	409	389	203	79	134	241	132	
Market volume [million]	1,262.06	444.47	638.62	441.43	446.34	312.21	208.64	
Population	200,506	198,964	198,259	198,303	198,993	199,288	199,868	
GDP [billion]	4.79	4.61	4.62	4.60	4.87	4.98	5.05	
Income	13,364.00	13,734.00	13,965.00	14,173.00	14,204.00	14,142.00		
Construction costs	1,233	1,235	1,245	1,246	1,241	1,233	1,244	
Rent	433.10	442.36	455.90	463.02	470.15	480.12	491.52	
Real Estate price	81,467.00	78,662.00	71,649.00	71,071.00	72,024.00	69,581.00	67,236.00	

Source: data research.

Examples like this show that the losses are very high during a bubble burst. In the case of Rostock, the lowest values shown in Table 4 were the lowest ever. The cost of construction increased until the year 1996. Then there was a phase of decline until 2000, followed by a new phase of growth. Other economic variables, such as GDP, rent and wages increased during the period from 1992 to 2006. For all cities which had a high decrease it was not possible to determine a trend in the economic variables, for either positive or negative growth.

4. Speculation cycle

Finally, the question remains, what is really the typical cycle of real estate speculation? Considering that only 101 cities in 10 countries were analyzed, the typical cycle presented here is a result of this range. The range was determined by using the standard deviation of the percentage of the price increase per year in relation to the price at the peak. As mentioned in Subchapter 3.1 (initial point), the speculation begins with a slight increase in absolute and relative prices. Prices vary depending on the absolute price level of the primary city, and the growth in real estate prices is low. The behavior of variables for the ideal cycle is shown in Figure 6.

Fig. 6. Variables of a typical cycle in percentages. *Source:* data-based research.

Also, as shown in Figure 6, during the growth phase of the bubble, relative prices in percentage peaked up to 17% per year. In the year of peak values, the growth in real estate prices fell to approximately 13% of the average growth, and subsequently, prices stop growing and begin to drop, either slowly declining or falling rapidly. At the growth stage of the bubble, the number of transactions was low, with an annual growth of 18%. However, in the year of the peak of real estate prices, the traded quantity increases even more, reaching 20%. Later, the number of transactions also starts to fall, first slowly, then faster (Figure 6). As one can see from Figure 6, the volume of the housing market during the growth of the bubble increases by 34%. In the year of the peak, this growth is reduced to 20% and the following year, the process of decreasing the volume of the real estate market began.

Rent during the growth phase shows low growth rates of 8%, and during the peak, a growth of only 1%. Contrarily, construction permits in the growth phase of the bubble show a large increase of 23%. However, before reaching maximum values, prices start to fall, slowly in the beginning, i.e. less than 1%, speeding up later, falling by as much as 15% (Figure 6). The average land value also had its largest growth of 14% per year during the growth phase of the bubble. During the peak, the land value begins to decrease with rates of 10%. After this peak, the land value begins to fall.

5. Conclusions

The market cycle with real estate speculation is divided into four phases: the initial phase, growth of the bubble, peak of the bubble and the bubble burst. In the initial phase, the growth in real estate prices is slow, with values ranging from 3% to 6%. The other indices also show a small growth at this stage. During the growth of the bubble, the increase in real estate prices was between 10% and 17% a year, with some cities showing the largest growth at this stage. For construction permits and land value, the growth rate varied by more than 70%. The market volume had an annual growth of up to 138% and the rent, GDP and population varied widely, with increases between 0% and 30%. The cities that had not yet reached the highest rates of growth in real estate prices reached it during the peak of

the bubble. For those that had already reached the highest rates before the peak, the growth rate then begins to decline, in some cases falling to 0%. However, the traded quantity amongst all cities reached the highest growth at this stage. At this time, the variables were influenced by declining growth rates, which finally reach 0%.

To summarize what we have learned in this paper, a burst of the bubble occurs in three different ways. First, the bubble does not burst; the economic variables change and the bubble just dissipates. This lack of a burst can be due to the fact that the growth of some economic variables was sufficient for the housing market to stabilize. The second way the burst of a bubble can occur is by a slow decline of real estate prices. Lastly, there can be a sudden and rapid drop of prices. If this happens, a decline can also be seen in building permits, the value of land, traded quantities and the market volume. The ideal market cycle, determined by the real estate data, shows that many of the variables begin to fall before the peak. Therefore, it is possible to know that the bubble is at the beginning of its burst when other real estate variables begin to fall. We encourage our readers and fellow cycle researchers to offer comments and suggestions on the framework and model offered here, so that it can be further refined and implemented.

6. References

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