

TECHNOLOGY SHOCKS AND MONETARY POLICY: ASSESSING THE FED'S PERFORMANCE

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ABSTRACT. This paper basically has two objectives. Firstly, we characterize the Fed's systematic response to technology shocks and its implications for other economic variables such as output, inflation and hours in the US. Secondly, we evaluate if we can explain these responses with policy rules as modeled in our standard sticky price model. We find significant differences across period in the response of the economy to a positive technology shock. Also, the Fed's response in the Volcker-Greenspan period appears to be consistent with a rule that seeks to stabilize prices. On the other hand, under the pre-Volcker period the Fed's policy seems less effective and we see high volatility in inflation. So overall, our results support the results in the literature that suggest an improvement in the way the Fed has conducted policy in recent years.

1. INTRODUCTION

We are interested in the role of endogenous components of monetary policy in shaping the responses of real and nominal variables to shocks in the economy. As in Gali, Lopez- Salido, Valles (2003), we study the behavior of the Federal Reserve in response to a particular kind of fluctuation in the economy: technology shocks.

We find the economy's response to a technology shock, based on a structural VAR and identify the technology shock the same way as Gali(1999), as having long run effects on labor productivity.

We are motivated by the results presented in Clarida et al. (2000), that a significant difference is apparent between pre-Volcker era where we saw high and volatile inflation and several severe recessions, and the Volcker-Greenspan era where inflation has remained steadily low while output

This work was done as a class project and is primarily a replication of the results in the Gali, Lopez-Salido, Valles (2003) paper, Fall 2005.

growth has been relatively stable. They suggest that pre-Volcker the Fed had a highly 'accommodative' policy, whereas in the recent times the Fed has adopted a highly aggressive policy to control inflation. In this paper our basic strategy is to study the differences in the response of the Fed in these two sub-periods: Pre-Volcker era and Volcker-Greenspan era.

Our theoretical framework gives us three alternative monetary policy rules and we are interested in seeing which gives us the better approximation for the Fed's systematic response to supply shocks.

The paper is organized as follows. In Section 2 we characterize the economy's equilibrium and responses to a positive technology shock under the three rules considered. In Section 3 we review the empirical techniques we will be using to estimate the response of the Fed in the two sub-sample periods mentioned above. Section 4 presents our findings and a comparison of the empirical responses with the theoretical counterparts. Section 5 concludes.

2. TECHNOLOGY SHOCKS AND MONETARY POLICY IN A STICKY PRICE MODEL

2.1. A baseline sticky price model. In this section we describe the Calvo model with staggered price setting, based on the description in Gali (2001).

The representative consumer is infinitely lived and maximizes the following:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\phi}}{1+\phi} \right)$$

subject to a sequence of budget constraints and a solvency conditions. Here N_t denotes the hours worked, and C_t is a CES aggregator of the quantities of different goods consumed, $C_t = \left(\int_0^1 C_t(i)^{\frac{\epsilon-1}{\epsilon}} di \right)^{\frac{\epsilon}{\epsilon-1}}$.

Solving for the first order conditions, log linearizing and using the market clearing condition $Y_t = C_t$ gives us the following equilibrium conditions.

$$y_t = -\frac{1}{\sigma}(r_t - E_t\{\pi_{t+1}\} - rr) + E_t\{y_{t+1}\}$$

where y_t denotes the log of aggregate output, r_t is the nominal interest rate, π_{t+1} is the rate of inflation between periods, t and $t + 1$, and $rr \equiv \rho$ represents the steady state real interest rate. Second, under the assumption of perfectly competitive labor market, the supply of hours satisfies,

$$w_t - p_t = \sigma c_t + \phi n_t$$

where w_t is the (log) nominal wage, p_t is the (log) aggregate price level, and $n_t = \log(N_t)$.

Now considering the firm side of the problem, we assume a continuum of firms, each producing a differentiated good with the following technology

$$Y_t(i) = A_t N_t(i)$$

where (log) productivity $a_t = \log(A_t)$ follows an exogenous process,

$$\Delta a_t = \rho_a \Delta a_{t-1} + \epsilon_t \tag{2.1}$$

with $\rho_a \in [0, 1)$, and here we assume that this variation in aggregate productivity are the only source of fluctuations in the economy.

All firms face a common real marginal cost, which is equilibrium is given by $mc_t = w_t - p_t - a_t$. Note also that by using the fact that $n_t = \log \int_0^1 N_t(i) di$ we can derive the following mapping between labor input and output aggregates.

$$n_t = y_t - a_t \tag{2.2}$$

Combining the equations we obtain an expression for the equilibrium real marginal cost,

$$mc_t = (\sigma + \phi)y_t - (1 - \phi)a_t.$$

Note that if we allow each firm to adjust prices optimally each period, i.e we have a flexible price framework, then the price- marginal cost markup is common across all firms, and constant over time, given by $mc = -\log(\epsilon/(\epsilon - 1))$. So, under flexible prices we get an equilibrium which

is independent of monetary policy, and the equilibrium level of output, employment and expected real rate are given as follows,

$$\begin{aligned}\bar{y}_t &= \gamma + \psi a_t \\ \bar{n}_t &= \gamma + (\psi - 1)a_t \\ r\bar{r}_t &= \rho + \sigma\psi\rho_a \Delta a_t\end{aligned}$$

where $\psi = (1 + \psi)/(\sigma + \psi)$, and $\gamma \equiv mc/(\sigma + \psi)$. Note that these equilibrium values are referred to as the *natural levels* of output, employment and real interest rate respectively.

Note however that in the case where all firms are not allowed to readjust prices, the markup is no longer constant. Therefore a gap emerges between that output in that case and the natural level of output, which we call the *output gap*, defined as follows.

$$x_t = y_t - \bar{y}_t \tag{2.3}$$

Recall, that in the Calvo setting we assume that a firm is allowed to reset its price with probability $(1 - \theta)$ each period. So each period $(1 - \theta)$ of the firms reset their prices, while a fraction θ keep their prices unchanged. In this case, we can derive the forward looking, new Phillips curve,

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \kappa x_t \tag{2.4}$$

where $\kappa = (1 - \theta)(1 - \beta\theta)(\sigma + \phi)/\theta$.

Also, we can rewrite the Euler equation in terms of the output gap and the natural real rate to yield,

$$x_t = -\frac{1}{\sigma}(r_t - E_t\{\pi_{t+1}\} - r\bar{r}_t) + E_t\{x_{t+1}\} \tag{2.5}$$

In addition to this system of equation we just need a specification of a monetary policy, i.e. how the interest rate is determined, to describe the equilibrium dynamics of the model economy with exogenous variations in the aggregate technology. Next we consider three alternative specifications

of the monetary policy rule, the optimal monetary policy, the simple Taylor rule and the constant money growth rule. We are interested in how the different variables respond to a technology shock in each of the policy frameworks.

2.2. Dynamic Effects of Technology Shocks under Optimal rule. Notice, that there are distortions present in the model described above due to opportunity cost of holding money, monopolistic competition and so on. If we assume that all distortions unrelated to nominal rigidities are corrected by some non-monetary means, then we can focus on distortions which are related to nominal rigidities. Note that in the presence of sticky prices and staggered nature of price setting, the firms inability to adjust prices each period with shocks leads to persistent deviations of markups from frictionless levels. We also see a relative price distortion as in the staggered price setting there is coexistence of different prices.

To correct these distortions, we need the output gap to be stabilized and production at the natural level, and zero inflation would help get rid of the price dispersion in the economy. So, the optimal policy, for the monetary authority requires,

$$x_t = \pi_t = 0.$$

The resulting allocation under this policy replicates the efficient, flexible price equilibrium allocations. We can implement these allocations in practise by using the interest rate rule,

$$r_t = r\bar{r}_t + \phi_\pi\pi_t + \phi_x x_t. \tag{2.6}$$

In Figure (1) we have shown the response of the variables to a positive technology shock using DYNARE. The complete system of equations defining our system under the optimal policy rule is given by equations (2.1) through (2.6) and the Fisher equation.

$$r_t = rr_t + \pi_{t+1} \tag{2.7}$$

As far as calibration is concerned, we use the same values as suggested in Gali et. al. (2003). We set $\phi_\pi = 1.5$, and the output gap coefficient $\phi_x = 0$, since they argue that the output gap in this framework is the deviation of output from its natural level, and is thus an unobservable variable. The rest of the parameters were assigned the following values, $\sigma = 1$, $\beta = 0.99$, $\phi = 1$, $\rho = 0.2$ and $\theta = 0.75$.

Once again notice that under this policy rule, we replicate the allocations associated with the flexible price equilibrium, under the assumption that productivity can be observed contemporaneously by the monetary authority. So basically, all variables are at their natural level.

2.3. Dynamic Effects of Technology Shocks under Taylor rule. Here we consider that the central bank follows the simple Taylor rule,

$$r_t = \rho + \phi_\pi \pi_t + \phi_x x_t \quad (2.8)$$

so the nominal interest rate responds systematically to the the contemporaneous values of inflation and output gap. Under this rule the equilibrium dynamics can be described by the following system,

$$\begin{bmatrix} x_t \\ \pi_t \end{bmatrix} = A_T \begin{bmatrix} E_t\{x_{t+1}\} \\ E_t\{\pi_{t+1}\} \end{bmatrix} + B_T \Delta a_t \quad (2.9)$$

where,

$$A_T = \Omega \begin{bmatrix} \sigma & 1 - \beta\phi_\pi \\ \sigma\kappa & \kappa + \beta(\sigma + \phi_x) \end{bmatrix} \text{ and } B_T = \sigma\rho_a\psi\Omega \begin{bmatrix} 1 \\ \kappa \end{bmatrix}$$

and $\Omega \equiv 1/(\sigma + \phi_x + \kappa\phi_x)$.

In this case to find the response to a positive technology shock by using the same baseline model as above, from equations (2.1) through (2.3), (2.9) replaces (2.4) and (2.5), and we use the Taylor rule as the monetary policy rule, i.e (2.8).

Now if we compare the response to our variables of interest to a positive technology shock under the two different policy rules we see that under the Taylor rule output and employment increase

beyond their natural levels (refer to Fig(1)). This leads to an increase in temporary inflation. So we can conclude that the policy response under the Taylor rule is not sufficiently contractionary, as they do not adjust the interest rate high enough to keep zero inflation. This is also apparent in our picture as the path of the real rate under the Taylor rule is uniformly below the path associated with the optimal policy.

But overall, the deviations from the optimal rule are quantitatively small and converge to the same response as under the optimal rule after about only 3 periods, and can be further reduced by choosing a more aggressive response, i.e higher values of ϕ_π and ϕ_x . But note that no finite values for these parameters can replicate the optimal response. This is because, supporting optimal response requires that prices remain stable and that real rate increases. So accordingly, nominal interest rate should also increase, but the Taylor rule will not generate a rise in the nominal rate unless a deviation from the optimal rule occurs in the form of positive inflation or output gap.

2.4. Dynamic Effects of Technology Shocks under Monetary Targeting rule. Suppose that the monetary authority targets the rate of growth of money supply. Say,

$$m_t - m_{t-1} = \gamma_m$$

where m is the quantity of money circulating in the economy, expressed in logs. Without loss of generality, we set $\gamma_m = 0$, which is consistent with zero inflation in the steady state. We have the usual money demand equation $m_t - p_t = y_t - \eta r_t$, and so we define

$$m_t^* \equiv m_t - p_t - \psi a_t$$

so that we can rewrite the money demand in terms of a stationary variable.

$$m_t^* = x_t - \eta r_t \tag{2.10}$$

and it also follows from the definition of m_t^* , that

$$m_{t-1}^* = m_t^* + \pi_t + \psi \Delta a_t \quad (2.11)$$

And so we use these two additional equations, (2.10) and (2.11), in our setup to compute the response to a positive technology shock under a constant money growth rule in DYNARE (Fig (2)).

Under monetary targeting rule, central bank keeps the money supply unchanged. In comparison to the optimal policy rule, monetary targeting implies a monetary stance that is too tight. The resulting path for the real rate lies uniformly above the optimal one. Consequently, output does not increase as much as would be efficient and employment declines. Nominal rates are unchanged under constant money growth rate. In comparison to the optimal rule, the responses are far from negligible, as with just 1% percent shock to productivity we see significant effects in the rate of inflation, employment and output gap, which remains constant under the optimal rate. So overall money targeting is less desirable than a simple Taylor rule because of larger deviations from the optimal rule, at least when technology shocks are a dominant source of fluctuations.

3. THE FED'S RESPONSE TO TECHNOLOGY SHOCKS: EMPIRICAL EVIDENCE

We determine the empirical effects of technology shock by estimating a structural VAR. We will be using the same long-run identifying restriction as in Gali(1999), that only technology shocks have long- run effects on labor productivity.

3.1. Description of data. Our VAR model contains four variables: labor productivity, hours, the nominal interest rate and inflation. Our hours series is constructed from hours worked in the non-farm business sector, normalized by the working age population. Labor productivity was constructed by taking the difference of the log of GDP, which is also normalized by working age population and the hours series. The nominal interest rate is the Federal funds rate and the price is measured with the log of the ratio of GDP and GDP deflator. Note that all the series are quarterly.

Our analysis covers the sample period 1959:I-2002:III. As suggested in Clarida et al. (2000), the U.S. monetary policy has experienced important structural changes over that period. So in light of the evidence given in that paper we have split the sample into two sub-samples: the Pre- Volcker era and the Volcker-Greenspan era. Also, we have removed 79:III-82:II from our analysis because of unusual operating procedures effective during that period, as suggested in Gali et al (2003).

3.2. Estimating the VAR. We are considering a structural VAR(4) with four variables, as we are dealing with quarterly data. It can be represented as follows:

$$Y_t = F_1 Y_{t-1} + F_2 Y_{t-2} + F_3 Y_{t-3} + F_4 Y_{t-4} + E_t$$

where

$$Y_t = \begin{pmatrix} \text{productivity}_t \\ \text{inflation}_t \\ \text{hours}_t \\ \text{nominalrate}_t \end{pmatrix}$$

and F_i are 4×4 coefficient matrices and $E(E_t E_t') = \Omega$, which is also a 4×4 matrix. So we can re-express this VAR(4) as a MA(∞) form,

$$\begin{aligned} Y_t &= (I - F_1 L - F_2 L^2 - F_3 L^3 - F_4 L^4)^{-1} E_t \\ &= \Phi(L)^{-1} E_t = E_t + \tilde{\phi}_1 E_{t-1} + \tilde{\phi}_2 E_{t-2} + \dots \end{aligned}$$

Note that the structural MA form looks as follows,

$$Y_t = C(L)U_t = C_0 U_t + C_1 U_{t-1} + C_2 U_{t-2} + \dots$$

It is apparent from comparing coefficients that $C_0 U_t = E_t$, since we have $\Phi(L)^{-1} E_t = C(L)U_t$. So taking variance on both sides we get that, $C(1)C(1)' = \Phi(1)^{-1} \Omega \Phi(1)^{-1}$. Now using the long run identifying restriction, that only technology shocks have long run effects on labor productivity,

we restrict $C(1)$ to be lower triangular. This identifying restriction allows us to use Cholesky decomposition, and we conclude that $C(\hat{1}) = chol(\Phi(\hat{1})^{-1}\hat{\Omega}\Phi(\hat{1})^{-1})'$, and since $C(1)U_t = \Phi(1)^{-1}E_t = \Phi(1)^{-1}C_0U_t$, we can estimate $\hat{C}_0 = \Phi(\hat{1})C(\hat{1})$.

3.3. Computing the Impulse Response Functions. We can also estimate the VAR(4) using the companion form, by rewriting the VAR(4) as a VAR(1),

$$\begin{pmatrix} Y_t \\ Y_{t-1} \\ Y_{t-2} \\ Y_{t-3} \end{pmatrix} = \begin{pmatrix} F_1 & F_2 & F_3 & F_4 \\ I_4 & 0 & 0 & 0 \\ 0 & I_4 & 0 & 0 \\ 0 & 0 & I_4 & 0 \end{pmatrix} \begin{pmatrix} Y_{t-1} \\ Y_{t-2} \\ Y_{t-3} \\ Y_{t-4} \end{pmatrix} + \begin{pmatrix} I_4 \\ 0 \\ 0 \\ 0 \end{pmatrix} E_t$$

$$Z_t = FZ_{t-1} + GE_t$$

Note that since this is a VAR(1), we know that $E_t Z_{t+k} = F^k Z_t$ and we can also derive the following,

$$Z_t = \sum_{j=0}^{\infty} G' F^j G E_{t-j} = \sum_{j=0}^{\infty} G' F^j G C_0 U_{t-j}$$

To find the impulse response function, we are interested in the response of Z_t to a shock U_t , so we consider the following,

$$\begin{aligned} \frac{\partial Z_{t+k}}{\partial E_t} &= \frac{\partial Z_{t+k}}{\partial Z_t} \frac{\partial Z_t}{\partial E_t} = G' F^k G \\ \frac{\partial Z_{t+k}}{\partial U_t} &= \frac{\partial Z_{t+k}}{\partial U_t} \frac{\partial E_t}{\partial U_t} = G' F^k G C_0 \end{aligned}$$

We are only interested in the response of the various variables to a technology shock, so we just consider the first column of the impulse response matrix.

3.4. Confidence Interval Using Bootstrapping Procedure. For our impulse response function we created confidence intervals using a bootstrapping procedure. We took the matrix of residuals E_t from the estimation of our VAR, and saved the coefficient estimates F_i for $i = 1, \dots, 4$. Then by random drawing we reshuffled the residuals and for each newly generated residual matrix we then constructed a synthetic data series one entry at a time by estimating a VAR and using the historical initial conditions. We then re-estimated the VAR using this synthetic series and calculated the implied impulse response functions. We repeated this process 500 times and then sorted our impulse response functions. We then calculated the 12th lowest and 487th highest values of the corresponding impulse response coefficients across all 500 synthetic impulse response functions. The boundaries of the 95% confidence intervals in our figures correspond to the graph of these coefficients.

4. EMPIRICAL RESULTS AND ADDITIONS TO EARLIER WORK

4.1. Pre-Volcker era. The Pre-Volcker period corresponds to 1959:III-1979:III, and Fig (3) shows the estimated response of the variables in our VAR to a positive technology shock, where we have specified hours in levels. Note that in the Gali et al. (2003) paper, they used quadratically detrended series for hours, and also since we did not have data identical to theirs we do not get exactly the same impulse response functions but the direction of the impulse response at impact is the same as theirs. Note also that we have shown the corresponding responses under the optimal rule. These were constructed to match the observed response of productivity as close as possible. We constructed them by setting $\rho_a = 0.4$ and the appropriate size for the shock, with standard deviation equaling 0.03.

Notice that initially productivity is slightly negative but only after five quarters the effect becomes positive and then keeps building on, and as should be expected with our long run identification, there is a persistent effect on productivity. The response of hours is also initially negative, and is reversed after around five quarters also. So basically we see large deviations from the responses

under the optimal rule. Also, the negative output gap that arises due to the shock causes the negative effect on inflation which is in stark contrast to the price stability implied by the optimal rule.

Notice also that compared to the response of nominal rate under the optimal rule, in the pre-Volcker era the nominal rate declines in response to the shock and persistently lies below the response under the optimal rule. So we can conclude that the changes in the nominal rate are insufficient to counteract the effect of the technology effect on inflation.

We can not reject the null hypothesis of a unit root for the hours series, so we carry out the same analysis with hours in first difference in our VAR, but the impulse responses overall look the same (Fig(4)). The response of hours seems even more significantly negative and quite large, and so the deviation from the optimal rule seems to increase in that case. Notice that regardless of us specifying hours in levels or first difference we get a negative initial response.

4.2. Volcker-Greenspan era. The Volcker-Greenspan era corresponds to 1982:III-2002:III, and Fig (5) shows the estimated impulse response to a positive technology shock, with hours in level specification. Note here that in the paper we're trying to replicate the data runs until 1998:III, so we have some additional observations. Here also we have shown the corresponding response under the optimal rule, where to approximate the path of the productivity, we set $\rho_a = 0.3$ and $\sigma_\epsilon = 0.2$ in our calibrated model. We observe an impact jump in the level of productivity, and it appears to stabilize at a slightly lower level. Unlike the Gali et. al (2003) paper, we see a persistent effect on hours after the initial negative response on the part of hours. But as far as nominal rate and inflation are concerned we see the same muted response, with reversion to zero after some initial response. So overall, apart from the hours we see results which are pretty consistent with the optimal rule.

When we consider the Volcker-Greenspan period with hours in first difference specification (refer

to Fig.(6)), then see greater deviations from the optimal rule. Both hours and nominal rate seem to be persistent and significantly positive.

4.3. Greenspan era. We also include the results from running the VAR and computing the impulse responses to a positive technology shock for the sub-sample time period which spans only Greenspan's rule as the Fed chairman (Figs. 7 and 8). This sub-sample corresponds to 1987:III-2002:III. As would be expected the results are not very different from what we get for the Volcker-Greenspan period, since we are using quarterly data and so for the Greenspan period we are only excluding a small fraction of observations from our sample.

4.4. Testing the Optimality Hypothesis. We are interested in evaluating if we can approximate the response of the Fed's to a positive technology by the theoretical policy rules that we mentioned earlier in the paper. As in the Gali et al. (2003) paper, our null hypothesis is that the Fed's follows the optimal rule. Since the optimal rule stabilizes output gap and prices, and as is apparent from the responses under the optimal policy, we have null hypothesis of a zero response for hours and inflation.

To test our null hypothesis of a zero response we can take two possible approaches. Firstly, we can observe the impulse responses of hours and inflation under both Pre-Volcker and Volcker-Greenspan period, and see if they are significantly different from zero by considering their 95% confidence bands. For now we only focus on the impulse response for both sub-samples with hours in levels, i.e Fig. (3) and (5). Note that in the Pre-Volcker period the response of inflation is significantly negative and the response of hours is ultimately significantly positive, so we can reject the null hypothesis in that case. On the other hand, for the Volcker-Greenspan period if we look at the confidence bands for inflation we can not reject the null of a zero response. But as far as hours go, their response is significantly positive. So overall it is ambiguous whether we can reconcile these two results to conclude that the Volcker-Greenspan period is consistent with the optimal rule.

Note also that if we were to use this approach then even for inflation our results are not robust

to specifying hours in first difference instead of levels.

Apparently, the Gali et al. (2003) paper uses a second approach to test the null hypothesis of a zero response. It seems that they create the 95% confidence bands for a zero response for inflation and hours by computing the standard deviation of each series, say σ and then compute $\mu \pm 1.96\sigma$ for each series respectively, where since we want a confidence band around a zero response, we set $\mu = 0$. They then test this null against the impulse response to a positive technology shock for both inflation and hours. In their case they were unable to reject the null for both hours and inflation for the Volcker-Greenspan era. But when I carried out the same analysis, I can not reject the null for the inflation series, but I can reject the null for the hours in the Volcker-Greenspan period, Fig(10). In both their and our results we reject the null for the Pre-Volcker period, Fig(9). This approach does not seem to be too concrete, because the null is assuming that the series is always zero, whereas the null we want to test for is that the series has zero response to a positive technology shock, and in our VAR framework we have other non-technology shocks also. So it would probably require something more sophisticated to isolate the effects of technology shocks alone on inflation and hours and then test the null for that to be zero.

Another problem with this approach is that even in the Gali et al. paper the first approach of looking at the confidence bands around the impulse response functions, would give us a different results from the second approach where we look at the confidence bands around a zero response. However, we would in general expect both approaches to give us the same result.

A potential way of testing for a zero response could be to consider the variance of the shock introduced in our theoretical model to resemble the impulse responses we get using the data. But once again the problem is that we are using a structural VAR framework, where several variables and their lagged values are explanatory variables for inflation and hours respectively and so it is not clear how we would test for a zero response of inflation to technology shock alone.

So at the end it remains an unsolved problem for me as to how we would conclusively test the optimality hypothesis which is basically the big result of the Gali et al.(2003) paper.

5. CONCLUSION AND POSSIBLE EXTENSIONS

In this paper we have estimated the Fed's systematic response to technology shocks. The analysis for the US data allows us to evaluate the extent to which the Fed has sought to stabilize prices in response to such shocks, as would be prescribed by the optimal policy in an environment where the staggered price setting is the major distortion corrected by the monetary authority.

Note that we had justifiable reasons to divide the data into two sub-samples, pre-Volcker and Volcker-Greenspan periods and we see significant differences in the response of the economy to a positive technology shocks across periods. Also, the Fed's response in the Volcker-Greenspan period appears to be consistent with a rule that seeks to stabilize prices. On the other hand, under the pre-Volcker period the Fed's policy seems less effective when facing a technology shock and we see high volatility in inflation. So overall, our results support the results in the literature that suggest an improvement in the way the Fed has conducted policy in recent years.

Note that our analysis supports the improvement of the Fed's performance under the assumption that technology shocks are the major source of fluctuation in the economy. Throughout our analysis we do not attempt to identify any other sources besides exogenous variations in technology. So it could be potentially interesting to consider other shocks besides technology shocks, and then we would have to reconsider our identification scheme also.

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