Identifying the Effects of Government Spending Shocks Using Real-Time Budget Plans

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Abstract

Inside lags in response to economic conditions that justify standard Cholesky identification of government spending shocks at a quarterly frequency are not sufficient for annual data. We propose using shocks based on real-time measures of government spending plans from the Office of Management and Budget as instruments to identify the effects of overall government spending shocks based on local projection methods. Addressing the apparent endogeneity using these instruments produces estimates of fiscal multiplier that are closer to what is found using Cholesky identification at a quarterly frequency, with positive and significant fiscal multiplier.

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1. Introduction

The Blanchard-Perotti (2002) identification scheme is a popular approach to identify government spending shocks at the quarterly frequency (see Ramey, forthcoming); and it has been popular in the annual frequency (see Ardagna, Caselli, and Lane (2007), Beetsma, Giuliodori, and Klaassen (2008, 2009) and Lane and Benetrix (2013)). But is the BP identifying assumption sufficient in the context of the annual data?

This paper shows that the Blanchard-Perotti (BP) identifying assumption is not sufficient in the annual data and offers relevant instruments from the real-time budget plans to identify the effects of government spending shocks. By modelling the real-time government spending from the Office of Management and Budget (OMB) which is annual frequency, we show that the BP identified annual shocks is a mixture of shocks to government plans and shocks to actuals. We identify the BP shocks using the shocks to plans as instruments.

This paper contributes to the literature in three ways. First, we illustrate that the BP identifying assumption is not sufficient in the annual data and is a mixture of shocks to plans and shocks to actuals. Second and related, we offer instruments i.e. the shocks to plans to identify the effects of government spending. Third, we illustrate the use of real-time data on final-vintage data analysis via the local projects instrumental variable in line with the general suggestions in Stock and Watson (2018)[2].

[2] Stock and Watson (2018) suggest that the most exciting work to be done in the identification by instruments is empirical: "We look forward to the development of new external instruments that provide plausibly exogenous variation to provide more credible identification of dynamic causal effects."

We illustrate the point of this paper in measuring the fiscal multiplier. We compute the impulse responses with local projection, comparing the impulse responses for the BP spending shocks (LP-OLS) with the impulse responses to BP spending shocks instrumented by the real-time shocks (LP-IV). The real-time shocks are obtained from a quasi-difference real-time model of the OMB budget data. These real-time shocks – implementation, current and deferred – are extracted from a real-time VAR developed in Lee et al. (2018). The fiscal multiplier is the integral responses of output over government responding with respect to the shock. As Ramey (forthcoming) points out, the method of computing the fiscal multiplier matters so we follow the best practice to connect with the literature.

We find that the fiscal multiplier using annual data matches that the estimate when using quarter data when we instrument the BP shocks with shocks to the real-time budget plans. The real-time shocks pass instrument relevancy tests and deliver a positive and significant fiscal multiplier compared to the BP case where the fiscal multiplier is negligible and not statistically different from zero.

The paper is organized as follows. Section 2 discusses the local projection estimation approaches and the identification of the real-time shocks. Section 3 describes the data sources and presents some descriptive statistics. Section 4 discusses the results. Section 5 concludes.

2. Modelling Frameworks

2.1 Estimating the Impulse Responses

We estimate the impulse responses via local projection, following Jordà (2005) and Ramey (2016).

Identification via BP:

$$\log \mathrm{g_t} = \mu + \sum_{i=1}^{2} \rho_{i1} \log g_{t-i} + \sum_{i=1}^{2} \rho_{i2} \log \tau_{t-i} + \sum_{i=1}^{2} \rho_{i3} \log y_{t-i} + \gamma_1 \mathrm{D_{09}} + \mathrm{bp_t} \quad (1)$$

where $\Delta \log \mathrm{g_t}$, $\Delta \log \tau_t$ and $\Delta \log y_t$ are first-difference log of final-vintage spending, taxes and outputs, $\mathrm{D_{09}}$ is 2009 dummy and $\mathrm{bp_t}$ is the identified BP spending shocks.

Instrumenting the BP shocks:

$$\sum_{i=0}^{h} \log z_{t+i} = \beta_h + \theta_h \widehat{bp_t} + \psi_h(L) x_{t-l} + \gamma_1 D_{09} + \nu_{t+h} \quad (2)$$

where z_t are spending and output, $\widehat{bp_t}$ is the fitted BP shock using the real-time shocks as instruments, x_t is a vector of control variables (two lags of the shock, two lags of log spending, log taxes and log outputs) The coefficient θ_h gives the response of accumulated z at time t+h to the shock induced by the real-time shocks at time t.

The fiscal multiplier is θ_h^y / θ_h^g (in elasticity); to convert this to levels, we scale it by the ratio of government spending to output. We compute the standard error of the fiscal multiplier using the delta method.

2.2 Identifying the Real-Time Shocks

The shocks – implementation-, initial fiscal- and deferred fiscal shocks – from the real-time model of budget plans are obtained from the quasi real-time model that is based around the following five equation system (Lee et al., 2018):

$$\begin{pmatrix} {}_{t}g_{t-1} - {}_{t-1}g_{t-1} \\ {}_{t}\tau_{t-1} - {}_{t-1}\tau_{t-2} \\ {}_{t}y_{t-1} - {}_{t-1}y_{t-2} \\ {}_{t}g_{t} - {}_{t}g_{t-1} \\ {}_{t}g_{t+1} - {}_{t}g_{t} \end{pmatrix} = A \begin{pmatrix} {}_{t-1}g_{t-2} - {}_{t-2}g_{t-2} \\ {}_{t-1}\tau_{t-2} - {}_{t-2}\tau_{t-3} \\ {}_{t-1}y_{t-2} - {}_{t-2}y_{t-3} \\ {}_{t-1}g_{t-1} - {}_{t-1}g_{t-2} \\ {}_{t-1}g_{t} - {}_{t-1}g_{t-1} \end{pmatrix} + \alpha \begin{pmatrix} {}_{t-1}g_{t-2} - {}_{t-1}y_{t-2} \\ {}_{t-1}\tau_{t-2} - {}_{t-1}y_{t-2} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{pmatrix} \tag{3}$$

where ε_{1t} is the implementation shock, the initial fiscal shock is ε_{4t} orthogonal to ε_{1t} and the deferred fiscal shock is ε_{5t} orthogonal to both ε_{1t} and ε_{5t} are obtained.

3. Data

Figure 1 plots the log of real government outlays (final-vintage) and the log of real GDP between 1957 and 2015. Our sample covers the post World War II and Korean war periods.

Figure 2 plots the BP shocks from equation (1) and the real-time shocks – implementation errors, initial shocks and deferred shocks from the real-time in equation (3).

4. Results

4.1 Relevance

Figure 3 plots the first-stage F-statistics of the BP shocks for the sum of government spending estimated in equation (2). Figure 4 plots the first-stage F-statistics of the Ramey and the real-time shocks estimated in equation (2).

The BP shock is a strong instrument the government spending, particularly in the first four years but the Ramey shock is a weak instrument for the BP shocks. This is consistent with the quarter findings (Ramey and Zubairy 2018)**.**

The real-time shocks are relevant instruments for the BP shock throughout the horizons considered. Individually, only the lagged deferred shocks are relevant instruments for the BP shocks, at the 10% significance level.

Treating the implementation errors as part of the endogenous response of fiscal policy, we could instrument the BP shocks with lagged deferred and initial

shocks, which we call as the initiative shocks. The initiative shocks are significant at 10% in the first five years and significant at 5% thereafter.

4.2 Estimates of the fiscal multiplier

Figure 5 plots the estimates and standard errors of the fiscal multipliers. Table 1 reports the 2-year and 4-year integral fiscal multipliers.

When we use the BP shocks to measure the fiscal multiplier, the estimate is typically negative and never significantly different than zero. But when we use the initiative shocks i.e. shocks to budget plans to instrument for the BP shocks, we obtain a positive and statistically significant fiscal multiplier that matches the estimate obtained using quarterly frequency. The 2-year and 4-year integral fiscal multiplier for the BP shocks are -0.49 and -1.22 respectively, whereas the 2-year and 4-year integral fiscal multiplier for the instrumented BP shocks using the initiative shocks are 1.00 and 1.16 respectively.

4. Concluding remarks

We show that the inside lags used to justify the standard Cholesky identification of government spending shocks at a quarterly frequency are not sufficient for annual data; related, we propose using the real-time government spending as instruments to identify the effects of government spending at an annually frequency. We illustrate this in measuring the fiscal multiplier. Measuring the fiscal multiplier with the final-vintage BP shocks yield a negligible fiscal multiplier but when we instrument the BP shocks with the shocks to real-time budget plans, we get an estimate that is typically found at a quarterly frequency i.e. positive and statistically significant.

Our results show that the BP identified shocks using final-vintage data at the annually frequency is a combination of shocks to government planned and actual spending announced at every fiscal year. Our results imply that the shocks to the actual spending is part of the endogenous response of fiscal policy and this component bias the fiscal multiplier negatively.

We invite others to use these instruments to identify the causal effects of government spending at the annual frequency as measuring the fiscal multiplier is only an illustration. These instruments from the real-time budget plans can be used in other contexts via the local projects instrumental variable.

Going further, the deferred shocks can be thought of as a news shock in the fiscal foresight literature (see Forni and Gambetti (2016); Caggiano et al. (2015); Ong (2018)). We want to investigate if identifying the news shocks would matter when using the real-time data vs. the final-vintage data.

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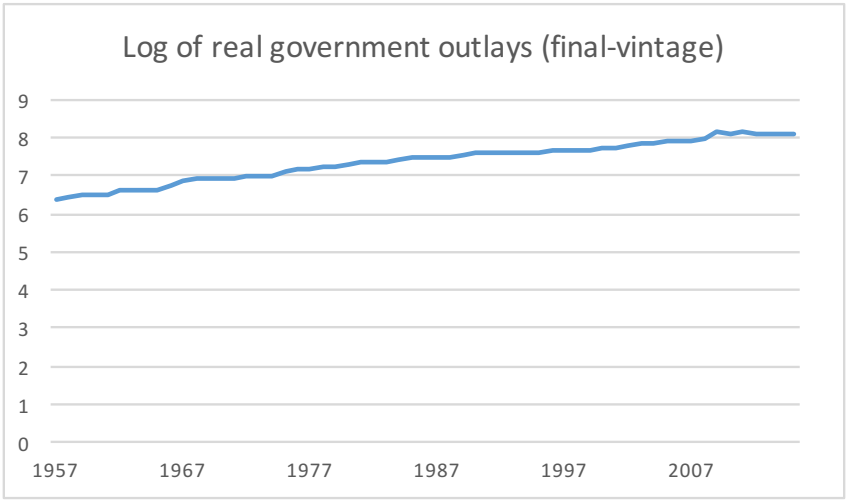
Table and Figures

Table 1: Annually Estimates of Fiscal Multipliers: 1957-2015

	BP shocks	Real-time shocks	Initiative shocks	Deferred shocks
2-year	-0.49	0.02	1.00	2.54
integral	(0.47)	(0.53)	(0.53)	(0.77)
4-year	-1.22	-0.30	1.16	4.25
integral	(0.83)	(0.82)	(0.80)	(1.81)

Note: The values in brackets under the multipliers give the standard errors.

Figure 1 Government Outlays and GDP



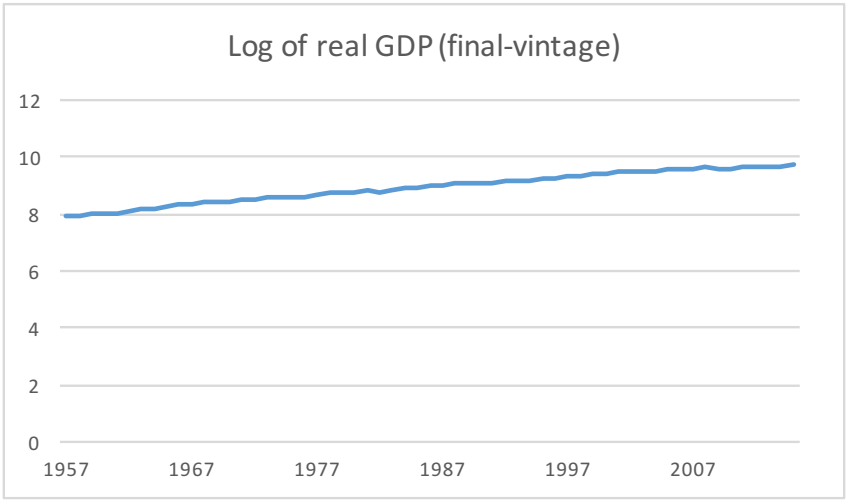
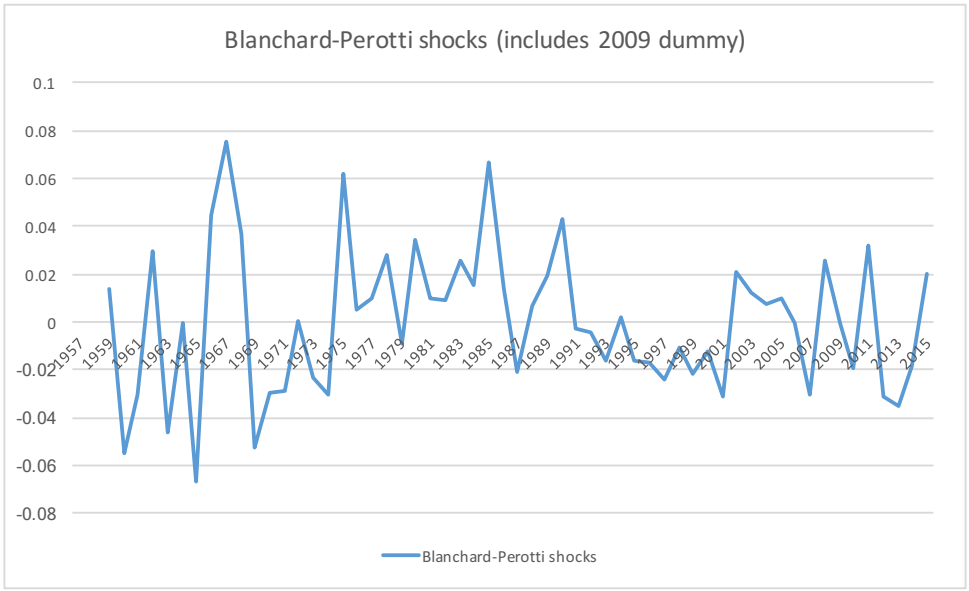
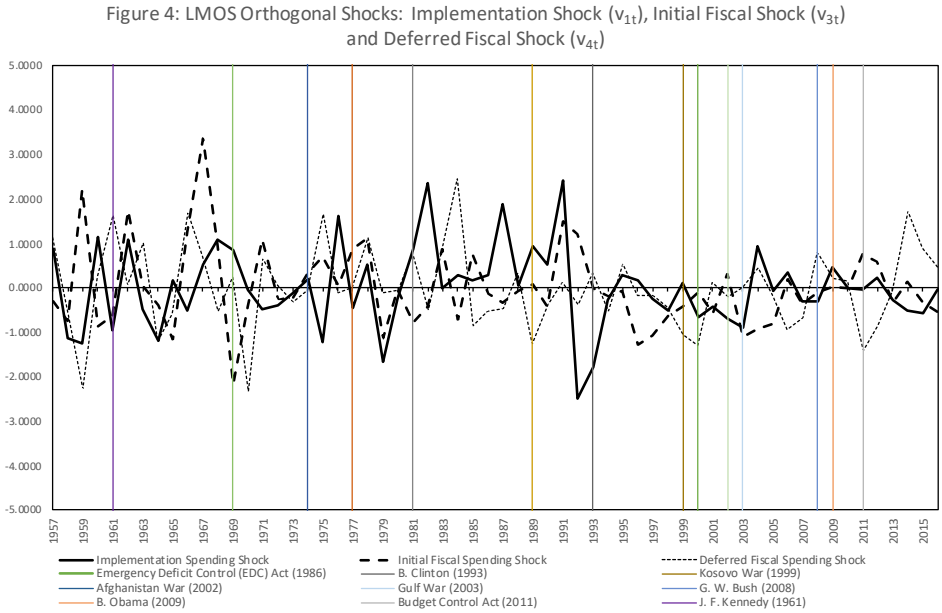


Figure 2 The Blanchard-Perotti shocks and the Real-time shocks

BP shocks

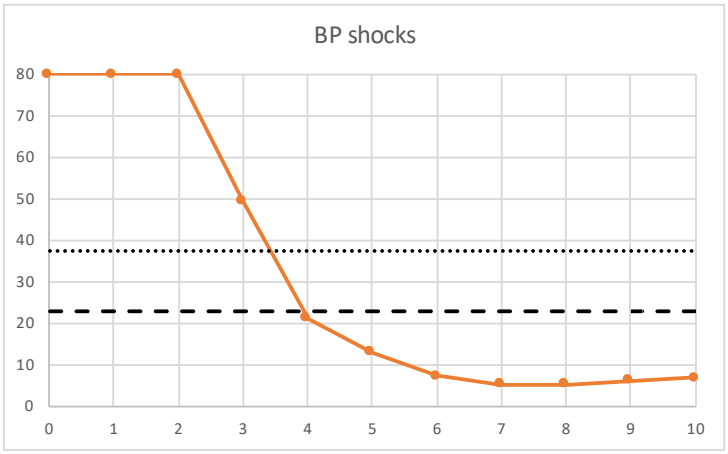


Real-time shocks



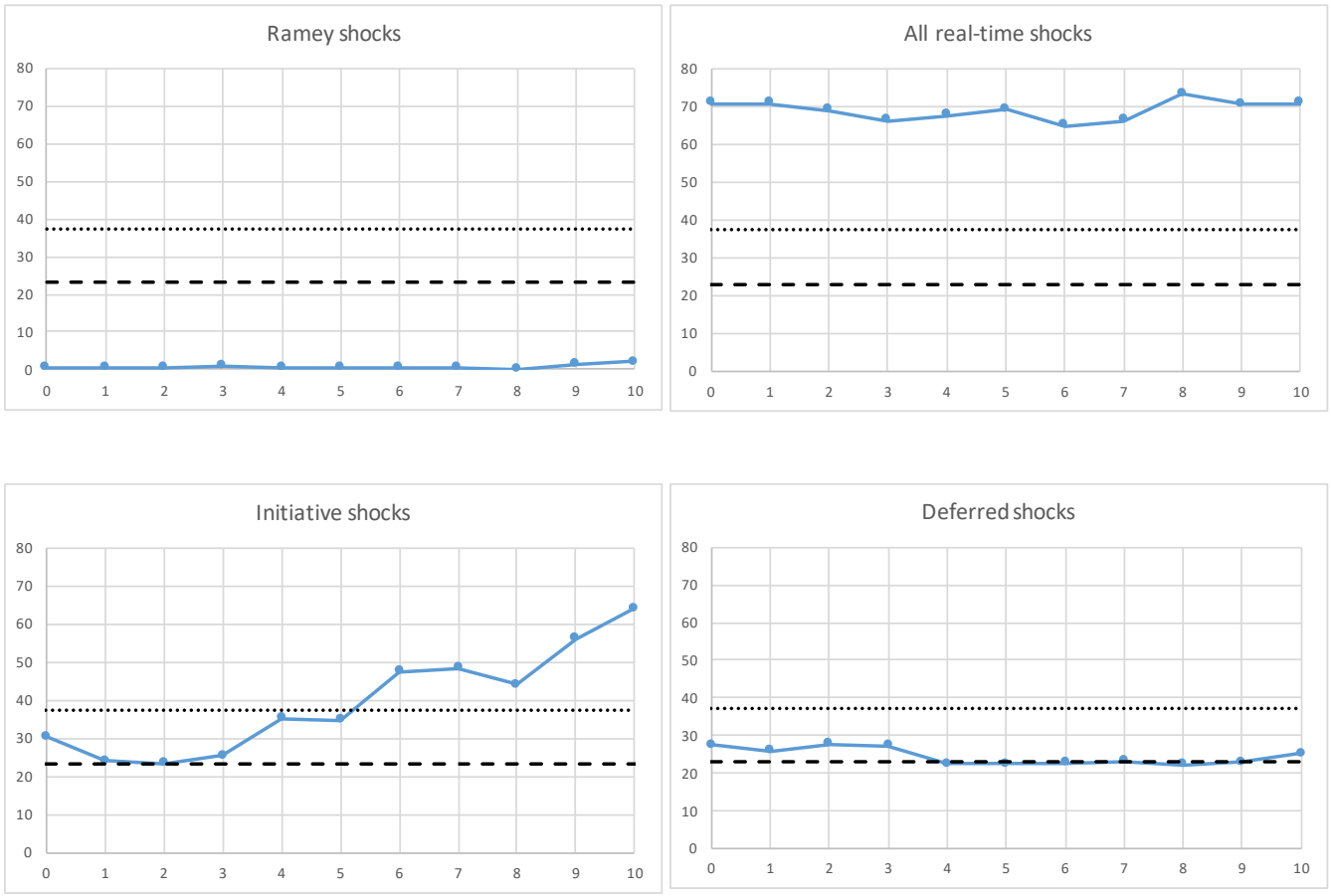
Note: The Blanchard-Perotti (2002) shocks are obtained by regressing the final-vintage government outlays on two lags of government outlays, taxes and real gdp and a 2009 dummy. The LMOS orthogonal shocks are obtained from the model (3).

Figure 3 First Stage F-Statistics for Blanchard-Perotti Shocks



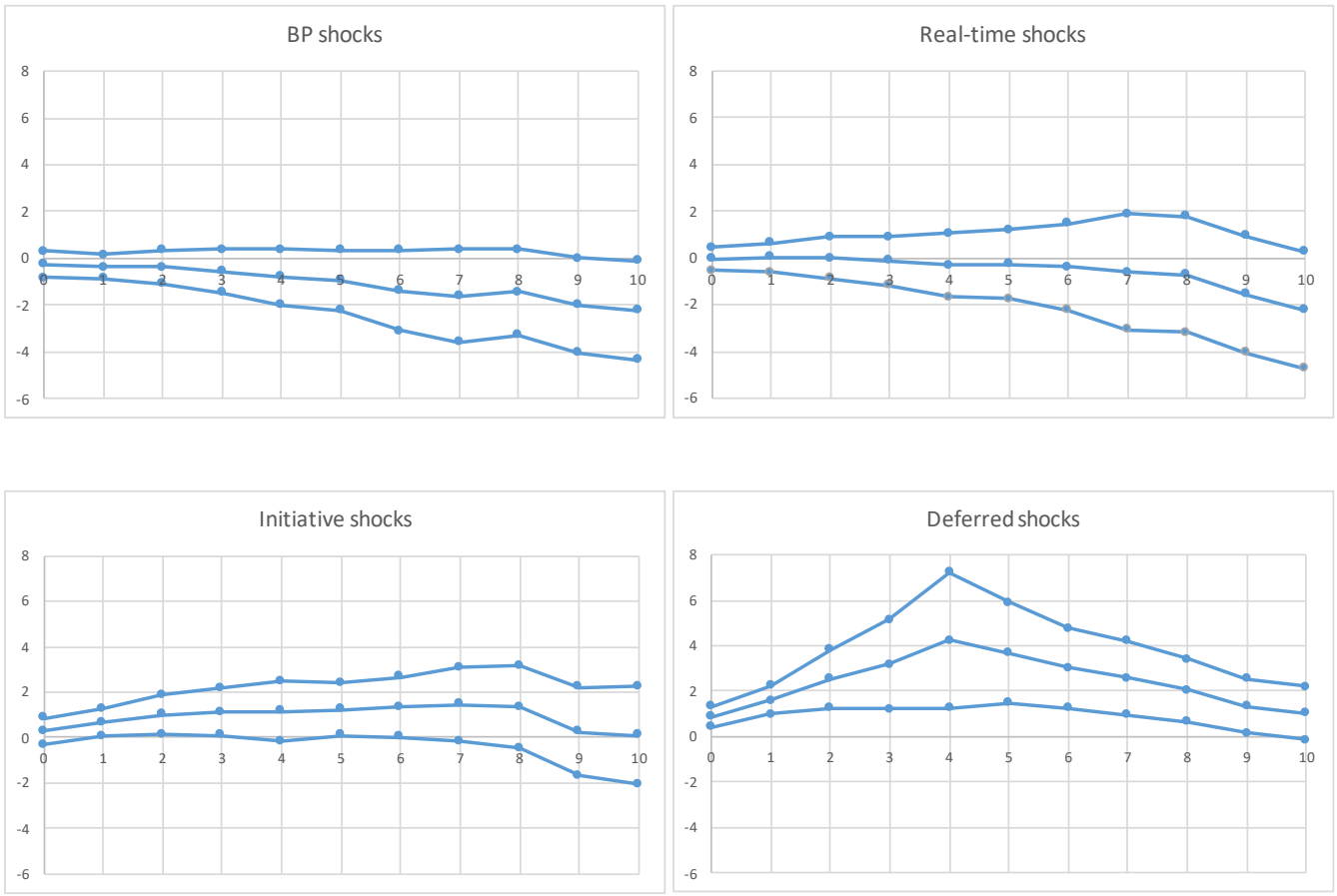
Note: The F-statistics are based on the regression of the sum of government spending from t to t+h on the shock at time t, plus the lagged control variables. Values above 80 have been capped at 90. The horizontal dashed lines are the Montiel-Pflueger (2013) 5% (upper line) and 10% (lower line) thresholds.

Figure 4 First Stage F-Statistics for Real-Time Shocks



Note: The F-statistics are based on the regression of the Blanchard-Perotti (2002) government spending shocks from t to t+h on the instrument at time t, plus the lagged control variables. Values above 80 have been capped at 90. The horizontal dashed lines are the Montiel-Pflueger (2013) 5% (upper line) and 10% (lower line) thresholds.

Figure 5 Estimates of Fiscal Multiplier



Note: 90% confidence band is shown.