Time Variation in the Responses of Output, Prices, and the Interest Rate to Monetary Policy Shocks

By

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Abstract: This paper examines the extent to which variations in the parameters of the monetary policy rule alter the responses of output and inflation to monetary policy shocks. The results provide strong evidence that increases in the gap and smoothing coefficients in a variable parameter version of a standard Taylor type monetary policy rule cause increases in the total size and the peak response of output to a policy shock. In addition, increases in the same two policy parameters alter the response of inflation to a policy shock, but the change in the response is characterized by a redistribution of the shock's impact rather than reducing the overall size of the response. Finally, the results show that increases in the smoothness parameter in the monetary policy reaction function are strongly associated with reductions in the magnitude of the response of output to unexpected inflation. Thus, smoothing the variation in the target interest rate also smoothes the response of output to inflation shocks.

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I. Introduction

The reasons for the Great Moderation – the time period after 1984 when the variance of output and the level of inflation both declined dramatically – are not known with certainty.[1] But even though the causes remain elusive, after nearly two and a half decades of relative calm, many people began to believe that the increase in stability was most likely a permanent change in the economy. Recent events in financial markets and the subsequent decline in the real economy have caused a reassessment of the extent to which the Great Moderation is permanent, but permanent or not, it is still worthwhile to try to understand why the volatility of output and the level of inflation fell so much during this time period.

Several recent papers, including Boivin and Giannoni (2006) and Gali and Gambetti (2008), find that the Fed's decision in the early 1980s to place greater weight on deviations of inflation from its target value in its policy decisions played a key role in reducing the variability of output while simultaneously bringing inflation under control.

This paper also examines the role that monetary policy played in moderating the behavior of output and inflation in recent decades. In particular, the paper looks at the relationship between changes in the parameters of a Taylor type monetary policy rule over time and changes in the economy's response to monetary policy shocks. Two measures of the response to shocks are used to track this relationship, a measure of the total size of the response over all time periods and a measure of the peak impulse response.

[1] Factors that have been cited to explain the moderation in inflation and output include technological progress that, for example, allows better business practices such as improved inventory management (McConnell and Perez-Quiros 2000), financial deregulation and innovation (Dynan, Elmendorf and Sichel 2005), a lucky run of small shocks (Ahmed, Levin and Wilson 2002 and Stock and Watson 2002), dispersion of risk through globalization (Mishkin 2008), demographic shifts (Jaimovich and Siu 2007), and better monetary policy (Boivin and Giannoni 2006 and Clarida, Galí and Gertler 2000 among many others). For more on this, see Cecchetti, Flores-Lagunes, and Krause (2006). Also, as noted in Gali and Gambetti (2008), early papers on the Great Moderation include those of Kim and Nelson (1999), Mc-Conell and Pérez-Quirós (2000), and Blanchard and Simon (2001). A survey of the literature, as well as a discussion of alternative interpretations, can be found in Stock and Watson (2002).

These two measures are used to assess how the ability of policymakers and/or the economy to dampen the effects monetary shocks has changed over time. The use of these two measures also allows the separation of two different types of dampened response to shocks. It is possible for the peak response to a shock to fall, while the total size of the response remains the same. In this case, the maximum value of the response is reduced by spreading the shock out through time. However, it also possible for both the peak response and the total response over all time periods to fall. In this second case, the reduction in variability represents more than just a redistribution of the shock through time, it is also a reduction in the total size of the response.[2]

The results, which look at how these measures change over time in response to changes in the parameters of a Taylor type monetary policy rule, provide strong evidence that increases in the gap and smoothing coefficients cause increases in the peak response and the total size of the response of output to a policy shock. In addition, increases in the same two policy parameters alter the response of inflation to a policy shock, but the change in the response is characterized by a redistribution of the shock's impact over time rather than reducing the overall size of the response. Finally, the results show that increases in the smoothness parameter in the monetary policy reaction function are strongly associated with reductions in the magnitude of the response of output to unexpected inflation. Thus, smoothing the variation in the target interest rate also smoothes the response of output to inflation shocks.

II. The Empirical Model

Following Boivin and Giannoni (2006), and adopting the same notation, the model used in this paper is:

[2] The reverse is also possible, though not expected, i.e. the peak response could remain the same while the total size of the response decreases.

$$\begin{pmatrix} Y_t \\ R_t \end{pmatrix} = a + A(L) \begin{pmatrix} Y_{t-1} \\ R_{t-1} \end{pmatrix} + u_t$$

In this model, R_t is the policy variable -- the federal funds rate is used below -- and Y_t is a set of non-policy variables. This vector of variables can be any size, but following Boivin and Giannoni, detrended output, inflation, and a measure of commodity prices are used. The identification of the structural shocks and the policy shock relies upon the same assumptions as in Boivin and Giannoni. In particular, the key assumption is that the variables in Y_t respond to shocks to the policy variable only after at least a one period lag.[3]

Measuring the Change in the Response to Shocks

To assess how the response of output and other variables to shocks has changed over time, a rolling regressions framework is used to obtain impulse response functions for a sliding window of data. The impulse response functions are then used to obtain two measures of the size of the response of variables in the model to shocks, one that measures the area under the impulse response function,[4] and another that measures the size of the maximum impulse response. The measures are illustrated in Figure 1:

[3] See equations (1) and (2) in Boivin and Giannoni, and the related discussion. The authors note that "Although debatable, this identifying assumption is consistent with many recent VAR analyses" such as Bernanke and Blinder (1992), Rotemberg and Woodford (1997), Bernanke and Mihov (1998), and Christiano, Eichenbaum, and Evans (1999). They add that "Importantly, the key empirical feature that we are trying to explain, namely the reduced effect of monetary shocks on output and inflation, is corroborated by different specifications and identifying assumptions."

[4] 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 $c = i + [y_i / (y_i - y_{i+1})]$. The second is simply the maximum of the absolute value of the impulse response function, i.e. $|\max\{y_i\}|$, i = 1, 2, …, n, where y_i is the impulse response and *n* is the number of steps.

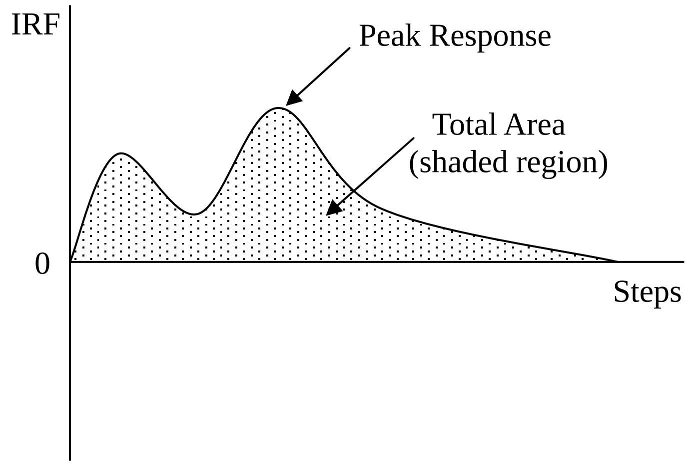


Figure 1 – Measures of the Peak and Total Size of the Response to Shocks

Together, the two measures capture the idea that an economy that responds more flexibly to a shock, or uses better policy, would be expected to experience a smoothed response to shocks that push the economy away from its long-run path.

The two measures can be used to sort out two potential ways in which policy, technology, or some other force could smooth the response of variables in the model to shocks. First, it is possible for the shock to be smoothed by spreading it out over time. In this case, the maximum size of the shock would fall, but there would be little change in the total magnitude of the response to the shock as measured by the area under the impulse response function.

The other possibility is that the smoother response involves a reduction in both the magnitude of the largest response and the total size of the response. In this case, the size of the maximum shock and the area would move both fall. It is also possible for the opposite to happen, i.e. a third case where the maximum response falls while the area gets larger. This is not expected, but it cannot be ruled out a priori.[5]

[5] This could even be welfare enhancing if very large shocks cause correspondingly larger reductions in social welfare.

The data used in the estimation are quarterly, and the sample period is 1959:2 to 2007:4 allowing for differencing. The window that is rolled through the data is 80 quarters long.[6] Given the window size, the procedure is to estimate the model for the period 1959:2 through 1979:1, generate the impulse response functions, then save the two measures of the size of the response measures – the area and the maximum response – for each series and each shock under consideration. Next, move the window forward one period and estimate the model for the time period 1959:3 through 1979:2, generate new impulse response functions, save the new measures of the size of the response. Then, repeat the process again, i.e. estimate the model for the period 1959:4 through 1979:3, generate the impulse response functions, and save the size measures, and continue this process until the window bumps into the end of the sample, i.e. until the sample period is to 1989:1 to 2007:4.

The output from this procedure is, for each variable and each shock, a series of estimates of the size of adjustment to shocks, with each series indexed by the date of the end of the window. That is, suppose, as will be done below, that we are interested in the adjustment of output and prices to monetary policy shocks. Then the procedure above will yield four series, the two measures of the size of the adjustment over time for output, and the two measures of the size of the adjustment over time for prices. All four series will run from 1979:1, the end of the first window, until 2007:4, the end of the last window in the rolling window procedure.

III. The Results

This section presents two sets of results. The first set looks for systematic movements in the response of output, prices, and the federal funds to policy shocks over time. In particular, the results indicate whether measures of the peak and total magnitude of the response of output and

[6] Smaller windows deliver a noisier version of the same basic results.

prices to policy shocks have diminished over time. Then, having established that systematic movements are present in the data, the second set of results examines the extent to which these movements can be explained by changes in the parameters of the monetary policy feedback equation.

A. Changes in the Response to Policy Shocks over Time

The first set of graphs show how the maximum impulse response and the area under the impulse response functions vary as the window rolls through the data. Figure 1a shows the maximum response of output (black line), prices (blue line) and the federal funds rate (green line) to a shock to the federal funds rate, and Figure 1b shows the evolution of the area under the impulse response functions for the same three variables due to the same shock.

Figure 1a

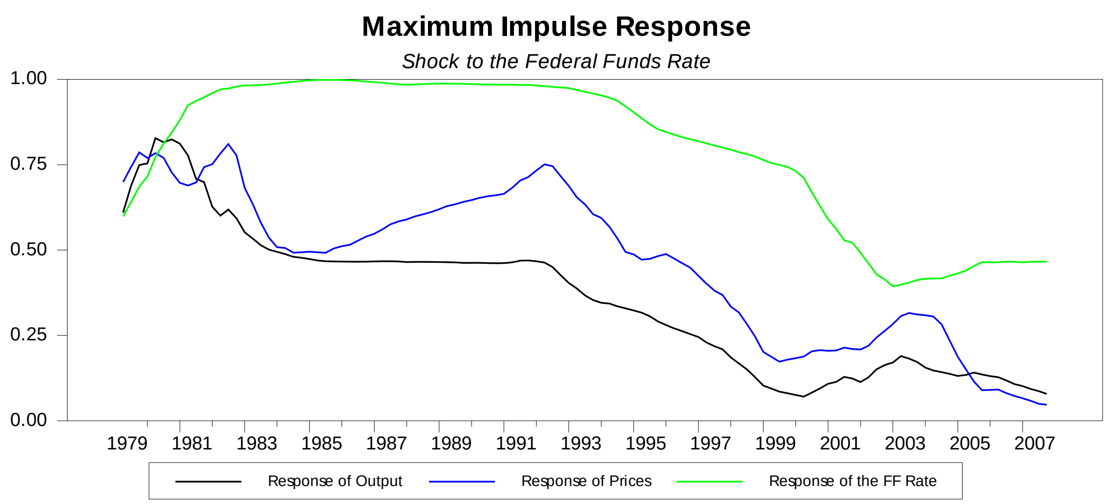
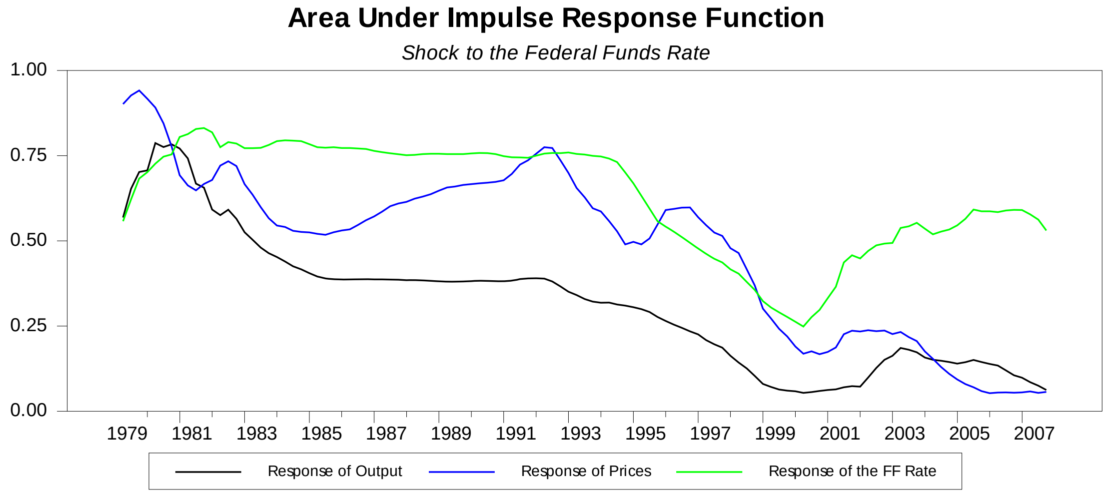


Figure 1b



The graphs for the maximum response in Figure 1a exhibit a clear trend over time, with the maximum being generally stable until the early 1990s, followed by a relatively steep decline, then the series bottom out somewhere in the late 1990s or early 2000s depending upon the particular series.[7]

Overall, it appears that there are three phases (ignoring the turbulence at the beginning of the sample period), a period a stable or slightly rising maximums until the early 1990s, a period from the early 1990s to around 2000 where the maximum declines, and a period where the maximum stabilizes at a relatively low level.

The pattern for the area under the impulse response function shown in Figure 1b is very similar, though the pattern for the federal funds rate does vary some with respect to the point at which the series troughs and the turn upward at the end. But there is quite a bit of conformity between the two graphs, and overall it appears that the responses of output and prices (the blue and black lines) have diminished over time, particularly since the beginning of the 1990s. Further, it appears that the smoothed responses generally involve a reduction in both the

[7] The series in the graphs have been normalized to facilitate comparison.

maximum response and total size of the response across time periods. This means that the reduction in the size of the maximum response is not merely due to redistributing the shocks over time, there is also a reduction in the overall magnitude of the response.[8]

B. Was Monetary Policy Responsible for the Diminished Response to Shocks?

This section looks at the extent to which monetary policy can explain the changes in the maximum response and the area under the impulse response functions shown in Figures 1a and 1b. This is accomplished by estimating a Taylor rule within a rolling regressions framework, then examining how well changes in the parameters of the Taylor rule match changes in the maximum response and area under the impulse response function shown in Figure 1. The match is assessed both graphically and statistically.

The Taylor rule used to track changes in the parameters over time is:

$$ff_t = b_0 + b_1 ff_{t-1} + b_\pi \pi_t + b_{\tilde{y}} \tilde{y}_t + w_t \qquad (1)$$

In this equation, ff_t is the federal funds rate at time t, π_t is the inflation rate, and $\tilde{y}_t$ is the output gap as measured as the percentage deviation from potential output.[9]

This equation is estimated with rolling regressions using the same window size as above, 80 quarters, and the parameters b_1, b_π, and $b_{\tilde{y}}$ are tracked as the window moves through the data.

B.1 Graphical Results

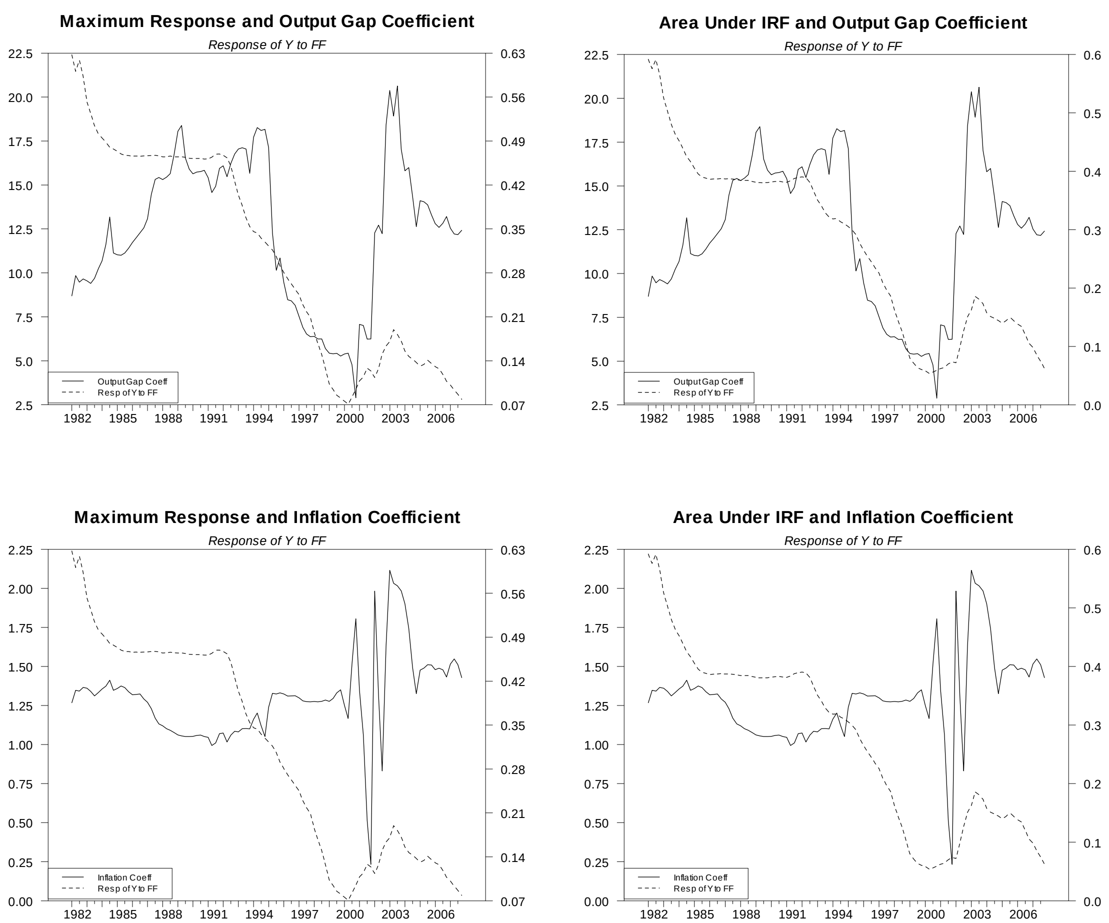
The result of this exercise is shown in Figures 2, 3, and 4.[10] The first set of graphs in Figure 2 show how the two measures of smoothness, the maximum response and the total size of

[8] Though it is harder to make the case that these shocks are identified, and hence the graphs are harder to interpret and will not be emphasized, Figures A1a-A1b and A2a-A2b in the appendix show the same results for shocks to prices and output rather than the federal funds rate.

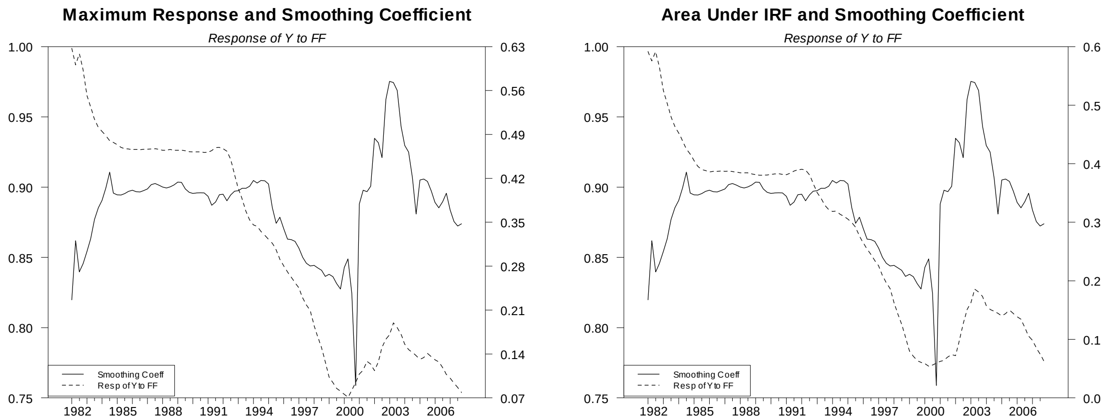
[9] The CBO estimates of real potential output are used to construct the percentage deviation. Data for the effective federal funds rate and on prices (the chained GDP deflator as in Boivin and Giannoni 2006) are from FRED at the St. Louis Fed. In the VAR models estimated later, the producer price index for commodities is also used, and it is from the same source.

the response, vary with changes in the parameters of the Taylor rule. In these diagrams, the shock is to the federal funds rate and the response is for output. Each graph in a particular column shows how the coefficients on inflation, the output gap, or the lagged interest rate (denoted with the term “smoothing” in the diagrams) vary with either the maximum response to the shock (left-hand column) or the area under the impulse response function (right-hand column):

Figure 2



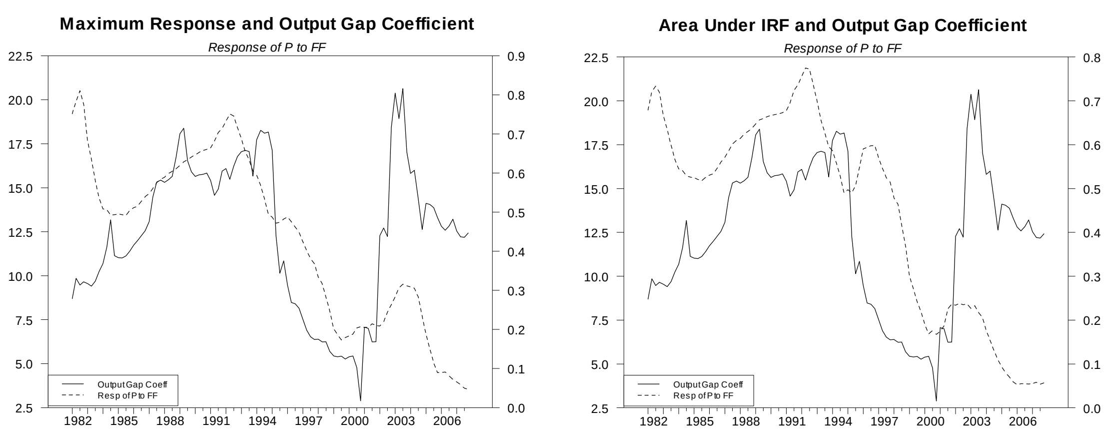
10 The full set of responses of all the variables in the model to all shocks and for changes in all of the slope coefficients of the policy rule, i.e. the complete set of results, can be found in Appendix B.



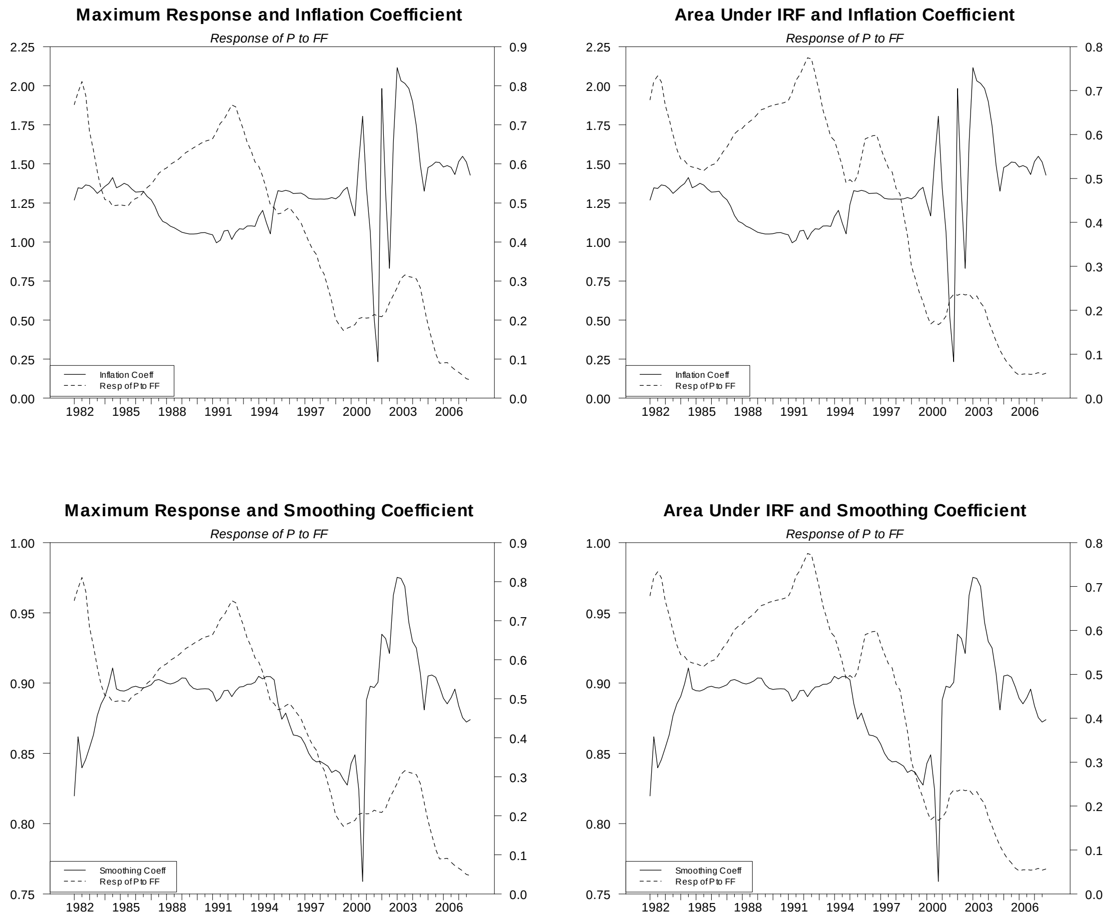
These graphs suggest that the output gap and smoothing coefficients shown in rows one and three, which are represented by the solid lines and move closely together,[11] vary positively with the response of output to federal funds rate shocks, particularly past the early 1980s during the period of the Great Moderation. This result holds for both the maximum response and the area under the response function.

Figure 3 show the same set of graphs, and the shock is still to the federal funds rate, but this time the responses are for inflation rather than for output:

Figure 3



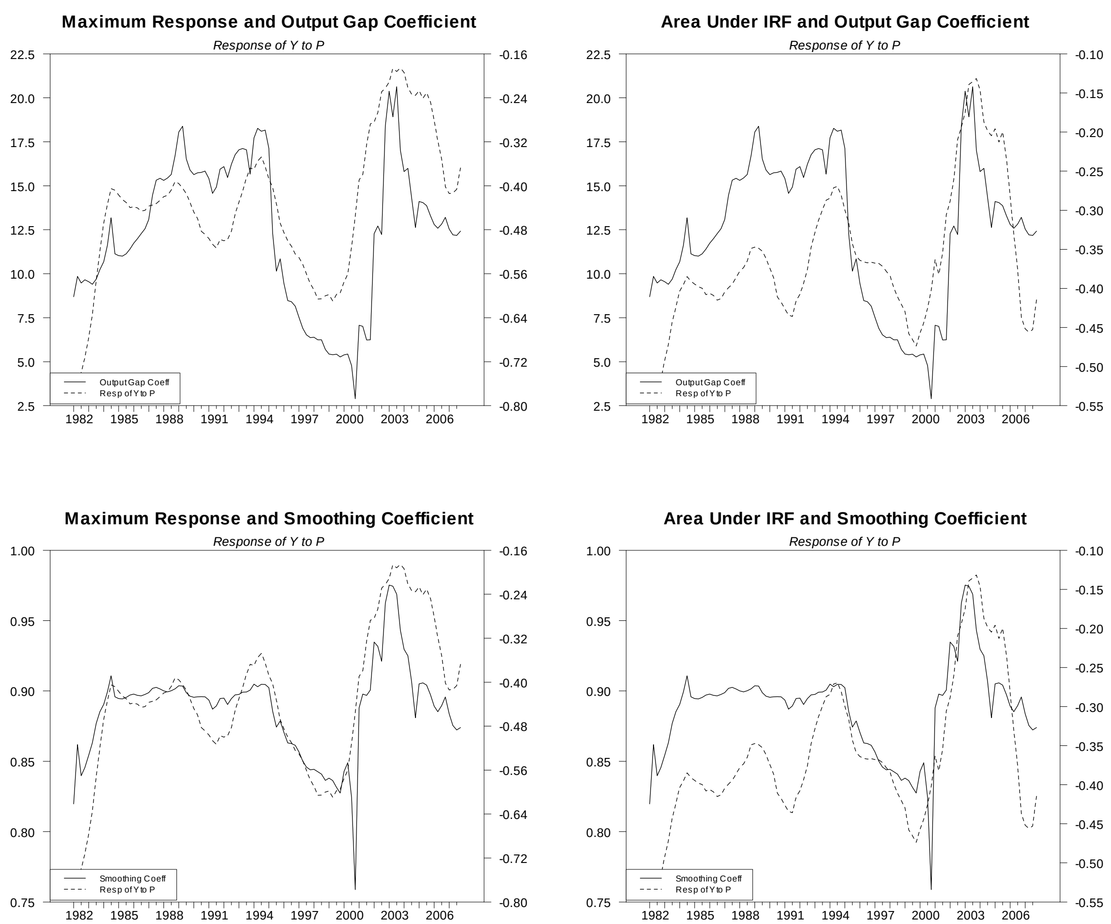
[11] The close association between movements in the output gap and smoothing coefficients is noteworthy because ignoring the correlation will confound the results in investigations of the effects of these variables taken in isolation.



Once again, as in the graphs 2a, 2b, 2e, and 2f, there is a suggestion in these results that the output gap and smoothing coefficients vary positively with the response of the price variable to federal funds rate shocks in the time period covered by the Great Moderation, i.e. since early 1980s. The strength of the association is assessed with regression techniques used below, but close inspection of the graph reveals that the association between the peak effects in the left-hand column of row one and three is stronger than the right-hand column showing the total size of the effect, and this result is apparent in the statistical results that are presented later in the paper.

The next set of graphs highlights a particularly strong association in the results between changes in the coefficients on the smoothing and output gap terms of the Taylor rule and the response of output to the shock extracted from the price variable (to highlight the association between the two series shown in the graph, the negative of the actual impulse response function is shown).[12] As noted above in footnote 5, the price shock is not necessarily identified, so the response shown in the diagram is likely the a linear combination of the shocks in the model, and this particular linear combination – the shock extracted from the output variable does not show the same pattern – is highly correlated with the Fed's response to changes in output or its response to lagged values of the interest rate. As explained later in the paper, the price shock can be interpreted as unexpected inflation.

Figure 4



[12] The phrase "the shock extracted from the price variable" rather phrase "price shock" is used in recognition of the fact that the structural price shock may not be identified in this model.

This suggests a high likelihood that movements in the gap and smoothing coefficients are key determinants of the relationship between unexpected inflation and movements in output, and that increases in these coefficients reduce the peak and total responses.[13]

B.2 Statistical Results

The graphs provide convenient summaries of the bivariate relationships among the parameters of the Taylor rule and the measures of smoothness, but the significance of the relationships is difficult to assess with precision from visual inspection. In addition, while the graphs are limited to illustrating bivariate relationships, the true relationship may involve more than just the two variables shown in each graph. To overcome these problems, regression analysis is used to assess the strength of the association, and to allow all of the parameters of the Taylor rule to enter analysis simultaneously rather than individually as in the graphical analysis.

The model that is estimated has either the maximum response or the total area as the dependent variable (indexed by the shock driving the response), and a constant along with the values of each of the parameters of the Taylor rule as the right-hand side variables. All variables on the right-hand side are contemporaneous, and the standard errors are corrected for heteroskedasticity and serial correlation using a four lag Newey-West estimator.

The results are shown in Table 1:[14]

[13] Again, please note that the negative of the actual response is shown on the diagram.

[14] The cases where a variable is responding to its own shock, e.g. the response of output to an output shock, have been omitted both because they are generally uninteresting, as usual, and because the maximum response in these cases does not change by construction.

Table 1

Changes in the Maximum and Area Measures: t- and F-Statistics

		Inflation		Gap		Smoothing		Joint	
Shock	Resp	Max	Area	Max	Area	Max	Area	Max	Area
				Policy Shocks					
FF	Y	-1.62	-1.69	**3.02**	**3.19**	-1.80	**-2.00**	**7.72**	**7.92**
FF	P	- .80	-.30	**2.58**	1.63	-1.32	-.97	**9.53**	2.11
				Policy Responses					
P	FF	**5.50**	**2.38**	**-5.15**	**-3.53**	.92	.28	**22.2**	**12.3**
Y	FF	**2.71**	1.56	**2.22**	**2.82**	1.37	**-3.52**	**25.2**	**6.28**
				Prices and Output					
P	Y	- .58	-1.53	.62	.97	**-2.92**	**-2.10**	**15.7**	**22.6**
Y	P	.72	.98	1.09	.33	-1.02	-1.26	.61	1.90

Joint= Test that the gap and smoothing coefficients are jointly zero. The standard errors are corrected for heteroskedasticity and serial correlation using a four lag Newey-West estimator. Entries in bold type are significant at the 5% level.

The results largely reflect the associations shown in the graphs.[15] The results for shocks to the federal funds rate shown in the first two rows of the table show that the most important coefficients for explaining the change in the response of output and prices over time are the gap and smoothing coefficients. As is evident in the graphs, the gap and smoothing coefficients are highly collinear, so a joint test is used along with the individual t-tests to assess the ability of these two coefficients to explain changes in the relationship between shocks to the federal funds rate and movements in prices and output.

More particularly, the results for the output response to policy shocks shown in the first row imply that changes in the gap and smoothing coefficients impact both the maximum response and the total size of the response.

[15] In both the graphs and the tables, the results are even stronger when the sample is restricted so that the first observation begins in mid 1984, i.e. after the start of the Great Moderation, rather than starting at 1979:1 (e.g. this is evident in Figures 2 and 3). However, given that the results are already significant, and given that restricting the sample might appear to throw away information and be an attempt to manipulate the results favorably (though there is also an argument there is a structural break in the early 1980s), the full sample results are presented.

In the case of the response of prices to policy shocks shown in the second row, the result is that the maximum response is reduced when these parameters fall, but the size of the total response is unchanged. Thus, unlike for output, the reduction in the maximum is achieved by redistributing the response through time.

The third and fourth rows in the table show how the policy variable responds to the shocks derived from the output and price variables. With the caution, once again, that the individual shocks to inflation and output are not identified, this shows systematic relationships between movements in the output gap and price coefficients and the subsequent policy response. In particular, the relationship between prices and policy shown in row three appear to depend mainly upon the inflation and gap coefficients.[16]

Finally, the fifth and sixth rows show the responses of the output gap and prices to shocks to the output gap and prices, but the focus in on the fifth row which corresponds to figure 4 above highlighting a very strong association in the results between the gap and smoothing coefficients and the response of output to the measured inflation shock. The table indicates that this result is mainly due to changes in the smoothing coefficient over time.

IV. Interpretation of the Results

Figures 1a and 1b show that both the maximum response to policy shocks and the total magnitude of the response have declined over time, with most of the decline occurring in, approximately, the 1992 through 2001 time period.

An examination of the solid line in the top and bottom rows of any of Figures 2-4 shows that both the output gap and smoothing coefficients underwent substantial declines during this

[16] The collinearity between the gap coefficient and the smoothing coefficient makes this hard to state with certainty, but there does appear to be important independent variation in the gap coefficient.

time period, while the middle row of either Figure 2 or 3 shows that the inflation coefficient was relatively stable.[17] Thus, interestingly, the decline in the variance (i.e. peak effect) and total size of the response of output and prices during this time period appears to be due to declines in both the output gap and smoothing. Thus, during this time period a relatively larger focus on inflation and, saying the same thing in reverse, a relatively smaller focus on smoothing and the output gap seems to have resulted in increased stability in response to monetary policy shocks.[18]

Connecting these results to the results in Table 1, rows one and two of the table correspond to Figures 2 and 3 above, while row five corresponds to Figure 4. The results in row five of Table 1 show that the change in the response of output to the shock derived from the price variable is due mainly to the smoothing coefficient, and that the relationship is negative, i.e. an increase in the smoothing coefficient reduces both the maximum response and the area under the impulse response function.[19] Hence, while this coefficient smoothes the interest rate - hence its name - it also smoothes variations in output that are transmitted through shocks to unexpected inflation.

Why can the unidentified shock to the price variable be interpreted as unexpected inflation? The reduced form specification for the price variable, which is what the VAR model represents in a general form, can be used to generate expected inflation. That is, suppose the reduced form price equation is as estimated above:

$$\Delta p_t = a_0 + \sum_{i=1}^{k} b_i Z_{t-i} + \sum_{i=1}^{k} c_i \Delta p_{t-i} + u_t^p \qquad (2)$$

[17] Note that the dashed lines in figure 2-4 repeat the results shown in the graphs in figures 1a and 1b.
[18] In the first row of the table, the sign of the estimate on the smoothing coefficient for the area measure is negative and significant, but only barely so, and the strongest and clearest effect among the two collinear variables is the positive response for the gap coefficient. A similar argument applies to row four.
[19] Once again, note that Figure 4 shows the negative of the actual impulse response to highlight the correlation between the two series.

where u_t^p is a linear combination of all the shocks in the model. In this case, unexpected inflation conditional upon all information dated $t-1$ and earlier is $\Delta p_t - \Delta \mathrm{p}_\mathrm{t}^\mathrm{e} = u_t^p$. Thus, the shock in the empirical model estimated above can be interpreted as the unexpected component of inflation.

The result, then, is that the smoothing coefficient has a large impact on the relationship between unexpected inflation as measured by the reduced form shock to the price equation and movements in output. As shown in line five of Table 1, an increase in the smoothing coefficient – which gives the federal funds rate more persistence – reduces both the maximum impact and the total magnitude of the shock on output. This is consistent with a linkage within the economy of the form:

$$y_t = \kappa(\phi_i)(\pi_t - \pi_t^e) + f(z_t) + e_t, \qquad (3)$$

where $\kappa_{\phi_i} < 0$ and z_t is a vector containing all the other variables affecting output, and ϕ_i represents the smoothing coefficient in the monetary policy rule.[20] This equation is similar to a standard Phillips curve, except for the fact that the coefficient on the unexpected inflation term depends upon the smoothing coefficient from the policy equation.

V. Conclusion

As noted in the introduction, the sources of the Great Moderation in inflation and output are not known with certainty. This paper examines the interaction between changes in the parameters of the monetary policy feedback rule and changes in the behavior of output and inflation in response to policy shocks. Two measures of the response of inflation and output to policy shocks are used, one that captures the peak response, and one that captures the total

[20] The assumption that $f(z_t)$ is additive is more restrictive than necessary.

magnitude over all time periods. This allows changes in the responses that merely redistribute shocks through time to be sorted from responses that reduce the overall magnitude of the response.

The results provide strong evidence that the response of output and prices to policy shocks has generally diminished over time, particularly in the 1990-2001 time period. In addition, the results show that a reason for this change is variation in the gap and smoothing coefficients of the policy reaction function. When these parameters increase, the response of output to policy shocks is reduced both in terms of the peak response and the size of the total response over time. In addition, changes in the same two parameters also impact the response of inflation to a policy shock, but the changed response is achieved by redistributing shocks rather than reducing their overall impact. Finally, the strongest result in the paper shows that increases in the smoothness parameter in the monetary policy rule are strongly associated with reductions in the magnitude of the response of output to unexpected inflation. That is, when the smoothing coefficient is increased, the slope of the Phillips curve changes so that output is less responsive to unexpected variations in inflation.

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Appendix A

Figure A1a

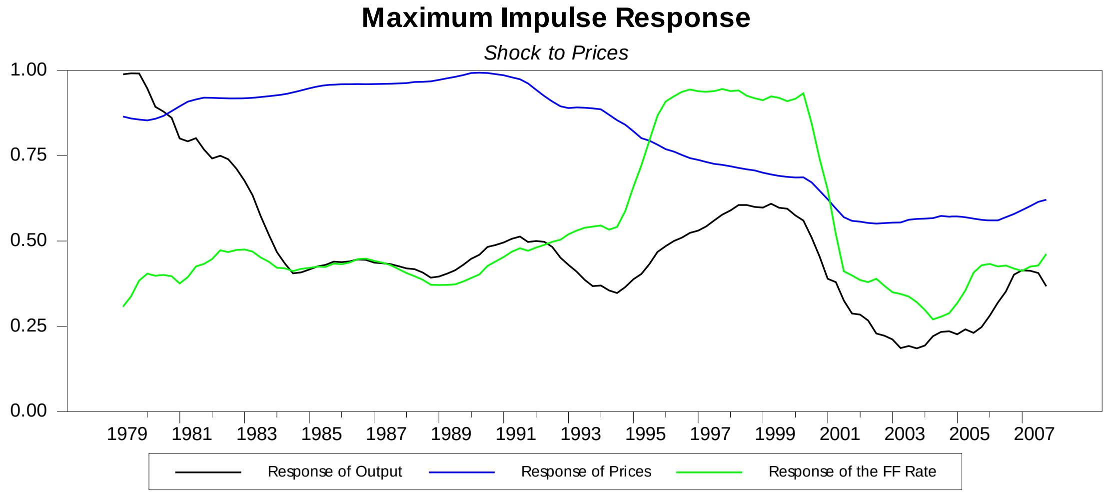


Figure A1b

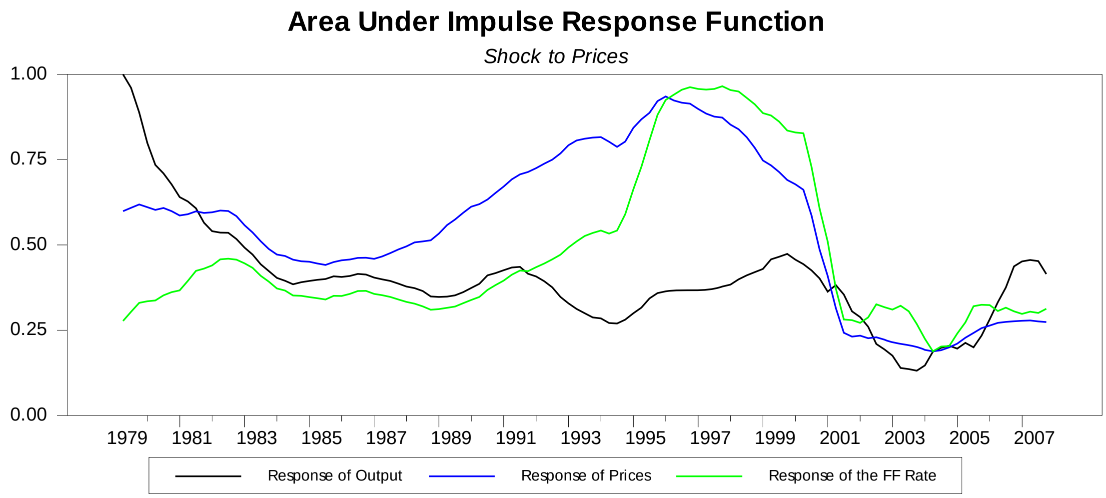


Figure A2a

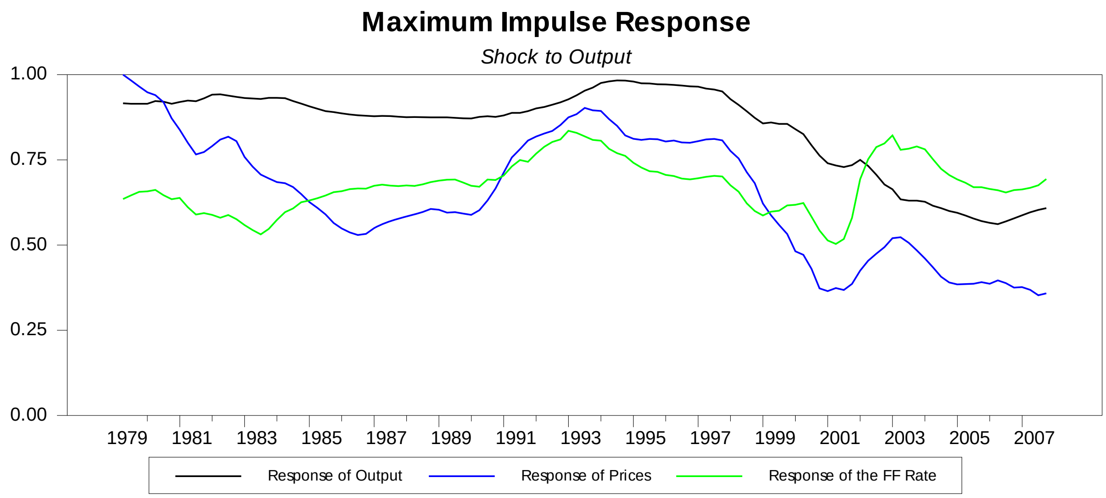
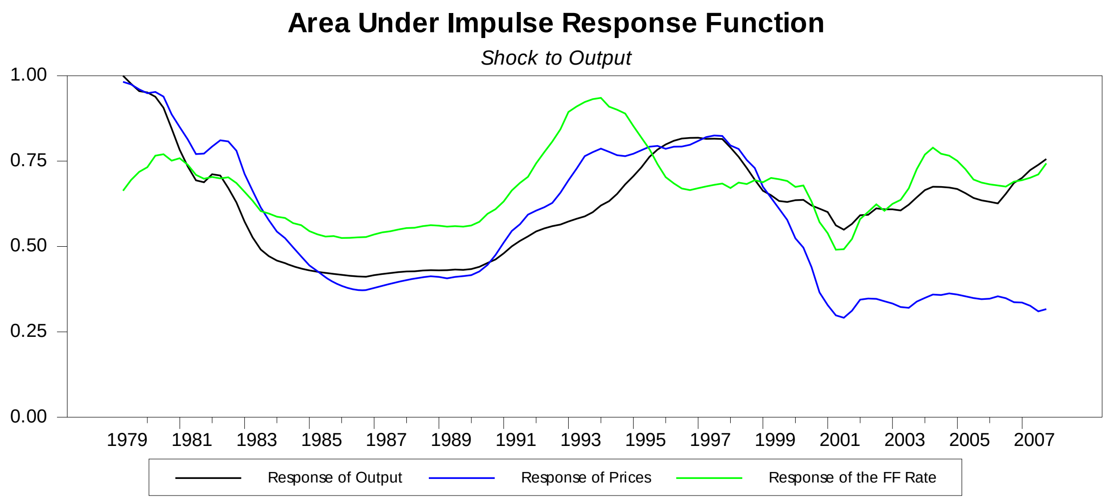
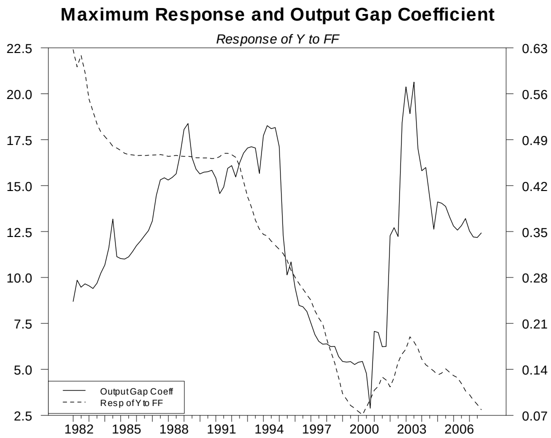


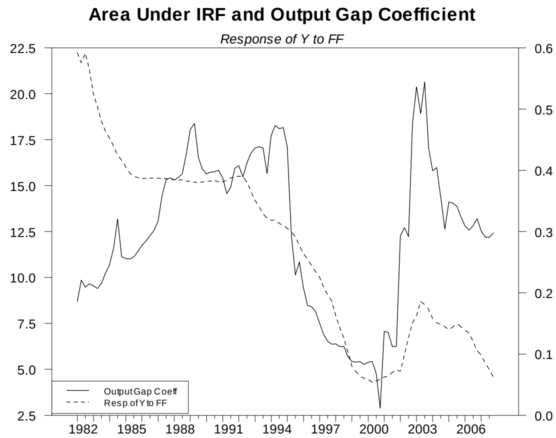
Figure A2b

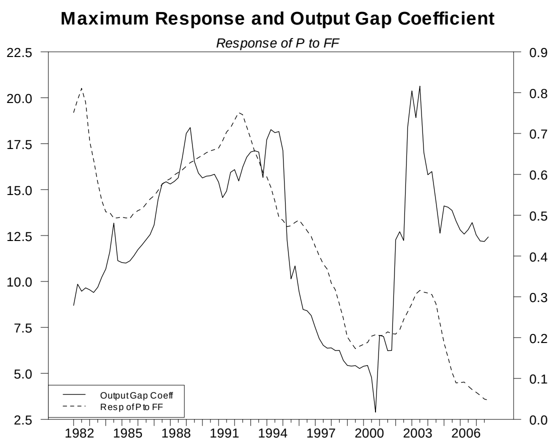


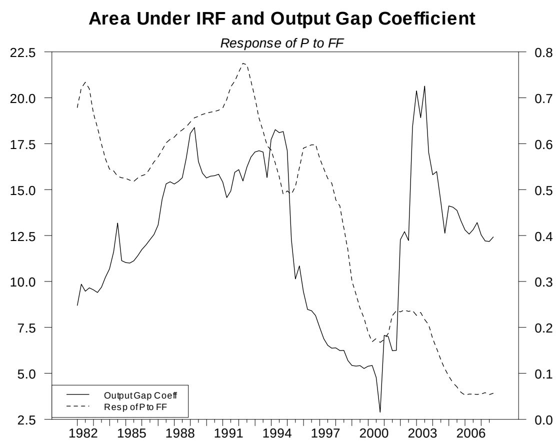
Appendix B

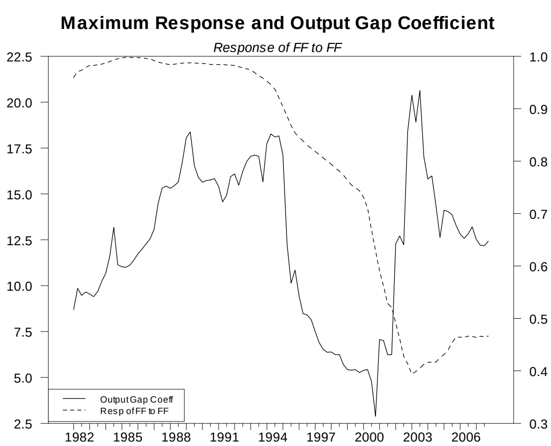
(This is the complete set of results, including the graphs shown in the paper in Figures 2-4)

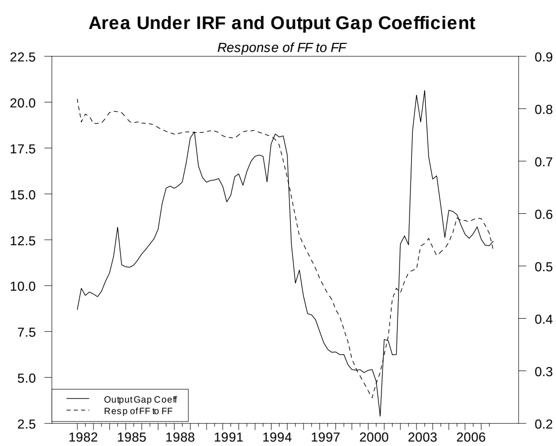




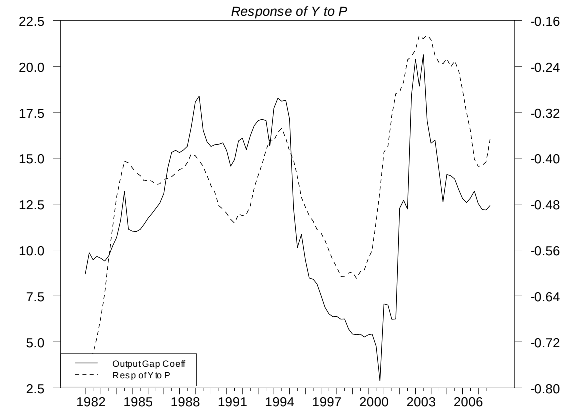




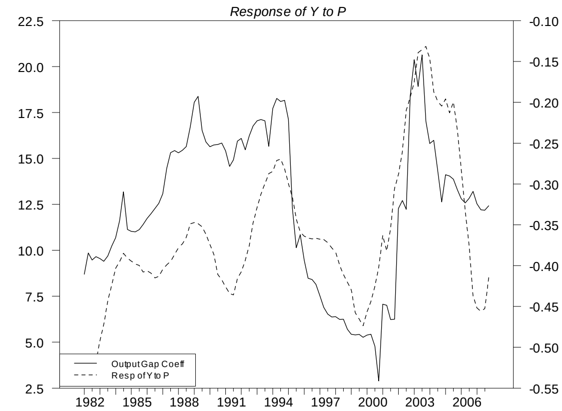




Maximum Response and Output Gap Coefficient



Area Under IRF and Output Gap Coefficient



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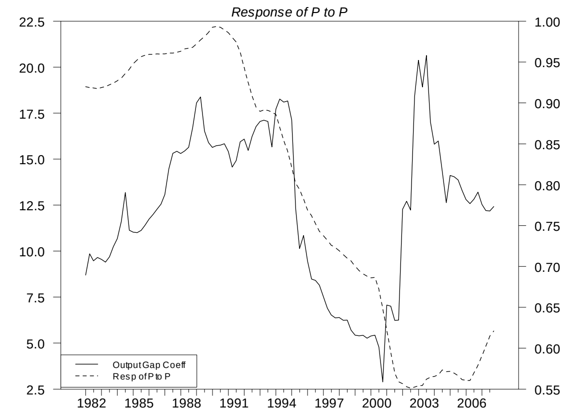
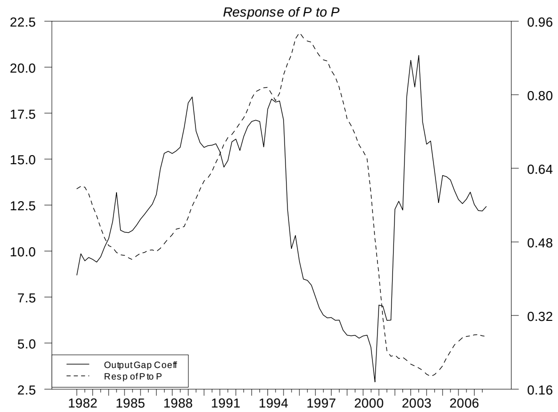
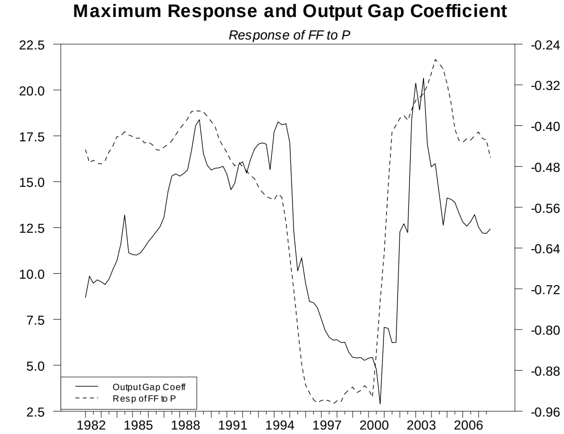


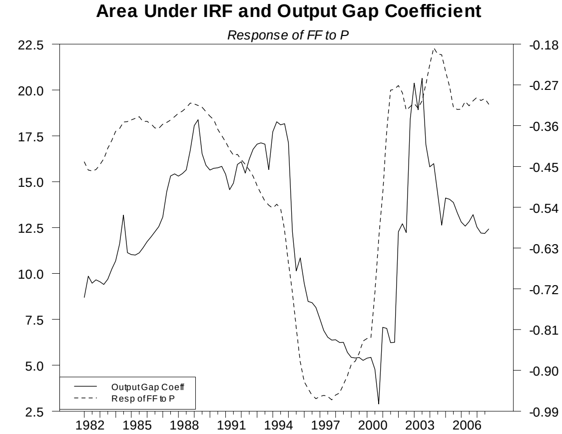
Area Under IRF and Output Gap Coefficient



Maximum Response and Output Gap Coefficient

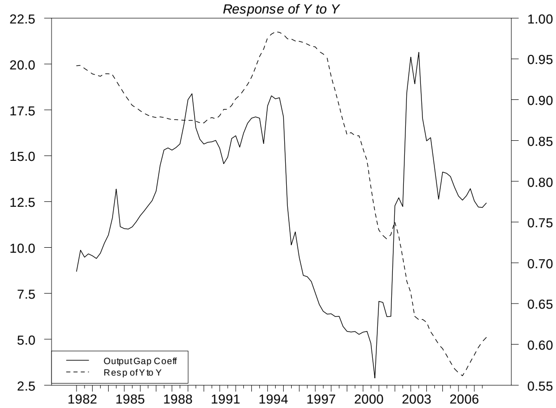


Area Under IRF and Output Gap Coefficient



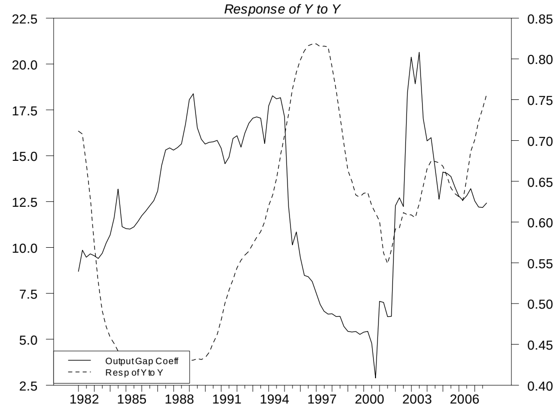
Maximum Response and Output Gap Coefficient

Response of Y to Y



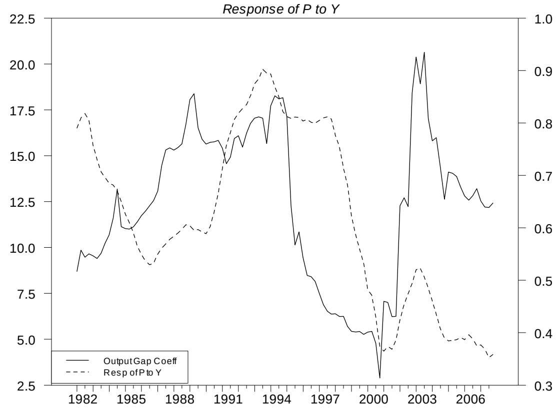
Area Under IRF and Output Gap Coefficient

Response of Y to Y



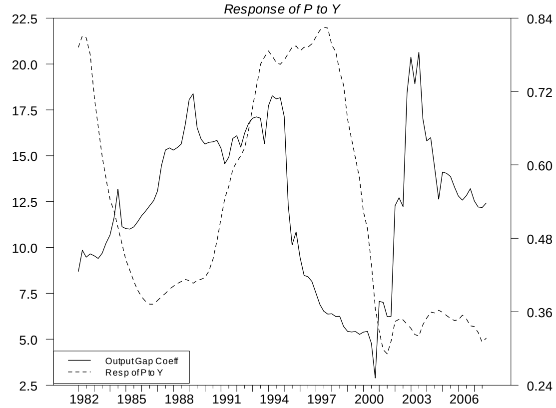
Maximum Response and Output Gap Coefficient

Response of P to Y



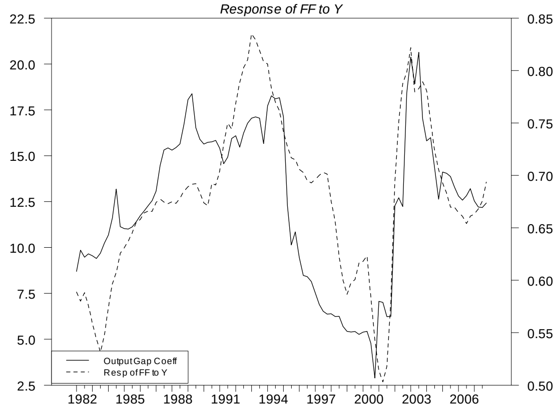
Area Under IRF and Output Gap Coefficient

Response of P to Y



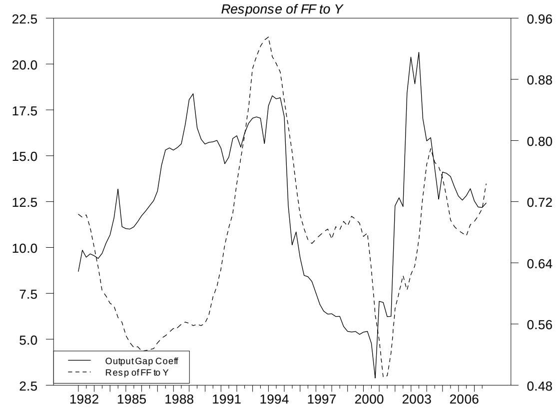
Maximum Response and Output Gap Coefficient

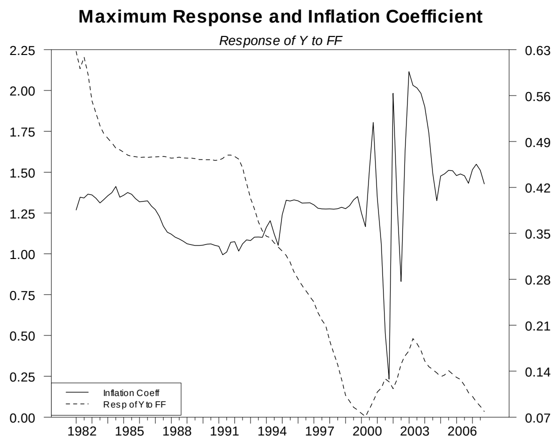
Response of FF to Y

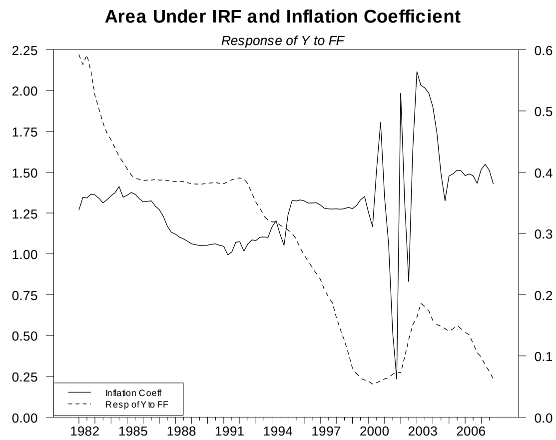


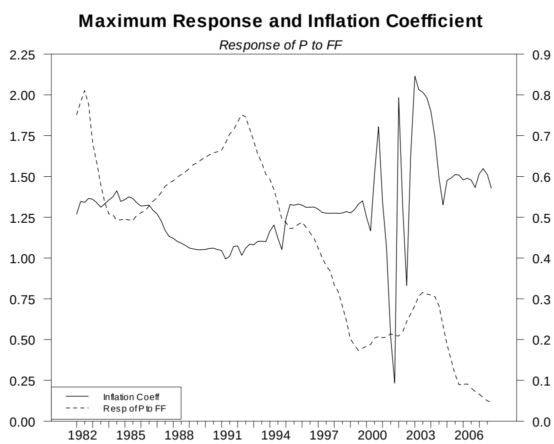
Area Under IRF and Output Gap Coefficient

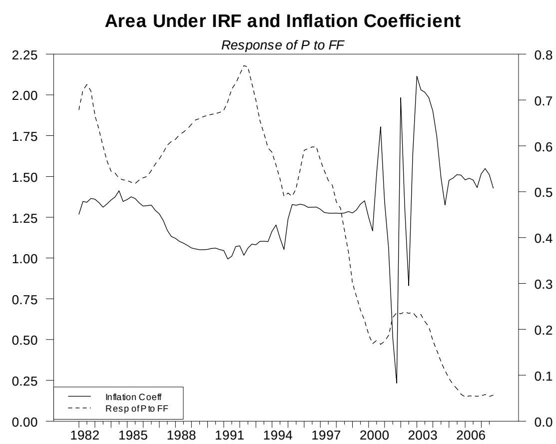
Response of FF to Y




Maximum Response and Inflation Coefficient
Response of Y to FF
Inflation Coeff
Resp of Y to FF


Area Under IRF and Inflation Coefficient
Response of Y to FF
Inflation Coeff
Resp of Y to FF


Maximum Response and Inflation Coefficient
Response of P to FF
Inflation Coeff
Resp of P to FF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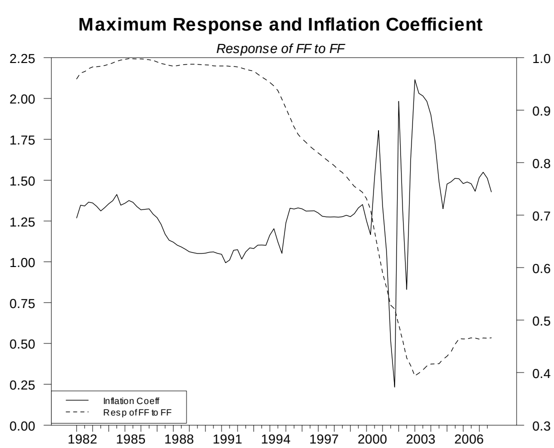
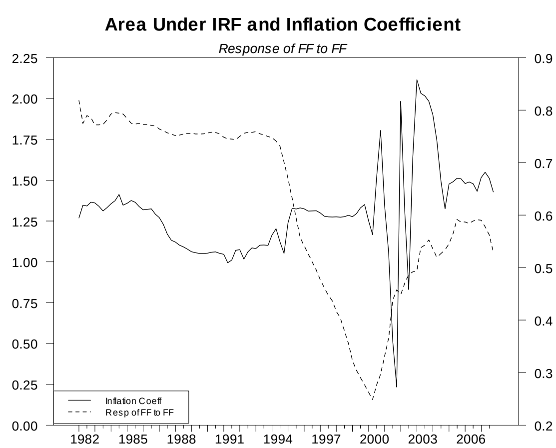
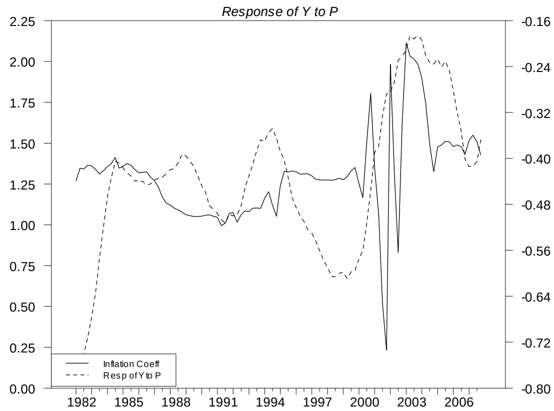
Response of P to FF
Inflation Coeff
Resp of P to FF

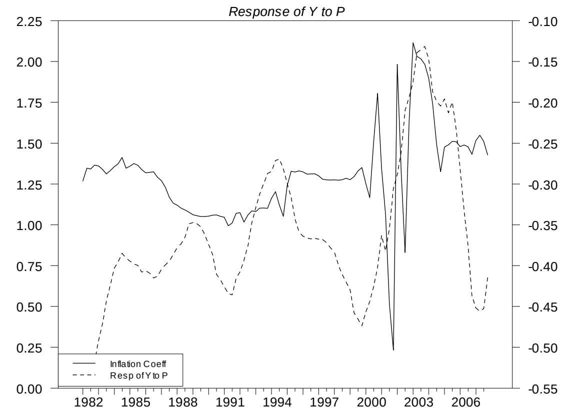

Maximum Response and Inflation Coefficient
Response of FF to FF
Inflation Coeff
Resp of FF to FF


Area Under IRF and Inflation Coefficient
Response of FF to FF
Inflation Coeff
Resp of FF to FF

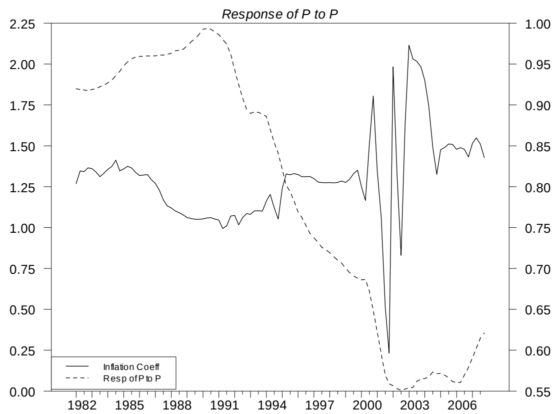
Maximum Response and Inflation Coefficient



Area Under IRF and Inflation Coefficient



Maximum Response and Inflation Coefficient



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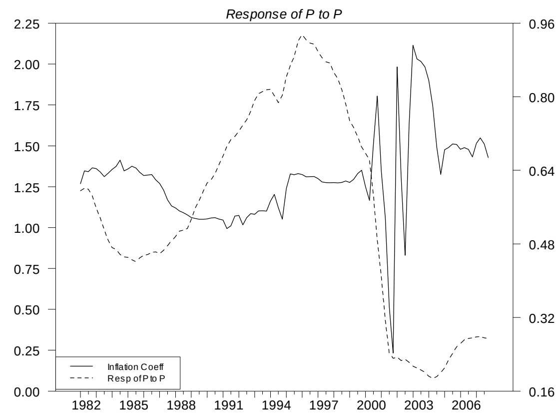

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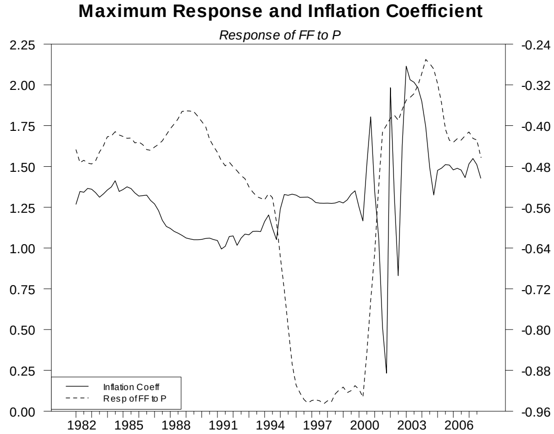

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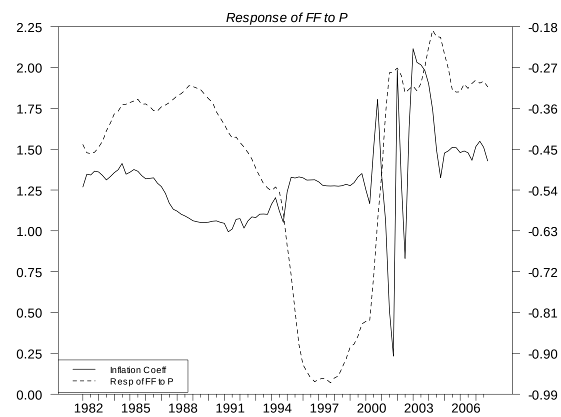
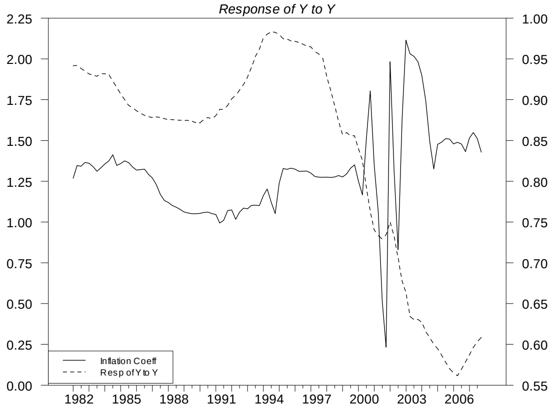


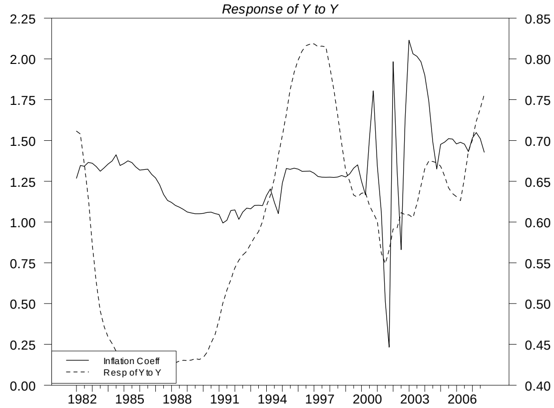
Maximum Response and Inflation Coefficient

Response of Y to Y



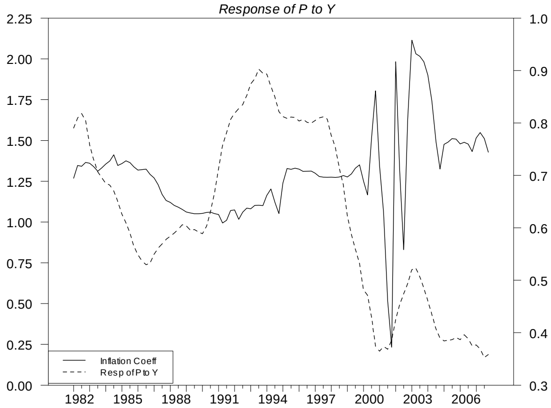
Area Under IRF and Inflation Coefficient

Response of Y to Y



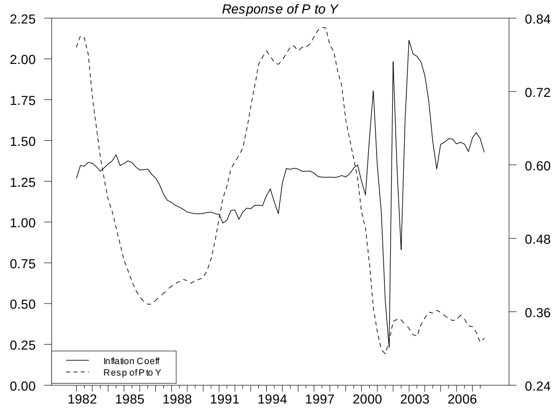
Maximum Response and Inflation Coefficient

Response of P to Y



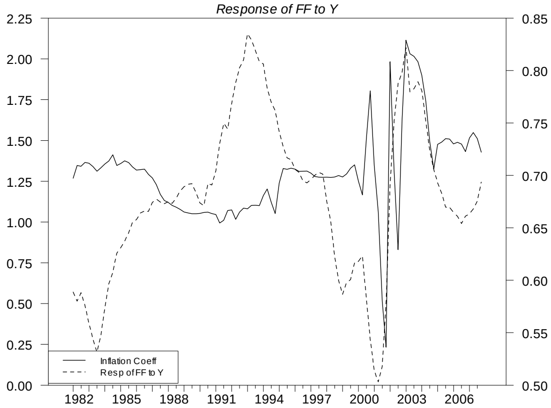
Area Under IRF and Inflation Coefficient

Response of P to Y



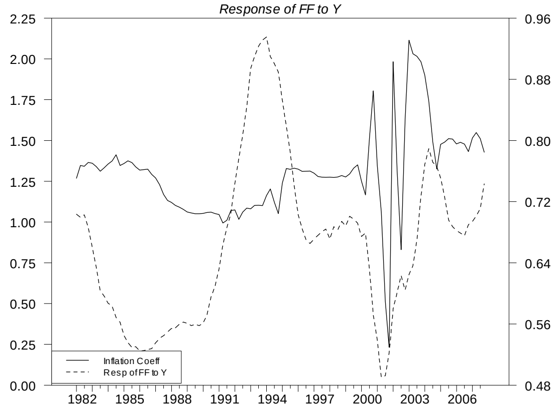
Maximum Response and Inflation Coefficient

Response of FF to Y

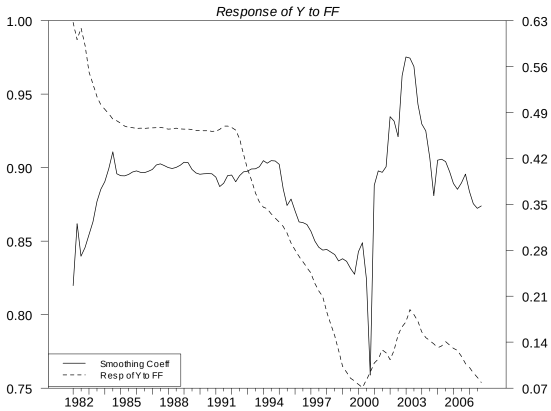


Area Under IRF and Inflation Coefficient

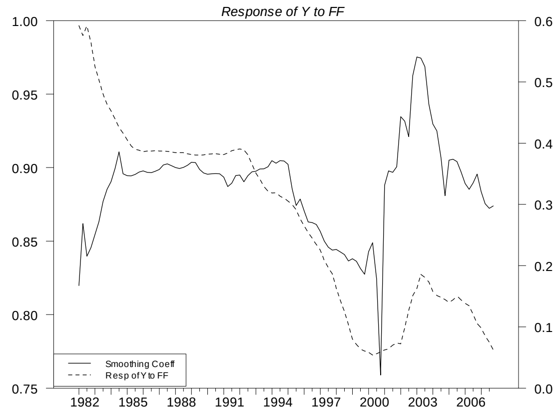
Response of FF to Y



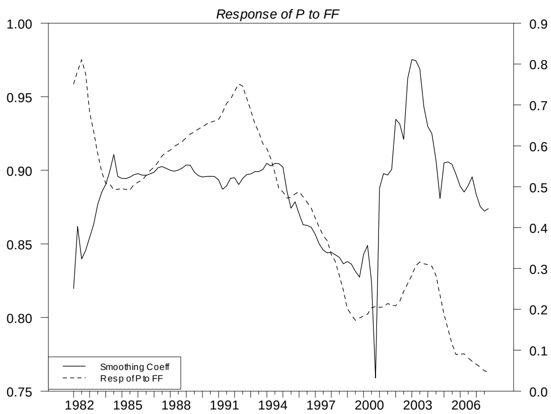
Maximum Response and Smoothing Coefficient



Area Under IRF and Smoothing Coefficient



Maximum Response and Smoothing Coefficient



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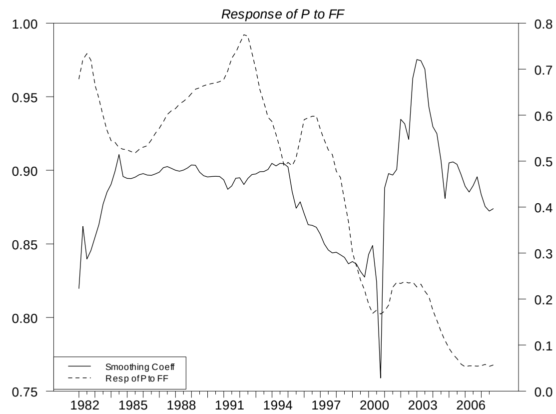

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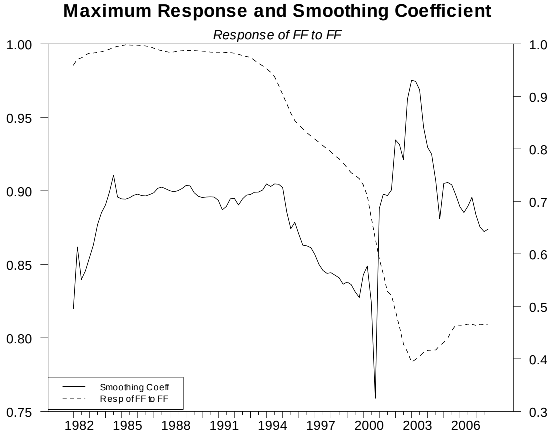

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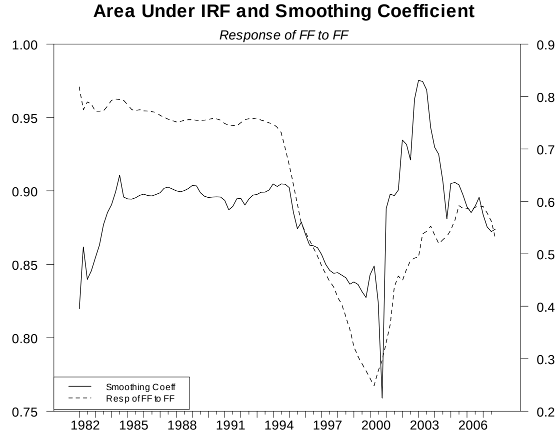

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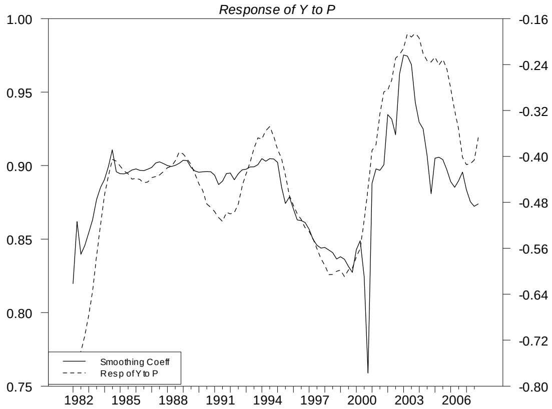
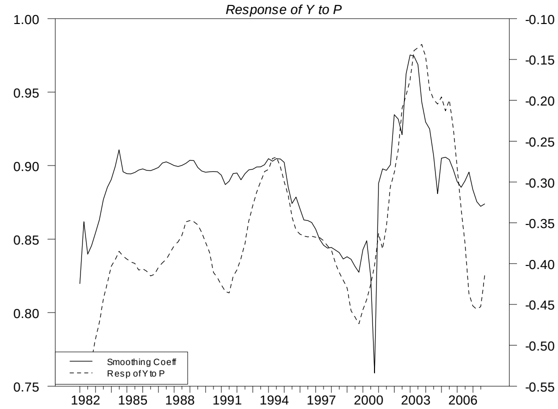
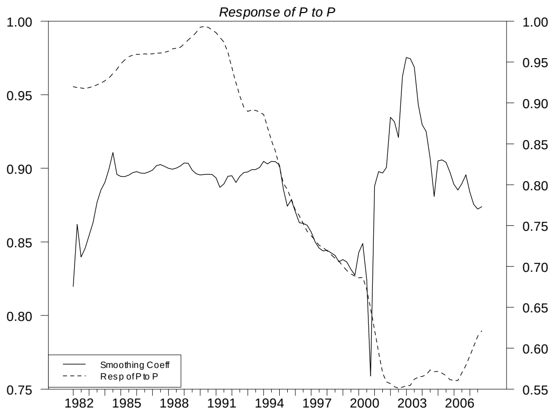


Area Under IRF and Smoothing Coefficient



Maximum Response and Smoothing Coefficient



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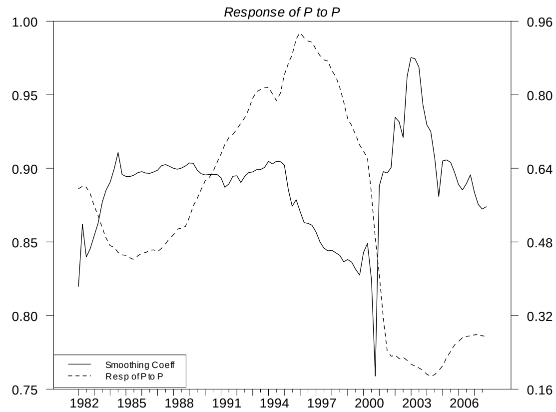
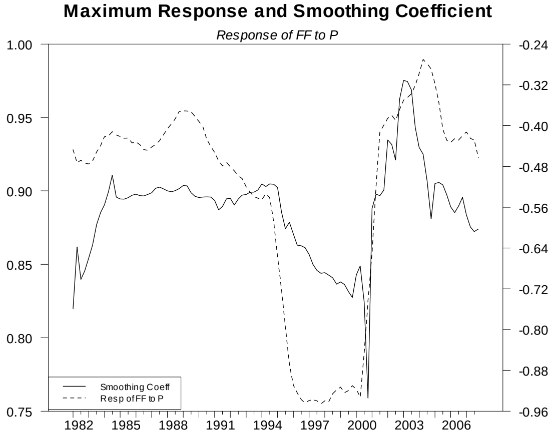


Maximum Response and Smoothing Coefficient



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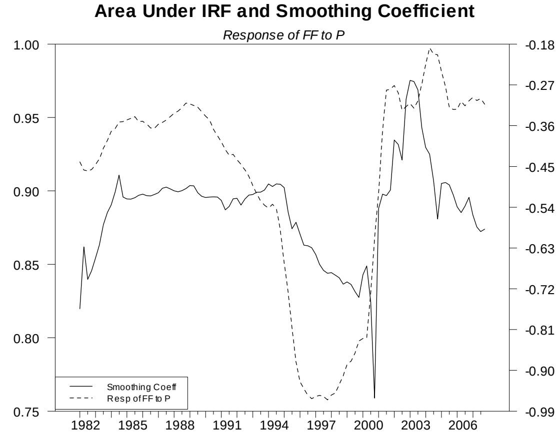

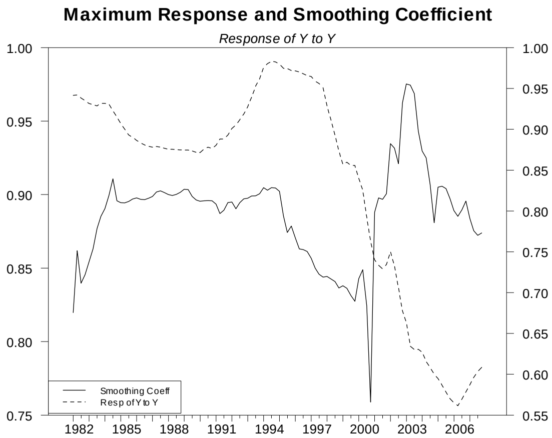
Maximum Response and Smoothing Coefficient
Response of Y to Y
Smoothing Coeff
Resp of Y to Y
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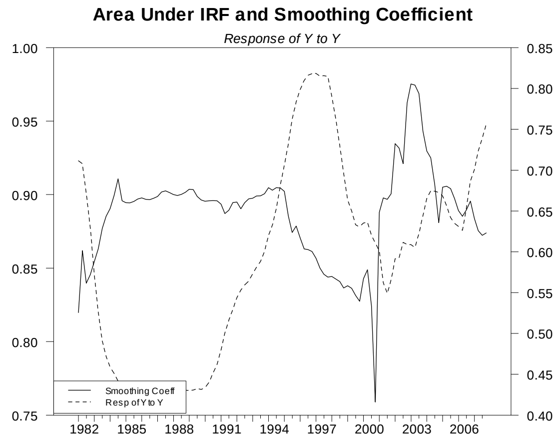
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Response of Y to Y
Smoothing Coeff
Resp of Y to Y
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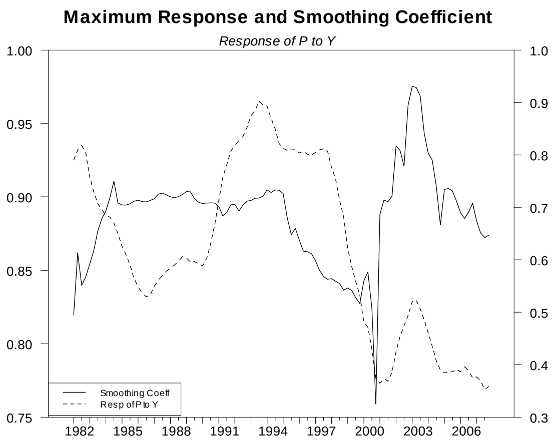
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Response of P to Y
Smoothing Coeff
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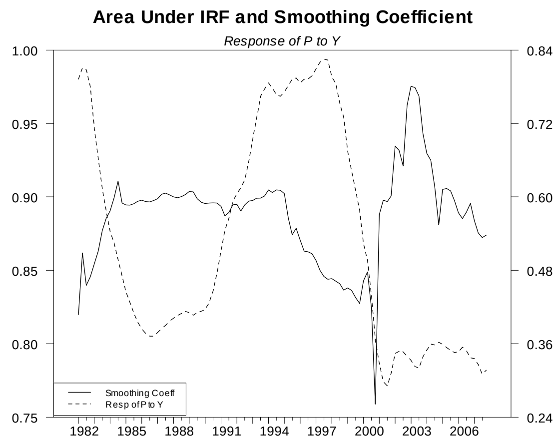
Area Under IRF and Smoothing Coefficient
Response of P to Y
Smoothing Coeff
Resp of P to Y
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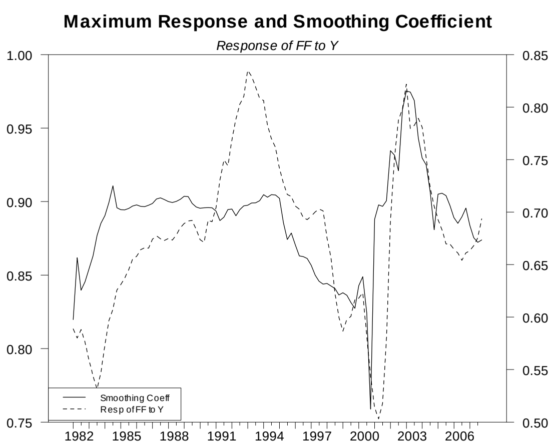
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Response of FF to Y
Smoothing Coeff
Resp of FF to Y
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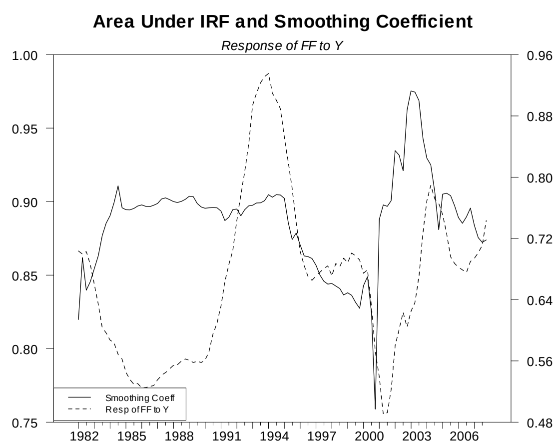
Area Under IRF and Smoothing Coefficient
Response of FF to Y
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Resp of FF to Y
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