Effects of fiscal policy shocks

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Motivation

Different predictions of response to government spending shocks:

1. (Old) Keynesian models: consumption and investment go up after increase in government spending, due to demand effects
2. Classical (i.e., RBC) models: consumption and investment go down due to income effect

Empirics: to be explored.

Public and private consumption in RBC models

Assume government spending G is increased by ΔG and financed by lump sum taxes.

- If gov. spending is a perfect substitute for private C:

$$U(C+G, L) \tag{1}$$

  then private consumption decrease by ΔG so that $C+G$ is unchanged, L remains unchanged, and the only change is that G replaces C, with no effect on output and utility.
- If utility is separable in C and public spending G:

$$u(C, L) + v(G) \tag{2}$$

  then $\Delta C = -\Delta G$ with L unchanged is not an equilibrum, because u_C goes up if C goes down. This is a negative wealth effect for households. HHs react by reducing both consumption and leisure (they work more). Output goes up.
- If spending is financed by distortionary taxation, this tends to reduce output and labor supply.

Empirical approach

- Difficulties
  - causality goes in both directions: macroeconomy responds to fiscal (or monetary policy), and policy responds to macroeconomic events.
  - anticipation effects: fiscal policy measures are announced before they are implemented
- Possible solutions to reverse-causality problem:
  - Find exogenous fiscal shocks (obvious example: wars)
  - Utilize the fact that fiscal policy moves slowly; does not immediately respond to macroeconomic events

Main results of Blanchard and Perotti (1999)

- Positive government spending shocks have positive effect on output (not surprising)
- Positive tax shocks have negative effect on output (not surprising)
- Positive effect of government spending shock on private consumption (Keynesian prediction)
- Both positive spending and tax shocks have negative effect on investment (classical prediction; difficult for Keynesian model)

Variables

- Government spending (log: G): expenditures on goods and services, both government consumption and investment
- Net taxes (log: T): tax revenues minus transfers
- GDP (log: X)

All variables are measured real and in per capital terms.

Vector-autoregressive model

$$Y_t = \sum_{i=1}^{4} A_i Y_{t-i} + U_t \tag{3}$$

where

- $Y_t = [T_t, G_t, X_t]'$
- $U_t = [t_t, g_t, x_t]'$ are reduced form residuals, in general correlated across each other.

The VAR (3) takes into account

- Trend (either deterministic or unit root)
- Seasonal patterns

Identification

- Problem: the residuals t_t cannot be considered as the shock to taxes, because taxes T_t can respond endogenously to current output X_t and can also react to current shocks to government spending and GDP.
  Similarly, g_t is not the government expenditure shock.
- To solve this problem, we need to make identifying assumptions:

$$t_t = a_1 x_t + a_2 e_t^g + e_t^t$$
$$g_t = b_1 x_t + b_2 e_t^t + e_t^g$$
$$x_t = c_1 t_t + c_2 g_t + e_t^x$$

Identifying assumptions

- $a_1 = 2.08$: captures automatic dependance of taxes on output (can be seen from tax code); no discretionary response within one quarter
- $b_1 = 0$: no automatic response of spending to output
- Then $t_t - a_1 x_t$ and g_t are independent of e_t^x; can be used as instruments to estimate c_1 and c_2.
- a_2 and b_2 cannot be identified. Whether assuming $a_2 = 0$ or $b_2 = 0$ makes little difference (correlation between t_t and g_t is always estimated small).

Deterministic versus stochastic trends

Two ways to think about long-term growth path: it can be

- deterministic: the trend line is a deterministic path about which the economy fluctuations;
  no matter which shocks hit the economy, in the long run the economy always gravitates back to the deterministic growth path
  Example: trend of log-GDP is linear
  Detrending: fit polynomial as trend, subtract from series
- stochastic: some shocks have a persistent effect on economic activity, so that the long-run trend is shifting
  Example: GDP is an AR process with a unit root
  Detrending: take first differences in logs

The authors allow for both possibilities.

TABLE II

ESTIMATED CONTEMPORANEOUS COEFFICIENTS

	c_1	c_2	b_2	a_2
		DT		
coeff.	−0.868	0.956	−0.047	−0.187
t-stat.	−3.271	2.392	−1.142	−1.142
p-value	0.001	0.018	0.255	0.255
		ST		
coeff.	−0.876	0.985	−0.057	−0.238
t-stat.	−3.255	2.378	−1.410	−1.410
p-value	0.001	0.019	0.161	0.161

DT: Deterministic Trend; ST: Stochastic Trend.
Sample: 1960:1–1997:4.
c_1: effect of t on x within quarter;
c_2: effect of g on x within quarter;
a_2: effect of g on t within quarter (assuming $b_2 = 0$, i.e., when spending is ordered first);
b_2: effect of t on g within quarter (assuming $a_2 = 0$, i.e., when net taxes are ordered first).
All effects are expressed as dollar for dollar.

TABLE III

RESPONSES TO TAX SHOCKS

	1 qrt	4 qrts	8 qrts	12 qrts	20 qrts	peak
			DT			
GDP	−0.69*	−0.74*	−0.72*	−0.42*	−0.22	−0.78* (5)
TAX	0.74*	0.13	−0.21*	−0.20*	−0.11	
GCN	−0.05*	−0.12*	−0.24*	−0.26*	−0.16*	
			ST			
GDP	−0.70*	−1.07*	−1.32*	−1.30*	−1.29*	−1.33* (7)
TAX	0.74*	0.31*	0.17	0.16	0.16	
GCN	−0.06*	−0.10*	−0.17*	−0.20*	−0.20*	

DT: Deterministic Trend; ST: Stochastic Trend. An asterisk indicates that 0 is outside the region between the two one-standard error bands. In parentheses besides the peak response is the quarter in which it occurs.

TABLE IV

RESPONSES TO SPENDING SHOCKS

	1 qrt	4 qrts	8 qrts	12 qrts	20 qrts	peak
			DT			
GDP	0.84*	0.45	0.54	1.13*	0.97*	1.29* (15)
GCN	1.00*	1.14*	0.95*	0.70*	0.42*	
TAX	0.13	0.14	0.17	0.43*	0.52*	
			ST			
GDP	0.90*	0.55	0.65	0.66	0.66	0.90* (1)
GCN	1.00*	1.30*	1.56*	1.61*	1.62*	
TAX	0.10	0.18	0.33	0.36	0.37	

Robustness

- Subsample stability: a lot depends on the 80s
- Cointegration:
  assume that taxes and expenditures follow a common trend: leads to very similar results
- Alternative net tax elasticities: quantitative results are sensitive: estimating a higher value of a_1 (stronger direct effect of taxes to GDP) leads to stronger estimated response of GDP to taxes

TABLE V

STABILITY OF RESPONSES TO TAX SHOCKS

Net taxes		Spending	
excl. period	max. GDP response	excl. period	max. GDP respons
	DT		
60–69	−1.18* (1)	60–69	1.44* (1)
70–79	−0.90* (5)	70–79	1.47* (10)
80–89	−0.49* (2)	80–89	0.96* (3)
90–97	−1.45* (7)	90–97	1.73* (12)
	ST		
60–69	−1.45* (11)	60–69	1.25* (1)
70–79	−1.48* (4)	70–79	0.62* (1)
80–89	−0.83* (7)	80–89	1.80* (3)
90–97	−1.52* (7)	90–97	0.85* (12)

TABLE VI

Responses of GDP Components

	1 qrt	4 qrts	8 qrts	12 qrts	20 qrts	peak
			DT, TAX			
GDP	−0.69*	−0.74*	−0.72*	−0.42*	−0.22	−0.78* (5)
GCN	−0.05*	−0.12*	−0.24*	−0.26*	−0.16*	−0.05* (1)
CON	−0.18*	−0.35*	−0.32*	−0.23*	−0.20*	−0.35* (5)
INV	−0.36*	−0.00	−0.00	0.18*	0.16*	−0.36* (1)
EXP	−0.02	0.01	−0.01	0.02	0.05	−0.08 (3)
IMP	−0.01	0.02	−0.14*	−0.06	0.04	−0.14* (7)
SUM	−0.60	−0.48	−0.43	−0.23	−0.18	−0.60 (1)

DT, SPE

GDP	0.84*	0.45	0.54	1.13*	0.97*	1.29* (15)
GCN	1.00*	1.14*	0.95*	0.70*	0.42*	1.14* (4)
CON	0.50*	0.63*	0.91*	1.21*	0.90*	1.26* (14)
INV	−0.03	−0.75*	−0.69*	−0.41*	−0.35*	−1.00* (5)
EXP	0.20*	−0.47*	−0.76*	−0.70*	−0.06	−0.80* (9)
IMP	0.64*	−0.19*	−0.46*	−0.42*	−0.16*	−0.49* (9)
SUM	1.03	0.74	0.86	1.22	1.07	1.39 (15)

ST, SPE

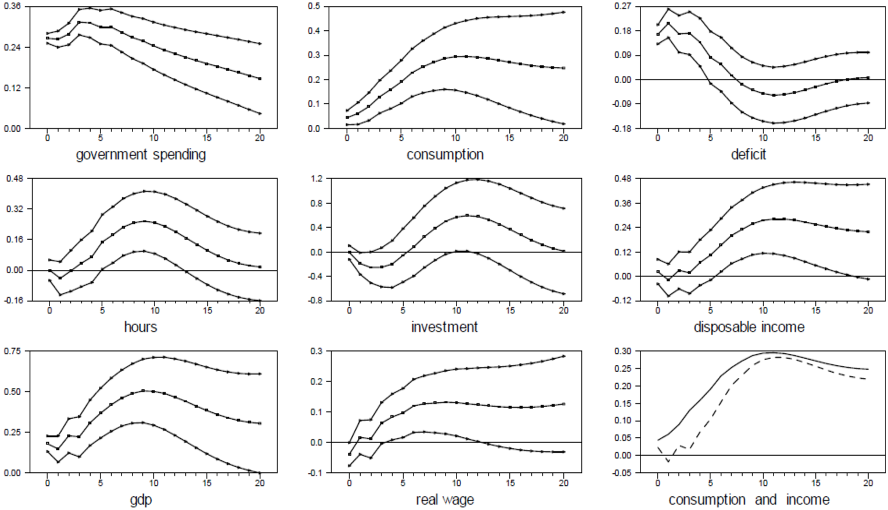
GDP	0.90*	0.55	0.65	0.66	0.66	0.90* (1)
GCN	1.00*	1.30*	1.56*	1.61*	1.61*	1.00 (1)
CON	0.33*	0.34	0.42	0.43	0.44	0.46* (2)
INV	0.02	−0.74*	−0.97*	−0.96*	−0.95*	−0.98* (9)
EXP	0.17*	−0.16	−0.30	−0.37*	−0.37	−0.37* (13)
IMP	0.56*	0.03	−0.06	−0.05	−0.04	−0.08 (9)
SUM	0.95	0.72	0.77	0.76	0.78	0.95 (1)

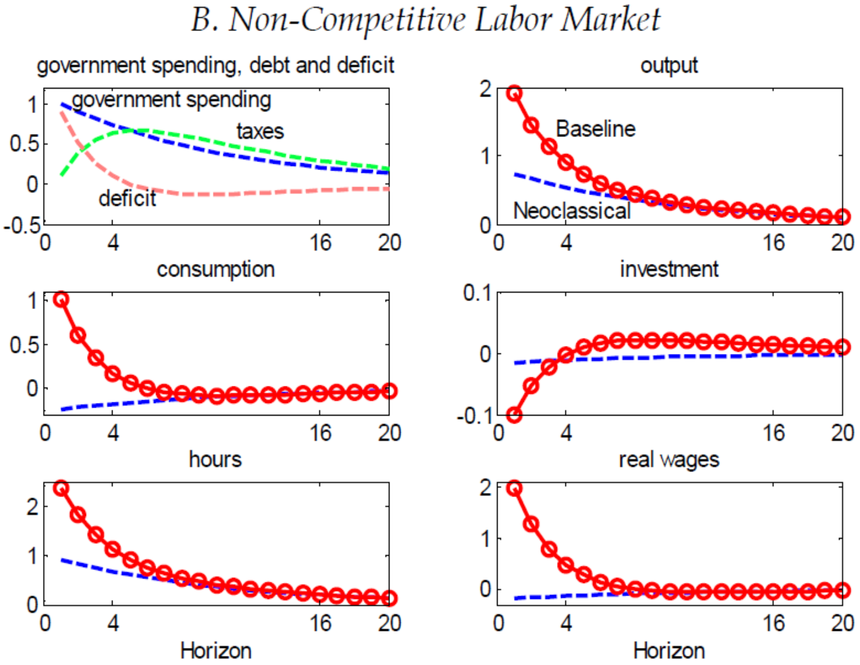
A model to explain the effect of spending shocks

Galí, López-Salido, and Vallés (2007)

- Optimizing (Ricardian) households (fraction $1 - \lambda$).
- Rule-of-thumb consumers: consume labor income minus net taxes
- NK setup: Calvo pricing, simple Taylor rule, capital adjustment costs
- Fiscal policy:
  - spending follows AR(1)
  - taxes: depend positively on government debt and spending

Figure 1
The Dynamic Effects of a Government Spending Shock




B. Non-Competitive Labor Market
government spending, debt and deficit
government spending
taxes
deficit
output
Baseline
Neoclassical
consumption
investment
hours
real wages
Horizon
Horizon

Gali model

Results are sensitive to

- fraction of rule-of-thumb consumers
- working of the labor market (employment response of the two types of households, wage response)
- timing of taxes, distortionary vs. lump sum
- persistence of government spending shocks

Is the multiplier always the same?

- In a linear(ized) model, impulse responses
  - are independent of the current state of the economy
  - are proportional to the size of the shock
- In a nonlinear model, impulse responses
  - can depend on the current state of the economy
  - can inrease more or less than proportionally with the size of the shock

  The government spending multiplier can then depend
  - on the size of the govenrment intervention
  - on the state of the business cycle

Reasons why the multiplier may vary over the cycle

- More ”slack” (such as unemployment) in a recession: higher demand is more likley to lead to higher production rather than higher prices
- Different response of monetary policy: if at or close to zero lower bound, monetary policy might be unresponsive to change in fiscal policy
- If government debt is already high
  - government may be forced to raise more taxes in response to higher spending
  - higher government spending may reducing credit rating of government (reduce trust of financial markets in government debt)

Findings in Auerbach and Gorodnichenko (2012)

- Results for linear model similar to Blanchard and Perotti (1999)
- Expansions: multiplier often negative (exception: government investment)
- Recessions: multiplier very strongly positive
- Recessions and expansions are identified by regime-switching model.

Table 1—Multipliers

	$max_{h=1,\dots,20}\{Y_h\}$		$\sum_{h=1}^{20} Y_h / \sum_{h=1}^{20} G_h$	
	Point estimate	Standard error	Point estimate	Standard error
Total spending				
Linear	1.00	0.32	0.57	0.25
Expansion	0.57	0.12	−0.33	0.20
Recession	2.48	0.28	2.24	0.24
Defense spending				
Linear	1.16	0.52	−0.21	0.27
Expansion	0.80	0.22	−0.43	0.24
Recession	3.56	0.74	1.67	0.72
Nondefense spending				
Linear	1.17	0.19	1.58	0.18
Expansion	1.26	0.14	1.03	0.15
Recession	1.12	0.27	1.09	0.31
Consumption spending				
Linear	1.21	0.27	1.20	0.31
Expansion	0.17	0.13	−0.25	0.10
Recession	2.11	0.54	1.47	0.31
Investment spending				
Linear	2.12	0.68	2.39	0.67
Expansion	3.02	0.25	2.27	0.15
Recession	2.85	0.36	3.42	0.38

Total spending; multipliers for alternative measures of normalized unanticipated shocks to government spending.

Evidence from Ramey and Zubairy (2018)

- Use data starting in 1889
- Find no significant asymmetry in multiplier between expansions and recessions
- Multiplier (correctly defined: cumulative output response divided by cumulative government expenditures) always below 1
- Why do Auerbach and Gorodnichenko (2012) get different results? They compute IRs in recessions based on the assumption that economy stays for at least 20 quarters in recession regime, which is unrealistic.
- Significantly higher multiplier near ZLB

TABLE 1
ESTIMATES OF MULTIPLIERS ACROSS STATES OF SLACK

	Linear Model	High Unemployment	Low Unemployment	p-Value for Difference in Multipliers across States
Military news shock:				
2-year integral	.66	.60	.59	HAC = .954
	(.067)	(.095)	(.091)	Anderson-Rubin = .954
4-year integral	.71	.68	.67	HAC = .924
	(.044)	(.052)	(.121)	Anderson-Rubin = .924
Blanchard-Perotti shock:				
2-year integral	.38	.68	.30	HAC = .005
	(.111)	(.102)	(.111)	Anderson-Rubin = .070
4-year integral	.47	.77	.35	HAC = .001
	(.110)	(.075)	(.107)	Anderson-Rubin = .031
Combined:				
2-year integral	.42	.62	.33	HAC = .099
	(.098)	(.098)	(.110)	Anderson-Rubin = .228
4-year integral	.56	.68	.39	HAC = .021
	(.084)	(.052)	(.110)	Anderson-Rubin = .199

NOTE.—The values in parentheses under the multipliers give the standard errors. HAC indicates HAC-robust p-values and Anderson-Rubin indicates weak instrument robust Anderson-Rubin p-values.

TABLE 4
ESTIMATES OF MULTIPLIERS ACROSS MONETARY POLICY REGIMES

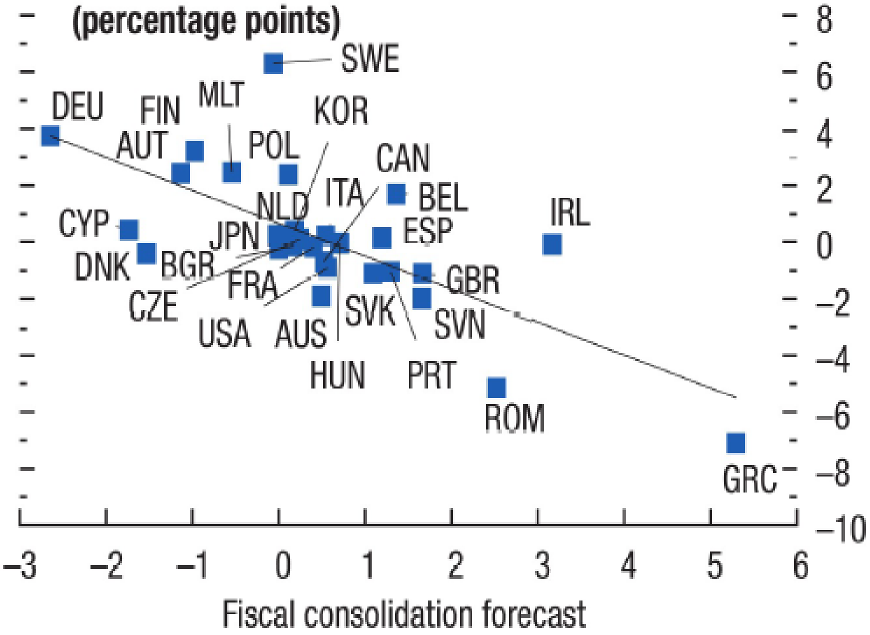
Baseline	Linear Model	Near Zero Lower Bond	Normal	*p*-Value for Difference in Multipliers across States
Military news shock:				
2-year integral	.66	.77	.63	HAC = .429
	(.067)	(.106)	(.149)	Anderson-Rubin = .504
4-year integral	.71	.77	.77	HAC = .992
	(.044)	(.058)	(.376)	Anderson-Rubin = .992
Blanchard-Perotti shock:				
2-year integral	.38	.64	.10	HAC = .000
	(.111)	(.033)	(.112)	Anderson-Rubin = .066
4-year integral	.47	.71	.12	HAC = .000
	(.110)	(.033)	(.115)	Anderson-Rubin = .062
Combined:				
2-year integral	.42	.67	.26	HAC = .000
	(.098)	(.027)	(.103)	Anderson-Rubin = .184
4-year integral	.56	.76	.21	HAC = .000
	(.084)	(.040)	(.136)	Anderson-Rubin = .208

Blanchard, IMF EO Oct 2012

- Assume forecasters (at IMF, OECD etc.)
  - use all available information,
  - know what the multiplier is

  Then GDP forecast errors should be indepencent of fiscal consolidation programs that were known at the time of the forecast
- Result:
  - Correlation of forecast errors with fiscal consolidation is significantly negative
  - Interpretation: multiplier is much higher (by up to one percentage point) than what forecasters were assuming (multiplier about 0.5)

1. Fiscal Consolidation Plans and Growth Forecast Errors[1]



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