

Subsample Instability in the Relationship between Monetary Policy and Housing Starts

By

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Abstract: This paper uses an augmented version of the Boivin and Giannoni (2006) model to shed light on the extent to which the Fed can be blamed for the financial crisis. The paper shows that the relationship between monetary policy shocks and housing starts has changed over time, in particular that there has been a substantial weakening of the relationship in the early 1980s. Overall, these results imply that even if the Fed had been more aggressive in trying to combat the inflating housing bubble by raising the target interest rate, the impact of the change in the target rate on housing starts may not have been as large as many of the Fed's critics presume.

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Introduction

Did the Federal Reserve cause the housing bubble? The extent to which the Federal Reserve's low interest rate policy adopted after the 2001 popping of the dot.com bubble contributed to the subsequent housing bubble is not clear. Some observers, such as John Taylor (2009), assert that holding interests below what the Taylor rule recommended resulted in an excess of liquidity that fueled the housing boom. Other observers cite factors such as inadequate regulation (Stiglitz 2008), regulation errors (White 2008), a global savings glut (Bernanke 2005), psychological forces (Akerlof and Shiller 2009), securitization (Shin 2009), the bad incentives embedded in mortgage markets (Giovanni, Deniz, and Laeven 2008), the failure of the ratings agencies (Mathis, McAndrews, and Rochet 2009; Jaffee 2009, and poorly designed executive compensation structures (Bebchuk 2009) as more important contributors to the financial crisis.

This paper uses an augmented version of the Boivin and Giannoni (2006) model to shed light on the extent to which the Fed can be blamed for the crisis. The augmented model is used to examine whether the relationship between monetary policy shocks and housing starts has changed over time, and the paper finds that there has been a substantial weakening of the relationship in the early 1980s. Prior to the 1980s, monetary policy shocks have a significant impact on housing starts, but after the early 1980s the significance is no longer present. Thus, these results imply that even if the Fed had been more aggressive in trying to combat the housing bubble as it was inflating by raising the target interest rate, the impact of the change on housing starts may not have been as large as many of the Fed's critics presume.

The paper proceeds as follows. First, rolling regression techniques are used to identify two distinct periods in the data where the response of housing starts to changes in monetary

policy are very different, a period prior to 1980 and a period after the beginning of 1982. These are standard subperiods in the literature assessing monetary policy. Second, the difference in the response of housing starts to monetary policy shocks across the two subperiods is examined using impulse response functions and variance decompositions. Finally, conclusions are drawn from the differences in the results across the two subsamples.

The Empirical Model

The model used to investigate changes in the effects of monetary policy on housing markets over time is a version of the Boivin and Giannoni (2006) model that adds housing starts as an additional variable. Thus, the VAR model used below includes output, prices, commodity prices, housing starts, and the federal funds rate.¹ As explained in the Boivin and Giannoni paper, identification of monetary policy shocks in this model is achieved through the assumption that variables in the model respond to changes in monetary policy only after a one period lag. Boivin and Giannoni note that this assumption, while debatable, is consistent with many recent VAR analyses including Bernanke and Blinder (1992), Rotemberg and Woodford (1997), Bernanke and Mihov (1998), and Christiano, Eichenbaum, and Evans (1999).

Rolling Window Regressions

To identify potential break points in the impulse response function for housing starts, the augmented VAR model is estimated using rolling window regressions. The procedure is to start with a subsample of a given length that begins with the first observation in the data set. For example, a 10 year window for quarterly data estimates the model using the first 40 observations

¹ The results below are very similar if measures of consumer, mortgage, or overall credit are used in place of housing starts.

in the data set, calculates the impulse response functions, and outputs them to a data set. Then, the window is rolled forward one period by dropping the first observation and adding one more observation at the other end (i.e. observations 2 through 41), the model is estimated using the new data set, the impulse responses are calculated, and they are also output to the data set. This continues as the window rolls through the data until the model is estimated and the responses are saved for the last 40 observations in the data set, at which point the procedure stops.

Tracking the multi-step impulse response functions through time for each of the many windows and then finding breakpoints in the responses is complicated and difficult, but if a summary measure characterizing the response for each sample period is used in the search for breakpoints, the dimensions of the problem are reduced considerably. Thus, a measure of the total magnitude of the response of housing starts to changes in policy, the total area under the impulse response,² is used as a summary measure to track the change in the impulse response as the window rolls through the data, and to identify breakpoints in the response.³

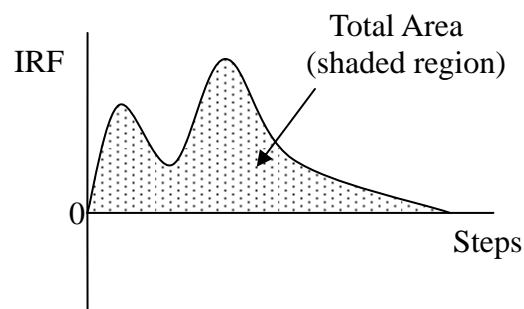


Figure 1: Summary Measure of IRF

² The formula used to measure the area under an impulse response function is

$$Area = \sum_{i=1}^{nsteps-1} .5[abs(y_i)(c-i) - abs(y_{i+1})(c-i-1)],$$

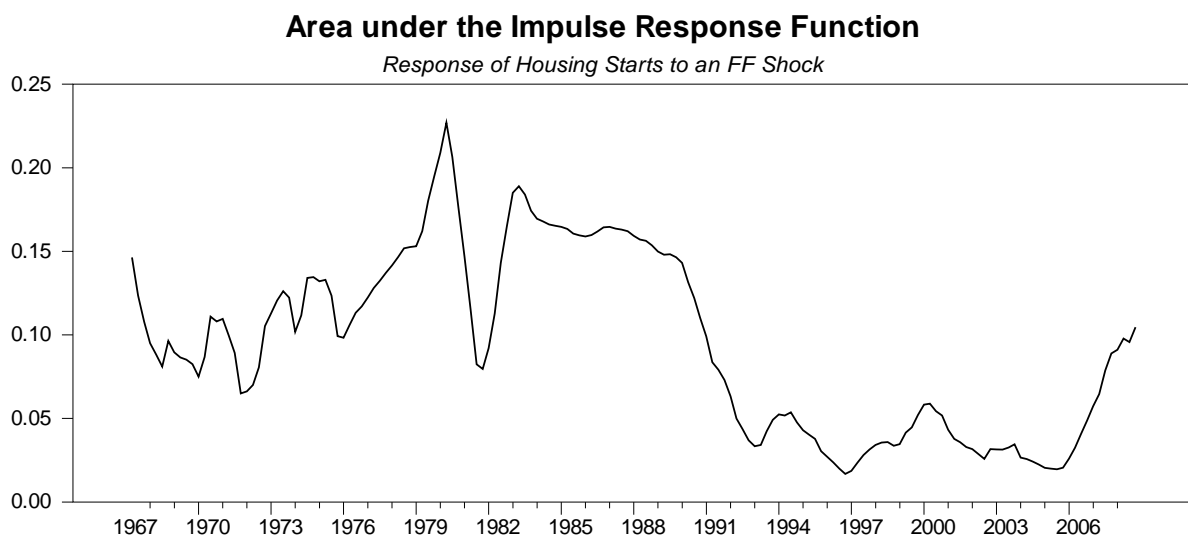
where c , the x-intercept, is $c = i + [y_i / (y_i - y_{i+1})]$. Thoma (2009) describes the measure in more detail and also examines another possible summary measure, the maximum response. The results below do not change appreciably when the maximum response is used instead of the area.

³ Figure 1 is taken from Thoma (2009).

The data are quarterly, and the sample period is 1957:2 through 2008:4, there are two lags of each variable,⁴ and the window size is forty quarters, though other window sizes are also examined.⁵ Each window is indexed by the date of the last of the 40 observations, though for reasons explained below the first observation is used to index the windows in Figure 3.

The first set of results are shown in the Figures 1 and 2. The first figure shows how the area under the impulse response of housing starts to monetary policy shocks changes as the 40 quarter long window rolls through the data.

Figure 1



As just noted, the dates on the horizontal axis indicate the end of the sample for each window. Thus, for example, the last point on the graph is associated with the date 2008:4, and

⁴ Using three lags does not have much effect of the results.

⁵ The order is output, prices, commodity prices, housing starts, and the federal funds rate. The robustness of the results to ordering is examined below, and it is shown that it makes little difference (so long as the identification assumption that the federal funds rate is last is preserved).

that corresponds to a sample period of 40 quarters ending at that date, i.e. a sample period of 1999:1 through 2008:4.

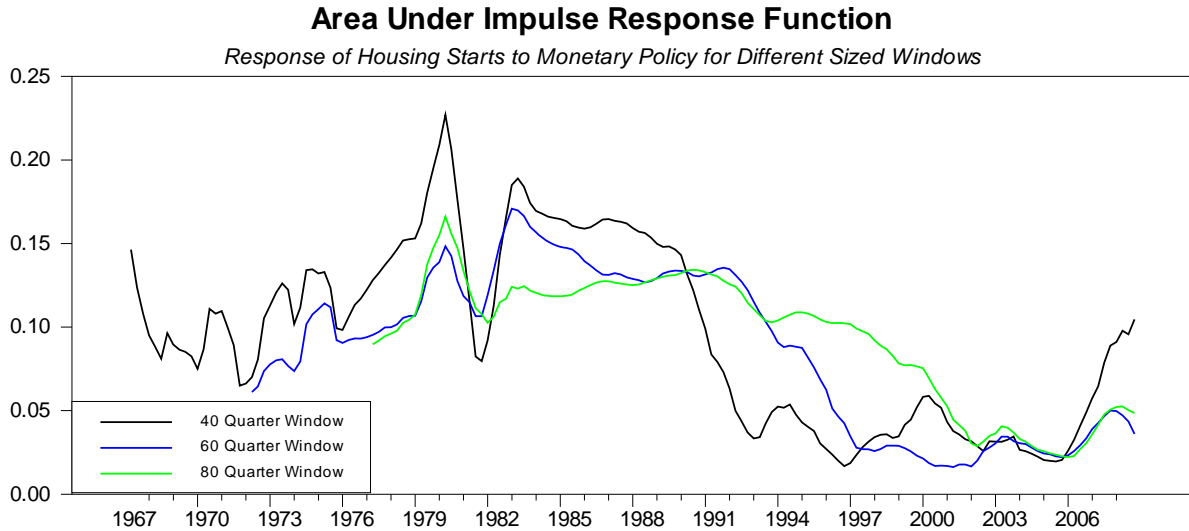
The results show a generally flat measure for the area up until around 1990, with perhaps a gradual increase prior to the volatile 1979-1982 period, followed by a steep decline from 1990 through 1992, followed by another flat period until a final uptick around 2006.

To interpret the changes in the area over time, it's important to realize that as the window rolls through the data, with each successive step a new observation enters the window on the front side, and an observation leaves the data on the backside.⁶ Thus, when there is a change in the area, e.g. the steep fall between 1990 and 1992, it is not clear which has the biggest effect, adding the new observations or dropping the old, or if there is an approximately equal combination from both. However, superimposing different window sizes on top of each other in the diagram can help to answer this question, and that in turn will help us to decide where the potential breakpoint(s) in the model occurs.

The next graph repeats the empirical exercise, but adds two more window lengths that are 60 and 80 quarters wide.

⁶ E.g., using a 40 quarter window as an example, moving forward from the 1989:1 through 1998:4 window to the next window from 1989:2 through 1999:1 drops the 1989:1 observation and adds the observation at 1999:1.

Figure 2



Since all three windows are indexed and aligned by the end of the sample, any difference in the three sets of results will be due to observations at the beginning of the sample, the only place where the samples contained in the windows differ. The results in Figure 2 are fairly similar across the three window sizes shown in the figure up until the late 1980s, and after the mid 2000s, but between the late 1980s and early 2000s that there is much less correlation evident in the series. For example, the point in time at which the area declines rapidly, the 1990-1992 period shown in Figure 1 for the 40 quarter window, varies across the three window sizes.

To make this clear, Figure 3, which shows the same data except it is now indexed and aligned by the start date rather than the end date of the windows, shows just the opposite. In this case, the results are fairly well aligned at the point in time where the area transitions quickly to a lower, stable value (i.e. around 1982-1983 in the graph), but prior to that date there is less correlation among the area measures for the different window sizes as compared to Figure 2. What does this tell us? Since all three windows share a common start point, this means that the

transition to the lower, stable value for the area does not occur until the windows only contain data dated 1982 or later.

Figure 3

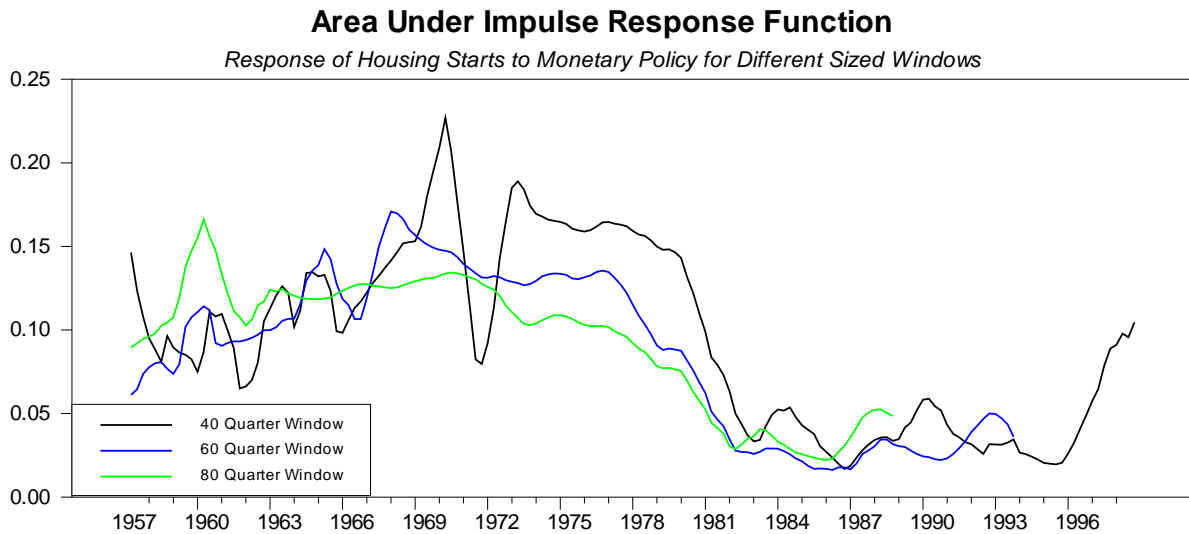


Figure 3 makes it clear that it would be difficult to reject that there are two distinct time periods in these results, the high and relatively flat values for data up until approximately 1980, a steep transition period as the data prior to 1982 leave the windows, and a relatively low and stable value for samples dated 1982 or later. Thus, there are two distinct periods, one prior to 1980 and one after 1982. The pre 1980 and post 1982 time periods are well established breakpoints in previous literature, and these subperiods correspond to different monetary policy regimes.⁷⁸ Thus, following Claida, Gali, Gertler (2000) and many others, the first sample period is defined over the 1957:2 through 1979:2 time period, the period from 1979:3 through 1982:3

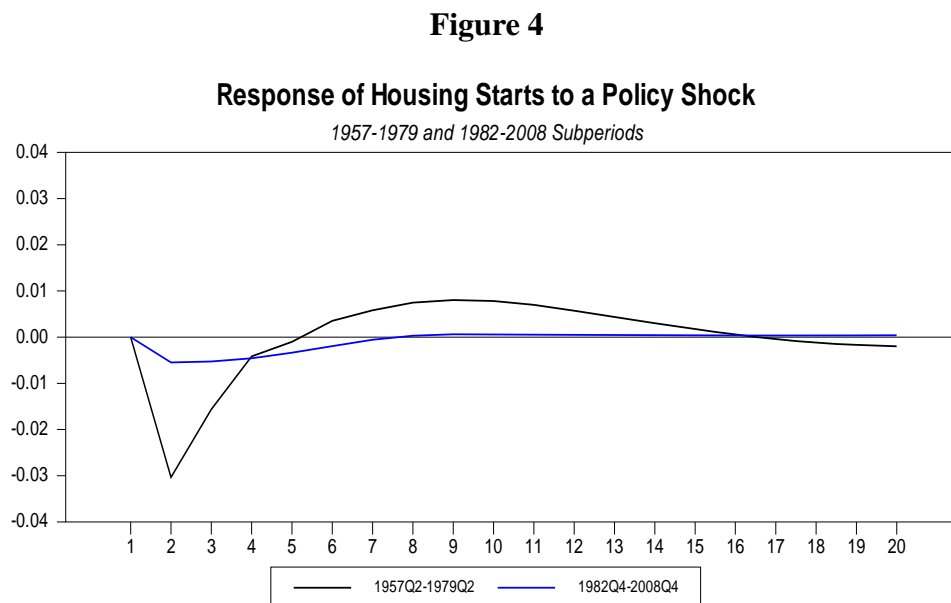
⁷ Formal tests can be used to further establish these breakpoints, but to preserve space these are not included since these subperiods are well established in previous literature.

⁸ It should also be noted that there was an important regulatory change around this time, in particular the Garn-St Germain act cited by Paul Krugman (2009) as an important contributor to the housing bubble.

when non-borrowed reserves rather than the federal funds rate was targeted is excluded,⁹ and the second time period is defined as 1982:4 through 2008:4.¹⁰

Subsample Results

The following graph shows the estimated impulse response functions for the two subperiods identified at the end of the previous sections, 1957:2 - 1979:2 and 1982:4 - 2008:4.¹¹



Consistent with the results showing the area under the impulse response function, the response is much larger in the earlier subperiod. In the earlier subperiod, a shock to the federal funds rate causes a period of negative growth rates that lasts for five quarters, with the peak decline in the growth of housing starts occurring two quarters after the policy shock. That is followed by a period of higher than baseline growth for quarters six through sixteen, with the

⁹ See footnote 22 and the associated discussion in the text for more on difference in monetary policy operating procedures over these three time periods.

¹⁰ Some papers also break the sample at 1987:3 when Greenspan became Chair of the Fed, but there is no evidence above of a break in the impulse responses at this point in time.

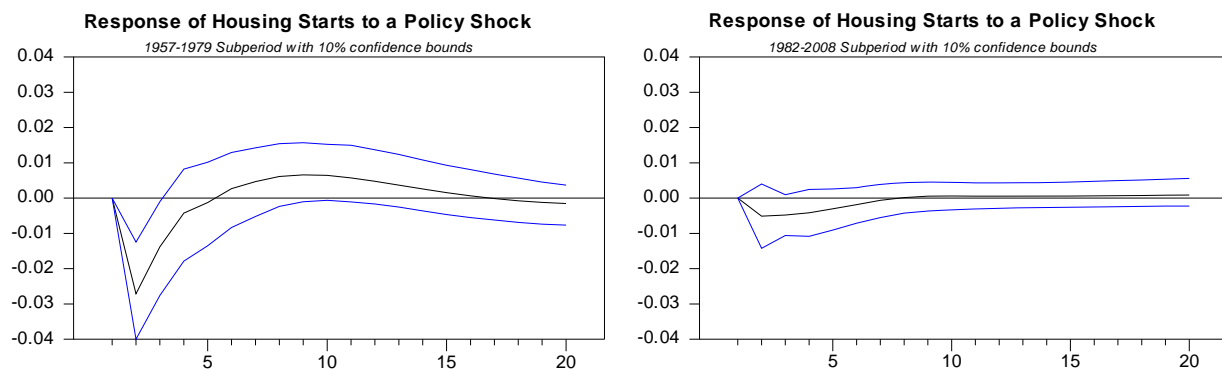
¹¹ One or two quarter variations in the beginning and endpoints of the two samples make little difference in the results.

peak at quarter nine, and thereafter the response gently oscillates back to baseline. Translating the response from differences to levels, the sum of the changes is approximately zero and this implies that a policy shock causes housing starts to decline relative to baseline for five quarters, then return to baseline over the next eleven quarters. This, the recovery is just over twice as long as the initial downturn. For the second subperiod, the responses are always negative, and this implies a permanent effect on the level of housing starts.

Thus, the implication of the first subperiod's response is that the impact on housing starts is largely temporary – there is a temporal disturbance but no long-run impact – while in the second subperiod the effect on the level of housing starts is permanent. However, the responses may not be significantly different from zero. To give a sense of the significance of the responses, the same two responses shown individually along with 10% confidence bounds are shown in

Figure 5:

Figure 5
IRFs with 10% Confidence Bounds



The only significant response occurs during the first subsample and only for the first three quarters, though the positive response at quarter 10 comes very close to being significant. In the later time period from 1982:4-2008:4, the response is insignificant at every step. Thus, all

we can say with confidence is that there is a negative response to policy shocks for three quarters after the policy change in the first subperiod, and no response at all in the second period.

The impulse response functions tell us how housing starts react to policy shocks in the two subperiods, but leave open the question of how important those shocks are in explaining the total variation in housing starts at various horizons. Variance decompositions, shown in Table 1, give us this information (the decompositions for output are also shown for comparison):¹²

Table 1|
Variance Decompositions:
Contribution of Policy Shocks to
Variation in New Housing Starts and Output

Step	Housing Starts		Output	
	57:2-79:2	83:4-08:4	57:2-79:2	83:4-08:4
1	0.0	0.0	0.0	0.0
4	15.3	1.4	15.5	4.7
8	16.0	1.6	38.1	7.8
12	18.0	1.6	45.8	11.0
16	18.3	1.6	47.6	14.1
20	18.3	1.6	47.8	16.7

As with the impulse response functions, there is considerable variation across the two subperiods. In the earlier subperiod, policy shocks explain fifteen to eighteen percent of the variation in housing starts depending upon the particular horizon, while in the second period policy shocks never explain more than 1.6% of the variation in housing starts. The results for output are similar in terms of the fall in the amount of the variance that is explained in the later

¹² The results for other shocks are omitted since they are not necessarily identified, the identification argument given above applies only to policy shocks.

subperiod, but the results are stronger for output than for housing starts in both subperiods.¹³ In addition, the results for output change more slowly as the steps increase implying that output takes more time to adjust than housing starts. The adjustment of housing starts as characterized by the variance decompositions appears to have been largely completed by the 4th quarter after the shock, that is where the variance decompositions level off, but the variance decompositions for output do not level off until around 12 quarters or more after the shock has occurred.

Conclusion

The Federal Reserve has come under considerable criticism for pursuing a low interest rate policy after the dot.com crash and causing the housing bubble, and for not popping the bubble once it began inflating.

The response to these criticisms from the Greenspan Fed is that the low interest rate policy was justified and necessary given the slow recovery of employment after the dot.com crash, and that bubbles should not be popped by raising interest rates because they are too difficult to identify while they are inflating. You are just as likely to stop beneficial innovation as you are to prevent problems if you start raising interest rates when you think you see a bubble inflating. Better to wait and see, and if a bubble does inflate and pop, the Fed has all the tools it needs to clean up afterwards. Their ability to do that cleanup work has been brought into

¹³ Changing the ordering so that housing starts appears earlier than fourth as above has very little impact on the variance decompositions. For example, when housing starts are first rather than fourth, the percentages corresponding to the steps table above are 0.0, 11.2, 11.7, 13.0, 13.2, 13.2 for the early period, and 0.0, 1.2, 1.4, 1.4, 1.4, 1.4 for the later period.

question with the recent crash of housing and financial markets, but the attitude was different prior to the market meltdown.

These results in this paper imply that although the Fed did have the ability to affect housing starts prior to the 1980s – an important policy tool – in more recent decades its ability to influence housing starts is much diminished. Thus, according to the results above, the low interest rate policy put into place in the early 2000s would not have had much effect on housing starts, and increases in the target interest rate once the bubble started inflating would not have done much to stop the housing boom.¹⁴

To the extent that these results are correct, the blame on the Fed is misplaced.

¹⁴ This does not mean the Fed was powerless. Regulatory changes could have been used to try to deflate the bubble, and Greenspan and other members of the Fed could have done a much better job of communicating the potential dangers ahead for people entering the housing market. Thus, even if changes in the federal funds rate would have been ineffective, both the regulatory changes and communication could have been used instead.

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