Markus K. Brunnermeier Oct. 2006

Comment on Inflation Illusion, Credit and Asset Pricing by Piazzesi and Schneider

The fact that the house price-rent ratio – a real measure of house price fundamentals – covaries with the nominal interest rate rather than the real interest rate is one of the many puzzles in real estate economics. Increases in the nominal interest rate, which may be completely caused by increases in inflation, depress the house price-rent ratio.

A similar negative correlation between inflation and stock prices prompted Modigliani and Cohn to conjecture that investors are prone to money illusion: they confuse nominal and real interest rates. When that is the case investors mistakenly discount real future cash flows with the nominal interest rate (or alternatively ignore the fact that cash flows tend to grow in nominal terms as inflation rises). Consequently, the price-earnings ratio of stocks negatively comoves with inflation.

Initially Modigliani and Cohn's money illusion hypothesis did not seem to apply to the housing market since – as Summers (1983) pointed out – in the early 1970s house prices were high even though inflation was rising. However, over a longer time-series there seems to be clear evidence that inflation depresses the house price-rent ratio even after controlling for fundamental factors that determine house prices (see Brunnermeier and Julliard (2006)). This naturally leads to the question: what was different in the U.S. in early 1970s.

The authors of this paper provide a fresh perspective on this puzzle. They argue that money illusion can also explain house price movements in the 1970s since it is not the level of inflation that matters, but the level of disagreement on inflation between rational investors and investors who suffer from money illusion. As inflation rises, rational households would like to short long-term nominal bonds, i.e. borrow money (if the nominal rate does not adjust fully). However, in order to do so, they have to buy real estate as collateral. The authors argue that this mechanism led to an increase in housing demand by rational investors in the 1970s. This is in contrast to the late 1990s, when investors that were prone to money illusion boosted demand for housing.

To make their point precise, the authors propose a very tractable two-period model. Agents derive utility from a single consumption good in both periods. Since agents' utility is linear we can alternatively think of a model in which consumption only occurs in the last period, but households can "store" wealth for one period with a storage return of $1/\beta$. In addition to storage, agents can transfer wealth in two ways. They can buy a bond that pays a real interest rate of $\mathbf{R}/\pi$ or, alternatively, they can buy real estate. For

simplicity the authors consider housing as pure investment good and abstract from any service flow housing provides. House prices in period one are exogenously fixed to be the constant p'.
In summary, in a frictionless world, agents have three ways to transfer wealth from period zero to the consumption period one.

	t=0	**t=1**
storage (analogy)	$-\beta$	$+1$
bond	-1	$+\mathbf{R}/\pi$
housing	$-\mathbf{p}$	$+ p'$

Of course, in a world without frictions and homogeneous beliefs, no-arbitrage guarantees that $R/\pi = 1/\beta$ and $p = \beta p'$.
To make the model interesting, the authors introduce heterogeneous beliefs about the real bond return, R/π. Rational agents have correct beliefs, while agents that are prone to money illusion have a distorted view of the real interest rate. They believe that inflation is always at some benchmark level, e.g. 4%.
The heterogeneity in beliefs about the real interest rate leads to trading activity in the bond market. Whenever investors with money illusion underestimate the real interest rate they sell the bond, while rational investors buy it. Without any further assumptions investors' risk-neutrality would imply that they trade an infinite amount of bonds, and the housing market would a complete side show.
What makes the model interesting are two constraints: (i) a collateral constraint that implies that one can only short bonds (borrow money) if one owns a house as collateral and (ii) a short-sale constraint for housing.[1] When inflation is low, money illusion investors underestimate the real interest rate and buy houses because they seem relatively cheap, while rational investors cannot short-sell houses. This is the standard effect of money illusion also studied in Brunnermeier and Julliard (2006). On the other hand, when inflation is high investors that suffer from money illusion mistakenly think that the real interest is high and buy bonds. Rational investors realize that the bond price is too high and want to short it. In order to do so, they have to buy houses as a collateral. This, together with the shorting restrictions that irrational investors face, leads to excessively high house prices. The authors claim that this mechanism explains the increase in the house price-rent ratio in the 1970s. My comments are the following:

Inflation Disagreement or Violation of Fisher Equation. What makes this analysis different from earlier work on money illusion is that the effects are primarily driven by disagreement among rational investors and investors who are prone to money illusion. While an extreme form of money illusion in which agents never change their belief about inflation predicts a (downward sloping) monotonic relationship between inflation and the mispricing in the housing market, this paper predicts a U-shaped pattern. Housing prices

[1] While the plausibility of short-sale constraints is fiercely debated for the stock market (see e.g. Battalio and Schultz (2006)), it seems uncontroversial for the housing market.

are excessively high whenever investors disagree about future inflation forecasts, which occurs when inflation is either very low (late 1990s) – since irrational investors predict inflation to be too high – but also when inflation is very high (as in 1970s) – since the irrational investors' inflation forecast is too low. To check the plausibility of this assumption it seems natural to look at inflation forecast survey data. There are three main surveys of inflation forecasts. The "Survey of Professional Forecaster" and the "Livingston Survey" elicit inflation expectations of professional forecasters working for the financial industry. Unlike the former two, the Michigan Survey of Consumer Attitudes and Behavior focuses on individual households and hence seems the most appropriate one since this model attempts to capture not only rational forecasters but also households that are prone to money illusion. Mankiw, Reis and Wolfers (2004) provide an interesting analysis of inflation expectations. Their study shows, among other things, that disagreement – measured by the interquartile range – slightly leads the median inflation expectation and steadily declines from 1983 onwards, with the exception of a blip in the early 1990s. Overlaying the plot with the house price-rent ratio shows that the disagreement explanation of this paper does a very good job for the 1970s, but is less convincing for the house-price frenzy that started in the late 1990s.

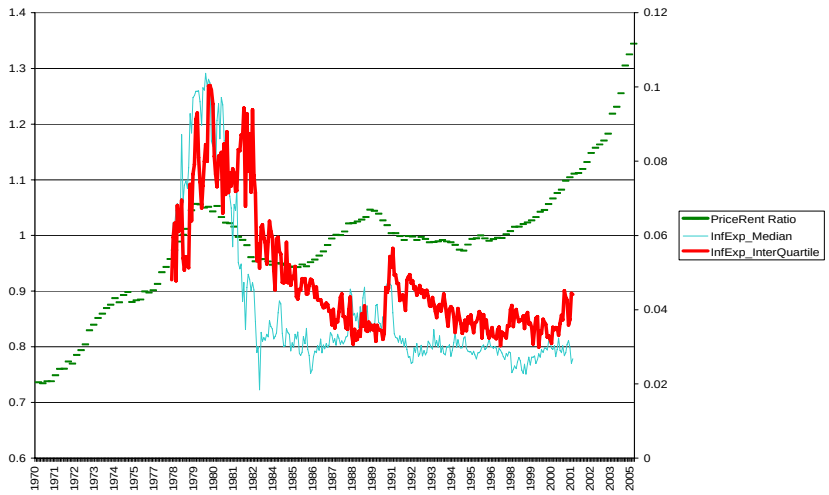

Figure 1: The green dashed line represents the house price-rent ratio (left scale). The thin blue line depicts the median inflation expectations from the Michigan Survey of Consumer Attitudes and Behavior as provided by Mankiw et al. 2004. The red line shows household disagreement measured as the interquartile range of inflation expectations.

However, simply looking at disagreement measures of inflation forecasts does not do full justice to this model since money illusion can take on very subtle forms. It might very well be that individuals – when asked – have a good estimate of inflation, but nevertheless fail to distinguish between nominal and real mortgage interest rates. Put differently, it is quite plausible that money illusion reflects a failure of the Fisher Equation – agents may ignore that real interest rates are roughly equal nominal interest rates minus inflation – rather than a biased inflation forecast. Hence, with a slight reinterpretation the authors' mechanism may still be compelling.

An Alternative Hypothesis for 1970s. Another unusual feature of the 1970s is that the house price-rent ratio – unlike in other periods – negatively comoves with the real mortgage interest rate. The price-rent ratio in the 1970s is above its trend when real mortgage rates are low (or even negative) and below its trend when real mortgage rates are high. This observation is consistent with the following alternative hypothesis: a sharp increase in inflation alerts households such that they subsequently correctly take inflation effect into account and focus on the real interest rate. On the other hand, a gradual change in inflation can easily go by unnoticed by a fraction of households. This alternative hypothesis suggests that in the 1970s the hedging aspect of housing against inflation risk and especially the tax-deductability of mortgage interest payments were driving housing demand. The fact that nominal mortgage interest payments are tax-deductible creates a huge incentive to buy a house and borrow money when inflation is high, an effect that was widely discussed at that time. It is therefore not surprising that house prices boomed (as emphasized in Poterba (1984) and Titman (1982)). Note also that this alternative hypothesis would also square nicely with Amihud's (1996) finding that the Modigliani-Cohn hypothesis does not hold for the Israeli stock market. High inflation in Israel may have alerted investors to the difference between nominal and real interest rates.

Loan-to-Value-Ratio. When disagreement is high, i.e. when either inflation is very high or fairly low, agents would be willing to leverage their housing investment more. One might therefore guess that the loan-to-value ratio should be higher in the 1970s and late 1990s. However, Japelli and Pagano (1989,1994) and Almeida, Campello and Liu (2006) document an average loan-to-value ratio of 89% for the 1980s which exceeds the 80% value registered in both the 1970s and 1990s. Since there are many caveats attached to these numbers, a more elaborate study of real estate leverage would be desirable. Of course, it might also be that banks act rationally and limit credit whenever real estate is overpriced, therefore reducing the average loan-to-value ratio.

Role of Intermediaries. There are no intermediaries in the model, even though they play a significant role in the mortgage market. Their importance was even more pronounced in the 1970s, before mortgages were securitized. While in the model irrational investors take the other side of the mortgage contract in a high inflation environment, in the 1970s, the banking sector, especially thrifts, took on a large part of the inflation risk. As inflation spiked, banks seemed to have lost a large fraction of their value, since they issued mortgages which were partially financed by short-term demand deposits (see e.g. White (1991)). Even though some thrifts were arguably poorly managed, I find it more plausible that professional bank managers were surprised by the inflation spikes and inadequately hedged rather than prone to money illusion.

Possible Extensions. The model could be extended in a variety of ways to gain further insights into the mechanism. Departing from the linear utility function specification would enrich the model in two ways. First it would allow studying the role of housing as a hedge against inflation risk. Second, one could also vary the intertemporal elasticity of substitution which may cause interesting wealth and feedback effects. Another possibility to augment the model is to allow for disagreement about future house prices. The authors abstract from this by assuming that the future house price is fixed at p'. If agents were to

disagree about the future house price p', current house prices would also increase in this disagreement measure. The reasoning is analogous to Miller (1977): Optimists push up house prices, while pessimists cannot push them back down since they face short-sale constraints.

Overall, the paper provides a very interesting U-shaped relation between the price-rent ratio and inflation by combining money illusion and disagreement about inflation with realistic collateral constraints and short-sale constraint on housing. The authors' focus on disagreement about inflation forecasts provides a novel explanation of why we observed relatively high house prices in the 1970s when inflation was high.

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