Identification of fiscal SVAR-IVs in small open economies

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Outline

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Introduction

Introduction

This paper: We propose a novel instrumental variable strategy to identify fiscal shocks in small open economies.

Our approach builds on the general idea that that identification in fiscal-SVARs can be achieved by accounting for the systematic component of fiscal policy (Caldara and Kamps, 2017)

With a suitable IV it is possible to find elasticities of fiscal *policy* to endogenous *non-policy* variables that enable this identification strategy

We propose to use trading partner forecast errors as instruments

This IV is motivated by the small open economy setup:

- Unexpected changes in trading partners correlate with output of an open economy (Relevance)
- Unexpected fiscal shocks of a small economy are unrelated to its trading partners' contemporaneous forecast errors (Exogeneity)

Introduction

We apply our approach to studying both Canada and a panel of five Euro area countries: Finland, Austria, Belgium, Portugal and the Netherlands

- Canada has a large neighbor in US and we are able to use US (SPF) forecast errors for IV
- For Euro area economies there is generally no single large trading partner and we construct IV as a weighted mean of trading partner forecast errors from OECD

We are able to contribute to literature by extending the non-fiscal proxy approach to other countries besides the US

With this set of countries we can also study the potentially different effects of fiscal policy outside (Canada) and inside a currency union (Euro area)

Preview of results

Some of our findings:

- Instrument is found to be relevant, forecast errors of trading partners do predict domestic output shocks
- We find suggestive evidence that the exogeneity assumption is fulfilled better than by non-fiscal instruments currently applied
- We find government spending multipliers of roughly $0.5 - 1$ for Canada and $0 - 0.5$ for a panel Euro area countries
- Government spending multiplier estimates are sensitive to small changes in the estimated systematic component
- Evidence in support of twin deficits hypothesis

Some of the related literature

SVAR-IV / Proxy-SVAR: Caldara and Kamps (2017); Angelini et al. (2020); Stock and Watson (2018); Mertens and Ravn (2013)

Fiscal multipliers: Blanchard and Perotti (2002); Perotti (2005); Mountford and Uhlig (2009); Ramey and Zubairy (2018); ...

Fiscal policy in open economies: Ilzetzki et al. (2013); Kim and Roubini (2008); Ravn et al. (2012); Forni and Gambetti (2016); Klein and Linnemann (2019); Ravn and Spange (2014); Beetsma and Giuliodori (2011); Corsetti et al. (2012)

Empirical strategy

Reduced form VAR model

Our empirical starting point is reduced form VAR model for vector y of:

- g, general government spending and investment
- r, general government net revenues
- gdp, output
- cab, current account balance (as a share of GDP)
- rer, real exchange rate
- $srate$, short-term interest rate
- $defl$, GDP deflator
- $f_{\Delta g}$, one step-ahead forecast of growth in g (OECD)
- $f_{\Delta gdp}$, one step-ahead forecast of growth in gdp (OECD)

$$y_t = c + \sum_{i=1}^{p} A_i y_{t-i} + u_t, \tag{1}$$

Reduced form VAR model

Sample is 1986Q1-2019Q4 for Canada ("Great Moderation") and 1999Q1-2019Q4 (EMU) for Euro area countries

We use 5 lags in the baseline specification

For Canada we estimate simply equation-by-equation OLS

For Euro area economies we estimate the model in panel form similarly to Ilzetzki et al. (2013) with country fixed effects but with common VAR coefficients on the lag terms (pooled OLS with country FE)

For constructing confidence intervals we utilize the residual-based moving block bootstrap proposed by Brüggemann et al. (2016) that is shown to be applicable for Proxy-SVARs / SVAR-IVs

Identification of VAR structural shocks

Caldara and Kamps (2017) develop an analytical framework under which different identification schemes to estimating fiscal multipliers can be considered

Their SVAR framework builds on the idea of characterizing the **systematic component** of fiscal policy and then retrieving shocks to fiscal policy as the unexplained part in the VAR residual of the policy variable

As an example, suppose there is a positive relationship between *policy* and *output* but that *policy* may systematically react to changes in *output*.

Any SVAR identification scheme must then decompose this positive co-movement between shocks to *policy* and other shocks that move *output*

This structural decomposition then in turn determines the estimated effect of *policy* on *output*

Identification of VAR structural shocks: BP

In the popular Blanchard and Perotti (2002) identification scheme government spending shock is identified under the assumption that the systematic component is zero at the quarterly frequency as it is thought that government spending does not react to other shocks contemporaneously due to implementation lags

$\Longrightarrow$ structural g shock is the reduced form VAR residual

Similarly, Blanchard and Perotti (2002) identify shocks to government revenues based on institutional knowledge of tax and transfers systems in order to construct the systematic component as the automatic response of revenues with respect to output

$\Longrightarrow$ structural r shock is retrieved from the reduced form residual minus the automatic response of r to gdp

(In addition there is a zero restriction between g and r structural shocks)

Identification of VAR structural shocks: non-fiscal proxies

We build also on another contribution of Caldara and Kamps (2017) which is their proposal to use non-fiscal proxies in order to identify the systematic component of fiscal policy.

Suppose we have an instrumental variable m_t that satisfies the following conditions:

$$E[m_t e_t^{non\text{-}policy}] = \Gamma \neq 0 \qquad \text{(relevance)}$$

$$E[m_t e_t^{policy}] = 0, \qquad \text{(exogeneity)}$$

where $e_t^{non\text{-}policy}$ are the unexpected non-policy shocks and e_t^{policy} are the unexpected policy shocks.

With m_t we can estimate the elasticities of the policy variables with respect to, e.g., output via 2SLS instead of relying on external estimates

This strategy is in contrast to directly instrumenting for policy shocks

With non-fiscal proxies the identification strategy explicitly hinges on capturing the systematic component of fiscal policy

Identification of VAR structural shocks: proposed instrument

We propose to use forecast errors of trading partner economies as a proxy for output shocks in the domestic economy

If the forecasts are sensible then forecast errors arguably capture unexpected foreign variation

We argue that the relevancy and exogeneity conditions for this instrument apply in the **small open economy** setup:

- Unexpected changes in trading partners output correlate with output shocks of an open economy (Relevance)
- Unexpected fiscal shocks of a small economy are unrelated to its trading partners' forecast errors of output (Exogeneity)

There is ample literature that makes one kind or another exogeneity assumptions about small open economies (e.g. Cushman and Zha, 1997)

Using forecast errors as IV

Building the proposed instrument

For our instrument we collect data on past macroeconomic forecasts of professional forecasters

We transform all level forecasts to log-difference forecasts as follows:

Let $F_t[.]$ denote a forecast operator and v_{t+1} is the value of variable v in period $t+1$. Then $F_t[v_{t+1}]$ is the forecast of the value of v in period $t+1$ made in period t.

Using this notation we can write the forecasted log-difference made at time t as

$$F_t[ln(v_{t+1}) - ln(v_t)]. \tag{2}$$

Forecast errors of variable v at time $t+1$ are then obtained as the difference between the realized log-difference and the forecasted one, i.e.

$$\{ln(v_{t+1}) - ln(v_t)\} - \{F_t[ln(v_{t+1}) - ln(v_t)]\}. \tag{3}$$

Instrument data

We collect **forecast errors of output** from trading partners and use it to instrument for domestic *gdp* in the VAR

$$E[m_t e_t^{gdp}] = \Gamma \neq 0 \tag{4}$$

$$E[m_t e_t^{j}] = 0, \quad j \in g, r \tag{5}$$

For Canada, we use quarterly forecasts of the US economy from the Survey of Professional forecasters (SPF)

For Euro area economies, our data for the instrument is from the OECD Economic Outlooks (OECD EOs)

Since, unlike in Canada's case, no single country has an overwhelming share in the exports of a typical euro area economy, we combine forecast errors from several countries into a single instrument

In doing so, we weight trading partner forecast errors by their share in domestic exports. The quarterly data on export weights are from OECD

Comparison to util. adj. TFP as an instrument

Earlier literature has utilized the quarterly utilization adjusted TFP series of Fernald (2014) which is available for the United States

This series is used as an instrument, for example, in Caldara and Kamps (2017) and in Angelini et al. (2020) when estimating the output elasticity of fiscal variables in a similar setting to ours

A bunch of (structural) assumptions are needed in building the TFP instrument (incl. production function, form of utilization adjustment)

$$TFP_{\text{util. adj.}} \approx \underbrace{output - F(K, L, ...)}_{TFP} - g(\text{capacity utilization})$$

The TFP series of Fernald (2014) has seen large revisions

In contrast to the TFP instrument, a major advantage of our instrument is that it is derived rather straightforwardly from observable data

Panel A: Relevance

	Dependent variable: Forecast error of Δgdp			
	CAN	EUR	US(CK)	US
	(1)	(2)	(3)	(4)
Trading partner forecast error instrument	0.463***	0.956***		
	(0.103)	(0.126)		
Δ Utilization adjusted TFP			0.085***	0.045***
			(0.027)	(0.016)
Observations	92	390	152	204
Adjusted R^2	0.188	0.366	0.133	0.038
Country FE		✓		

Panel B: Exogeneity

	Dependent variable: Instrument			
	CAN	EUR	US(CK)	US
	(1)	(2)	(3)	(4)
Forecast error of Δg (OECD)	-0.048	-0.029		
	(0.107)	(0.029)		
Forecast error of Δg (SPF)			-0.414	0.829***
			(0.338)	(0.312)
Observations	92	390	101	153
Adjusted R^2	-0.008	-0.010	0.007	0.037
Country FE		✓		

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Results

Results

1) 2SLS estimates of elasticities w.r.t. output (systematic component)

- Relevancy of the instrument, 1st stage F-statistics
- Differences in elasticities between BP and CK identifications

2) Estimates of the government spending multiplier

3) IRFs

- What can we learn from the effects of fiscal policy in small open economies?
- Differences in effects of spending and revenue shocks?
- Differences between CK/BP identifications?

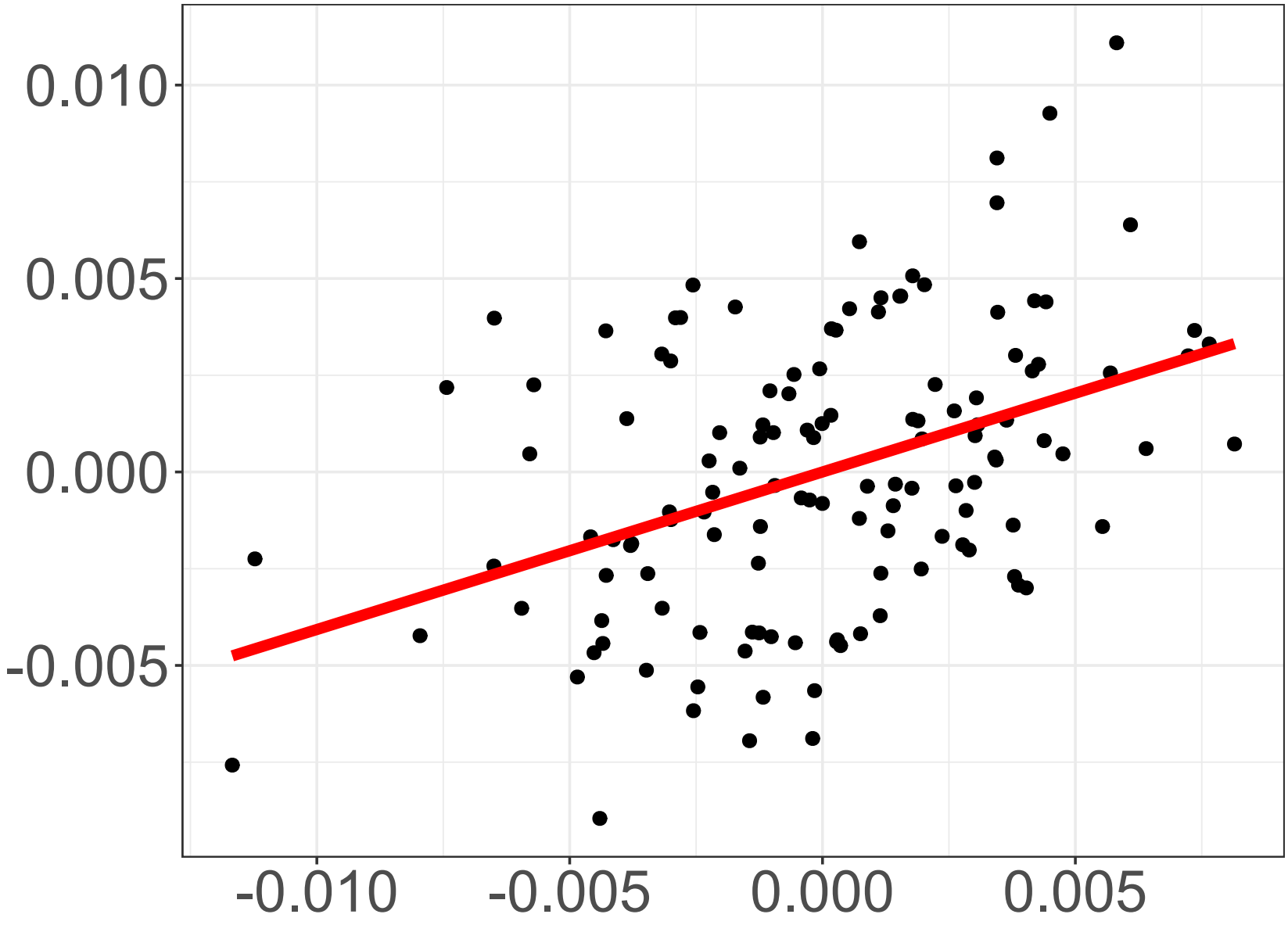
2SLS estimates of output elasticities

	Canada				Pooled EUR			
	BP		CK		BP		CK	
	g (1)	r (2)	g (3)	r (4)	g (5)	r (6)	g (7)	r (8)
gdp	**0**	3.58**	-0.280	3.81**	**0**	1.42	-0.490	1.43
		(1.67)	(0.365)	(1.74)		(0.948)	(0.785)	(0.962)
g		-0.810				-0.030		
		(0.498)				(0.118)		
$g - a_g gdp$				-1.03*				-0.052
				(0.590)				(0.127)
Standard-Errors	Newey-West ($L = 3$)				2-way clustered (Country & Time)			
Observations	131	131	131	131	367	357	357	357
Adjusted R^2	0.994	0.961	0.993	0.961	0.997	0.992	0.997	0.992
F-stat. (1st stage), gdp		16.6	15.7	16.7		16.7	17.2	16.8
Constant	✓	✓	✓	✓				
Country FE					✓	✓	✓	✓

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Notes: All models include 5 lags of VAR variables as controls.

1st stage, CAN (x: instrument (residual), y: *gdp* residual)



Cumulative government spending multiplier

We follow the convention of reporting the government spending multiplier over different horizons by calculating it as the ratio of the cumulative sum of output responses and the cumulative sum of the spending responses

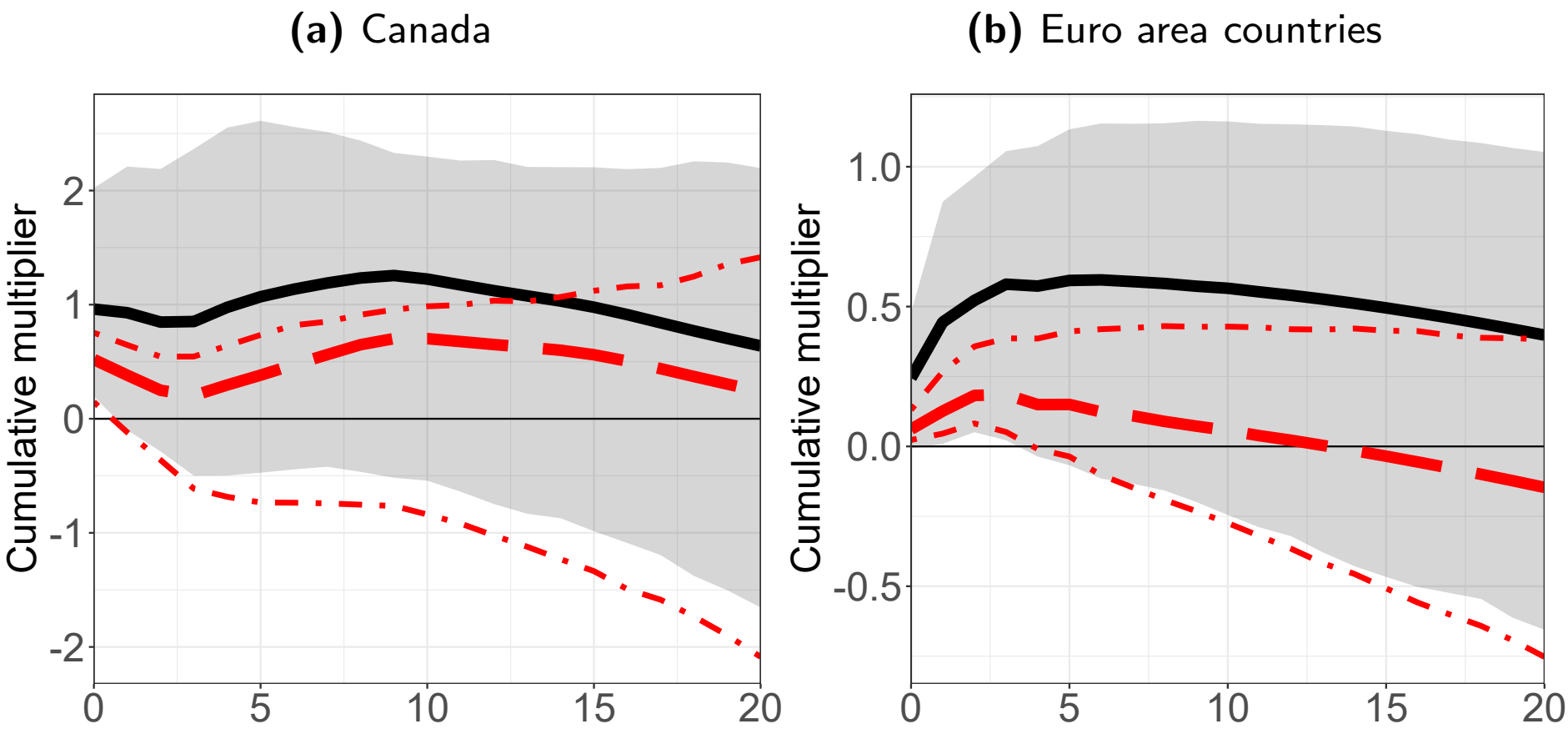
This convention is useful for characterizing the effectiveness of fiscal stimulus since it accounts for the persistence of the fiscal impulse

- A short-lived fiscal impulse means that fiscal cost are smaller than they are for a more persistent shock
- Effectively this is the present value multiplier of Mountford and Uhlig (2009) with a zero discount rate

$$\mathcal{M}_h = \frac{\sum_{i=0}^{h} IRF(g \to gdp, h)}{\sum_{i=0}^{h} IRF(g \to g, h)} \tag{6}$$

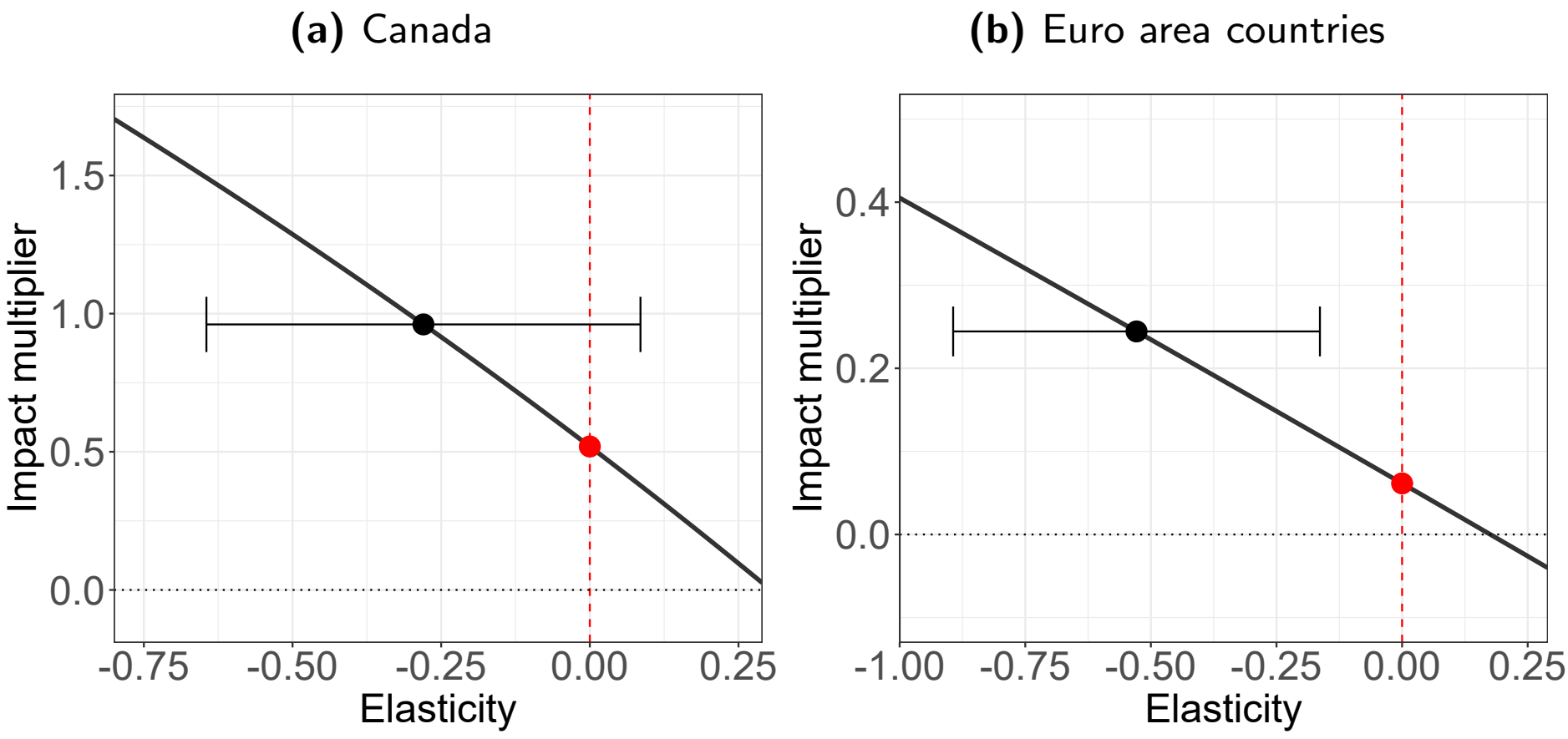
(IRFs must be transformed to same units, both in % of GDP here)

Cumulative government spending multiplier



Notes: CK in black; BP in red; 68% confidence intervals

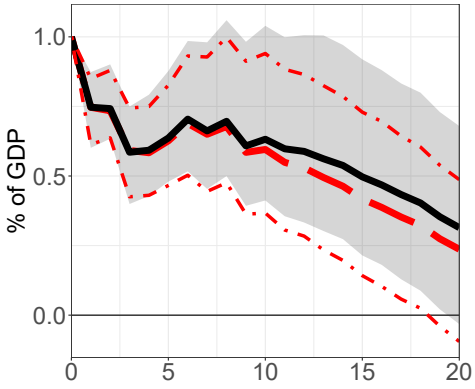
BP and CK elasticities and the impact multiplier



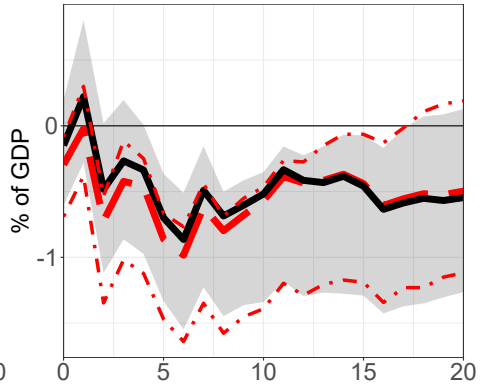
Notes: Black dot is CK; red dot is BP; 68% confidence interval for CK

IRFs for g shock (1% of GDP), Canada

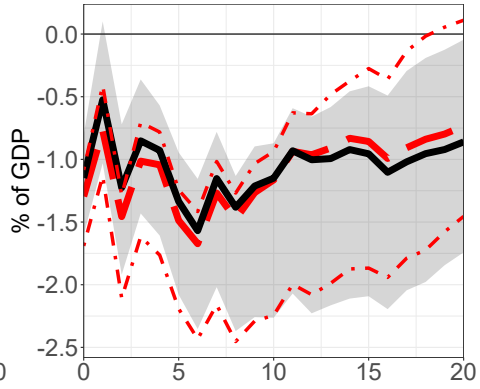
$g \to g$



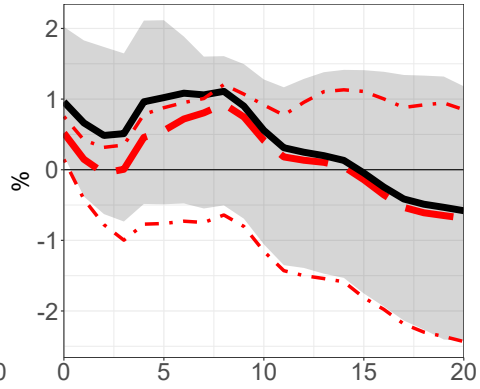
$g \to r$



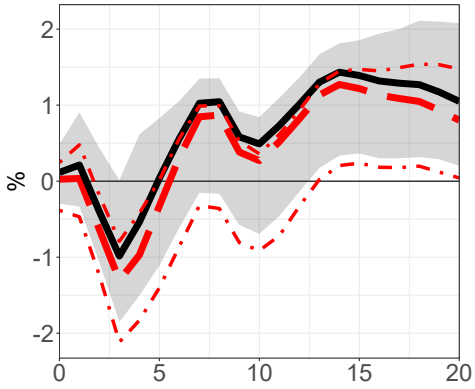
$g \to (r - g)$



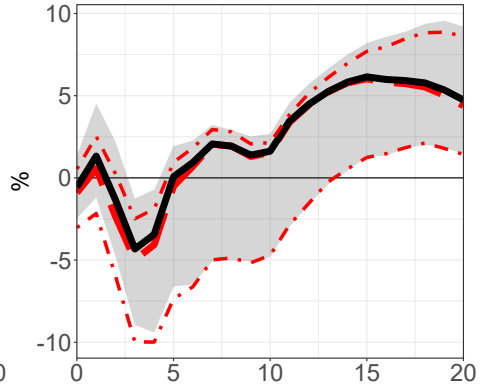
$g \to gdp$



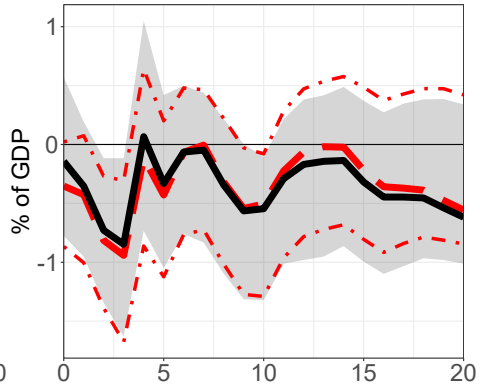
$g \to defl$



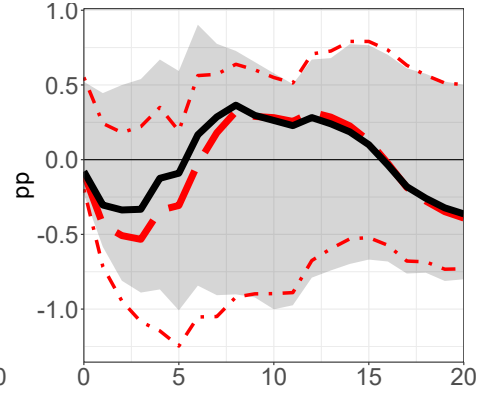
$g \to rer$



$g \to cab$

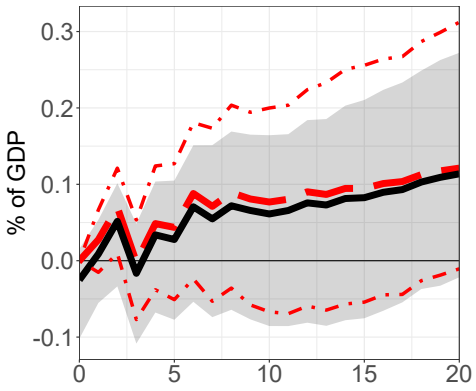


$g \to srate$

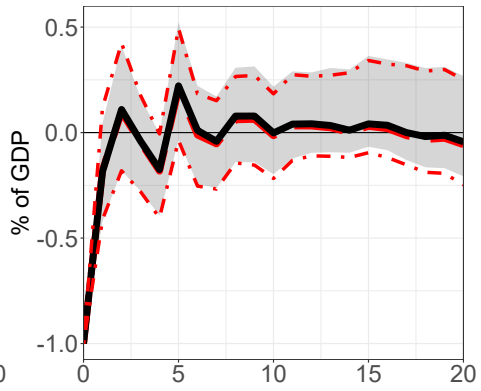


IRFs for r shock (-1% of GDP), Canada

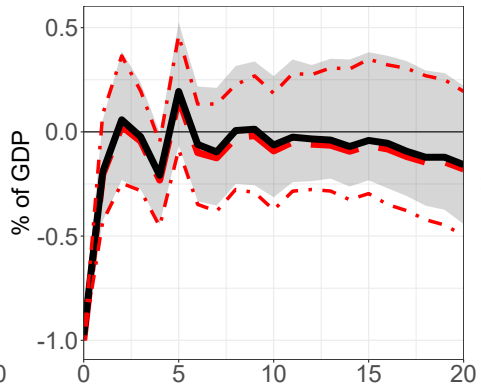
$r \to g$



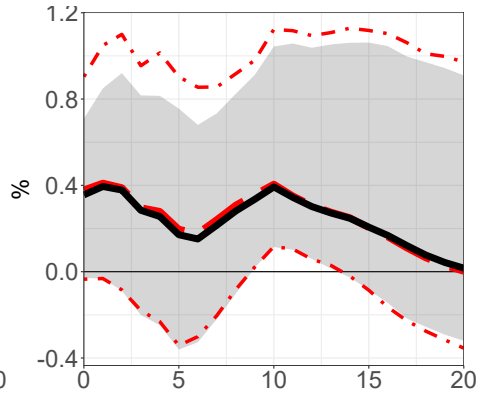
$r \to r$



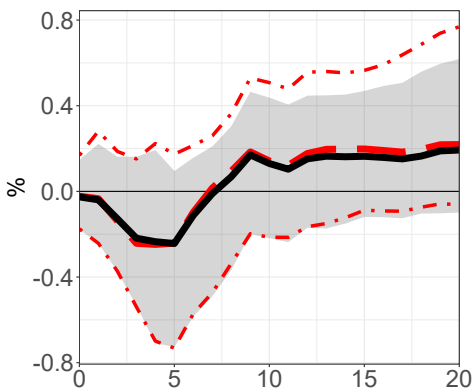
$r \to (r - g)$



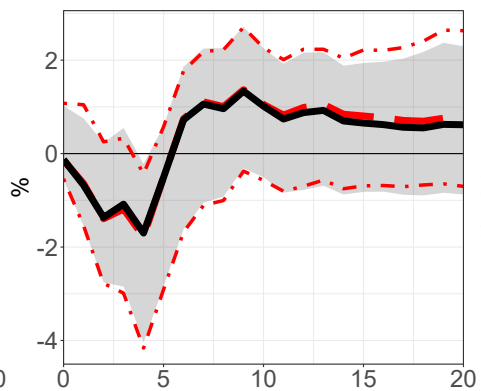
$r \to gdp$



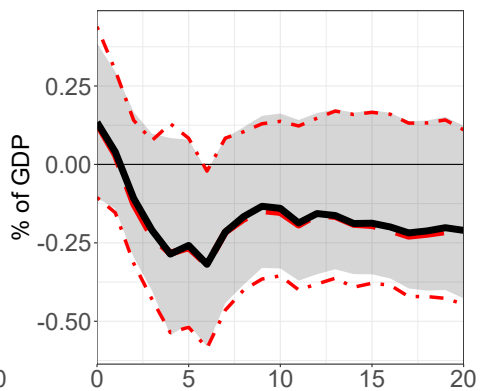
$r \to defl$



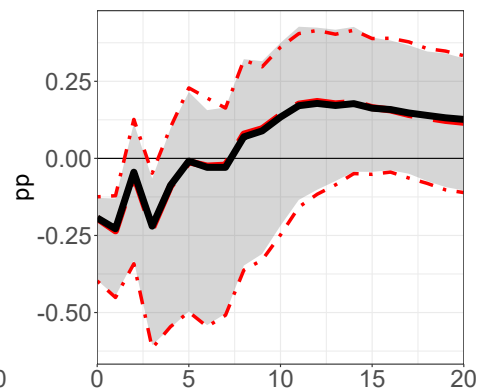
$r \to rer$



$r \to cab$



$r \to srate$



Summary for IRFs, Canada

Government spending shock

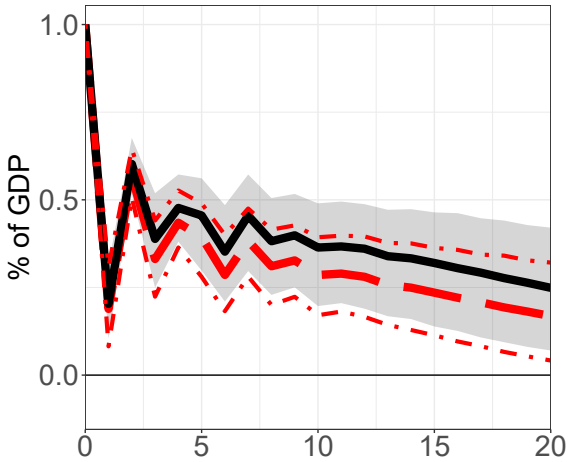
- Positive effect on output lasts for a couple of years
- We find that a government spending shock results in both a budget and a current account deficit in line with the twin-deficits hypothesis
- It seems that the decrease of the current account is not enough to fully offset the effects of a expansionary g shock as the traditional Mundell-Fleming framework would suggest

Government net revenue shock

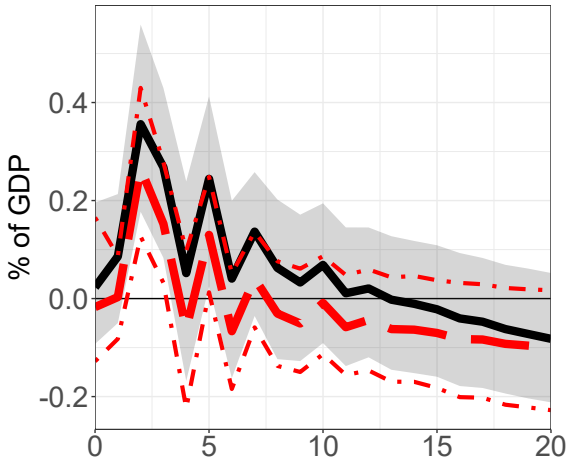
- The revenue shock is less persistent than the spending shock
- The effect on budget deficit is very short lived
- The effect on output is more muted than the the effect of g shock, but the budgetary costs are also lower
- Effects of expansionary revenue shock on *defl*, *rer*, *cab* and *srate* are also qualitatively quite similar, but more muted

IRFs for g shock (1% of GDP), Euro area countries

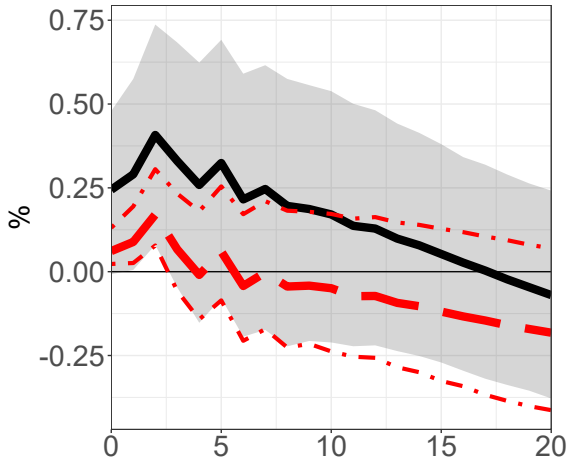
$g \to g$



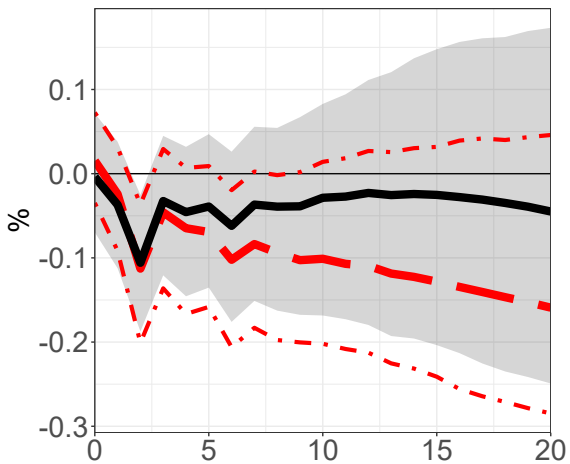
$g \to r$



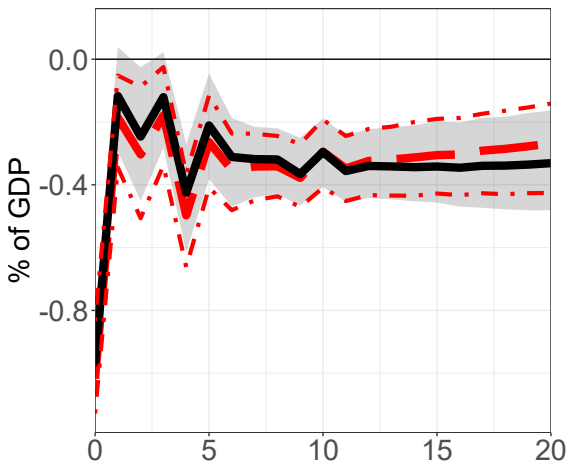
$g \to gdp$



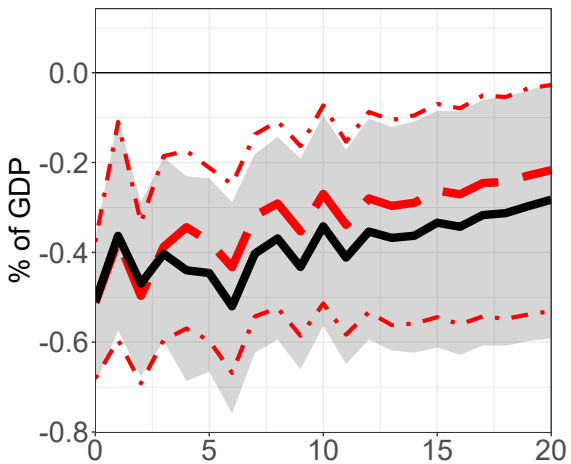
$g \to defl$



$g \to (r - g)$

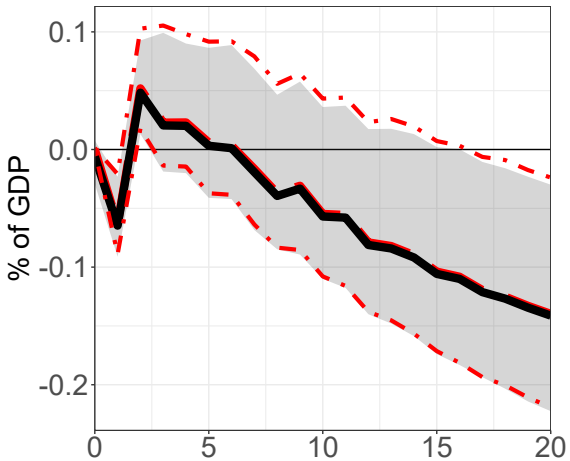


$g \to cab$

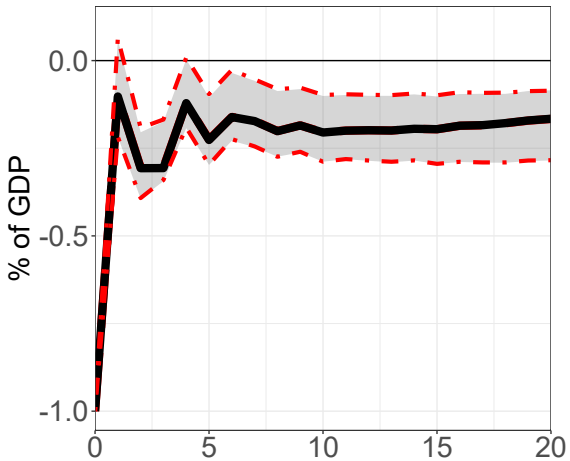


IRFs for r shock (-1% of GDP), Euro area countries

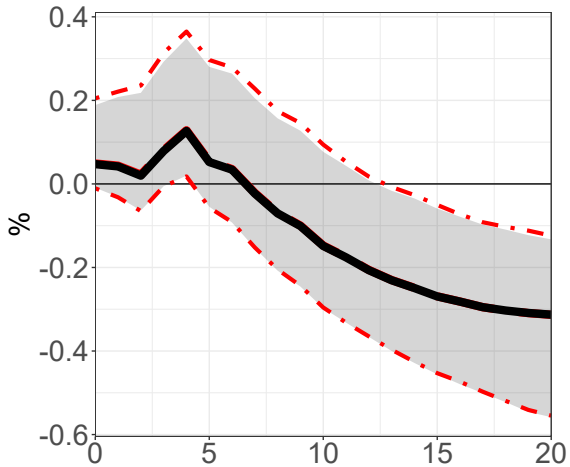
$r \to g$



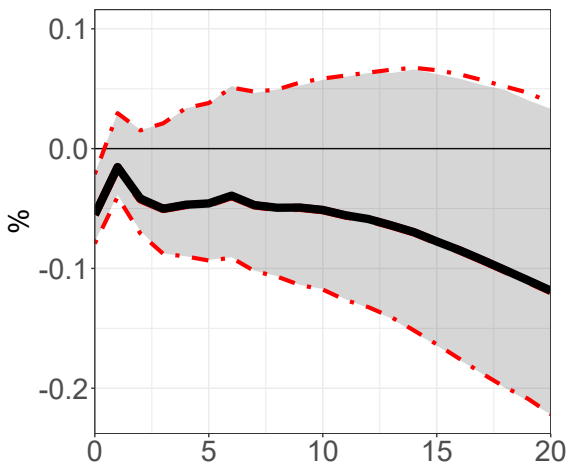
$r \to r$



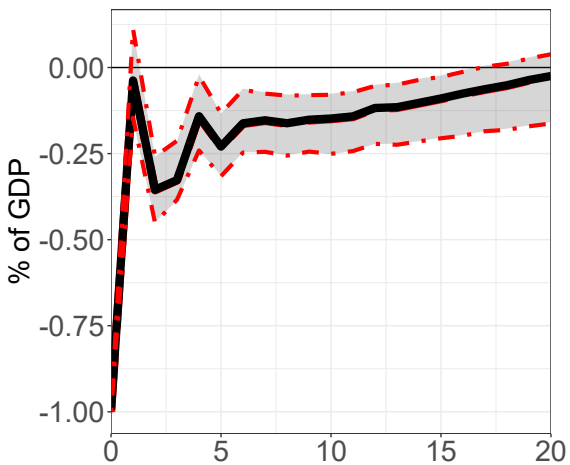
$r \to gdp$



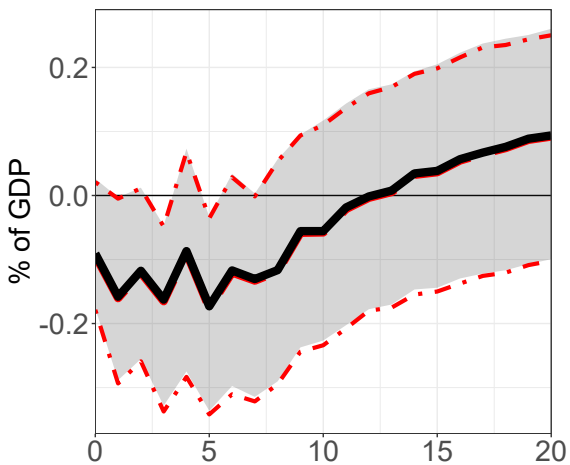
$r \to defl$



$r \to (r - g)$



$r \to cab$



Summary for IRFs, Euro area countries

Government spending shock

- The cumulative sum of the IRF for spending is a bit smaller than for Canada and spending shocks are not as costly in terms of deficit
- Also the effect on output is smaller; with CK somewhat positive, BP almost zero
- The impulse response for current account is clearly negative the whole period
- As spending shock also leads toward a government budget deficit, these effects are again consistent with the twin-deficits hypothesis

Government net revenue shock

- Expansionary shock to net revenue has first a very small positive effect on GDP but afterwards the effect turns negative
- Current account decreases at first but in the long run the point estimate turns somewhat positive
- As the shock increases budget deficit, for roughly the 10 first quarters these results are in line with the twin-deficits hypothesis

Conclusion

Conclusion

In this paper we have proposed a novel instrument for aggregate output that is based on professional forecast errors in trading partner economies

We apply the instrument in fiscal VARs in a SOE setting

This instrument, we argue, has a number of desirable properties when compared to the prevailing instrument for output used in the related literature which is the utilization-adjusted TFP

Estimates of the government spending multiplier are found sensitive to small differences in the output elasticity of government spending

- Our baseline estimates for cumulative government spending multiplier are ≈ 1 for Canada and ≈ 0.5 for Euro area economies
- With BP identification the estimated multiplier for Canada roughly halves and for Euro area economies it is close to zero

We find evidence in support of the twin-deficits hypothesis

Thank you

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