HOUSING PRICE CYCLES IN THE UNITED STATES

Strains in the residential mortgage market in the United States are generally perceived as one of the main triggers of the ongoing financial and economic crisis.[1] Empirical evidence suggests that an expansion in the supply of mortgages, in particular sub-prime mortgages, during the period when US house prices were rising was largely driven by borrowers and lenders extrapolating the most recently observed house price increases into the future.[2] On the borrowers' side, expectations of future house price appreciation rendered housing both a more attractive and an affordable asset.[3] On the lenders' side, default risk was perceived to be lower, as the loan-to-value ratio was expected to fall with future house price increases. Such myopic behaviour by market participants may have been encouraged by the fact that house prices tend to follow persistent cycles, which might induce market participants to become overly optimistic (or pessimistic) about the outlook for house valuations in each respective state of the cycle.[4] This box introduces an empirical model that tries to capture this peculiar price dynamic and assesses the vulnerability of the US housing market.

The chart below depicts the pronounced cyclicality in US house prices over the period from 1930 to 2007, and two boom-bust periods stand out particularly markedly. First, around the end of World War II, house prices rose by 60% from 1942 to 1947. Second, based on the Case-Shiller US Home Price index, the annual rate of price change increased almost every year from 1998 to 2006, with a cumulative price increase of 85% during that period.

A natural candidate to capture regular switches between periods or regimes of different house price dynamics is a Markov-switching model. In this case, a model specification that allows the mean rate of house price growth to switch between two states appears to effectively capture the essential dynamics of US house prices over the period from 1930 to 2007, based on the annual Case-Shiller US Home Price index.[5] The first identified state is associated with a "hot" housing market – where house prices increase relatively strongly by, on average, 8.9% per annum – and the second to a "cold" market – where house prices increase by, on average, just 0.1% per year.

The regime-switching model also produces estimates of the time-varying probabilities of being in a given state at each point in time, where the state probabilities of the previous period are

1 Sharp downgrades of residential mortgage-backed securities in general, and those of lower quality (sub-prime mortgages) in particular, triggered large drops in the prices of these asset-backed securities, resulting in a general increase in risk aversion and loss of confidence in the financial sector. See Box 2 in ECB, *Financial Stability Review*, June 2009.

2 See K.S. Gherardi, A. Lehnert, S.M. Sherland and P. Willen, "Making Sense of the Sub-prime Crisis," *Brookings Papers on Economic Activity*, forthcoming; and W.N. Goetzmann, L. Peng and J. Yen, "The Subprime Crisis and House Price Appreciation," *NBER Working Paper Series*, No 15334, National Bureau of Economic Research, 2009.

3 For example, the majority of the loans in the sub-prime sector were hybrid adjustable-rate mortgages; rates were fixed for two to three years and adjustable thereafter. As these adjustable rates were expensive, it was assumed that they would be refinanced at the end of the two to three-year period, taking into account house price appreciation. When house prices began to decline in 2006, a wave of defaults occurred. See D. Jaffee, A. Lynch, M. Richardson and S. Van Nieuwerburgh, "Mortgage origination and securitization in the financial crisis", in V. Acharya and M. Richardson (eds.), *Restoring Financial Stability*, Wiley, 2009, pp. 61-82.

4 See K.E. Case and R.J. Shiller, "The Efficiency of the Market for Single-Family Homes," *American Economic Review*, 79(1), 1989.
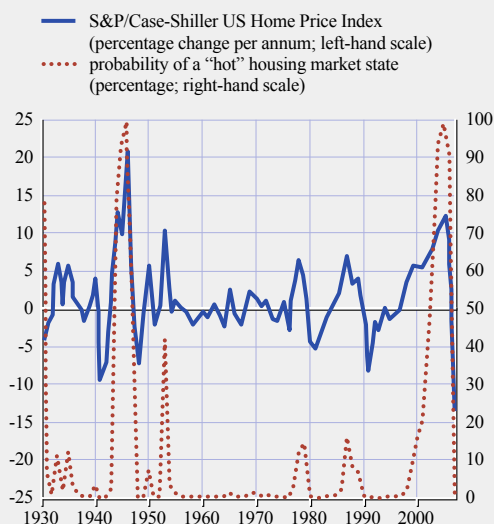
5 For details on the model set-up and estimation, see S. Corradin, J. Fillat and C. Vergara-Alert, "Optimal Portfolio Choice with Predictability in House Prices and Transaction Costs," mimeo, February 2009 (available at: http://ssrn.com/abstract=1342755). The Markov-switching model is estimated for the annual Case-Shiller US Home Price index because of the long time series available. Higher-frequency data are not available for a sufficiently long time period and would further complicate the analysis due to seasonality effects.

updated on the basis of incoming house price data as new information. The chart shows the estimated probability of being in a "hot" housing market state. In general, the probability of being in a "hot" state is rather low, except in periods of great price appreciation, indicating that "hot" housing market states in the United States tend to occur relatively infrequently. This is also reflected in the estimated (time-invariant) transition probabilities of switching to the alternative regime in the next period, assuming that the market is in a given state in the current period. For the "cold" market state, this transition probability is only about 4%, while it is 28% for the "hot" market state. Moreover, the probability of being in the "hot" growth state is greater than 50% only on two occasions. Those two occasions are identified with World War II and the most recent housing market boom. Regarding the latter, the probability of being in a "hot" state began to grow in 1996,

US housing prices and the probability of being in a "hot" housing market state

(1930 – 2007)

— S&P/Case-Shiller US Home Price Index
(percentage change per annum; left-hand scale)
····· probability of a "hot" housing market state
(percentage; right-hand scale)

Sources: Standard & Poor's and ECB calculations.

reached its peak of almost 100% in 2005, and stayed at 90% in 2006. "Hot" market states with such high probabilities are extraordinary by historical standards and proved to be short-lived, superseded by a downward correction in aggregate housing prices.

Against this background, the estimated probability of being in a "hot" housing market state could be taken as an indicator of the degree of vulnerability of the US housing market and related asset markets. Viewed in this light, the analysis suggests that the most recent housing market boom in the United States, which eventually led to the ongoing global financial and economic crisis, was indeed a very unusual and, by nature, fragile situation compared with the more regular house prices dynamics observed in that economy.