Using a DSGE model to look at the recent Boom-Bust Cycle in the US

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This paper presents an analysis of the drivers of the US economy over the last decade, including the collapse of the dot com bubble in 2001 and the more recent boom-bust in the US housing market. We use a DSGE model with residential investment and credit-constrained households estimated with US data over the period 1980Q1-2008Q4, which allows for frictions in financial markets. In order to better understand speculative movements of house prices, we model land as an exhaustible resource, implying that house prices have asset market characteristics. We conduct an event study for the US over the period 1999Q1-2008Q4, characterised by a housing boom and bust, and examine which shocks have contributed to the evolution of GDP and its components over this period. We devote special attention to the contribution of non-fundamental shocks to asset prices over this episode.

It is by now common wisdom that overborrowing of US households, especially to finance residential investment, is one of the major causes for the current financial crisis which started to unfold at the end of 2007 (see, for example, Reinhart and Rogoff (2008) or Hatzius (2008)). While there is little disagreement about the financial market origins of the current downturn there is still quite some uncertainty about the drivers of the boom in the US economy, since the bursting of the dot.com bubble at the beginning of 2000.

1. Financial innovation: many economists regard the expansion of sub-prime lending, i.e. a reduction of collateral requirements asked by commercial banks, as the major source of the current problem (e.g. Mayer et al., 2009)
2. Monetary policy: others find that US monetary policy has been too expansionary in recent years (e.g. Leamer,2007; Taylor,2007).
3. Bubbles: yet another group attributes major importance to a bubble in the housing market (e.g. Shiller, 2007)
4. Productivity growth revisions: others argue the driving force was revisions in medium to long term income growth expectations related to the turnaround in US productivity growth (e.g. Kahn et al.,2007, Kahn,2009)

In this paper we want to shed some light on how strongly the factors discussed above have contributed to US economic developments since 2001 with the help of an estimated open-economy DSGE model. Using a DSGE model we can identify shock processes and associate them with the four hypotheses presented above. Concerning the productivity explanation we identify a TFP growth process (both for final goods and for investment). Regarding bank lending we identify shocks to the collateral constraint. As to monetary policy we use estimated shocks to the Taylor rule in order to measure deviations from systematic behaviour estimated over the whole sample period. Finally we identify a housing bubble as a (negative) risk premium shock to the arbitrage condition for housing investment, a house price bubble as

a persistent negative shock to the risk premium of land prices, and we use the arbitrage equation for corporate capital to identify stock market bubbles.

The DSGE model we use in this paper differs from the standard model in two ways. First, unlike in the first generation DSGE models where capital and insurance markets are regarded as being perfect (see Gali et al. (2007)), we allow for financial frictions in the form of collateral constraints on borrowers with high rates of time preference, following Kiyotaki and Moore (1997), Iacoviello (2005) and Monacelli (2007). In addition, we do not require savers and investors/borrowers to satisfy exactly their optimising conditions for savings and investment, i.e. respond to fundamental shocks only, but we allow for bubbles, following Bernanke and Gertler. (1999). We use the term "bubbles" loosely to denote temporary but persistent deviations of asset prices from fundamental values due, for example, to noise traders, herd behaviour or waves of optimism or pessimism. Our strategy for identifying bubbles empirically is similar to the approach taken by Chirinko et al. (2001), using GMM estimation. We regard a DSGE model as a useful shock accounting device for the following reasons. First, it allows to look at a multiplicity of shocks. Second, DSGE models (unlike error correction models) have a well specified theory about the adjustment dynamics, thus making distinct predictions about the dynamic impacts of particular shocks. Third, as a special case they allow to characterise an efficient financial market benchmark, which can be tested against the time series evidence.

Our tentative conclusions are as follows.

- First, the 2001 recession appears to have been mainly caused by a collapse of the dot com bubble.
- Second, the 2001 recession did not signal an end to the high productivity growth period. In fact, TFP growth remained positive until 2004. After 2004 we do, however, observe a strong decline in productivity growth. US households and banks may not immediately have been aware of declining productivity trends and continued private consumption and residential investment spending patterns. Some empirical evidence on the late detection of trend productivity reversals is provided by Kahn (2009) who shows that a significant productivity growth regime shift, occurring in 2004 could only have been detected in 2007, using modern statistical techniques.
- Third, monetary policy reacted timely and countercyclically. This helped avoiding a stronger recession in 2002 and supported GDP in 2008.
- Fourth, the housing boom which started in 2002 is hard to explain by economic fundamentals. Even in the period of high productivity growth between 2002 and 2004, only about 10% of housing investment is explained by income growth.
- Fifth, the expansion of mortgages to subprime borrowers has also contributed significantly to the boom. Relaxation of credit conditions up to early 2007 boosted private consumption and residential investment, in particular of credit constrained households, and the subsequent tightening of conditions led to a fall in growth.
- Finally, the bursting of this housing bubble is an important factor driving the current US recession.