

Should the Fed Have Followed the Rule?

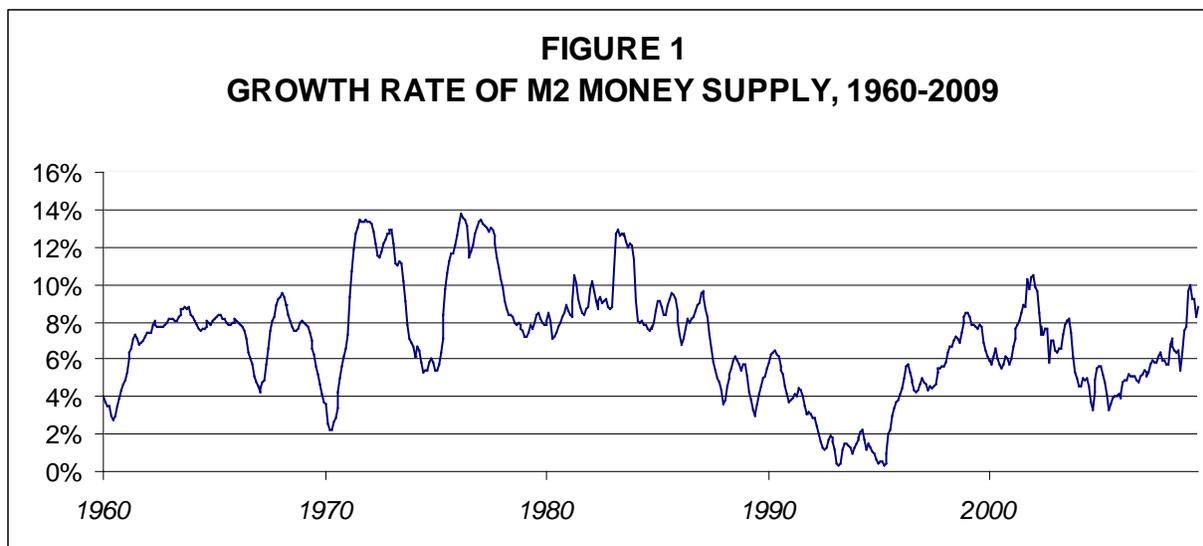
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Beginning in 2007, the US economy began experiencing its worst financial crisis since the 1930s. It's generally agreed that the financial crisis began with the bursting of the housing bubble. Though there are many factors that played a role, the focus of this study is the role of monetary policy in contributing to the housing bubble. Using Taylor's rule as a benchmark, monetary policy was found to be "too loose." Further, the degree of looseness was found to significantly affect housing prices, contributing to about half of the increase in housing prices from 2001 to 2007. Even if one allows for the Fed to conduct looser monetary policy than usual in the aftermath of the terrorist attacks of September 11, a quicker response to the clear strengthening of the economy in 2003 would have significantly reduced the increase in housing prices, taking the air out of the bubble before it could burst.

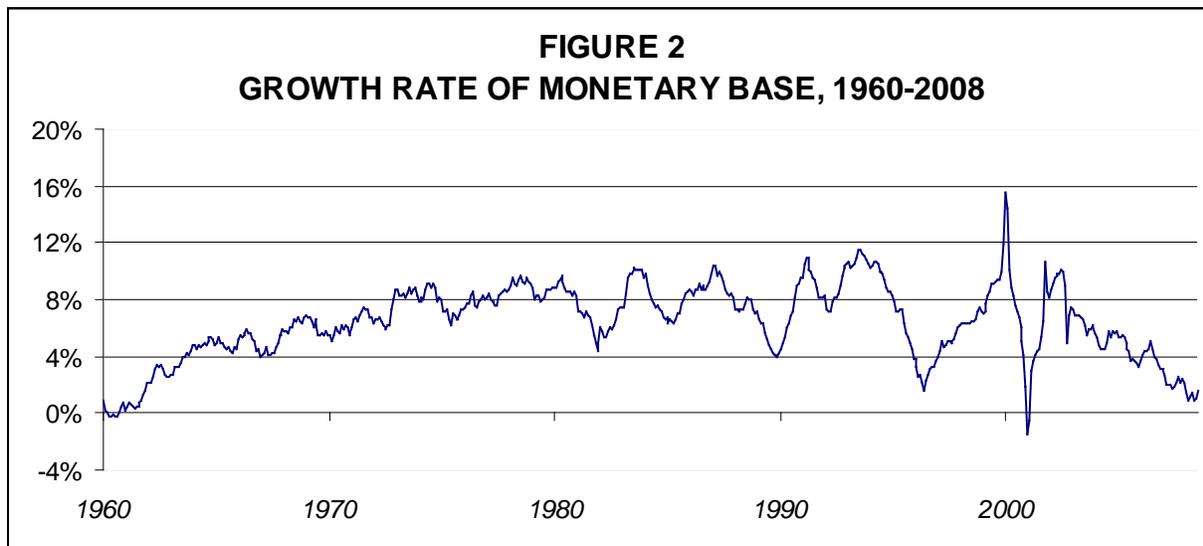
INTRODUCTION

Beginning in 2007, the US economy began experiencing its worst financial crisis since the 1930s. It's generally agreed that the financial crisis began with the bursting of the housing bubble. The question arises, what led to the housing bubble? Many causes have been cited including risky lending by banks, risky borrowing by consumers, abuse of credit default swaps, lax enforcement by regulators, etc (for example, see Rodrik, 2008 and Blinder, 2009). Many have also blamed the Federal Reserve for making credit too easy for too long earlier in the decade (Taylor, 2007). This study explores whether monetary policy was indeed too easy and, if so, did it contribute to the housing bubble?

There are different ways to assess whether monetary policy was too easy. A traditional measure is the growth of the money supply. The chart below shows the growth in the M2 measure of the money supply from 1960 to June 2009.



Inspection of the data for the period from 2001-2005 does not suggest higher growth in the money supply relative to the overall period or other post-recession periods since 1960. The average annual growth in M2 has been about 7% annually during the last fifty years whereas it ranged between 6 and 8% in the years following the 2001 recession before moving to less than 5% in the mid-2000s. A look at the growth of the monetary base also does not indicate loose policy compared to the period as a whole.



However, the use of the money supply as a gauge of monetary policy has been in doubt since the early 1990s (for example, the Fed ceased reporting targets for growth in the money supply beginning in 1993 - see Asso, Kahn and Leeson, 2007). Instead of the monetary base or the money supply, one can look at whether the federal funds rate was kept too low for too long. This raises the question – too low compared to what? A benchmark must be developed with which to compare it. In this study, we will make use of Taylor’s rule to help answer this question.

Alan Greenspan (2009) has defended Fed policy by stating that lower 30-year mortgage rates contributed to the housing bubble, not a low federal funds rate. He cites evidence of a high correlation between 30-year fixed-rate mortgages and housing prices, with a lead of 11 months. According to Greenspan, whereas monetary policy significantly affected fixed-rate mortgages in previous decades, the relationship was insignificant during the period of 2002-2005. Thus, though the Fed raised the federal funds rate beginning in 2004, mortgage rates didn't follow. What kept mortgage rates low according to Greenspan? Excess global savings from nations such as China were plowed into long-term bonds. However, adjustable-rate mortgages, which are more closely correlated to the federal funds rate than are 30-year fixed-rate mortgages, became a higher portion of the mortgage market during the period. The share of ARMs was 34% in 2004 and rose to 46% of new mortgages in 2005 (Li and Weagley, 2007). Thus, despite Greenspan's assertion, it is reasonable to think that the federal funds rate would be expected to have had a significant effect on the housing market through its effect on adjustable-rate mortgages.

Why did the Fed choose to lower interest rates in 2003 and keep them low? Alan Greenspan cites his risk management approach to monetary policy as the reason. In a speech at a symposium sponsored by the Kansas City Fed, Greenspan (2005) described the application of risk management to monetary policy during the period in question. "In the summer of 2003, for example, the Federal Open Market Committee viewed as very small the probability that the then-gradual decline in inflation would accelerate into a more consequential deflation. But because the implications for the economy were so dire should that scenario play out, we chose to counter it with unusually low interest rates. The product of a low-probability event and a potentially severe outcome was judged a more serious threat to economic performance than the higher inflation that might ensue in the more probable scenario. Given the potentially severe consequences of deflation, the expected benefits of the unusual policy action were judged to outweigh its expected costs." In essence, Greenspan considered the consequences of deflation, though unlikely, as justification for reducing the federal funds rate to a very low level.

TAYLOR'S RULE

When seeking to determine whether the federal funds rate was reduced too much and/or kept too low for too long, one needs to obtain a benchmark with which it can be compared. A popular rule used by economists is Taylor's Rule. Former president of the Saint Louis Fed, William Poole (2007) describes Taylor's rule as a useful and accurate guide to monetary policy. In addition, the Saint Louis Fed reports estimated value for the federal funds rate in its publication, *Monetary Trends* each month. Reports indicate that members of the Fed as well as its staff cite Taylor's rule during FOMC meetings (Asso, Kahn and Leeson, 2007). Thus, Taylor's rule seems to be a reasonable benchmark to use when examining monetary policy.

Taylor's rule basically says that the optimal federal funds rate should be associated with the inflation and output gaps where the inflation gap is inflation minus the inflation target and the output gap is the percent difference between GDP and its potential. The first part is pretty straightforward: if inflation exceeds its desired level, the Fed should raise its target for the federal funds rate to curb demand, thus reducing pricing pressures and inflation. The latter term requires more explanation. A positive output gap indicates that GDP exceeds its potential, thus putting upward pressure on inflation. Why? If the economy is exceedingly strong (as indicated by GDP exceeding its potential), resources become more scarce which makes them more expensive. For example, if GDP exceeds its potential, unemployment will be at a very low level

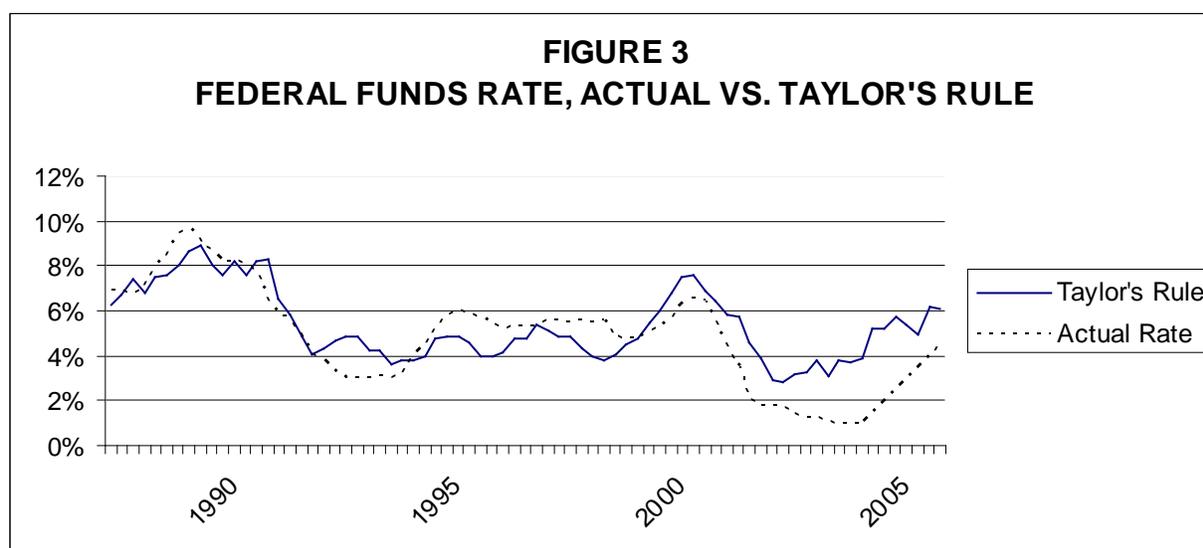
leading to a more rapid increase in wages. The higher wages increase the cost of doing business resulting in an increase in inflationary pressures. The Saint Louis Federal Reserve publishes a version of Taylor's Rule in *Monetary Trends* each month. The model they use can be described by equation (1):

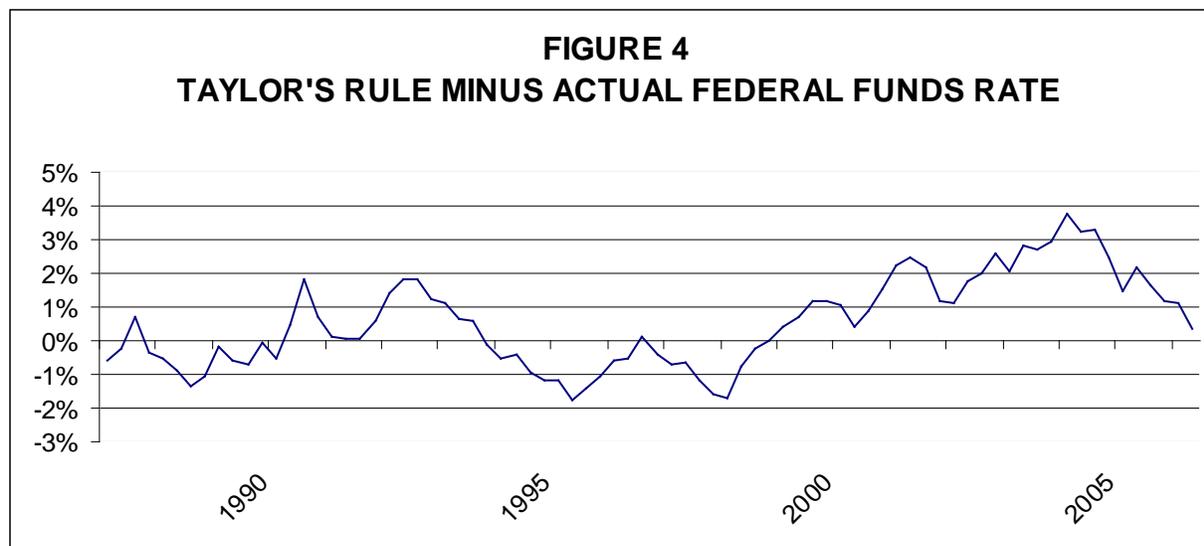
$$f = 2.5 + \pi + 0.5(\pi - \pi^*) + 0.5 \text{ output gap} \quad (1)$$

The first number represents what's perceived to be the long-term equilibrium real federal funds rate estimated to be 2.5%. In order to convert it to nominal terms, inflation is added. The latter two terms are the inflation and output gaps, respectively. To measure inflation, the Saint Louis Fed uses the personal consumption expenditure index. Several possible inflation targets are employed, ranging from a low of 1% to a high of 4%. Though the Fed doesn't explicitly state a target, in early 2009, it implied that its target is about 2% (Reddy, 2009). Minutes from the Federal Open Market Committee meeting of January 2009 included the following statement: "Longer-run projections represent each participant's assessment of the rate to which each variable would be expected to converge over time under appropriate monetary policy and in the absence of further shocks." The consensus of FOMC participants called for a range from 1.7 to 2% with a median and mode of 2%. Thus, in this study, we use 2% as the target.

Quarterly data from 1999 to 2008 were obtained for each of the respective variables from the online database at Federal Reserve Bank of St. Louis (known as FRED). The federal funds rate is the average during the quarter. The output gap is the percentage difference between actual real GDP and potential real GDP as estimated by the Congressional Budget Office. Inflation is measured as the percent increase in the PCE price index over the preceding four quarters.

The chart below plots the federal funds rate as suggested by Taylor's rule and the actual federal funds rate from the third quarter of 1987 to the first quarter of 2006 (roughly equivalent to Greenspan's tenure as chair of the Fed).





As one can see, Taylor's rule was very accurate in describing Fed behavior from 1987-1992 and reasonably accurate through the rest of the 1990s. However, beginning in 1999-2000, the federal funds rate remained below that suggested by Taylor's rule with the difference becoming quite significant beginning in 2002. A weakening economy as well as declining inflation justified a lower federal funds rate, but it appears that the Fed responded too much (perhaps due to the risk management approach advocated by Alan Greenspan). This raises the question, does the artificially low federal funds rate (measured as the difference between the rate suggested by the Taylor's rule and the actual federal funds rate) help explain the rapid increase in housing prices in the 2000s? Did an artificially low federal funds rate lead to low ARMs and thus contribute to the housing bubble?

EMPIRICAL MODEL

Though there are different strands of research used to explain the behavior of housing prices, most studies consider the impact of fundamental determinants of housing demand to explain prices. Similar to Pages and Maza (2003), we employ a model relating housing prices to past behavior of housing prices, disposable income and interest rates.

$$\% \Delta Ph = B_0 + B_1 \% \Delta Ph_{-1} + B_2 \log Ph_{-1} + B_3 \log Yd + B_4 \text{ mortgage}_{-4} + B_5 \text{ interest rate gap}_{-4} \quad (2)$$

Where:

- Ph is the housing price index (FHFA purchase-only house price index)
- Yd is real disposable income per capita
- Interest rate gap is the difference between the federal funds rate and that suggested by Taylor's rule as described above.
- Mortgage is the average thirty-year fixed-rate mortgage

The first term accounts for the persistence of housing prices in assessing whether rising housing prices lead to further increases in housing prices (B_1 is expected to be positive). Stein (1995) highlights the role of past increases in housing prices leading to further increases in

housing prices. This occurs in part since many people use existing equity in their homes to purchase new homes. If housing prices are already high, further increases are expected to be lower (B_2 is expected to be negative) since demand for housing is expected to be inversely related to its price (Higgins, et. al., 1999). Increases in disposable income increases the demand for housing leading to an increase in housing prices (B_3 is expected to be positive). The last two terms represent the effect of interest rates on housing prices. The four-quarter lags for both variables correspond to what is cited by Alan Greenspan (2009) in his analysis of previous studies as well as the optimal lag resulting from the application of Akaike's Information Criteria to analysis of the data (see Kennedy, 1998). The mortgage rate would be expected to have a negative impact on housing prices as higher mortgage rates lead to lower demand for housing and thus lower home prices, everything else equal.

The final term is the focus of this study. One would expect that interest rates affect housing demand and thus housing prices. However, the question is did artificially low interest rates implemented by the Fed contribute to rising housing prices? The coefficient on the interest rate gap provides an indication as to the role that monetary policy helped cause the housing bubble. A significant coefficient would suggest a role while the size of the coefficient would provide evidence of the size of its impact.

EMPIRICAL RESULTS

The model was estimated using OLS and checked for standard econometric problems. ARCH effects were detected and thus the model was re-estimated to correct for ARCH effects. The existence of ARCH effects is common when analyzing financial data due to the correlation of the variance over time (Kennedy, 1998). The results can be seen in table 1.

TABLE 1
EMPIRICAL RESULTS

Variable	Coefficient (t-stat)
Constant	-149.550 ^{***} (2.35)
% Δ Ph ₋₁	1.076 ^{***} (22.23)
Log Ph ₋₁	-8.794 ^{***} (6.96)
% Δ Yd	-0.022 (0.21)
Log Yd ₋₁	19.189 ^{***} (2.89)
Mortgage ₋₄	-0.274 [*] (1.71)
Interest Rate Gap ₋₄	0.319 ^{***} (2.76)
$R^2 = 0.99$	

***indicates 1% level of significance, ** 5%, * 10%

Variance Equation	Coefficient (t-stat)
Constant	-0.001 (0.23)
ARCH	-0.159 (1.10)
GARCH	1.291 ^{***} (4.70)

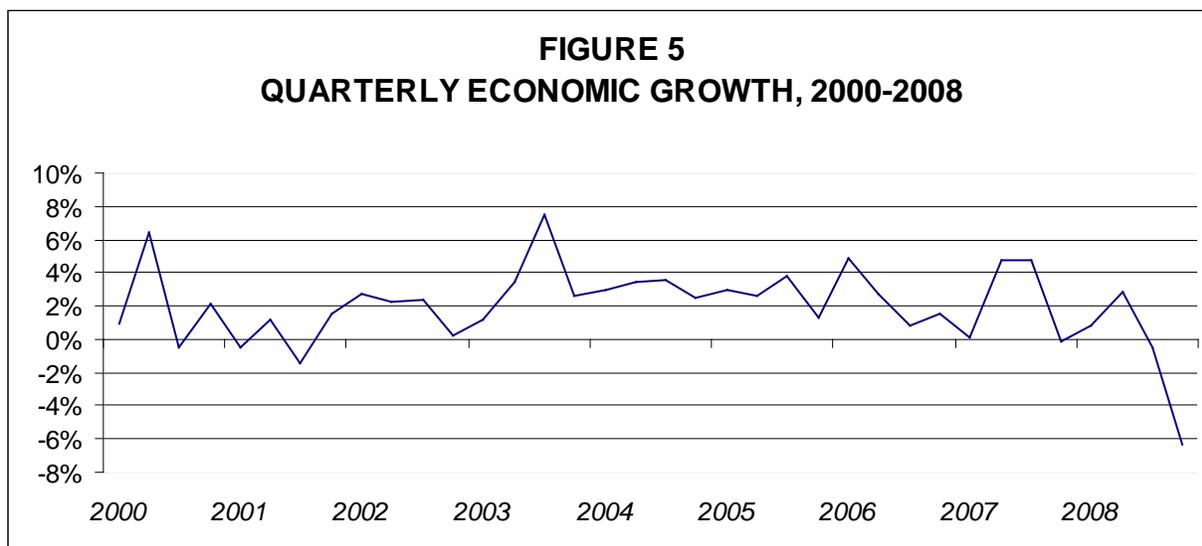
***indicates 1% level of significance, ** 5%, * 10%

Virtually all the results were as expected. Persistence in price movements was evidenced by a highly significant relationship between the growth in housing prices and its lag. Also, the lagged value of the log in the housing price was negative and significant. With regard to disposable income, the lagged value of the log of disposable income was highly significant in explaining housing prices though the growth in disposable income was not. As expected, the rate on the thirty-year mortgage was negatively related to housing prices.

Most important for this study, the difference between the federal funds rate and that suggested by Taylor's rule was positive and highly significant in explaining the behavior of housing prices. This suggests that loose monetary policy did indeed contribute to higher housing prices. However, it's important to determine how much of an effect it had. Was the impact very minor or more noticeable and thus a significant contributor to the housing bubble? One cannot just look at the coefficient since it doesn't account for the magnitude of the difference between the federal funds rate and Taylor's rule. Also, since persistence in housing prices were detected, if monetary policy contributed to higher housing prices in one period, the effect would be expected to continue for a period of time. Thus, the estimated model was simulated to assess the total impact of monetary policy on housing prices (see figure 6). If the federal funds rate was equal to that suggested by Taylor's rule, housing prices would not have risen as much. Specifically, instead of the index rising from 147 in early 2001 to above 230 in Spring 2007 (an increase of about 56% or about 7.5% per year), it would have only risen to about 183 (an increase of 24.5% or 3.5% per year). This suggests that loose monetary policy was a major contributor to the housing bubble.

An alternative way to examine the issue is to consider how monetary policy may have been modified given the economic and political events of the decade. Specifically, the Fed lowered the federal funds rate by fifty basis points to 1.75% in response to the attacks of September 11, 2001. One can justify this move given the economic risk posed by that event. This resulted in a lower rate than pure economic fundamentals would have suggested (and was not incorporated into Taylor's rule). Poole (2007) cites the ability to use Taylor's rule while making adjustments given such events as September 11. The weak economic recovery led the Fed to reduce the federal funds rate by another fifty basis points in November 2002 and an additional 25 basis points on June 25, 2003, resulting in a federal funds rate of 1% until June 2004. Beginning on June 30, 2004, the Fed raised the federal funds rate by 25 basis points at each FOMC meeting until it reached 5.25% in June 2006. Meanwhile, the weak economic recovery strengthened considerably with economic growth of 3.5% in Spring 2003 rising to 7.5% in the summer of 2003 (see figure 5). This suggests that the last interest rate cut was probably not necessary and also calls into question the prior cut (in late 2002) since monetary policy is known to act with a lag. In addition, one would have expected that the strengthening of the economy which began in the Spring of

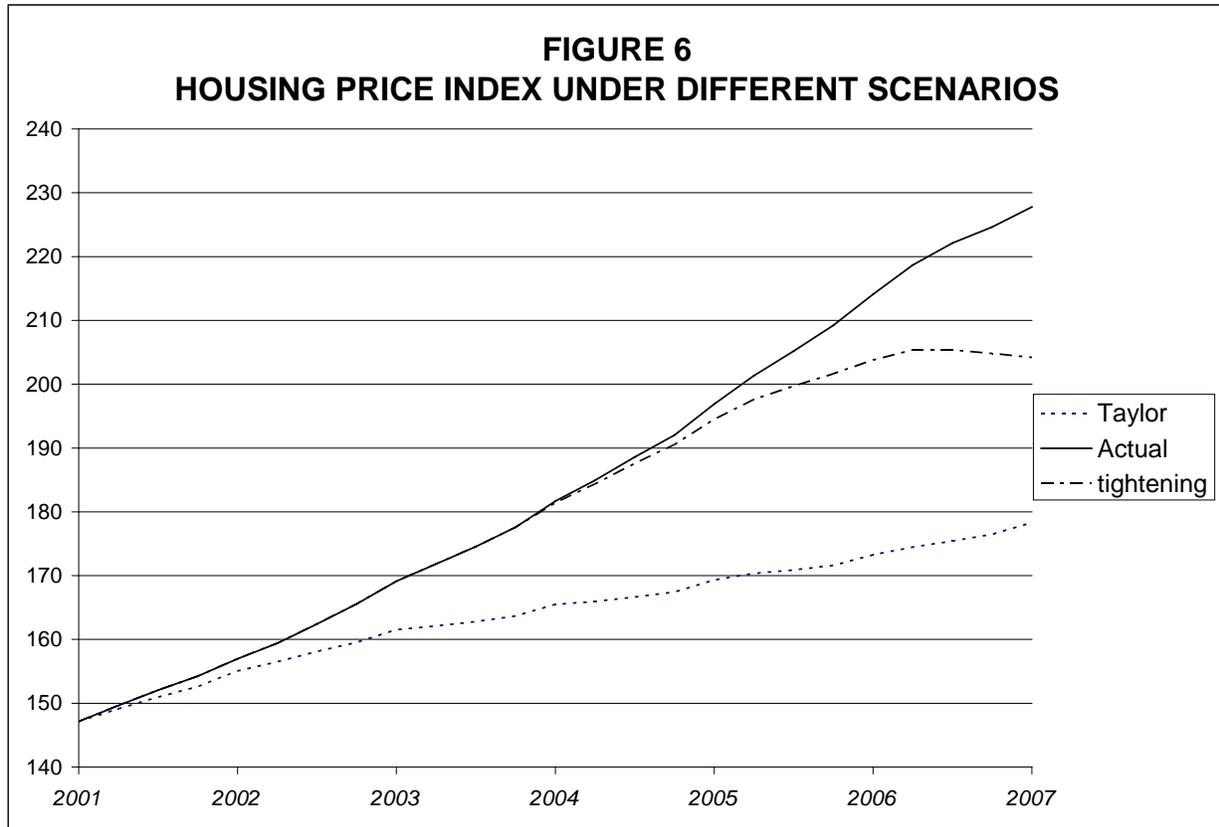
2003 would have led the Fed to raise the federal funds rate sooner and/or more quickly than it did.



Note: figures are seasonally adjusted annual rates

Given this context, a second simulation is undertaken assuming the Fed loosened policy in response to September 11, but didn't make any further interest rate cuts. In addition, the simulation assumes it began to raise interest rates once a strong economic recovery became evident. In fact, in the FOMC's statement released following its December 9, 2003 meeting, it states "The evidence accumulated during the intermeeting period confirms that output is expanding briskly..." (FOMC, 2003). Thus, the FOMC decided to keep the federal funds rate at a very low level despite recognizing that the economy was growing briskly. In this simulation, we assume that it started raising rates in the fourth quarter of 2003 with further increases in interest rates until it reached the rate suggested by Taylor's rule (25 basis points at each meeting until 2005).

This simulation allows for the Fed to have responded to the crisis of 2001 but then tighten policy as economists would expect once there were clear signs of economic strength. Under this scenario, the housing price index peaks at about 205 (39.5% increase from 2001-2007 or 5.6% per year). Though this still leads to higher housing prices than if it followed Taylor's rule throughout the entire period, it would have limited the increases in housing prices while still allowing for a response to September 11 and a delay in tightening until economic strength was clearly evident.



CONCLUSION

Given what many consider the worst economic crisis since the Great Depression, there's been plenty of discussion as to the likely causes. Though there are many factors that played a role, the focus of this study is the role of monetary policy in contributing to the housing bubble. Monetary policy was found to be "too loose" using Taylor's rule as estimated by the Saint Louis Federal Reserve. Further, the degree of looseness was found to significantly affect housing prices, contributing to about half of the increase in housing prices from 2001 to 2007. Even if one argues that the Fed needed to conduct looser monetary policy than usual in the aftermath of the terrorist attacks of September 11, a quicker response to the clear strengthening of the economy in 2003 would have significantly reduced the increase in housing prices beginning in 2005, taking the air out of the bubble before it could burst. This study doesn't "prove" that the Fed caused the crisis but that it helped provide the fuel that contributed to the financial crisis. Other policies likely played a role including lax lending practices, weak regulatory policy, and abuse of credit default swaps, but tighter monetary policy would have reduced the likelihood of such a severe crisis as the global economy experienced in 2008-2009.

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