Fundamental and Non-Fundamental Explanations for House Price Fluctuations

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Economic Advice

1 Unexplained Real Estate Crises

Several countries were affected by a real estate crisis in recent years. In many cases strongly falling house prices resulted in increasing default rates among home owners, solvency threatening losses at banks and one of the most devastating financial and economic crises in history.

This crisis was preceded by a long episode of strongly increasing house prices. While there were some economists that warned against the buildup of imbalances on the housing market and the risk of a real estate crisis, most investors, banks and politicians seemed to have believed that prices will continue to increase forever. Yet, real estate crises are not something new. The last wave of real estate crises was around 1990 when some Nordic countries but also in countries like the UK, Japan and Switzerland experienced strong price declines on the housing market.

How can we explain these price fluctuations? Similar to the 1990 crisis, the price increase that resulted in the recent crisis was accompanied by favorable economic conditions with high growth rates as well as relatively low interest rates. When prices declined, there was a very weak economic development. This would indicate that the price development can be explained by an endogenous interaction with fundamental factors like GDP and interest rates.

In order to evaluate, which part of the house price development can be explained by fundamentals, we develop a model of fundamental house prices. We then calibrate fundamental prices for ten different OECD countries and compare them to actual prices. The results indicate the prices fluctuate much more than fundamentally justified.

As prices fluctuate more than fundamentally justified there have to be non-fundamental effects which drive these excess fluctuations. We will therefore deviate from the standard rational agent model by incorporating herding behavior and speculation into the house-price model. We will then calibrate the modified models and examine the improvement of the fit to actual prices.

2 Fundamental Explanation for House Price Fluctuations

2.1 A Model of Fundamental House Price

Our model of fundamental house prices is built on Hott and Monnin (2008). This model takes into account that a house can be seen as an asset which price should reflect a risk-return tradeoff but also as a good which price should reflect the utility gain from owning it.

The asset view of a house price is given by a simple asset pricing model where the fundamental house price *(P)* is assumed to be equal to the sum of future discounted fundamental imputed rents *(H)*. The discount factor is given by the sum of the mortgage rate *(m)* and the risk premium ρ.

$$P_t^* = E_t\left[\sum_{i=0}^{\infty}\frac{H_{t+i}}{\prod_{j=0}^{i}(1+\rho+m_{t+j})}\right] \tag{1}$$

Hence, the fundamental house price depends positively on the fundamental imputed rent and its future growth rate and negatively on the risk premium as well as present and future mortgage rates.

The determination of the fundamental imputed rents brings in the utility view. We assume that *H* is the clearing price (i.e. rent) on the housing market. The supply in one period is given by the discounted (δ) housing stock *(S)* of the previous period plus the construction of new houses *(B)*. The demand side is driven by a variation of a Cobb-Douglas utility function and leads to an aggregated demand equal to a constant fraction α of aggregated income *(Y)* which is spend on housing plus an autonomous demand per household multiplied by the number of households *(N)*.

$$H_t = \alpha\frac{Y_t}{S_t - \hat{d}N_t} = \alpha\frac{Y_t}{(1-\delta)^t S_0 + \sum_{j=1}^{t}(1-\delta)^{j-1}B_{t-j} - \hat{d}N_t} \tag{2}$$

As we can see, the fundamental imputed rent and therefore also the fundamental house price, depend positively on aggregated income as well as the number of households and negatively on construction activities.

2.2 Calibration of the Fundamental House Price

In order to see to which degree our fundamental house price model can explain actual house price developments, we calibrate the model for ten different OECD

countries: Australia (AUS), Switzerland (CH), Spain (ES), France (FR), Ireland (IE), Japan (JAP), the Netherlands (NL), Sweden (SE), the UK, and the US.

Based on equation (1) and (2) we need data on mortgage rates (sources: BIS and OECD), GDP (as a proxy for aggregated income, sources: IMF and OECD), population (as a proxy for the number of households, source: IMF), and construction (sources: Datastream, OECD and SNB). For the calibration we need also the development of actual house prices (sources: BIS and S&P Case-Shiller National Home Price Values for the US) and actual rents (source: OECD). In addition, as we are interested in the real development, we need data on CPI (source: IMF).

One problem is that according to (1), we not only need the past development of the imputed rents and mortgage rates, but also their future development up to infinity. For simplicity and since we are mainly interested in the overall development of the prices, we assume that imputed rents will increase at a constant rate which is equal to the country specific average growth rate in the past. For the mortgage rate we assume that it stays constant at its country specific historical average.

Besides the development of the different variables, we need to have adequate values for the different parameters. As in Hott (2012), we chose the parameter values by taking established values from the literature and, where this is not applicable, by using them to adjust the development of the theoretical prices and rents to their actual developments.

Based on studies by Harding et al. (2007), Himmelberg et al. (2005), Pain and Westaway (1997), and Poterba (1992) we assume that the discount factor δ is 2 percent and that the risk premium ρ is 5 percent.

The initial housing stock , the utility parameter α and the autonomous demand are relevant for the fundamental imputed rent. As actual rents are expressed as an index value, we need an additional parameter which adjusts the level of the theoretical rents to that of the rent index. We multiply this adjustment parameter with α which has also only an influence on the level of house prices (and not their development) and get the new parameter $\alpha 1$. We choose the different parameter values by minimizing the mean squared difference between the logs of theoretical and actual rents.

Using the calibrated fundamental imputed rents, we can now calibrate the fundamental house prices. As with rents, we have to adjust the level of the theoretical prices to that of the house price index. We choose this adjustment parameter by minimizing the mean squared difference between theoretical and actual house prices. For the calibration of these fundamental prices we assume that there are no distortions and that households have perfect foresight.

The results of the calibration are displayed in Chart 1. As we can see, although the overall trend of the fundamental and actual prices is comparable, there are substantial deviation of the actual prices from their fundamental value from time to

time. On average, prices deviate about 25 percent from their fundamental value. The reason for this is that actual prices fluctuate much stronger than fundamentals would justify. On average, the variance of the actual price increases is about ten times higher than that of fundamental prices.

3 Non-Fundamental Reasons for Excess Price Fluctuations

As we have seen, house prices fluctuate much stronger than fundamentally justified. Shiller (1981, p. 434) gets similar results for stock prices and argues:

> *"The failure of the efficient markets model is thus so dramatic that it would seem impossible to attribute the failure to such things as data errors, price index problems, or changes in tax laws."*

In this chapter we will evaluate in how far herding behavior and speculation can explain the excess price fluctuations.

3.1 Herding Behavior

Following Hott (2012), herding behavior can be included into our basic house price model by using the main elements of Lux (1995).

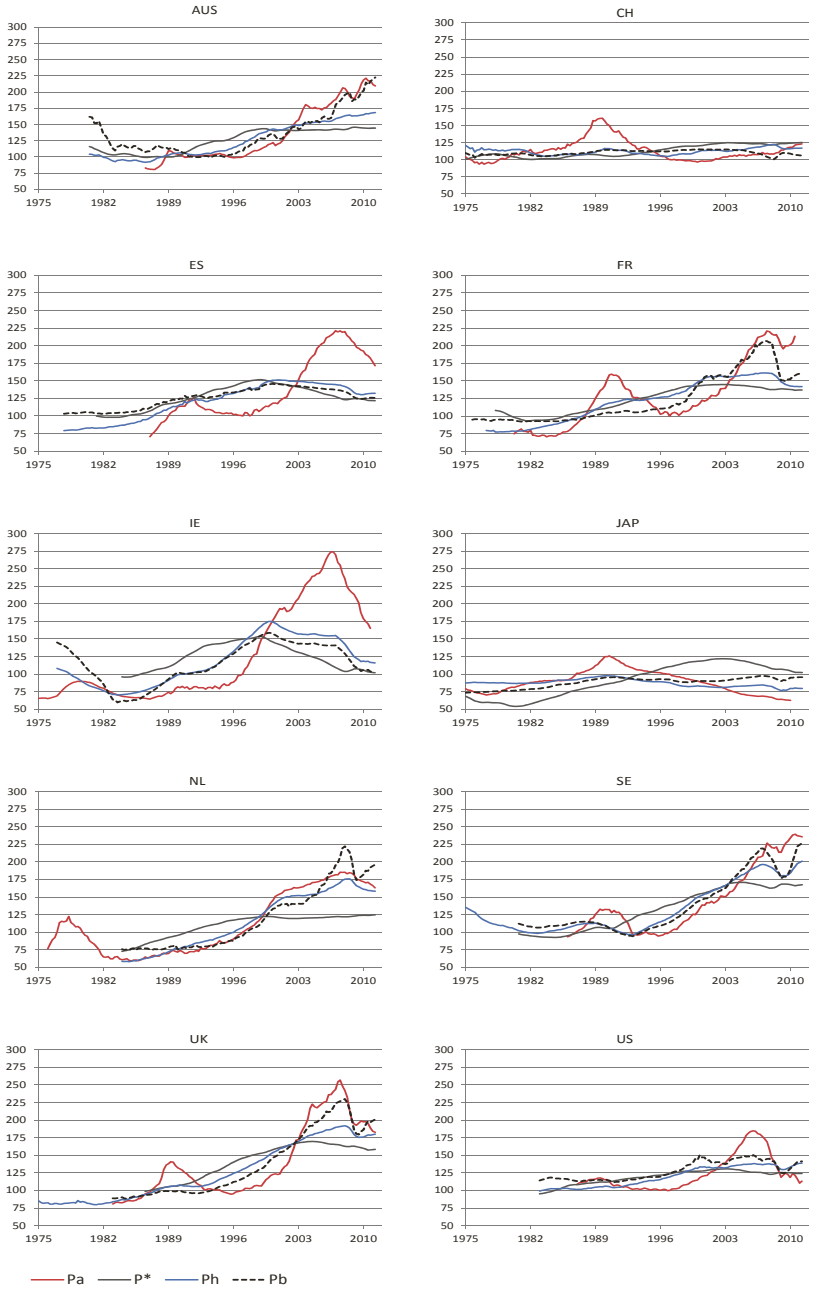
In the fundamental model we have assumed that the risk premium is constant. In this section we adjust this by assuming that the risk premium depends on the mood of households. If households get more optimistic, they demand a lower risk premium and they demand a higher risk premium if they get more pessimistic.

Further we assume that the mood of the households is affected by the returns on the housing market. If there is an excess return, households get more optimistic and they get more pessimistic if the return is too low. The return, however, depends on the investment decision of the households

This introduces an endogenous price dynamic: If there is a positive shock which results in a excess return, households get more optimistic. The more optimist households demand a lower risk premium and are therefore willing to pay higher prices. This in turn leads to an increase in prices and again to an excess return. The process is reversed when the return from the imputed rent gets too low to be compensated by the price increase. Now households get more pessimistic and prices fall.

This herding house price with endogenous risk premiums can be calibrated in the same way as the fundamental price. Only now we also have to find optimal parameter values for the speed of mood adjustment. The results of the calibration are displayed in Chart 1.

Chart 1: Actual, Fundamental, Herding and Speculative Real House Prices



Sources: BIS, S&P Case-Shiller National Home Price Values for the US, IMF, and author's calculations.

3.2 Speculative Bubble

When it comes to over- or undervaluations of assets speculative behavior is often named as a possible reason. Under speculation the investment decision is at least partially influenced by expected changes of the corresponding asset price. This could lead to a situation where a price increases only because investors believe that the price will increase in the next period, because they expect that the price will further increase in the period after that and so on.

This idea is formalized by Froot and Obstfeld (1991). The authors look at a pricing model where the price depends on the dividend, the price in the next period and a discount rate. Similar to our house price model, in this setting forward iteration leads to a price that is equal to the sum of all discounted future dividends. Froot and Obstfeld, however, show that this present value solution is only a particular solution. The general solution is that the price is equal to the present value of future dividends plus a (rational) bubble term that has to fulfill several requirements. Now the authors assume that this bubble term only depends on fundamentals. Hence, the dynamic of the bubble is entirely driven by the dynamic of fundamentals. If we transform this idea into our house price model we get:

$$P_t^b = \frac{H_t}{\left(\rho + \bar{m} - w\right)} + zH_t^{\lambda} \tag{3}$$

where $\lambda = (\rho+m)/w$ and z is an arbitrary constant.

Again, this speculative bubble house price can be calibrated in the same way as the fundamental price. Only now we also have to find optimal country specific parameter values for z. The results of the calibration are displayed in chart 1.

3.3 Comparison of Approaches

The performance of the herding behavior and speculative bubble approach is displayed in table 1. As we can see, both approaches substantially improve the fit to actual prices. For some countries, herding behavior can better explain the development of actual prices and for other countries it is the speculative bubble approach. On average, however, the improvement of the fit is very similar.

Table 1: Comparison of the Different Approaches

		AUS	CH	ES	FR	IE	JAP	NL	SE	UK	US
	Improvement of fit										
herding behavior	1-(MSE Ph/MSE P*)	59%	35%	**37%**	**40%**	**67%**	**82%**	**93%**	57%	53%	**31%**
speculative bubble	1-(MSE Pb/MSE P*)	**74%**	**41%**	20%	40%	52%	71%	90%	**67%**	**69%**	28%
	Fluctuations										
herding behavior	VAR wPh/ VAR wPa	10%	**18%**	**15%**	**12%**	**38%**	**17%**	49%	35%	8%	8%
speculative bubble	VAR wPb/ VAR wPa	**56%**	15%	9%	11%	12%	16%	**172%**	**86%**	**28%**	**33%**

Source: Author's calculations.

4 Conclusions

House prices fluctuate more than fundamentally justified. This finding might not be surprising but has several implications that call for an explanation for this excess fluctuations. First, forecasting models that rely on fundamentals miss part of the development. Second, and probably more important, the excess price fluctuations can have serious consequences for financial and economic stability of a country. A better understanding of the reasons of these fluctuations is a first step to be able to prevent them.

We argue that a deviation from standard rational agent models is necessary to explain house price fluctuations. Agents overreact to current fundamentals as well as past returns and they are influenced by their sentiment. Although the performance of the approaches differs across countries and time, speculation and herding can explain a part of the excess fluctuations of actual house prices.

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