Online appendix of "Is Bigger More Effective? Shock Size and the Efficacy of Monetary Policy"

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1 Additional robustness checks

Table 1 summarizes the additional robustness checks.

Following the SBIC, this study sets the lag length of the main results as one. However, the AIC suggests five lags as a preferable lag length. Column (a) shows that the main results are unchanged even when using the five-lag specification. The difference in impulse responses between the large and small shocks remain significant and similar to the benchmark results.

In the benchmark model, I use $\theta = 3$ for the smoothness parameter of the logistics function. This is the same as in Tenreyro and Thwaites (2016). To check the robustness to

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alternative parameter values, Column (b) presents the results under $\theta = 9$. It also shows that the differences in impulses are significant between large and small shocks.

In the benchmark model, I assume that the volatility of the monetary policy shocks is time-invariant. However, monetary policy shocks may switch between high- and low-volatility processes as in Hamilton (1989). If shocks' volatility is time varying, economic agents change their behavior under high- and low-volatility regimes. Consequently, economic responses to large and small shocks could be observed differently. Taking this scenario into consideration, we adopt the following regime-switching Romer regression model as an alternative policy reaction function,

$$\begin{aligned} \Delta FF_t &= \kappa(s_t)' \boldsymbol{X_t} + \tilde{\epsilon}_t, \quad s_t = \{0, 1\}, \\ \tilde{\epsilon}_t &\sim N\left(0, \sigma_{\tilde{\epsilon}}(s_t)\right), \\ \boldsymbol{p} &= \begin{bmatrix} p_{0,0} & 1 - p_{1,1} \\ 1 - p_{0,0} & p_{1,1} \end{bmatrix}, \end{aligned} \tag{1}$$

where parameters $\{\kappa(s_t), \sigma_{\tilde{\epsilon}}(s_t)\}$ vary depending on the state s_t and $\boldsymbol{p}$ denotes the matrix of state transition probabilities.

Column (c) reports that the impulse responses are significantly different between the high- and low-volatility regimes.

The "FOMC dates" in column (d) suggests that the main results are robust even if the monetary policy shocks of FOMC months are used for estimation.

This study presents the impulse response functions after adjusting an initial shock to equalize the area under the responses of the federal funds rate up to the 36th month. Although this length of adjustment period is the same one as in Coibion (2012), Column (e) also checks whether the results are robust to the alternative length of adjustment. Specifi-

cally, Column (e) reports that the differences between the large and small shocks remain significant even if I apply the adjustment up to the 26th month, in which the responses of production hit their negative peak.

Table 1: Responses of industrial production: robustness checks

	(a) Alternative lags 5 lags			(b) Alternative smoothness $\theta = 9$			(c) High/low volatility regime			(d) FOMC dates			(e) FF rate path matching up to 26th month		
	Small	Large	Diff.	Small	Large	Diff.	Small	Large	Diff.	Small	Large	Diff.	Small	Large	Diff.
h	shocks	shocks	t-value	shocks	shocks	t-value	shocks	shocks	t-value	shocks	shocks	t-value	shocks	shocks	t-value
6	0.0182	-0.0012	0.8523	0.0117	0.0056	0.3998	-0.0026	0.0036	-0.3204	0.0162	0.0039	0.3236	0.0202	0.0119	0.4297
12	-0.014	-0.0219	0.378	-0.0163	-0.0069	-0.5902	-0.0033	-0.0114	0.2607	-0.0384	-0.0109	-0.7298	-0.0139	-0.0198	0.2098
18	-0.084	-0.0231	-2.3613	-0.0697	-0.0129	-3.2656	-0.0287	-0.0241	-0.1588	-0.1501	-0.0193	-2.9924	-0.0782	-0.0337	-1.7798
24	-0.1587	-0.022	-3.5939	-0.126	-0.0173	-4.5732	-0.0956	-0.0271	-2.0978	-0.2641	-0.0241	-3.9592	-0.1512	-0.0417	-3.1678
30	-0.1608	-0.02	-4.019	-0.1251	-0.0188	-5.1074	-0.114	-0.025	-2.9597	-0.227	-0.0263	-3.5979	-0.1532	-0.0455	-3.4245
36	-0.1301	-0.007	-3.8729	-0.0878	-0.0086	-4.7388	-0.0922	-0.0108	-2.744	-0.1305	-0.0158	-2.2929	-0.1085	-0.0199	-3.3412

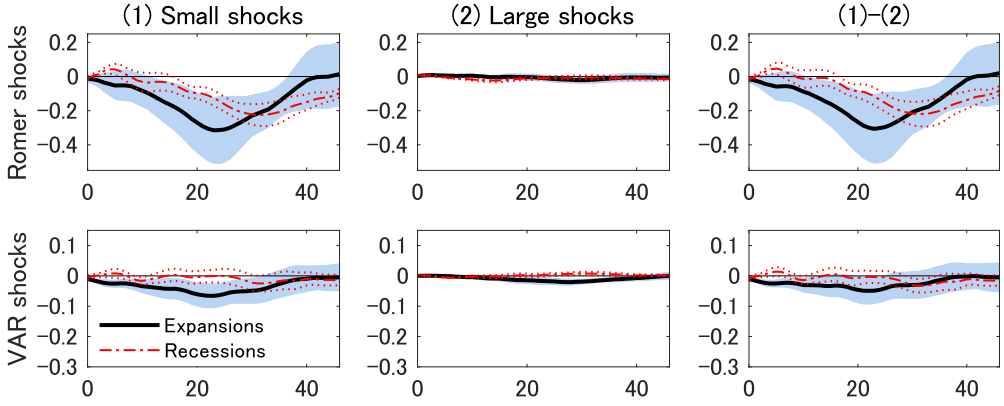
Note: The left column denotes the months after a contractionary monetary policy shock. In (a), the lag length of the covariates is five based on the AIC. In (b), the smoothness parameter of the smooth transition model is nine. In (c), monetary policy shocks are identified with Hamilton (1989)'s Markov switching model with high- and low-volatility states. Large shocks are defined as shocks that occur when the estimated probability of the high volatility regime exceeds 50%. In (d), the data for non-FOMC months are excluded. In (e), the initial impulse is adjusted to equivalate the areas under the federal funds rate up to the 26th month for both small and large shocks.

2 Relation to the previous studies

Lo and Piger (2005) found that asymmetry related to the size of policy actions disappears once business cycle phases are considered.

A key difference between this study and Lo and Piger (2005) is the monetary policy shocks. Employing a recursive vector autoregression (VAR) model, they identified monetary policy shocks, in which, as Romer and Romer (2004) argue, endogenous and anticipatory movements of monetary policy actions remain, whereas this study identifies the improved measure of monetary policy shocks following Romer and Romer (2004).

Figure 1: The policy effects on production during expansions and recessions



Note: Thick lines and shaded areas depict the impulse responses and 90 percent confidence intervals estimated after excluding the NBER recession periods, respectively. Broken lines with dotted lines are impulse responses and 90 percent confidence intervals after excluding the NBER expansion periods, respectively.

To investigate whether the difference in policy shocks creates the discrepancy between the results of this study and this previous work, we consider an additional exercise. In this, the estimation procedure is the same as for the main results, except for the monetary policy shocks, which are identified using a recursive VAR model as in Lo and Piger (2005).[1] The

[1]To maintain consistency with the previous analysis, this study uses a three-variable VAR model of

first row of Figure 1 represents the results in the main text for comparison. The second row of Figure 1 shows that the differences between small and large shocks become almost insignificant when the policy shocks are those used in the previous study. Thus, it appears that some of the conclusions in the former study depend on an inaccurate measure of monetary policy shocks.[2] Therefore, we consider that the conclusion of this study is robust if monetary policy shocks are properly estimated.

References

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logged output, logged PCE deflator, and the effective federal funds rate.

[2] I also check that Lo and Piger (2005)'s main conclusion (that the asymmetry relates to the business cycle phases) is unchanged even when the monetary policy shock is replaced with Romer and Romer (2004)'s shocks.

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