

HOUSING BUBBLE AND MONETARY POLICY IN U.S.

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ABSTRACT

This paper reviews the evidence of the link between monetary policy and the rapid rise in house prices that occurred in the early part of the last decade. A crucial point is the distinction between trend and cyclical movements in the housing market. Given that monetary policy have little impact on the economy over long-run, a large part of the run-up in house prices may be attributed to the slow but steady rise in the price of housing relative to that of other consumption goods. Moreover, the paper examines whether the conduct of monetary policy was appropriate through the estimation of simple monetary policy rules for the period from 1991:I to 2008:IV. Although the most rapid increases in house prices occurred when the short-term interest rates were at their lowest levels, the magnitude of house price gains seems too large to be explained by the conduct of monetary policy alone. The shifts in preferences away from consumption goods towards housing goods as well as the weak financial supervision seem to play an important role in this housing bubble.

JEL Classification: E52, C13, C30

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1. Introduction

There is recently a growing research interest in investigating whether the monetary authorities in US have played a significant role in the housing bubble that occurred in the early part of the last decade. Understanding the relationship between monetary actions and the housing market requires in fact the understanding of the monetary actions' transmission to the real economy, namely, the way that changes in the housing market affect monetary policy actions and how the monetary policy stance affects the link between real estate and the macro-economy.

The house prices in US had amazing performance during the period from 1970 to 2005. As it is pointed out by Iacoviello (2008), although the path over time of house prices in real terms appears to have been irregular, it is clearly seen that house prices have been on an upward trend well before the boom in the mid of the last decade. A house bought in 1970 in US could have been sold at the end of 2005 for twice as much, after adjusting for inflation. Data from other countries (with the exception of Germany and Japan) confirm the previous evidence. Indeed, in most developed countries throughout the 20th century, house prices have been on a constant upward trend, both in nominal and in real terms (see, e.g., Miles, 1992). This evidence has to be kept in mind when trying to loosely connect the stance of monetary policy with long-run trends in house values.

Despite this fact, the experience of the last 10 or 15 years in many developed economies appears somewhat more puzzling. The main reason is that the growth rate of house prices has increased, despite any significant increase in the growth rate of many other macroeconomic variables. It is therefore important to understand what risks the acceleration in house price inflation poses for the macro-economy.

The paper is organized as follows. Section 2 presents the related literature. Section 3 analyzes the conduct of monetary policy and the use of simple monetary policy rules. Section 4 presents the empirical analysis. Section 5 concludes the paper.

2. Literature Review

Nowadays there has been a great come back of interest in the issue of how to conduct monetary policy. One factor of this phenomenon is the huge volume of recent working papers and conferences on the topic. Another is that over the last years specific policy rules have been proposed by many leading macroeconomists. John Taylor's (1993) recommendation of a simple interest rate rule and the recent widespread endorsement of inflation targeting (e.g., Bernanke and Mishkin, 1997) are well known examples. Especially the so called Taylor rule has received considerable attention mainly due to the fact that it's simple and describes the actual behavior of the Federal Funds rate in the United States in a meaningful way. According to Taylor rule the central bank sets its nominal interest rate using current values of inflation and current values of the deviation of real output from its target level. This rule is characterized as active when the monetary authorities respond to increases in inflation with a more than one-to-one increase in the nominal interest rate.

The literature considering how monetary policy should address the development of an asset price bubble is quite large. A number of authors have argued that a central bank could increase their official interest rates somewhat in response to asset market misalignments even if the near-term inflation and output outlook did not warrant such actions. This "leaning against the wind" strategy, proponents argue, would limit the size of the bubble, and could be seen as buying insurance against a possible bad outcome (see, e.g., Cecchetti et al. 2000, 2002; Borio and Lowe, 2002).

Meltzer (2011) and Taylor (2012) set out a distinction between a "rules-based era", from 1985 to 2003, and an "ad hoc era", from 2003 to present. Over the rules-based era, a period characterized by inflation stabilization, the Federal Reserve's policy is well described by a simple Taylor rule whereby the Federal Funds Rate is set as a linear function of inflation and the output gap with coefficients of 1.5 and 0.5, respectively. Over the ad hoc era, a period devastated by the boom and bust in the housing market, the Federal Reserve's policy deviates from the Taylor rule. In particular, from 2002 to 2006 the Federal Funds Rate was 2-3 percentage points below the path prescribed by the Taylor rule for any period since 1980s (Poole, 2007; Taylor, 2007).

Leamer (2007) and Taylor (2007, 2010, 2011) argue that such a "Great Deviation" from rules-based policy making, resulting in a too accommodating monetary stance, was a major cause of the economic and financial crisis erupted in 2007, since it triggered boom-bust dynamics in house prices. On the contrary, Brito et al. (2012) demonstrate that house price instabilities can well occur even if the central bank follows monetary policy feedback rules of the Taylor type. The same argument is shared by Bernanke (2010) who suggests that the best response to the housing bubble would have been regulatory and not monetary. According to Dokko et al. (2009), monetary policy was not a primary factor in the housing bubble and a tighter monetary policy would not have been the best response to the bubble. Moreover, monetary policy actions in response to asset price

bubbles, above and beyond the effect that such bubbles may have on price stability and full employment, should be guided by several principles (see, e.g., Kohn, 2008).

3. House Price Movements and Monetary Policy in U.S.

This section quotes a brief review of the conduct on monetary policy in U.S. and examines whether the monetary policy was responsible for the house price movements.

3.1 *The conduct of monetary policy*

The Federal Reserve has three ways to expand or contract money and credit. The primary method is called open market operations and it involves the Fed buying existing U.S. Treasury securities (or those that have been already issued and sold to private investors). Second, the Fed can also change reserve requirements, controlling a portion of deposits that banks must hold as currency or on deposit at the Fed, which affects the available liquidity within the market. Finally, the Fed permits certain depository institutions to borrow from it directly on a temporary basis. That is, these institutions can “discount” at the Fed some of their own assets to provide a temporary means for obtaining reserves. Discounts are usually on an overnight basis. For this privilege they are charged an interest rate called, appropriately, the discount rate. The discount rate is set by the Fed at a markup over the federal funds rate (see, e.g., Labonte, 2013).

Because the Fed defines monetary policy as the actions it undertakes to influence the availability and cost of money and credit, this suggests two ways to measure the stance of monetary policy. One is to look at the cost of money and credit as measured by the rate of interest relative to inflation (or inflation projections), while the other is to look at the growth of money and credit itself. Thus, one can look at either interest rates or the growth in the supply of money and credit in coming to a conclusion about the current stance of monetary policy, that is, whether it is expansionary, contractionary, or neutral. Since the great inflation of the 1970s, most central banks have preferred to formulate monetary policy more in terms of the cost of money and credit rather than on their supply. The Federal Reserve thus conducts monetary policy by focusing on the cost of money and credit as proxied by an interest rate. Until financial turmoil emerged in 2007, a consensus had emerged among economists that a relatively stable business cycle could be maintained through prudent and flexible changes to interest rates via transparently communicated and signaled open market operations. That consensus broke down as the financial crisis worsened, and the Fed took increasingly unconventional and unprecedented steps to restore financial stability (see, e.g., Labonte, 2013).

As the U.S. economy was coming out of the short and shallow 2001 recession, unemployment continued rising until mid-2003. Due to the fear that the economy would slip back into recession, the Fed kept the federal funds rate extremely low. The target federal funds rate was lowered quickly in response to the 2001 recession, from 6.5% in late 2000 to 1.75% in December 2001 and to 1% in mid-2003. As the expansion continued and prices began to rise, the target federal funds rate was slowly increased in a series of moves to 5.25% in mid-2006 (see, Bernanke, 2010).

According to some economists, the financial crisis was, at least in part, due to Federal Reserve accommodative policy for a considerable period (see, e.g., Henderson, 2009). In particular, critics now claim that the low short-term rates were kept too low for too long after the 2001 recession had ended, and this caused an increased demand for housing that resulted in a “price bubble.” The shift in financing housing from fixed to variable rate mortgages made this sector of the economy increasingly vulnerable to movements in short-term interest rates. Moreover, critics argue that one consequence of the tightening of monetary policy later in the decade was to burst this “price bubble”. On the contrary, Bernanke (2005) believes that the low mortgage rates that helped fuel the housing bubble were mainly caused by a “global savings glut” over which the Fed had little control.

The bursting of the housing bubble led to the onset of a financial crisis that affected both depository institutions and other segments of the financial sector involved with housing finance. The lack of credit soon had a negative effect on both production and aggregate demand. In December 2007, the economy entered a recession. As the spillover effects from the housing slump to the financial system, as well as its international scope, became apparent, the Fed responded by reducing the target federal funds rate and the discount rate (see, e.g., Labonte, 2013). Beginning on September 18, 2007, and ending on December 16, 2008, the target was reduced from 5.25% to a range between 0% and 0.25%, where it currently remains.

3.2 *Simple Monetary Policy Rules for U.S.*

Dokko et al. (2009), in order to gauge whether the settings of federal funds rate were “loose” or “tight”, focus on versions of Taylor rules of the following form

$$i_t^* = a + \beta(\pi_t - \pi^*) + \gamma \tilde{y}_t \quad (1)$$

where i_t^* is the nominal federal funds target rate, π_t is the inflation measured by the four-quarter growth rate of a price index, π^* is the inflation target assumed to be 2% and $\tilde{y}_t$ is the output gap measured by a percentage deviation of real GDP from its potential level. The parameter a is the desired nominal interest rate when inflation and output are at their target values ($a = r^* + \pi^*$) with r^* being the long-run equilibrium real interest rate. Taylor showed that this rule provides a reasonable good description for the period 1987-1992 setting the following values for the parameters: $r^* = 2$, $\beta = 1.5$ and $\gamma = 0.5$.

According to this rule and measuring inflation using the consumer price index (CPI), Dokko et al. (2009) agree that monetary policy was too easy during the period 2002 to 2006 as the actual federal funds target rate is below the values implied by the Taylor rule by about 2%. But the calculations based on other measures of inflation or on real time data may differ than previous. Indeed, when they use the real-time core personal consumption expenditures (PCE) price index and the real-time output gap they found that the calculated rate is closer to the actual federal funds target rate.

Moreover, due to the fact that it is important to place the magnitude of deviations of nominal Fed funds rate from the nominal interest rate implied by simple policy rules, they calculate a set of Taylor rules taking into account alternative measures of inflation and output gap for the period 1965 to 2008. These calculations show clearly that the deviations of the nominal Fed funds rate from the range of prescriptions from these rules were significant prior to 1987 reflecting the weak policy response to the rise in inflation in the 1970s and the aggressiveness of the disinflation under the Volcker's tenure, after the third quarter of 1979. More specifically, the nominal Fed funds rate was below the nominal interest rate range implied by these policy rules. Although the deviations in the period since then have been smaller, it is worth noting that the Fed funds rate was below the implied range from 2003 to 2005.

Taking into consideration the fact that monetary policy works with a lag, the policy decisions must be forward looking (see, e.g., Bernanke, 2010; Clarida et al., 1999). This means that the policy instrument of the Fed has to react to expected deviations of inflation and output from their target levels. Using inflation forecasts over the current and subsequent three quarters, Bernanke (2010) gives evidence that this alternative Taylor rule prescribes a path for policy that is much closer to that followed throughout the past decade. So, when taking into account that monetary authorities should and do respond differently to temporary and longer-lasting changes in inflation, monetary policy following the 2001 recession appears to have been reasonably appropriate compared to a simple policy rule.

This paper extends these simple policy rules analyzing whether these rules can be augmented with a financial stress index containing information from some asset prices and financial variables (see, e.g., Castro, 2011). Namely, it examines whether the U.S. monetary authorities have followed a stabilizing policy towards to inflation, output and financial conditions of the economy. Despite the apparent risk financial stress poses to the real economy, the relationship between financial stress and economic activity is complex and not well understood (see, e.g., Davig and Hakkio, 2010). The paper assumes the following augmented version of a forward-looking Taylor rule:

where $E_t(\cdot) \equiv E(\cdot | \Omega_t)$ is the conditional on the current information set of the economy at time t , denoted as Ω_t , π_{t+n} is the rate of inflation n -periods ahead, $\tilde{y}_{t+k}$ denotes the real output gap k -periods and $\tilde{z}_{t+l}$ the financial stress index l -periods ahead.

Taking into account the smoothing attitude of the Fed implying that the actual level of nominal rate, denoted as i_t , is adjusted partially to its target level i_t^* as follows:¹

$$i_t = (1 - \rho)i_t^* + \rho i_{t-1} + \varepsilon_t$$

where ε_t is an i.i.d. (independent and identically distributed) error term with zero mean and the autoregressive parameter ρ captures the degree of smoothness in interest rate process i_t . So, the monetary policy rule given by equation (2) can be written as follows:

In this form, the forward monetary policy rule implies that the CB adjusts the current level of its policy instrument i_t only by a fraction $(1 - \rho)$ of the expected deviations of inflation from its target level, expected output gap $E_t(\tilde{y}_{t+k})$ and expected deviations of the financial stress index $E_t(\tilde{z}_{t+l})$. The remaining fraction is an adjustment driven by its previous periods' policies.

¹ See, e.g., Clarida et al (1999). The tendency of central banks to smooth changes in short term interest rates stems from various reasons as the fear of instability of capital markets, the loss of credibility from sudden large policy reversals or the need for consensus building to support a policy change. Moreover, the central banks may regard interest rates smoothing as a learning device due to imperfect market information.

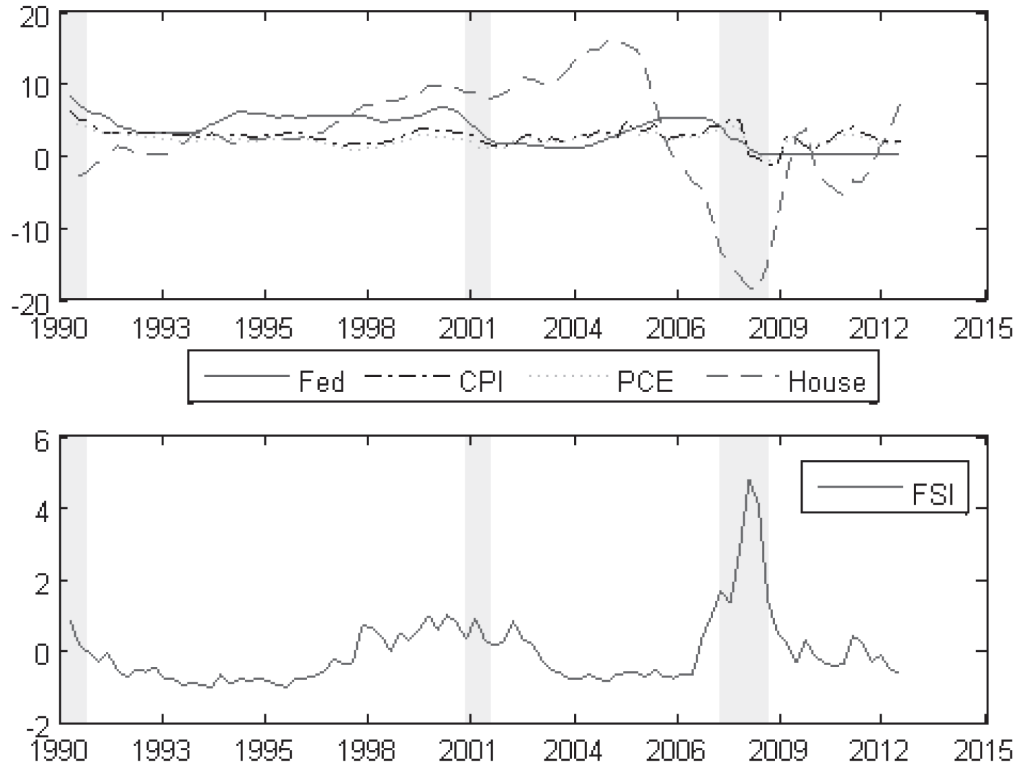
4. Empirical Analysis

This section reports estimates of alternative monetary policy models based on equation (3) for U.S. The Fed has received by government a significant degree of independence in conducting monetary policy and has announced its commitment on targeting inflation since the seventies, where the U.S. economy has started experiencing very high inflation rates (see, e.g. Clarida et al., 1999).

4.1 Data

The data set consists of quarterly observations from 1991:I to 2012:IV on the four variables of the monetary policy model, namely the short term interest rate i_t , inflation rate π_t , output gap $\tilde{y}_t$ and financial stress index $\tilde{z}_t$. As short rate i_t , we consider the average Federal Funds rate in the first month of each quarter expressed at annual rates. Inflation rate π_t is measured as the annual rate of the consumer price index (CPI) or the personal consumption expenditure (PCE) index at the last month of each quarter, defined as $P_t = \frac{\text{nominal } GDP_t}{\text{real } GDP_t} \cdot 100$, i.e. $\pi_t = \frac{P_t - P_{t-4}}{P_{t-4}} \cdot 100$. The output gap $\tilde{y}_t$ is measured as the percentage change of the real GDP with respect to potential real GDP i.e. $\tilde{y}_t = \frac{\text{real } GDP_t - \text{real potential } GDP_t}{\text{real potential } GDP_t} \cdot 100$. The real GDP and real potential GDP are expressed in annual rates with the year 2005 being the base year. Finally, financial stress is measured using the Kansas City Federal Reserve's Financial Stress Index (KCFSI) at the last month of each quarter. The KCFSI has a mean of zero and a standard deviation of one. Thus, when the KCFSI exceeds zero, financial conditions are more stressed than average. Moreover, we use national composite home price index for the U.S. All data were downloaded from the Federal Reserve Bank of St. Louis.

Figure 1: Fed funds rate, CPI inflation, PCE inflation, nominal House price inflation and Financial Stress Index.



Note: Shaded areas indicate recessions.

Figure 1 shows the annual increase in nominal house prices from 1991 to the present. After some years of slow growth, U.S. house prices began to rise more rapidly in the late 1990s. Prices grew at a 7 to 8 percent annual rate in 1998 and 1999, and in the 9 to 11 percent range from 2000 to 2003. Thus, the beginning of the run-up in housing prices predates the period of highly accommodative monetary policy. Shiller (2007) dates the beginning of the boom in 1998. On the other hand, the most rapid price gains were in 2004 and 2005, when the annual rate of house price appreciation was between 15 and 17 percent. CPI and PCE inflation movements are similar with the Fed funds rate to have an aggressive reaction to these movements. Moreover, regarding the FSI index we observe that monetary authorities loose their stance during periods of financial stress, namely when the FSI takes positive values, especially in 2000s. This means that monetary policy in U.S. takes into consideration not only the issues of price and output stability but also the issue of financial stability.

In order to give evidence to this result three alternative Taylor-type rules are estimated according to relationship (3) for the period from 1991:I to 2008:IV. The first rule (Rule I) is a backward-looking augmented Taylor rule ($n=k=l=1$). This means that the nominal interest rate reacts to deviations of inflation, output and financial conditions from their target levels over the previous quarter. The second rule (Rule II) is a forward-looking augmented Taylor rule with $n=k=1$ and $l=0$. This means that the nominal interest rate reacts to the expected deviations of inflation and output from their target levels over a quarter ahead and to financial conditions over the current quarter. Finally, the third rule (Rule III) is the second rule without the financial stress index.

Table 1: Estimates of the alternative models

	Rule I	Rule II	Rule III
α	2.53*** (0.62) [4.09]	2.29*** (0.40) [5.67]	2.55*** (0.83) [3.08]
β	0.92** (0.44) [2.10]	2.24*** (0.33) [6.77]	2.13*** (0.72) [2.95]
γ	1.76*** (0.42) [4.18]	1.05*** (0.17) [6.27]	1.00*** (0.32) [3.16]
δ	-5.07*** (1.29) [3.92]	-1.77*** (0.2) [8.85]	
ρ	0.90*** (0.025) [35.83]	0.88*** (0.011) [78.69]	0.85*** (0.04) [20.17]
$Adj.R^2$	0.96	0.91	0.90
J-stat (p-value)		6.73 (0.82)	13.32 (0.10)
Quandt-Andrews test (Maximum LR F-statistic)	4.67*** (2001:II)		

Notes: The reported estimates in forward-looking models (II) and (III) are obtained based on the GMM estimation procedure using the Newey-West optimal weighting matrix with 4 lags. Standard errors are in parentheses and t-statistics are in brackets. J-stat stands for the over-identifying parameters test statistic. ***, **, * denote 1%, 5%, 10% significance.

The estimates of the two forward-looking rules are obtained based on the generalized method of moments (GMM) estimation procedure which considers the following moment (orthogonality) conditions:

$$E\left[i_t - (1 - \rho)(\alpha + \beta\pi_{t+n} + \gamma\tilde{y}_{t+k} + \delta\tilde{z}_{t+l}) - \rho i_{t-1} \mid \mathbf{h}_t\right] = \mathbf{0},$$

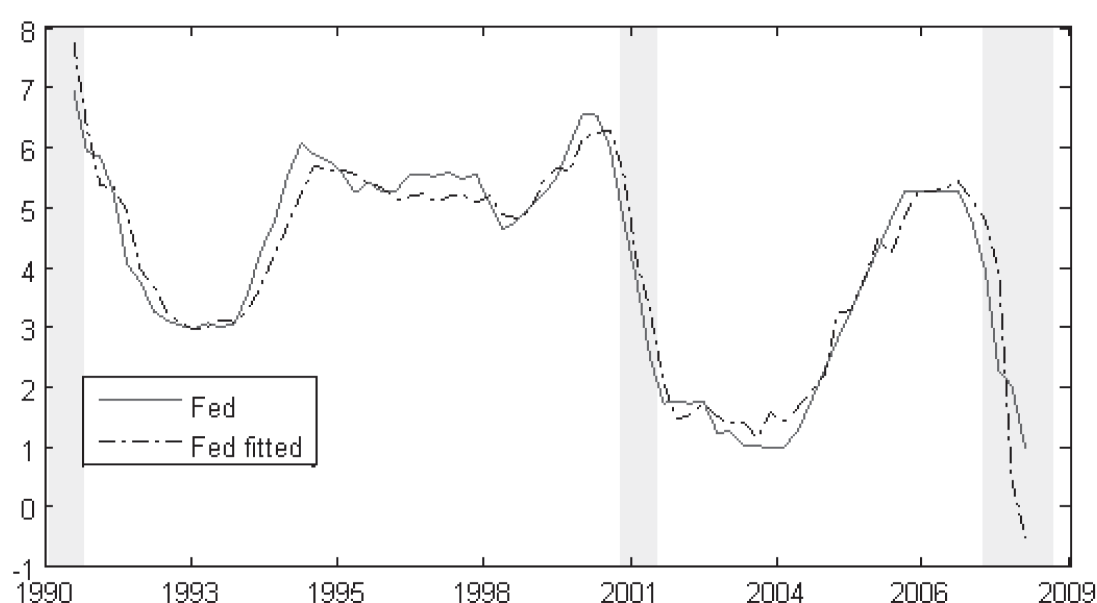
where $\mathbf{h}_t$ is a vector of instrumental variables. In our analysis, this vector includes the constant and one up to four lagged values of the following variables: π_t , $\tilde{y}_t$ and $\tilde{z}_t$. Moreover, two to four lagged values of nominal interest rate i_t are used. Instead of expected values of inflation and output their realized values are used over a quarter ahead.

Table 1 presents the estimates of the alternative Taylor rules². All estimates are statistical significant at the conventional levels. The first rule, backward-looking rule, states that the reaction of monetary authorities was passive towards to inflation as the coefficient β is less than unity and active towards to output gap and financial conditions ($\gamma > 1$ and $\delta < -1$). The Quandt-Andrews test gives evidence to a significant regime switching in the conduct of monetary policy in the second quarter of 2001 something that has to be taken into consideration in a future research (see, e.g., Kazanas et al., 2011).

The estimates of the other two forward-looking rules reveal the strong attitude of the monetary authorities to stabilize the deviations of inflation and output from their target levels ($\beta > 1$ and γ marginally higher or close to unity). The set of instruments is valid as according to the J-statistic of Hansen the null hypothesis of overidentifying restrictions is satisfied. Moreover, the $Adj.R^2$ is in favor of Rule II something that means that the financial stress index plays a significant role in the conduct of monetary policy for the period under scrutiny.

Figure 2 presents the actual values of the Fed funds rate as well as the fitted values based on Rule II. It's clearly seen that the Taylor Rule II prescribes a path for policy that is close to that followed throughout the examined period. The monetary policy becomes looser when the economy enters to recessionary conditions and seems to remain loose for a significant period after the end of recession so that the sustainability of growth to be achieved. So, the results of this study seems to confirm the Bernanke's (2010) view that the monetary authorities followed the appropriate policy taking into consideration the general macro-economic and financial conditions.

Figure 2: Actual and fitted Fed funds rate from Rule II.



Note: Shaded areas indicate recessions.

5. Conclusions

This paper reviews the evidence of the link between monetary policy and the rapid rise in house prices that occurred in the early part of the past decade. The direct linkages seem to be weak. When the policy makers take into consideration the expected changes in inflation and other economic variables and when the policy makers' responses depend on whether these changes are expected to be temporary or longer lasting the followed monetary policy seems to be appropriate. House prices began to rise in the late 1990s, and although the most rapid price increases occurred when short-term interest rates were at their lowest levels, the magnitude of house price gains seems too large to be readily explainable by the stance of monetary policy alone. Moreover, cross-country evidence shows no significant relationship between monetary policies and the pace of house price increases (see, e.g., Bernake, 2010).

²The reported estimates are based on CPI inflation. The use of PCE inflation gives similar results.

The most important source of this house boom was not the level of short-term interest rates but the increasing use of more exotic types of mortgages and the associated decline of underwriting standards. So, the best response to the housing bubble would have been regulatory, not monetary. Building risk concentrations and inadequate risk-management practices could have more effectively addressed by regulators, supervisors and the private sector without any judgment about the sustainability of house prices increases to be needed. This means that financial regulation and supervision weren't ineffective for controlling emerging risks, but their execution should be better and smarter (see, e.g., Bernanke, 2010; Dokko et al., 2009)

The final conclusion is that the role of monetary policy in addressing bubbles is minor. Even if interest rate increases in 2003 or 2004 were sufficient to constrain the bubble they could have seriously weakened the economy at just the time when the recovery from the previous recession was established. The monetary policy must be used as a supplementary tool for addressing these risks and more efforts should be made to strengthen the regulatory system in order to prevent a recurrence of the crisis.

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