Online Appendix to
"Fiscal Stimulus and the Systematic Response of Monetary Policy"

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This online appendix contains supplemental material for the article "Fiscal Stimulus and the Systematic Response of Monetary Policy".

A Theory & model details

In Section I.C of the main paper I illustrate the theoretical identification result in Result 1 through a simple textbook New Keynesian model. This appendix section presents the model, discusses the example parameterization, and shows how I construct the policy counterfactuals displayed in Figures 1 and 2. I also further discuss Result 1.

A.1 The textbook NK model

The model consists of four standard relations: first, a simple Euler equation,

$$y_t - g_t = \mathbb{E}_t\left[y_{t+1} - g_{t+1}\right] - \frac{1}{\gamma}\left(i_t - \mathbb{E}_t\left[\pi_{t+1}\right]\right); \tag{A.1}$$

second, an NKPC,

$$\pi_t = \kappa\left(\frac{1}{\varphi} + \gamma\right) y_t - \kappa\gamma g_t + \beta\mathbb{E}_t\left[\pi_{t+1}\right]; \tag{A.2}$$

third, a simple fiscal policy rule specifying that government purchases evolve exogenously,

$$g_t = \rho_g g_{t-1} + \nu_{g,t}; \tag{A.3}$$

and fourth, a standard monetary policy rule subject to the full menu of contemporaneous and news shocks,

$$i_t = \phi_i i_{t-1} + (1-\phi_i) \times \left(\phi_\pi \pi_t + \phi_y y_t + \nu^0_{m,t} + \nu^1_{m,t-1} + \nu^2_{m,t-2} + \ldots\right). \tag{A.4}$$

Mapping to the general model structure (1) - (2b). It is straightforward to see that the model (A.1) - (A.4) can be represented in perfect-foresight sequence-space notation in the form (1) - (2b). I begin by writing each equation in matrix notation, with boldface again denoting time paths. The Euler equation becomes

$$\begin{pmatrix} 1 & -1 & 0 & \ldots \\ 0 & 1 & -1 & \ldots \\ 0 & 0 & 1 & \ldots \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix} (\boldsymbol{y} - \boldsymbol{g}) + \frac{1}{\gamma}\boldsymbol{i} - \frac{1}{\gamma} \begin{pmatrix} 0 & 1 & 0 & \ldots \\ 0 & 0 & 1 & \ldots \\ 0 & 0 & 0 & \ldots \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix} \boldsymbol{\pi} = \boldsymbol{0}; \tag{A.5}$$

the NKPC is

$$\begin{pmatrix} 1 & -\beta & 0 & \ldots \\ 0 & 1 & -\beta & \ldots \\ 0 & 0 & 1 & \ldots \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix} \boldsymbol{\pi} = \kappa \left(\frac{1}{\varphi} + \gamma\right) \boldsymbol{y} - \kappa\gamma \boldsymbol{g}; \tag{A.6}$$

the fiscal rule can be written as

$$\begin{pmatrix} 1 & 0 & 0 & \ldots \\ -\rho_g & 1 & 0 & \ldots \\ 0 & -\rho_g & 1 & \ldots \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix} \boldsymbol{g} = \begin{pmatrix} \nu_{g,0} \\ 0 \\ 0 \\ \vdots \end{pmatrix}; \tag{A.7}$$

and finally the monetary policy rule is

$$\begin{pmatrix} 1 & 0 & 0 & \ldots \\ -\phi_i & 1 & 0 & \ldots \\ 0 & -\phi_i & 1 & \ldots \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix} \boldsymbol{i} = (1-\phi_i) \times (\phi_\pi \boldsymbol{\pi} + \phi_y \boldsymbol{y} + \boldsymbol{\nu}_m). \tag{A.8}$$

To write (A.5) - (A.8) in the form (1) - (2b) let $x = (y, \pi)'$, $g = g$ and $m = i$. Then, stacking (A.5) - (A.6), we get an equation of the form (1), while (A.7) and (A.8) are already in the

Parameter	Description	Value
Private sector		
γ	Inverse EIS	1
φ	Frisch elasticity	1
κ	NKPC slope coefficient	0.01
Policy		
ρ_g	Spending persistence	0.75
$\{\phi_i, \phi_\pi, \phi_y\}$	Monetary rule (baseline)	$\{0.8, 1.5, 0.5\}$
$\{\tilde{\phi}_i, \tilde{\phi}_\pi, \tilde{\phi}_y\}$	Monetary response (counterfactual)	$\{0, 0, 0\}$

Table 1: Simple NK model, parameterization.

required form.

Example parameterization. The parameters considered for the numerical illustration in Figures 1 and 2 are displayed in Table 1. Note that I set $\kappa = 0.01$ to ensure an NKPC slope of 0.02, consistent with recent evidence.

A.2 Constructing policy counterfactuals

The policy counterfactuals constructed via finitely many monetary policy shocks and displayed in Figures 1 and 2 are computed exactly as in McKay & Wolf (2022). Please see Appendix A.6 of that paper for a detailed description. Since the counterfactual monetary policy rule considered in my experiment does not induce a unique equilibrium (recall that it pegs the nominal rate of interest), the constructed counterfactual should be interpreted as giving us a *particular* equilibrium—here the so-called MSV equilibrium.[1]

A.3 Proof of Result 1

Let $x' = (x, g)$ and re-write the model (1) - (2b) to subsume the fiscal rule (2a) into an appended "private-sector" block:

$$\mathcal{H}'_x \boldsymbol{x}' + \mathcal{H}'_m \boldsymbol{m} + \mathcal{H}'_g \boldsymbol{\nu}_g = 0 \tag{1'}$$

[1] One justification for focusing on this particular equilibrium is that it will be selected if monetary policy instead becomes active again with a delay (e.g., $\tilde{\phi}_\pi$ switches back to 1.5 in the far future).

Together, (1') and (2b) fit into the structure of McKay & Wolf (2022) and so the proof of their Proposition 1 applies without change.

B Empirical analysis

This section provides data sources and discusses implementation details for my empirical analysis in Section II.

B.1 Data

The empirical analysis requires three ingredients: measures of fiscal and monetary shocks as well as of the outcome variables of interest.

Fiscal shock. My identification of a fiscal policy shock closely follows Caldara & Kamps (2017). Specifically, I replicate their analysis and save the fiscal shock series implied by their identification applied to the OLS estimates of the reduced-form VAR. This is the shock series used for all further computations.

Monetary shocks. I use the monetary policy shock series of Romer & Romer (2004) and Gertler & Karadi (2015). Please see Appendix C.1 of McKay & Wolf (2022) for further details on these series.

Outcomes. To construct the counterfactuals displayed in Figure 3 I need to estimate impulse responses for three outcome series: the output gap, inflation, and nominal interest rates. As an additional control I will furthermore in all regressions include a measure of commodity prices. All four series are measured exactly as in McKay & Wolf (2022).

B.2 Shock impulse response estimation

I estimate the propagation of all shocks using a simple recursive VAR, following the discussion in Plagborg-Møller & Wolf (2021). The monetary policy shock specifications are exactly as in McKay & Wolf (2022), while for the fiscal shock I restrict the sample to 1981:Q1 – 2006:Q4. I do so to ensure a plausibly stable monetary reaction function: I start after Volcker and end before the zero lower bound episode.[2]

[2] Note that, for the study of monetary shocks, the underlying monetary rule need *not* be stable, allowing me to consider a longer sample period. This argument is made in more detail in McKay & Wolf (2022).

B.3 Constructing the policy counterfactual

I study the counterfactual propagation of the Caldara & Kamps fiscal policy shock under strict inflation targeting—that is, as my policy counterfactual, I consider the implicit monetary policy rule $\mathbb{E}_t\left[\pi_{t+s}\right] = 0$ for all $s = 0, 1, \ldots$. To do so I proceed as follows. First, I compute the OLS point estimates of how the various outcomes of interest respond to this baseline fiscal shock. Second, I draw the monetary policy shock causal effects from the posterior of the monetary policy VAR. For each draw I construct the best feasible approximation to strict inflation targeting by solving the minimization problem for $\boldsymbol{v}_m$ stated in Section II. Finally I report posterior percentile bands.

References

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