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Indicators for Bubble Formation in Housing Markets

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Abstract

It widely is assumed that property markets can be predicted and to be able to make forecasts, concerning future housing prices, a number of different indicators are used. But if it possible to know the future today, why do we still experience bubbles in housing markets? To answer this question the reliability of four of the most commonly used indicators were tested for the time period between 2000 and 2010. To evaluate the indicators predicting power the development in, Germany, Sweden, Spain and the UK was studied. Germany and Sweden did not experience a correction during the most recent financial crises, while Spain and the UK did. If the evaluated indicators would be good predictors of future developments, it should have been possible to see differences in the attained values prior to the crises and it should have been easy to forecast that prices would fall in the UK and Spain and that they would be fairly stable in Germany and continue to increase in Sweden. The results from this study do not support the statement, that property prices can be forecasted, but, on the contrary, indicates that the investigated indicators have very limited predictive power in forecasting future price developments in housing markets. The result also show that variable rate mortgages can be expected to play a smoothing effect on property prices during economic cycles.

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1. Introduction

1.1. Background

In many of the world's fastest growing economies there is a strong process of urbanization, with strong growth in households' disposable income and an increasing demand for new homes. This has led to rising real estate prices and increasing production volumes (Claussen, Jonsson, & Lagerwall, 2011).

Considering the real estate sectors strong influence on the economy, this development is a powerful engine in overall economic growth. But this development also poses a threat if it leads to a so called bubble formation, i.e. a price increase that is not supported by the underlying assets fundamental value (Lind, 2009). From a financial perspective, a bubble formation, especially if it takes place in one of the major international housing markets, would pose a significant risk to both the national and the global economy. Based on the severe negative impact a substantial fall in major property markets is expected to have, considerable efforts have been invested in finding reliable indicators for risk levels in real estate markets.

With reliable indicators at hand it would be possible for central banks and governments to adjust their policies in time and thereby prevent a bubble formation. Also, it would give banks and investors a better tool for their risk assessment (Andersson, Claussen, Lagerwall, & Torstensson, 2011).

In addition the above mentioned problems, there is, also, evidence for large differences' between property markets', indicating that the reason behind a bubble can vary strongly between markets. Therefore it does not seem possible to find a single indicator that can be used for all regions and all situations. Instead, it is more reasonable to assume that a set of indicators will be necessary and that each one will require adjustment depending on the specific conditions that exist in the investigated market (Lind, 2008). But the use of a set of indicators is, also, not expected to give sufficient information unless psychological factors, like the motivation of buyers are included in the analyses (Shiller & Case, 2004).

1.2. Purpose

The aim of this paper is to evaluate the reliability and applicability of a number of commonly used indicators and to compare markets that have experienced a major, recent, decline in property values, like Spain and the UK, with markets that have been more or less unaffected during the most recent recession, like Sweden and Germany. Additionally, the analyses, also, aims at investigating if underlying variables can be found which caused markets to react differently, compared to the development forecasted by the indicators.

1.3. Disposition

In *chapter 2* the main driving factors behind bubbles' are explained.

In *chapter 3* the most commonly used indicators are listed, explained and ranked according to frequency of use. Additionally, exogenous factors which can influence the value of indicators are discussed. At the end of the chapter a list of the most frequently used price indices for real estate is given and the theory behind them explained.

In *chapter 4* the methodology used in the investigation is explained and the evaluated indicators and countries, as well as the data sources used, are listed.

In *chapter 5* the findings are analyzed and explained. The first sets of results' are attained from testing each indicator on the development in all four countries. The second set is from the evaluation of the four indicators on one country at the time.

In *chapter 6* the results from chapter 5 are discussed and conclusions drawn and explained.

In *chapter 7* the findings and conclusions are summarized.

2. The concept of a bubble

A bubble can be defined as a short term price increase due to psychological effects. For example, when real estate prices have been increasing for some time there may be a perception in the population that this increase will continue forever and that the investment is risk free. When the common belief is that prices can only go up, there is, also, a pressure to buy quickly, before housing gets even more expensive. As soon as the prices cease to increase demand will decrease and prices will start to decline. With the psychological effect that fueled the increase no longer present, the bubble is expected to burst (Shiller & Case, 2004).

Even though a bubble can be defined as a price increase that is not supported by the underlying assets fundamental value, there is, unfortunately, no clear definition of fundamental value. Therefore a bubble could be defined as a rapid increase followed by an equivalently rapid decrease in value. For it to be considered a bubble the time between the increase and decrease should be no more than two years. If the time between the two events is longer, it can be expected that the bubble was influenced by one set of factors and the bust by a different set (Lind, 2009). It cannot be predicted if a boom will be followed by a bust or just a slowdown. Also, a bust does not have to be triggered by a boom, but can come after a period of stable prices. Additionally, a bust normally happens in connection with a considerable negative change in GDP growth (Helbling, 2003). If the housing market would be efficient, like the stock market, it would not be possible to predict future outcomes.

But, since the market for real estate is not fully efficient and since historical changes in property prices show strong autocorrelation (Englund, 2011), it is widely assumed that the future development of the housing market can be forecasted to some degree. To be able to make a good estimation it is necessary to find reliable indicators (Lind, 2009).

3. Indicators: a literature review

3.1. Overview

A number of indicators for the assessment of property markets can be found in the literature and the most commonly used are:

- *Housing prices vs. vacancy rate.* A large number of vacancies will have a downward pressure on prices, since in this case; supply exceeds demand (Geltner, Miller, Clayton, & Eichholtz, 2007).
- *Price rent ratio.* If the ratio between the price of a property and the market rent will increase far above the historical average, a bubble can be suspected (Quigley, 2001). But if the relation between price and supply can be assumed to be permanently inelastic, or if rents are below market rents, i.e. if rent control exists, as is the case in Sweden, a price increase above the historical average can be supported by fundamentals (Englund, 2011). The value of commercial property can be derived from the income it is expected to generate, i.e. the net operating income (NOI) minus capital expenditure (Capex) (Fanning, 2005). If the real estate value increases faster than the income it produces the yield is falling, making the investment questionable (Geraci, 2001).
- *Real housing prices vs. demography.* If there is a net inflow of tenants the cost of dwelling can be expected to increase (Englund, 2011).
- *Real housing prices vs. supply elasticity.* If demand increases, but supply does not, prices can be expected to go up (Englund, 2011).
- *Housing price vs. disposable income.* If the owner's net income, minus ownership costs (disposable income), decreases due to increasing cost for ownership, like increasing interest rates, this indicates a risk that prices will decrease, since the owners' capacity to pay is reduced. (Himmelberg, Mayer, & Sinai, 2005). According to Claussen (et.al.) the price for housing can be found from the relation:

$$p_t^* = -16.4 + 1.23di_{t-1} - 0.06rr_{t-1} + 0.15df_{t-1}$$

where:

- rr_{t-1} is the lagged after tax real interest rate
- df_{t-1} is the lagged real value of households financial assets
- di_{t-1} is the lagged real disposable income
- All lags are equal to one quarter (three month)

The model was tested on the Swedish property market and three periods were evaluated: 1987 to 1990, 1990 to 1996 and 1996 to 2010. During the first two periods the real interest rate was the main influencing factor, while both the real interest rate and the disposable income were the main drivers during the most recent period. Households' financial assets only played a minor role during all three periods, especially during the most recent one (Claussen, Jonsson, & Lagerwall, 2011).

- *Housing prices vs. building costs.* Assuming that productivity increases at the same rate in the building industry, as it does in the rest of the economy, and all other influencing factors are help constant, real property prices ought to decline as a function of increased productivity. (Claussen, Jonsson, & Lagerwall, 2011). But this does not seem to be the case and in the US productivity in the construction sector fell by 0.75% annually between 1995 and 2004 (Corrado, Lengermann, Bartelsman, & Beaulieu, 2007).
- *Housing prices vs. GDP* can be used if data on income is unavailable, since changes in GDP and income can be expected to correlate (Claussen, Jonsson, & Lagerwall, 2011).
- *The loan to value ratio (LTV)* is a good indicator for the risk involved for the lender as well as for the borrower. The higher the ratio the higher is the risk (Kokko, 1999).
- *The debt service ratio or debt coverage ratio (DSCR)*, i.e. the ratio of funds available for the payment of interest and principal. This is, also, considered a good indicator for the level of risk involved (Joshi, 2006).
- *The ratio between loan and disposable income* should not change over time. An increase above the long term average indicates that the market may be overvalued (Finocchiaro, Nilsson, Nyberg, & Sultanaeva, 2011).

- *Housing prices vs. interest rates.* If interest rates increase it will be more expensive to own a piece of real estate and to compensate for the higher user cost it can be expected that the price will drop. (Englund, 2011).
- The *imputed-rent-to-rent* and *imputed-rent-to-income ratio* is as an alternative to the frequently used price to income ratio. The imputed rent is calculated from the annual total cost of living in a dwelling and to estimate the user cost (UC) the following relation is proposed (Himmelberg, Mayer, & Sinai, 2005):

$$\text{Annual cost of ownership} = P_t r^{ff} + P_t \omega_t - P_t \tau_t (r_t^m + \omega_t) + P_t \delta_t - P_t g_{t+1} + P_t \gamma_t$$

Where:

- $P_t r^{ff}$ is the buying price times the risk free interest rate, i.e. the profit a home buyer would have received if he/she would have invested in a risk free asset.
- $P_t \omega_t$ is the amount of property tax that the property owner has to pay.
- $P_t \tau_t (r_t^m + \omega_t)$ is the amount that the home owner can deduct from his/her taxes.
- $P_t \delta_t$ is the maintenance cost
- $P_t g_{t+1}$ is the expected appreciation or depreciation in the property's value.
- $P_t \gamma_t$ accounts for the added risk a home owner must accept compared to one that rents his/her home.

The imputed rent is the product of the User Cost (UC) and the OFHEO house price index (Gerardi, Foote, & Willen, 2010).

The addition of the expected appreciation or depreciation of property values does not just add an income variable to the regression, but also aims at explaining why prices in attractive areas are higher. The reasoning behind the assumption is that buyers will expect to get higher capital gains in attractive areas, especially if zoning or other regulations (which make buildable land scarce) exists. With the assumption that they will receive high future capital gains they are expected to be willing to pay higher prices today. Also, since families living in attractive areas normally have higher income, and thereby have higher marginal tax rates, it will be possible for them to deduct a larger portion of their interest payment and thereby to reduce the ownership cost.

Areas with higher land values will, also, have lower depreciation rates since the building makes out a smaller fraction of the total value of the property (Himmelberg, Mayer, & Sinai, 2005).

The imputed-rent to income ratio gives an indication of the owners' ability to pay and is therefore expected to be a suitable indicator when forecasting if a market is overvalued or not (Himmelberg, Mayer, & Sinai, 2005).

The regression seems to pose two problems though:

- The property tax is not always based on the purchase price.
- The assumed appreciation or depreciation in property value can be expected to account for a substantial portion of the ownership cost. Since the calculation of the property value is based on serial correlation and psychological factors (Davis, Karim, & Fic, 2011) (Shiller R. J., 2007) and therefore only can be estimated, it adds a considerable uncertainty to the calculated annual cost of ownership. Also, recent research indicates that the future value of the property is without significance in the regression (Englund, 2011).

The difference in property tax could easily be accounted for, but the addition of the expected future property value seems to add too much uncertainty to the estimate.

The imputed-rent-to-rent and the imputed-rent-to-income ratios, also, give little information of the market risk when used in aggregate form, since the regression does not take into account that the majority of households, living in a certain area, will have entered the market at lower price levels (Himmelberg, Mayer, & Sinai, 2005). This problem applies to a number of indicators (unless they are evaluated on an individual level) like: housing price vs. disposable income, housing prices vs. GDP, loan to value ratio and the debt service or debt coverage ratio.

3.2. Exogenous factors that influence the value of indicators.

Unfortunately indicators are not always stable and equilibriums can change over time. The most common influencing factors are listed below:

- *Changes in preference for housing compared with other kinds of consumption.* If housing consumption is preferred compared to other kinds of consumption this will increase the price of dwelling above the long term average (Claussen, Jonsson, & Lagerwall, 2011).
- *Difference in the productivity development in the housing sector and the rest of the economy* (Claussen, Jonsson, & Lagerwall, 2011).
- *Rent regulation* makes it impossible to use the relation between rent and user cost, especially if the market has low elasticity between price and supply. In this case prices will be higher compared to a market without rent regulation and high elasticity (Finocchiaro, Nilsson, Nyberg, & Sultanaeva, 2011).
- *The equilibrium between variables is not always stable* and research has shown that factors such as:
 - Housing credits offered to subprime borrowers. A group which previously had no access to the mortgage market.
 - The introduction of Collateralized Default Obligations (CDS's).
 - Changes in underwriting standards.

can change the balance (Gerardi, Foote, & Willen, 2010).

- *The use of different indices* can yield large differences in indicator values. There is not just a large discrepancy between indicators calculated from different indices, but, also, between indicators attained from different data bases (Gerardi, Foote, & Willen, 2010).

3.3. Commonly used indicators: an overview

Table 1 gives an overview of the most commonly used indicators found in the literature. From the table we can conclude that the four most frequently used are:

- Real housing price vs. real disposable income.
- Real housing prices vs. real interest rates.
- Real housing prices vs. demography.
- Real housing prices vs. the total stock of dwellings.

Author	Variable													
	Real housing prices vs. vacancy rate	Real housing price vs. real disp. income	Real housing prices vs. real building costs	Real housing prices vs. demography	Real housing prices vs. real interest rates	Real housing prices vs. supply elasticity	Price rent ratio	Loan to value ratio	Debt service coverage ratio	User cost vs. rent ratio	User cost vs. disp. income ratio	Real housing price vs. building sector productivity	Loan vs. disp. income ratio	Housing prices vs. financial wealth
(Claussen, Jonsson, & Lagerwall, 2011)		x		x	x		x					x		x
(Davis, Karim, & Fic, 2011)		x		x	x	x		x		x				x
(Englund, 2011)		x	x	x	x	x	x	x		x	x	x		
(Finocchiaro, Nilsson, Nyberg, & Sultanaeva, 2011)		x			x			x						
(Frisell & Yazdi, 2010)				x							x		x	

Author	Variable													
	Real housing prices vs. vacancy rate	Real housing price vs. real disp. income	Real housing prices vs. real building costs	Real housing prices vs. demography	Real housing prices vs. real interest rates	Real housing prices vs. supply elasticity	Price rent ratio	Loan to value ratio	Debt service coverage ratio	User cost vs. rent ratio	User cost vs. disp. income ratio	Real housing price vs. building sector productivity	Loan vs. disp. income ratio	Housing prices vs. financial wealth
(Girouard, Kennedy, Van den Noord, & Andre', 2006)		x		x	x	x	x		x	x		x		
(Glaeser, Gyourko, & Saiz, 2008)						x								
(Himmelberg, Mayer, & Sinai, 2005)										x	x			
(Jönsson, Nordberg, & Wallin Fredholm, 2011)		x			x									x
(Terrones & Otrok, 2004)		x		x	x									

Author	Variable													
	Real housing prices vs. vacancy rate	Real housing price vs. real disp. income	Real housing prices vs. real building costs	Real housing prices vs. demography	Real housing prices vs. real interest rates	Real housing prices vs. supply elasticity	Price rent ratio	Loan to value ratio	Debt service coverage ratio	User cost vs. rent ratio	User cost vs. disp. income ratio	Real housing price vs. building sector productivity	Loan vs. disp. income ratio	Housing prices vs. financial wealth
(Shiller & Case, Is there a bubble in the housing market? An analyses, 2004)		x	x	x	x	x								
Number of authors' that used or4 referenced the indicator	0	8	2	7	8	5	3	3	1	4	3	3	1	3

Table 1 Categorization of the most commonly used indicators

3.4. Indices

To be able to calculate reliable indicators it is necessary to have reliable price indices'. If there would be no other factors influencing the value of real estate, the price would be equal to the replacement cost (Hilbers, 2003). But, since the replacement cost is not the only variable affecting the price, it is not possible to know the exact value of a piece of real estate and we have to apply other methods to estimate the price. To perform this task, various indices are used, but, unfortunately, the choice of index can have a strong influencing effect on the market value estimate (Gerardi, Foote, & Willen, 2010). The following indices' are commonly used in, for example, the US:

- The *NARIET index* is the index with the fastest response. It is similar to a stock index and is based on the value of shares of RIET's (Real Estate Investment Trusts) that are traded on the stock exchange. Since these trades are performed in liquid markets and with transaction costs similar to other equities, the NARIET index has a faster response and higher volatility than other real estate indices'. (Geltner, Miller, Clayton, & Eichholtz, 2007).
- The index with the second highest response and volatility is the *constant liquidity index*. For this index one assumes constant transaction volumes and a transaction price that equals the price offered by the buyer, i.e. the seller accepts the price the buyer offers (Geltner, Miller, Clayton, & Eichholtz, 2007).
- *Mean* and *median* prices, of previous transactions, fall into the category *transaction price indices*, since they map actual trades. Since some trades will take place at the constant liquidity price level and others at higher or lower prices, they have more time lag and lower volatility compared to the NARIET and constant liquidity indices (Case & Wachter, 2003) (Geltner, Miller, Clayton, & Eichholtz, 2007). Drawbacks of this method are that it does not account for if cheaper or more expensive property was traded during a certain period of time, or if new and renovated real estate will hit the market.

Nor does it recognize the depreciation of existing property, or if more expensive real estate and/or a larger number of new and newly renovated dwellings, compared to previous periods, have been sold. These shortcomings will, unless mainly cheaper property was traded, yield an upward bias, making the price level look higher than it actual is. Also, average or median prices for new dwellings are used to account for quality changes, but, since new property is built in areas with high elasticity between price and supply, this index may miss appreciations in areas where elasticity is lower (Case & Wachter, 2003).

- An additional *transaction price indices* is the *hedonic* price model (Geltner, Miller, Clayton, & Eichholtz, 2007). The index makes it possible to account for differences between properties, but it has the drawback that it requires a lot of data on the traded dwellings and that it is costly to use. An additional difficulty, due to the complexity of the model, is that an important attribute may easily, accidentally, be omitted from the regression and thereby cause the regression to yield an incorrect result (Case & Wachter, 2003). A further problem is that different hedonic models may not use the same regression models. Advantageous, though, is that it allows the price of property to be divided into building and land values and it gives an accurate estimate when all variables are included (Diewert, 2009). This index is, also, used to estimate the price level of Swedish property (Thornley, 2011).
- The *repeated sales* method (Case & Wachter, 2003) is an additional *transaction price indices* (Geltner, Miller, Clayton, & Eichholtz, 2007). It assumes that no major changes have been made to the property between transactions and it is therefore a cheaper alternative to the hedonic approach. The limitation is that it may be difficult to find sufficient number of transactions, for the method to yield statistically reliable results (Case & Wachter, 2003). This type of index is frequently used in the US and is considered to be inferior to the hedonic method (Thornley, 2011).
- The *hybrid model* is a combination between the hedonic and repeated sales method, taking changes to the property into account (Case & Wachter, 2003).

- *Assessed values* are sometime used, but since this value is the basis for property taxation, in many countries, the owner has an incentive to keep the value low, creating negative bias (Case & Wachter, 2003).
- *Appraisals* made in connection with, for example portfolio value assessments' or mortgage transactions (purchase or refinancing) yield indices that are smoother compared to the once above. An index based on appraisals is very similar to a transaction based index, but, since appraisals are based on estimates of value this index will show a slight increase in time lag and a reduction in volatility (Case & Wachter, 2003).
- *The NCRIF property index (NPI)* is based on *staggered appraisals'*, i.e. it does not just use contemporaneous information, but also values attained during previous appraisals'. This index therefore yields additional time lag and reduced volatility. (Geltner, Miller, Clayton, & Eichholtz, 2007). The NCRIF index is commonly used for commercial real estate and assumes that a basket of properties was purchases at the beginning of a quarter and sold at the end. Values attained during previous periods may be needed when valuing commercial property, since the number of transactions' is much lower and the number of quality parameters much larger, compared to family dwellings. This difference between commercial and family property makes repeatable sales and hedonic methods difficult to use for commercial real estate. The NCRIF index is calculated from the change in value plus the generated income (Fisher, 2003).

4. Methodology

To evaluate how good the most commonly used indicators are in predicting future changes in property values, the latest development in four housing markets (Sweden, Germany, the UK and Spain) has been compared and the following indicators calculated:

- Real housing price index vs. real disposable income ratio
- Real housing price index vs. real interest rate
- Real housing price index vs. population index
- Real housing prices index vs. total housing stock index.

The first reference group consists of Sweden and Germany, which did not experience any major downturn in property values, and the second group contains the UK and Spain, which suffered a major decline in the price of dwellings. Data was downloaded from the following homepages:

- SCB (SCB), Swedish data.
- Eurostat (Eurostat), Swedish, German, Spanish and UK data.
- The Swedish Central Bank (Riksbank), Swedish data.
- Statistisches Bundesamt (Bundesamt), German data.
- Office for national statistics (Statistics), UK data.
- Instituto Nacional de Estadística (Estadística), Spanish data.
- Bank for International Settlement (BIS), Spanish data.
- Gobierno de España, Ministerio de Fomento (Fomento), Spanish data.

Consistent data series on property values were only available for Sweden and Germany, but the Swedish information is based on buildings with one or two dwellings for permanent living (SCB), while the German data (Bundesamt) is based on all residential property. For all countries in the EU Eurostat is developing a house price index and from the third quarter of 2012 all member states will be requested to supply Eurostat with data on their domestic price development for residential housing (Dechent, 2011).

Since 2005 Eurostat is reporting domestic data as an experimental house price index (Marola, 2011). Unfortunately the data from Eurostat does not go further back in time than 2005 and to evaluate the price development in Spain and the UK this data has been combined with earlier domestic statistics. This might not be optimal, but the lack of useful and reliable statistics makes it difficult to generate reliable series. The Bank for International Settlement (BIS) supplies non-seasonally adjusted Spanish price information on multi dwelling rental buildings, but does not include privately owned housing which are owner occupied. To accommodate for this problem, data from Eurostat has been used from 2005 to 2010 and has been combined with the series from 2000 to 2005 from BIS. The same procedure has been used when evaluating UK data, since information on house prices for 2010 were not yet available from the domestic data base (Statistics). To be able to compare the attained data all series have been normalized to 100 index point for the year 2000.

Since our main interest is to evaluate if the recent change in property values in Spain, the UK, Sweden and Germany could have been predicted from the studied indicators, the used time span seems sufficiently long.

To get real housing prices, the attained data has been deflated with each countries harmonized rate of inflation (HIPC), available from Eurostat (Eurostat). Data on real disposable income, official central bank lending rates and population were downloaded from the Eurostat home page, while information on the number of dwellings was attained using domestic data:

- For UK data, the office for national statistics (Statistics).
- For Germany, Statistisches Bundesamt (Bundesamt).
- For Spanish data, Gobierno de Espana, Ministerio de Fomento (Fomento).
- For Sweden, SCB (SCB).

The disposable income data was used in the form supplied by Eurostat and is calculated as income (consisting of wages, operating surplus, rent, interest, dividends and social benefits) earned by private households minus taxes, social security payments and transfers (Eurostat, 2009).

The real lending rate was computed by using the relation between nominal and real interest rates:

$$r_{real} = \frac{1 + r_{nom}}{1 + i} - 1$$

Where:

- r_{real} is the real interest rate
- r_{nom} is the nominal interest rate
- i is the inflation

To determine if the most recent downturn in property values could have been forecasted, each indicator is first separately applied on all four countries. By doing this we investigate how well a single indicator would have been able to predict future developments. As a second step we look at the development of all indicators when applied to the property prices in one country. The idea behind this approach is to find out if a set of the most commonly used indicator would have been able to predict future prices. To be able to fit the curve for the price of dwellings vs. interest rate on the same graph, as the other results, the attained value for house prices vs. interest rate was divided by 1000 in Fig. 9 to 12.

As a last step, the influence of real interest rates, as an important variable in understanding future price development, was investigated.

5. Analyses and results

5.1. Local price development

The regional difference in price development can be seen in Fig.1 and the data for the construction of all graphs is available from the appendix. From the plots we can assume that the increase was strongest in the Spanish market, followed by the UK and Sweden. In Germany prices have declined during the full period and in Sweden prices were not affected by the recession. Also, the decline, in property values, since 2008, seems to have been largest in Spain, followed by the UK.

Since the indices were calculated using different data we can, unfortunately, not with certainty compare the absolute price level in the countries under investigation and conclusions based on the prices levels should mainly be used to compare developments in one and the same market.

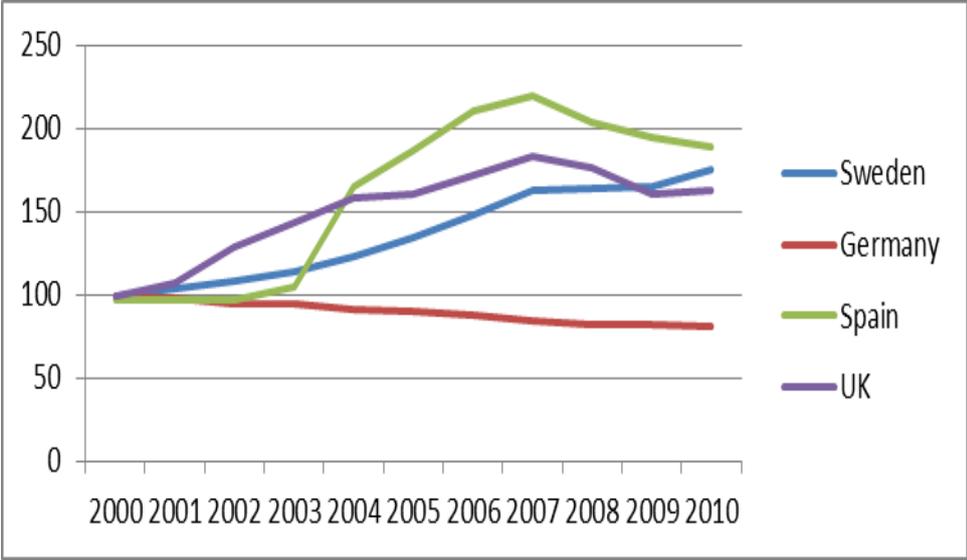


Fig. 1 Real housing price index

5.2. Relation between prices and housing stock

As can be seen from Fig.2, the total housing stock, in relation to the total population, varied between the investigated countries during the period between 2000 and 2010, and the Swedish market is the only one where the number of dwellings, as a function of population, decreased. The largest increase was seen in Spain followed by Germany, while the development in the UK was closer to the one observed in Sweden.

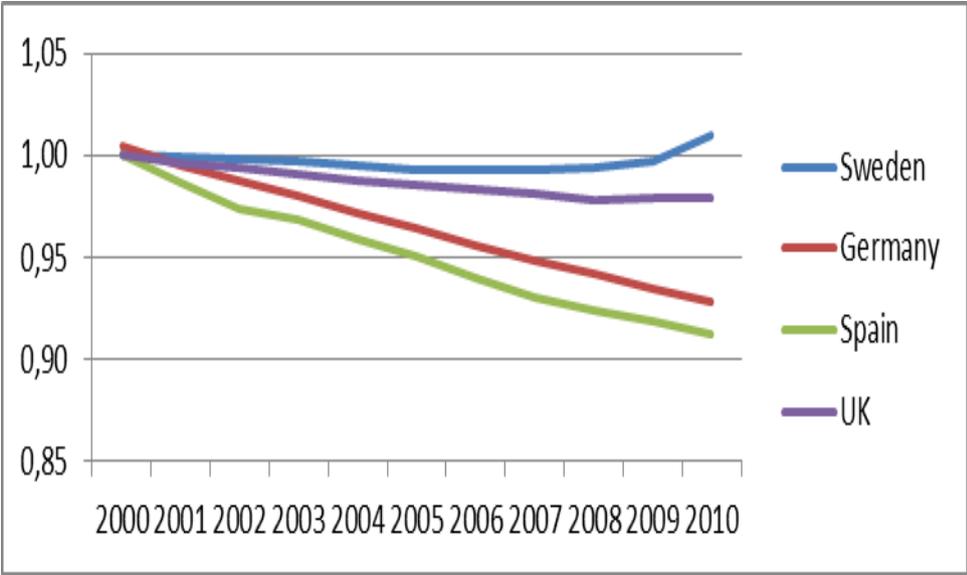


Fig. 2 Total population index vs. total number of houses index

5.3. Local real interest rate development

From Fig. 3 we can see the real interest rate development in the countries under investigation. In the literature the real interest rate is considered an important factor for the development of housing prices, since low rates will reduce the user-cost. This effect is assumed to be especially strong in markets with short interest rate guarantee periods, like Sweden, where 90% of all new mortgage loans in 2009 had three month adjustable rates (Hansson, 2011). In the UK fixed rates predominate and variable rate mortgages only make up approx. 40% of total mortgage lending (Financial Service Authority, 2009). In Germany fixed rate mortgages is the standard form (http://www.mortgagesorter.co.uk/property_buying_germany2.html) and in Spain variable rates are more common compared to fixed mortgages (<http://www.spanish-living.com/mortgages>).

In the case of Spain it is possible to find a correlation between prices and real rates prior to the recession. This relation can be seen by comparing Fig. 1 and Fig. 3. The two graphs show that, before the financial contraction, Spain had the strongest increase in property prices and the lowest real rates, of all investigated countries'. But the market with the second highest increase, the UK, had the highest interest rates prior to the financial downturn. Swedish and Germany rates show a fairly similar development from the year 2000 to 2008, but while house prices increased in Sweden they decreased in Germany.

During the financial contraction, and the recovery, real rates in the UK were the lowest in the study, but property prices continued to decline and became flat at the end of the investigated period. Sweden had the second lowest rates during this time and was the only country in the investigation with increasing prices. In Germany and Spain the interest rate development from the year 2008 to 2010 was quite similar and in both countries prices continued to go down.

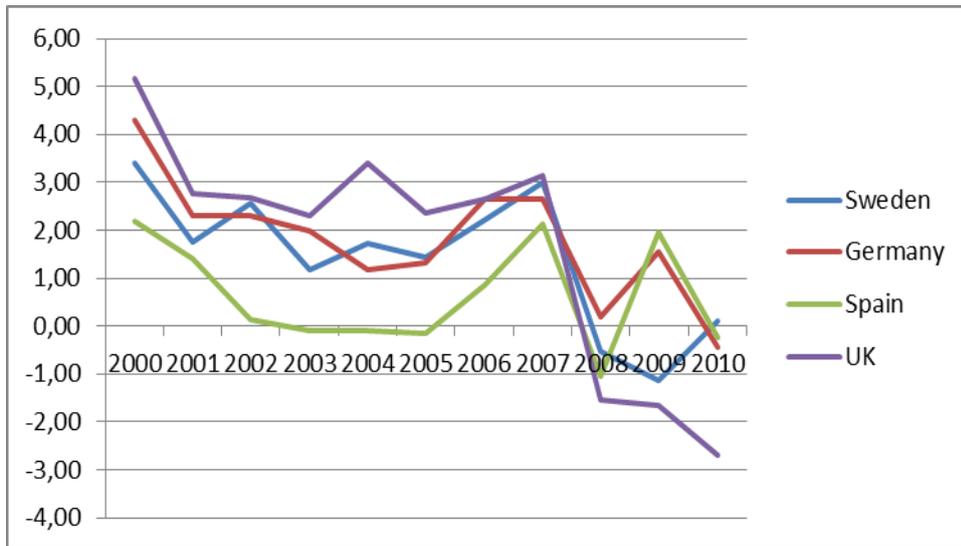


Fig. 3 Real interest rates

5.4. Real disposable income development

The real disposable income development in the studied markets can be seen in Fig. 4. Income increased slightly more in Spain prior to the recession, while the development in Sweden and the UK turned out to very similar, and in Germany income increased considerably less compared to the other countries. After the downturn in the economy income declined in all markets, but started to pick up in Germany and the UK in 2010.

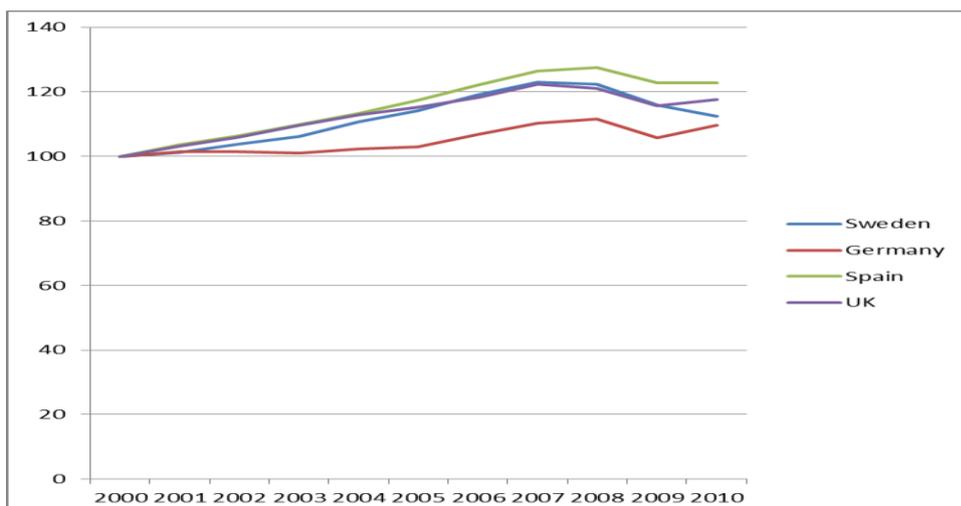


Fig. 4 Real disposable income

5.5. Real housing price index vs. real disposable income ratio

When trying to predict future developments of housing markets, the relation between real housing prices and real disposable income is one of the most commonly used indicators. Fig.5 shows us that there were indications of a bubble formation in the Spanish market, prior to the downturn in the economy and the subsequent fall in property values. But, when evaluating the UK market, the indication of a bubble was much less strong and there was no information that supported the continuous increase in Sweden, or the, since the year 2000, steady decrease in German property values, i.e. the fall in the Spanish and UK markets could possibly have been predicted, by the use of this indicator, but not the development in the other two countries.

As earlier stated, we need to be cautious when comparing markets, since different indices have been used, but the trend analyses in the individual markets is not affected by this limitation.

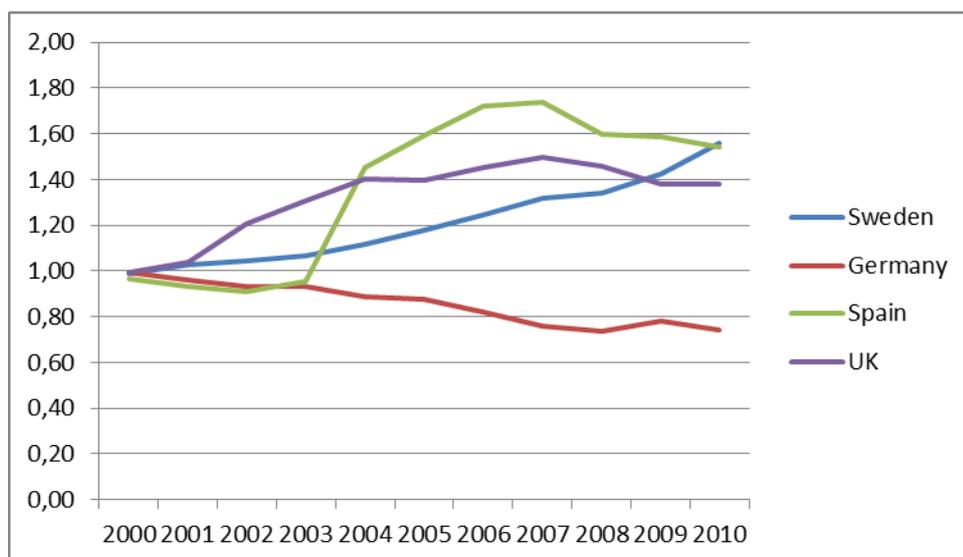


Fig. 5 Real housing price index vs. real income ratio

5.6. Real housing price index vs. real interest rate

When trying to predict future developments of housing markets, the relation between real housing prices and real interest rates is equally frequently used as real housing prices vs. real disposable income. The idea behind this index is that falling rates will support prices, since the user cost is falling when households need to use fewer funds to cover interest rate payments. Fig. 6 shows the relationship between prices and interest rates, for the years 2000 to 2010.

Prior to the recession, real rates in Spain dropped from 2% in the year 2000 to approx. 0% in 2002 and from 2002 until the end of 2005 they turned slightly negative (Fig.3 and Fig.6). As rates started to go up, at the end of 2005, the increase in Spanish property values slowed and prices started to decline in 2007 (Fig.1 and 6). In the case of Sweden, Germany and the UK, no major effect from the relation between prices and rates can be seen during this period (Fig.6).

At the beginning of the recession, interest rates went down in all four countries. Prices fell sharply in Spain and the UK and continued their slow decline in Germany. At the same time property values continued to increase in Sweden (Fig.1, 3 and 6).

During the financial contraction rates turned positive in Spain and Germany and negative in the UK and Sweden, but, again, only Swedish prices went up (Fig.1, 3 and 6).

At the end of the contraction, rates were negative in all four countries, but while they were close to zero in Sweden, Spain and Germany they approached -3% in the UK, but, as before, only Swedish property prices continued their upwards trend (Fig.1, 3 and 6).

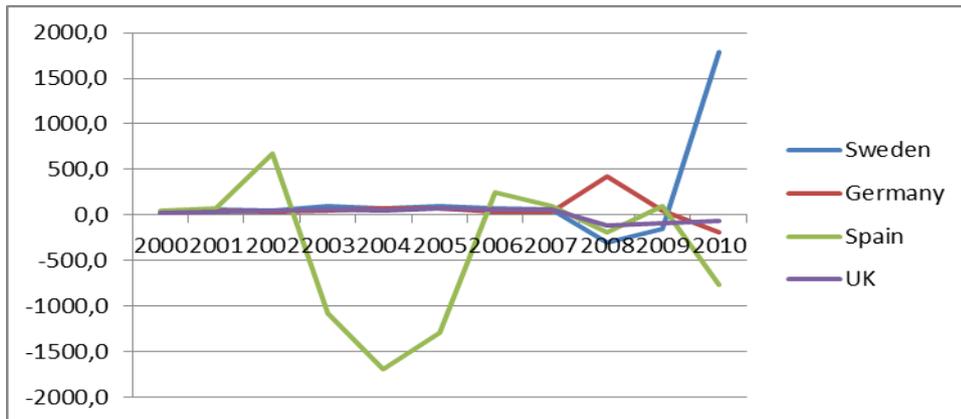


Fig. 6 Real housing price index vs. real interest rate

5.7. Real housing price index vs. population index

The relation between real housing prices and the total population is almost as commonly used as housing prices vs. interest rates or disposable income. In Fig.7 we can see the relation between changes in prices and changes in population. From the graphs we can conclude that the ratio increased substantially in all markets, apart from Germany which had a negative development. The increase, prior to the most recent recession, was higher in the UK and Spain compared to Sweden, but this still does not explain why Swedish property prices continued to increase during the downturn, while those in the UK and Spain fell. Additionally, there is no explanation for the continuous decline in Germany. As pointed out earlier, since the indices were calculated using different data we cannot with certainty compare the absolute price level in the four countries.

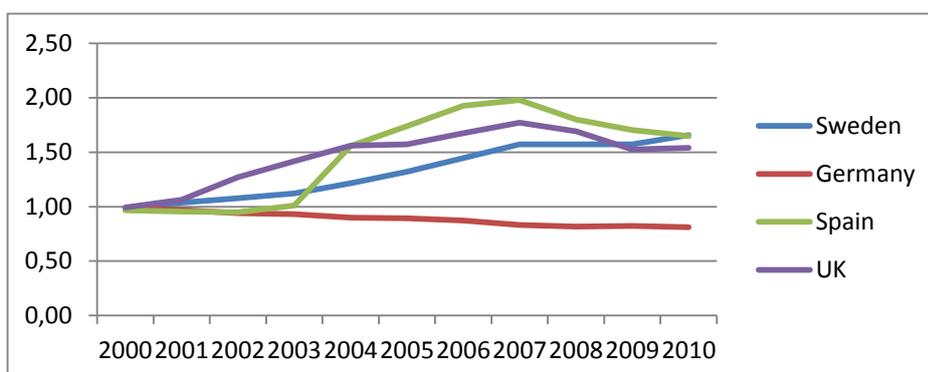


Fig. 7 Real housing price index vs. population index

5.8. Real housing price index vs. total number of dwellings

The relation between real house prices and the total stock of dwellings was found to be the fourth most commonly used indicator and the result for the four markets under investigation can be seen in Fig. 8. Unfortunately values for the UK housing stock for 2009 and 2010 were not available and had to be estimated. To account for this problem the values attained for the years 2000 through 2008 were extrapolated to include the years 2009 and 2010. The result is shown in Fig.8 and is quite similar to that attained from the relation between housing prices and population (Fig.7). From the graphs we can conclude that that the price increase was highest in Spain, even though the housing stock per capita grew more in this country compared to the other three (Fig.2). The price development in the UK was similar, but the number of dwellings per person was almost stable in this market (Fig.2). In Germany living space increased and prices fell (Fig.1 and 2) and the combined effect of these two variables is shown in Fig. 8. Only the Swedish market showed a slight drop in supply, combined with an increase in price.

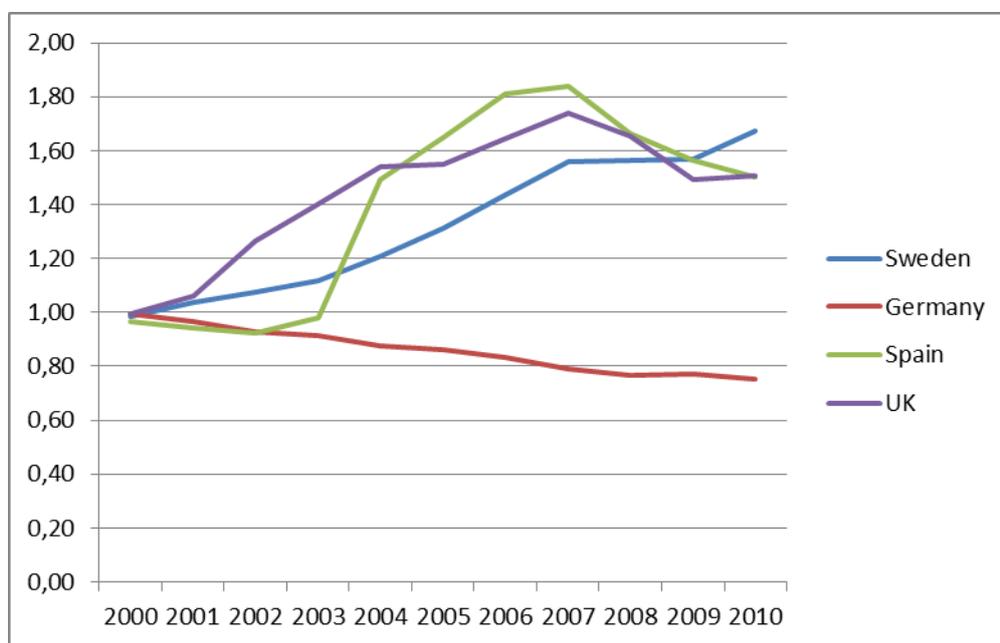


Fig. 8 Real housing price index vs. total number of dwellings

5.9. Swedish indicators

As a first step, in evaluating how well the four indicators correlate, the results for Sweden are plotted in Fig. 9. From the graphs we can conclude that the relation between real housing prices and population, as well as real housing prices vs. housing stock, correlate extremely well and basically match each other. Also real housing prices vs. income show a similar pattern to the other two indicators, but the relation between prices and interest rates only show a correlation with the other three during and after the recession.

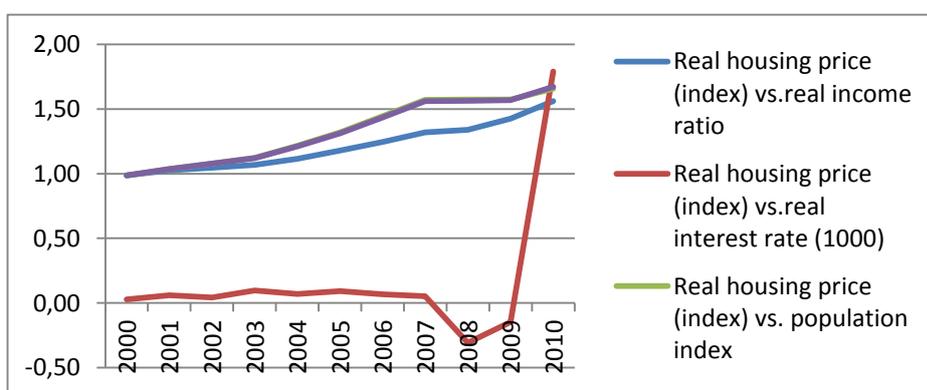


Fig. 9 Indicators for Sweden

5.10. German indicators

The results for Germany are plotted in Fig. 10. From the graphs we can conclude that all of the investigated indicators, apart from the relation between price and interest rate, show good correlation.

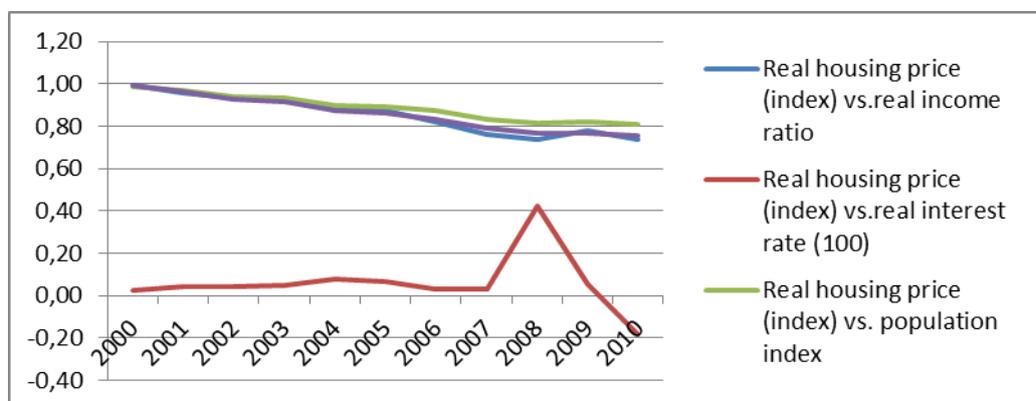


Fig. 10 Indicators for Germany

5.11. Spanish indicators

From Fig11 we can conclude that the relation between real housing prices and income, as well as housing stock, correlate extremely well. Also, the relation between housing prices and population track the other two indicators closely. For Spain the relation between prices and interest rates tracks the other indicators until the start of the recession, but from the start of the financial contraction until 2010 it is difficult to deduce any correlation between it and the other three.

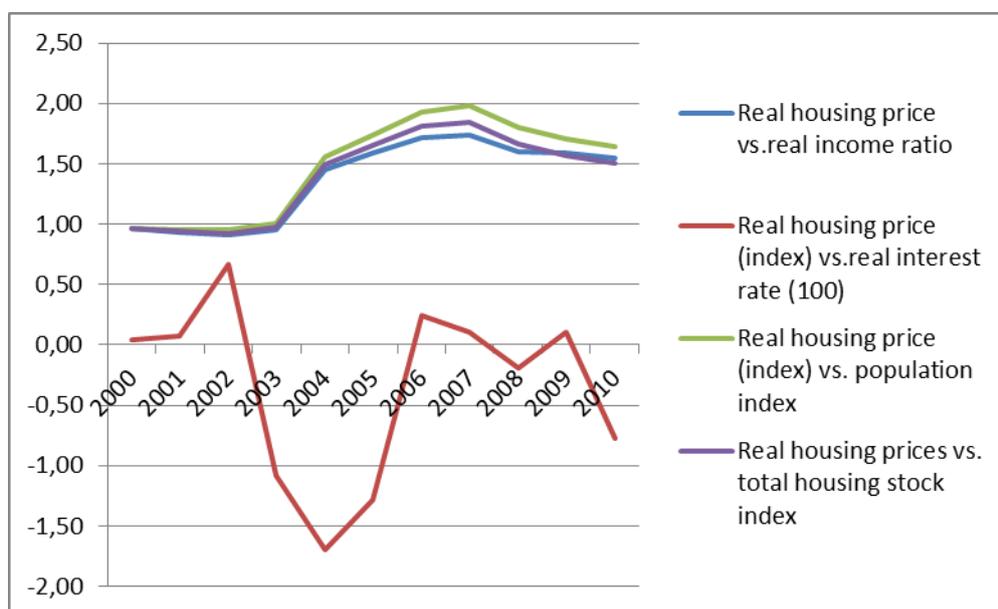


Fig. 11 Indicators for Spain

5.12. UK indicators

There is a good fit between the price of dwellings and population and housing stock, as can be seen in Fig. 12. Also, the relation between price and income track the other two indicators quite well. But there is no correlation between these three indicators and the relation between housing prices and interest rates, and for the UK data, the lack of correlation is complete. During the years with increasing prices rates were positive, and to some extent even increasing, and during the downturn they were negative. This lack of correlation is especially clear when comparing Fig.1 and Fig.12

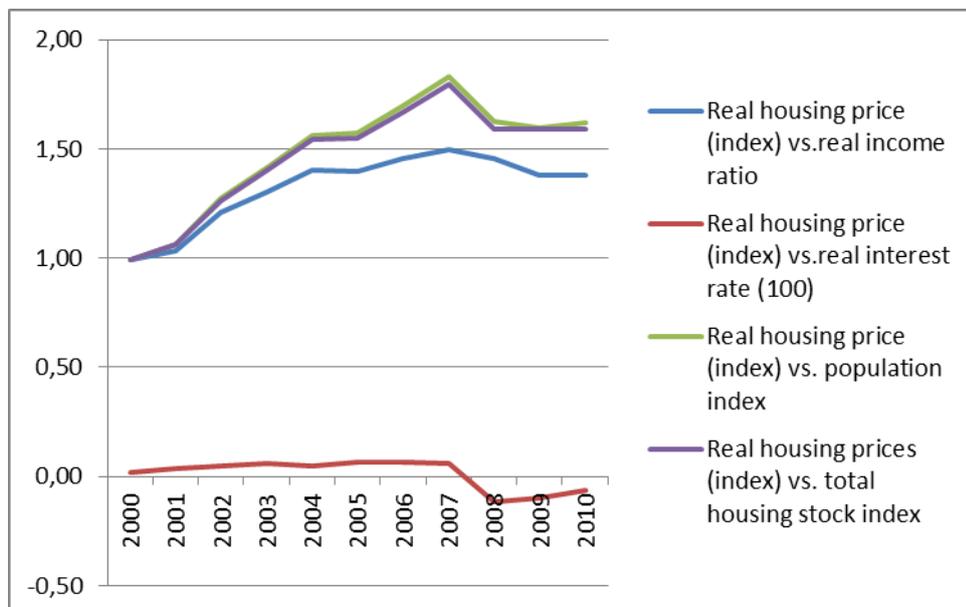


Fig. 12 Indicators for the UK

6. Discussion

In the literature there is considerable support for the use of various indicators for forecasting future property values, but is this assumption really sustainable? In an effort to shed some light on this issue, four commonly used indicators were tested against the development of four property markets. The chosen markets were Germany, Sweden, Spain and the UK and the tested indicators were:

- Real housing price index vs. real disposable income ratio
- Real housing price index vs. real interest rate
- Real housing price index vs. population index
- Real housing prices index vs. total housing stock index

The evaluated time period was the years 2000 to 2010. The four countries were selected, since their housing markets have experienced different developments during this time. In Spain and the UK prices increased considerably from the year 2000 until the onset of the financial contraction in 2008 and have fallen during the remaining part of the investigated period. In Sweden prices have constantly increase and in Germany they have constantly decreased from the year 2000 to 2010.

It is not clear if the use of the year 2000, as the year of reference (indicating the baseline for the fundamental value), is correct, but this should not be of concern, since the main interest is to understand the development before, during and after the recession, i.e. if the most commonly used indicators would have been able to forecast the price development and if other factors exist that might have influenced the outcomes. Also, since different indicators were used in the studied countries and, in the case of the UK and Spain, two different series on property values had to be combined; it is not possible to draw any reliable conclusion concerning the relative price level between the four markets. But, for this study, information on the trends in the evaluated markets is sufficient, since the aim is to determine if the indicators were reliable in forecasting the future development and if underlying factors can be found that strongly influence the price development.

From Fig.1 we conclude that, prior to the financial crises, Spanish, Swedish and UK markets were valued higher, compared to the reference year of 2000. But only properties in Spain and the UK, which seems to have had the most overvalued markets, declined during the recession. At the same time Swedish property values continued to increase and at the end of 2010 they reached a level similar to the one in the UK (based on the base year 2000).

6.1. Real housing prices vs. real income

From Fig.5 it can be concluded that the indicator (real housing prices vs. real income) had the necessary predictive power for the Spanish and UK markets but not for Sweden. Only if Swedish property values had fallen, in line with those in Spain and the UK, could it have been considered a reliable predictor of future price developments.

If one would single out the German market, the increased number of dwellings vs. population (Fig.2) could explain part of the constant decline in this country's real house price vs. real income ratio (Fig.5). But when compared with, for example the Spanish market, which had the largest increase in dwellings per capita, it does not seem like this variable can be used in explaining the difference in price vs. income development.

In Sweden and the UK, the relation between total population and total number of houses was, more or less, unchanged between the year 2000 and 2010. But while UK prices declined, during and after the recession, they continued to increase in Sweden.

The reason for the increase in Sweden can, also, not be found in the change in disposable income, since Sweden experienced the longest period of falling real income levels of the countries in the study. Sweden was not just the only country which in 2010 suffered from falling income, but also the only one with increasing property prices (Fig.1 and 4).

6.2. Real housing prices vs. real interest rates

The second evaluated indicator, real housing price index vs. real interest rate is, according to the literature, considered to be an important tool in predicting future market developments. But the results plotted in Fig.6 only assign limited predicting power to this indicator.

For the Spanish market we can conclude that the low, and during a considerable period even negative real interest rates, strongly supported the increase in property values. But for the other three markets, no difference can be seen prior to the financial crises. Since low real interest rates reduces the cost of living, this variable can be expected to have a supporting function, especially in countries where most loans are taken with short interest rate guarantee periods, like Sweden and Spain. But used by itself, without considering a countries mortgage structure, it does not seem to bring much assistance in the projection of future market development. In the case of Sweden we can, also, conclude that a correlation between housing prices and interest rates existed during and after the recession, indicating that mortgage conditions may play an important role.

6.3. Real housing price vs. population and total number of dwellings

The third and fourth evaluated indicators, real housing price index vs. population index (Fig.7) and real housing price index vs. total number of dwellings (Fig.8) both show a development that closely resembles that of the first one, real housing prices vs. real income (Fig. 5).

For changes in population and the total number of dwellings to have a positive effect on prices, the population has to increase more compared to the available living space. Only the Swedish market indicated a small increase in this ratio, while the relation in the UK stayed more or less unchanged (Fig.2). With no change in the ratio no effect on property prices should have been expected. In Germany, and to an even higher degree in Spain, the ratio declined by almost 10%-points, indicating that prices should have decreased in these two countries (Fig.1 and 2).

It can be concluded that the indicators, prior to the recession, forecasted that a bubble could be expected to have been formed in Spain and the UK, but also in Sweden. Only in areas with low elasticity between demand and supply, like the central parts of Stockholm, could an increase in prices have been explained by fundamentals, since, in this case, an increase in demand could not be met by an increase in supply.

Based on these results it is difficult to find support for any reason indicating that the increase in Sweden should not have qualified as a bubble. But instead of decreasing, Swedish property prices continued to go up. To explain this development there has to exist an additional variable which needs to be accounted for. This part of the analyses will be discussed further in section 6.5.

6.4. Correlation between indicators

As a second step, all four indicators were simultaneously tested on each of the studied countries and the results can be viewed in Fig. 9 to 12. The trend between:

- Real housing price index vs. real disposable income ratio
- Real housing price index vs. population index
- Real housing prices index vs. total housing stock index

shows good correlation in all markets. The problem, though, is the information the three indicators yielded concerning the future development in the four regions before the onset of the recession. Even though Spanish and UK property prices seemed to have increased more compare to the ones in Sweden, there is no clear support for the continued increase in the Swedish market.

Looking at the possible price supporting variables, like total population vs. the total number of dwellings (Fig. 2) and real interest rates (Fig. 3), we conclude that population vs. the number of houses cannot have had any major influence on prices in Sweden and the UK, since the ratio stayed more or less unchanged. But it should have exerted a downward pressure on German and Spanish property values. Although, prior to the recession, only German property values fell, while those in Spain increase more than the others.

In the case of interest rates we need to differentiate between countries where rates are predominately variable (Sweden and to some extent Spain) and where the majority of mortgages are based on fixed rates (to some extent in the UK and almost exclusively in Germany).

Adding the expected supportive function of low interest rates, in preventing property values from falling, it can be concluded that the Spanish market was helped by the low real rates during the boom years. When comparing Germany, Sweden and the UK, though, there is basically no difference in real interest rates prior to 2008. But the German market declined while the other two gained in value.

Even though the differences in mortgage conditions are largest between Sweden and Germany, comparing these two markets, to determine the influence of lending conditions on property values, will not shed much light on this issue. The reason for this limitation is that German prices constantly declined, while they increased in Sweden. Also, the ratio between population and number of dwellings (Fig.2) changed considerably in Germany while it was unchanged in Sweden, making comparative analyses difficult.

Mortgage conditions in Spain are similar to those in Sweden and comparing these two markets would therefore not yield much information concerning the influence of interest rates conditions. Also, during the larger part of the investigated time period, Spanish rates differed considerably from those in Sweden and there is a large difference in the population vs. total number of houses index.

Swedish and UK rates tracked each other fairly well from the year 2000 until 2010 (Fig. 3) and both the population vs. housing index (Fig.2) and the real disposable income development (Fig.4) are very similar in both countries. Since Swedish mortgages were almost exclusively based on variable rates during the recession and the majority of those in the UK were based on rates which are fixed, comparing these two markets should give us an indication of the importance of mortgage conditions in predicting future price developments.

6.5. Variable rate mortgages as a supporting variable for property prices

To determine if mortgage conditions play a supportive function for property values during times of financial contraction, we compared the development in Sweden and the UK. Fig.1 and 3 shows us the price and interest rate development in real terms in Sweden and the UK. In both countries real rates turned negative during the recession, especially in the UK. But prices only increased in Sweden and not in the UK. With rates more negative in the UK one would have expected prices to increase more here compared to the Swedish market. Since this was not the case there has to exist an important variable, which makes the Swedish market respond more quickly. With other variables, like; population vs. total number of houses (Fig.2) and disposable income (Fig. 4) at very similar levels in both countries we are only left with the different mortgage condition.

With fixed rates predominating in the UK (60%) and variable rates being the most common mortgage condition in Sweden (90%), we conclude that the different development most likely can be assumed to be the cause of the difference in lending conditions. When the economy contracts, interest rates fall and reduce the cost of living in the dwelling. With user costs falling there is no need for housing prices to go down, to accommodate for losses in disposable income, since the drop in income has already been compensated for by the reduction in interest payments.

7. Summary

Four commonly used indicators were tested against the development of four property markets from the year 2000 to 2010. The chosen markets were Germany, Sweden, Spain and the UK and the evaluated indicators were:

- Real housing price index vs. real disposable income ratio
- Real housing price index vs. real interest rate
- Real housing price index vs. population index
- Real housing prices index vs. total housing stock index

The four countries were chosen, since their housing markets experienced different developments during this time period. In Spain and the UK prices increased considerably from the year 2000 until 2008 and have since fallen. In Sweden prices have constantly increase and in Germany they have decreased throughout the investigated time period.

To determine, both, the predicting power of each indicator and the forecasting ability of a set of indicators, each indicator were first separately tested on the set of countries and secondly all four indicators were simultaneously tested on each country.

If the relationship between housing prices and interest rates is ignored, good correlation could be found between all indicators when applied to each country separately. But no support for the usefulness of the chosen indicators, as reliable predictors of future market developments, could be verified, since, prior to the recession, both Spanish, UK and Swedish markets indicated that a bubble had been formed, but prices only declined in Spain and the UK, while they continued to increase in Sweden. The same argument holds true when each indicator was tested on all four countries, i.e. a bubble could be forecasted in Spain, the UK and Sweden, but prices only declined in the first two countries and continued to go up in Sweden.

Disregarding the (prior to the recession) higher real rates and larger increase in property values in the UK, compared to Sweden, the two countries experienced a very similar development. Disposable income and the ratio between population and total number of houses tracked each other well throughout the investigated time period. During and after the financial contraction real rates became lower in the UK compared to Sweden, but Swedish prices increased and in the UK they decreased. In Sweden variable rate mortgages predominate and in the UK fixed rates are the more common form of financing. The dissimilar price development in the UK and Sweden can, most likely, be explained by the two countries different lending conditions, since changes in variable rates will have an immediate effect on the user cost, while the effect from fixed rates will channel through to the households at a much slower rate. It can therefore be concluded that variable rates have a stabilizing effect on property values and can be used to prevent a decline in prices during times of financial contraction and lessen an increase when the economy is expanding.

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Appendix

Sweden											
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
HICP ⁹ (%)	1.3	2.70	1.90	2.30	1.00	0.80	1.50	1.70	3.30	1.90	1.90
Housing price index ⁸ (year 1981=100 units)	263	284	302	322	353	387	431	477	491	501	538
Housing price index ⁸ (year 2000=100 units)	100	108	115	122	134	147	164	181	187	190	205
Real housing price index	99	104	109	113	123	134	148	162	164	165	176
Real disposable income ²	100	101.3	103.8	106.2	110.7	114.2	119.1	123.1	122.3	116	112.5
Riksbank official nominal lending rate ³ (%)	4.75	4.5	4.5	3.5	2.75	2.25	3.75	4.75	2.75	0.75	2
Riksbank official real lending rate (%)	3.41	1.75	2.55	1.17	1.73	1.44	2.22	3.00	-0.53	-1.13	0.10
Population ¹	8 882 792	8 909 128	8 940 788	8 975 670	9 011 392	9 047 752	9 113 257	9 182 927	9 256 347	9 340 682	9 415 570
Population index (year 2000=100 units)	100	100	101	101	101	102	103	103	104	105	106
Total housing stock ¹	4 293 644	4 307 538	4 329 180	4 351 308	4 379 541	4 404 059	4 435 903	4 469 772	4 503 041	4 526 625	4 508 373
Housing stock index (year 2000=100 units)	100	100	101	101	102	103	103	104	105	105	105
Real housing price (index) vs real income ratio	0.99	1.03	1.05	1.07	1.11	1.18	1.24	1.32	1.34	1.42	1.56
Real housing price (index) vs real interest rate	29.0	59.3	42.5	96.7	71.2	93.5	66.9	54.1	-307.7	-146.4	1789.1
Real housing price (index) vs. population index	0.99	1.04	1.08	1.12	1.22	1.32	1.44	1.57	1.57	1.57	1.66
Real housing prices (index) vs. total housing stock index	0.99	1.04	1.08	1.12	1.21	1.31	1.43	1.56	1.56	1.57	1.67
Germany											
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
HICP ⁹ (%)	1.4	1.9	1.4	1	1.8	1.9	1.8	2.3	2.8	0.2	2.2
Housing price index ⁸ (year 2000=100 units)	100.6	100.7	99.3	99.7	98.2	99.4	99.0	96.9	98.2	99.0	100.0
Real housing price index	99.2	97.4	94.6	94.0	90.8	90.0	87.9	83.7	82.0	82.5	81.1
Real disposable income ²	100	101.5	101.5	101.1	102.3	103	106.8	110.3	111.5	105.8	109.7
ECB official nominal lending rate ³ (%)	5.75	4.25	3.75	3	3	3.25	4.5	5	3	1.75	1.75
ECB official real lending rate (%)	4.29	2.31	2.32	1.98	1.18	1.32	2.65	2.64	0.19	1.55	-0.44
Population	82 163 475	82 259 540	82 440 309	82 536 680	82 531 671	82 500 849	82 437 995	82 314 906	82 217 837	82 002 356	81 802 257
Population index (year 2000=100 units)	100	101	101	101	101	101	101	101	101	100	100
Total housing stock ¹ (1000 sqm)	3 179 728	3 213 967	3 243 361	3 271 962	3 301 278	3 326 849	3 353 117	3 375 171	3 393 400	3 409 819	3 426 896
Housing stock index (year 2000=100 units)	100	101	102	103	104	105	105	106	107	107	108
Real housing price (index) vs real income ratio	0.99	0.96	0.93	0.93	0.89	0.87	0.82	0.76	0.74	0.78	0.74
Real housing price (index) vs real interest rate	23.1	42.2	40.8	47.5	77.0	67.9	33.1	31.7	421.6	53.3	-184.2
Real housing price (index) vs. population index	0.99	0.97	0.94	0.93	0.90	0.89	0.87	0.83	0.82	0.82	0.81
Real housing prices (index) vs. total housing stock index	0.99	0.96	0.93	0.91	0.87	0.86	0.83	0.79	0.77	0.77	0.75
Spain											
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
HICP ⁹ (%)	3.5	2.8	3.6	3.10	3.10	3.40	3.60	2.80	4.10	-0.20	2.00
Housing price index ⁸ (year 2000=100 units)	N/A	N/A	N/A	N/A	N/A	105.8	121.2	128.1	121.2	115.9	113.7
Housing price index ⁸ (residential property, multi-dwelling rental) (year 2006=100 units)	43.3	44.6	46.5	51.8	82.7	95.5	102.2	97.8	95.7	85.7	96.7
Housing price index ^{8*} (adjusted to year 2000=100 units)	100	103	107	120	191	221	253	267	253	242	237
Real housing price index ^{8*} (adjusted to year 2000=100 units)	97	97	97	105	165	187	210	220	204	195	189
Real disposable income index	100	103.7	106.5	109.8	113.3	117.4	122.2	126.4	127.6	122.8	122.7
ECB official nominal lending rate ³ (%)	5.75	4.25	3.75	3	3	3.25	4.5	5	3	1.75	1.75
ECB official real lending rate (%)	2.17	1.41	0.14	-0.10	-0.10	-0.15	0.87	2.14	-1.06	1.95	-0.25
Population	40 049 708	40 476 723	40 964 244	41 663 702	42 345 342	43 038 035	43 738 250	44 474 631	45 283 259	45 828 172	45 989 016
Population index (year 2000=100 units)	100	101	102	104	106	107	109	111	113	114	115
Total housing stock	20 528 514	21 033 753	21 551 426	22 029 220	22 623 443	23 210 317	23 859 014	24 495 844	25 129 207	25 557 237	25 837 108
Housing stock index (year 2000=100 units)	100	102	105	107	110	113	116	119	122	124	126
Real housing price vs real income ratio	0.97	0.93	0.91	0.96	1.45	1.59	1.72	1.74	1.60	1.59	1.54
Real housing price (index) vs real interest rate	44.4	68.5	670.7	-1083.4	-1697.7	-1287.3	242.1	102.6	-192.7	99.7	-771.9
Real housing price vs. population index	0.97	0.96	0.95	1.01	1.56	1.74	1.93	1.98	1.80	1.70	1.65
Real housing prices vs. total housing stock index	0.97	0.94	0.93	0.98	1.49	1.65	1.81	1.84	1.66	1.57	1.50
UK											
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
HICP ⁹ (%)	0.8	1.2	1.3	1.4	1.3	2.1	2.3	2.3	3.6	2.2	3.3
Average price Q4 ⁵ (£)	110 221	119 982	145 320	164 000	183 000	188 000	204 000	216 000	220 000	216 000	N/A
Housing price index ⁸ (year 2000=100 units)	100	109	132	149	166	171	185	196	200	196	N/A
Real housing price index	99	107	128	143	158	161	172	180	180	174	N/A
Housing price index ⁸ (annual average) (year 2005=100 units)	N/A	N/A	N/A	N/A	N/A	100	110	121	110	111	115
Housing price index ^{8*} (annual average) (adjusted to year 2000=100 units)	100	109	132	149	166	171	185	200	196	180	187
Real housing price index ^{8*} (annual average) (adjusted to year 2000=100 units)	99	107	128	143	158	161	172	183	176	160	163
Real disposable income ²	100	103.1	105.9	109.6	112.9	115.2	118.2	122.3	121	115.7	117.7
Bank of England official nominal lending rate ³ (%)	6.00	4.00	4.00	3.75	4.75	4.50	5.00	5.50	2.00	0.50	0.50
Bank of England official real lending rate (%)	5.16	2.77	2.67	2.32	3.41	2.35	2.64	3.13	-1.54	-1.66	-2.71
Population	58 785 246	58 999 781	59 216 138	59 435 480	59 697 057	60 038 695	60 409 918	60 781 346	61 191 951	61 595 091	62 026 962
Population index (year 2000=100 units)	100	100.4	100.7	101.1	101.6	102.1	102.8	103.4	104.1	104.8	105.5
Total housing stock ¹ (1000 units)	25 281	25 462	25 619	25 799	25 987	26 198	26 418	26 652	26 910	27 043	27 245
Housing stock index (year 2000=100 units)	100	100.7	101.3	102.0	102.8	103.6	104.5	105.4	106.4	107.0	107.8
Real housing price (index) vs real income ratio	0.99	1.04	1.21	1.31	1.40	1.39	1.45	1.50	1.46	1.38	1.38
Real housing price (index) vs real interest rate	19.2	38.6	48.0	61.7	46.5	68.3	65.2	58.6	-114.1	96.1	-60.0
Real housing price (index) vs. population index	0.99	1.06	1.27	1.42	1.56	1.57	1.67	1.77	1.69	1.53	1.54
Real housing prices (index) vs. total housing stock index	0.99	1.06	1.26	1.40	1.54	1.55	1.65	1.74	1.66	1.49	1.51