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An Estimation and Decomposition of the Government Investment Multiplier

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Motivation

- ▶ deep global recession
- ▶ large fiscal stimulus packages
  - ▶ US: rescue and recovery plan 15% of GDP
  - ▶ Europe: NextGenerationEU package 800 billon euros + national funds
- ▶ aging societies, climate change, digital transformation
- ▶ large funds for government investment
  - ▶ short run stimulus?
  - ▶ medium/long run potential?
- ▶ empirical literature ambiguous
- → We construct a novel and unique narrative series as an instrument in a SVAR model to identify the causal effects of public investment programs.

Aim of the paper

- ▶ estimate SVAR to determine macroeconomic effects (multiplier, crowding-in/out) of gov investment shocks

- ▶ estimate DSGE model to understand transmission and decompose the output effects of government investment shocks.

Our contribution

▶ **Measuring fiscal policy with instruments** (Romer and Romer (2010), Ramey (2011), Cloyne (2013), Mertens and Ravn (2014), Gechert et al. (2021)) → narrative public investment instrument.

▶ **Government investment multiplier** (Boehm (2020), Auerbach and Gorodnichenko (2012), Ilzetzki et al. (2013), Ramey (2021) → based on narrative approach: cumulative multiplier between 2 (short term) and 3 (medium term), crowding-in of private investment

▶ **Productivity of public investment** (Aschauer (1989a), Aschauer (1989b), Bom and Ligthart (2014)) → production elasticity of 0.06, long-term multiplier of 2, crowding-in

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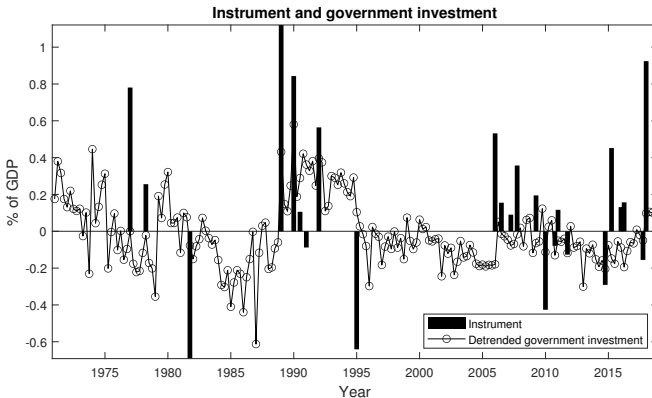Conclusion
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Construction of instrument

- ▶ unique data source: **Annual Finance Reports** ('Finanzberichte') 1970-2018 and **budgetary plans** of German Federal Ministry of Finance
  - ▶ available physically in library archive
- ▶ cross-check and fill with
  - ▶ **legislative documents** from German Bundestag
  - ▶ semiannual reports **Joint Economic Forecast Group**

Computation of instrument

computation of instrument follows Romer and Romer (2010, AER)

1. no endogenous response → distort causal interpretation
2. start/end of investment programs clearly documented
3. size of the shock (bn. euro) (isolate other endogenous influences)
4. no concurrent government consumption programs
5. circumvent problems in official data series (definition changes, investment grants, outsourcing)

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25 non-zero instrument observations

Instrument and government investment

VAR approach

Reduced form VAR with 4 lags

$$y_t = c + A_1 y_{t-1} + \cdots + A_4 y_{t-4} + \Gamma x_t + u_t \qquad (1)$$
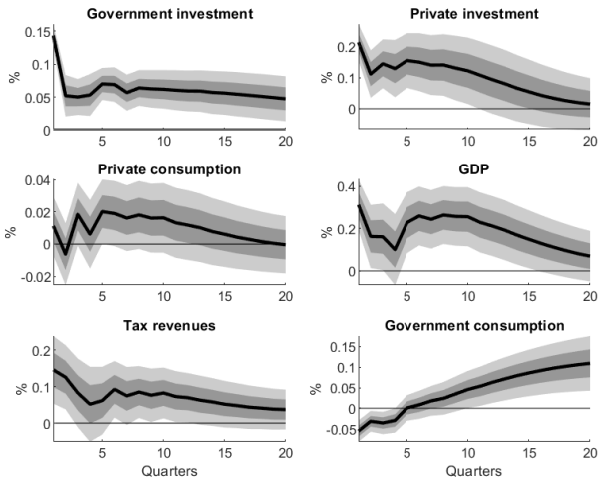
y_t all in ratios to trend GDP:

1. government investment
2. private investment
3. private consumption
4. GDP
5. government revenues
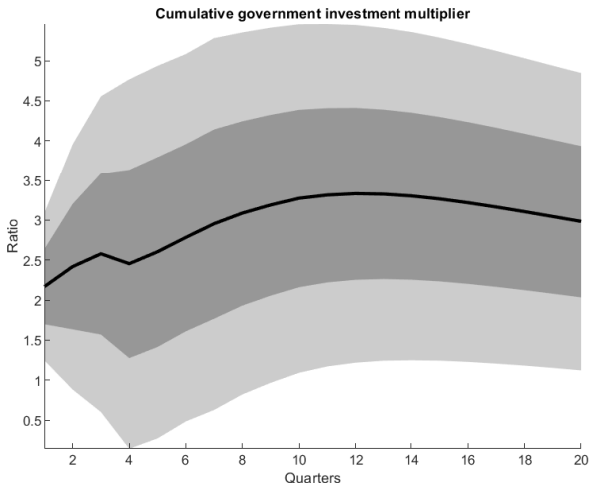6. government consumption

Exogenous variables

x_t exogenous variables:

1. quarter dummies
2. linear trend
3. dummy for global financial crisis
4. dummy for re-unification

▶ sample 1970Q1-2018Q4

▶ Instrument is neither autocorrelated nor predictable and strong. Test statistics

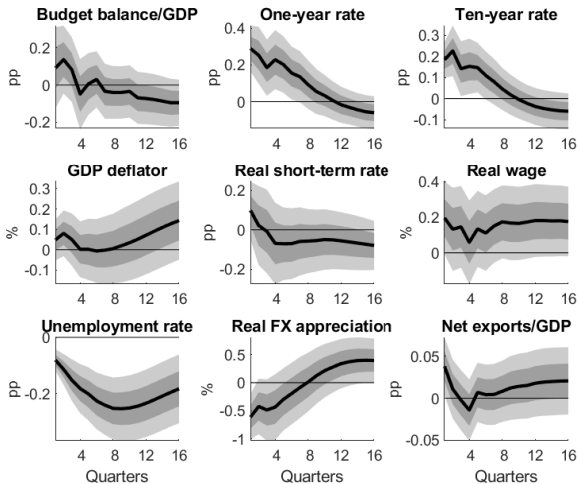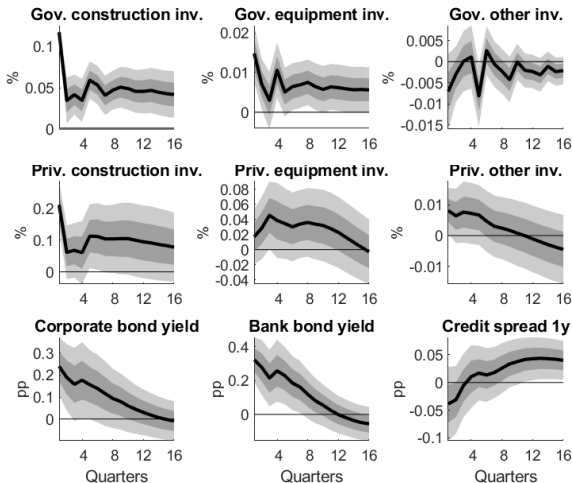## Macroeconomic effects of government investment shocks

Cumulative government investment to output multiplier

Cumulative government investment multiplier

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Economy-wide effects

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Investment responses

Robustness

1. Alternative construction `Appendix A1`

2. Winsorization `Appendix A2`

3. Dropping non-zero instrument observation `Appendix A3`

4. Alternative endogenous variables `Appendix A4`

5. Lag-length `Appendix A5`

6. Trends `Appendix A6`

7. Aggregate and log-levels `Appendix A7`

8. Alternative GDP detrending `Appendix A8`

9. Dropping dummies `Appendix A9`

10. After Fall of the Wall `Appendix A10`

11. Fiscal foresight `Appendix A11`

Model in the nutshell

▶ builds on Leeper et al. (2018, AER)

▶ rich fiscal sector with many taxes

▶ substitutability/complementarity between private and public consumption

▶ long-term government debt

▶ rule-of-thumb consumers

▶ habit formation

▶ sticky prices and wages

▶ monetary policy

→ add government investment!

Public investment in the model

1. public investment shocks

$$log(I_t^G) = \gamma + \rho^{IG} log(I_{t-1}^G) + u_t^{IG} \qquad (2)$$

2. production function of firm i

$$Y_t(i) = \exp(e_{a,t}) K_t(i)^\alpha L_t(i)^{1-\alpha} (K_t^G)^{\alpha^{kg}} - \bar{O} \qquad (3)$$
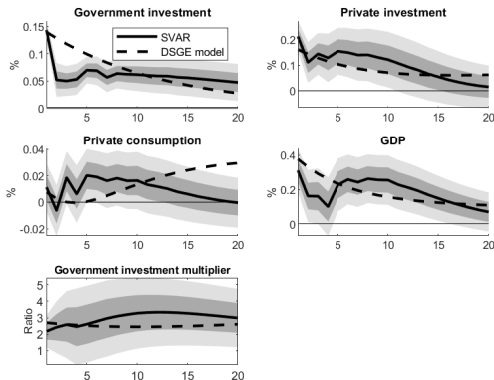
3. investment adjustment costs household j

$$\Phi_t(j) = 1 - \frac{\kappa^k}{2} \left[1 - \kappa^g - \left(\frac{I_t(j)}{I_{t-1}(j)} - \kappa^g \frac{I_t^G}{I_{t-1}^G} \right) \right]^2 \qquad (4)$$

Estimation

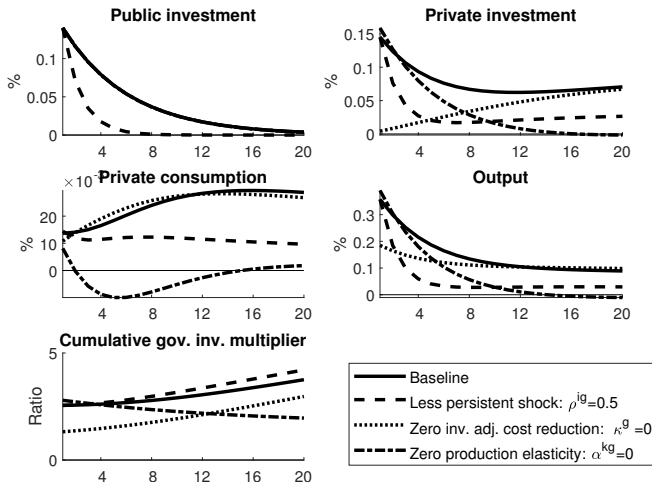▶ estimate $\zeta = (\rho^{IG}, \kappa^g, \alpha^{kg})'$ by impulse response matching

$$J = \min_{\zeta}[\hat{\Theta} - \Theta(\zeta)]'V^{-1}[\hat{\Theta} - \Theta(\zeta)]$$

Parameter estimation

Parameter	Notation	Value	68% CI
Persistence gov. inv. shocks	ρ^{IG}	0.918	[0.796,0.916]
Sensitivity priv. inv. adj. costs to gov. inv.	κ^{g}	0.158	[0.085,0.171]
Elasticity of output to gov. capital	α^{kg}	0.062	[0.020,0.092]

Decomposition of government investment multiplier

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▶ government investment effective

▶ short run ✓

    ▶ output multiplier 2

    ▶ reduction of private investment adjustment costs:
$\kappa^g = 0.158 > 0$

▶ medium run ✓

    ▶ output multiplier 3

    ▶ output elasticity of public capital: $\alpha^{kg} = 0.062 > 0$

Thank you for your attention!

Literatur I

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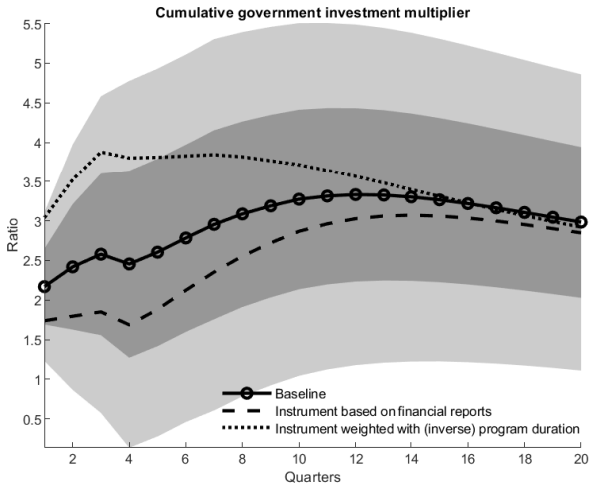
Test statistics

▶ tests for instrument strength

	F-test OLS	F-test robust	F-test HAC	Reliability	
F-statistic	16.00	24.69	24.72	$R^2(\epsilon_t^{IG}, m_t^{\neq 0})$	0.65
p-value	0.00	0.00	0.00	p-value β_m	0.00

▶ tests for instrument predictability

Lags	1	1-2	1-3	1-4
F-statistic regression	0.884	0.726	0.536	0.385
p-value regression	0.520	0.746	0.952	0.998
p-value lags instrument	0.164	0.260	0.411	0.734

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A1 Alternative construction
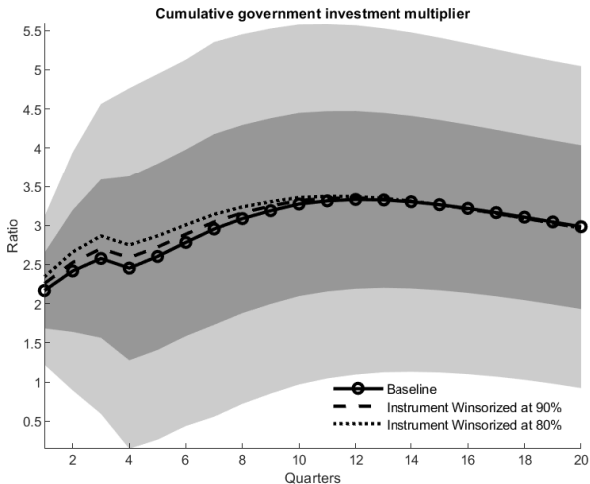
Cumulative government investment multiplier

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A2 Winsorization

Cumulative government investment multiplier

(Quarters on x-axis, Ratio on y-axis)

Legend:
- —○— Baseline
- – – Instrument Winsorized at 90%
- ···· Instrument Winsorized at 80%

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A3 Dropping non-zero instrument observation

Cumulative government investment multiplier

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A4 Alternative endogenous variables

Cumulative government investment multiplier

A5 Lag-length

Cumulative government investment multiplier

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A6 Trends

Cumulative government investment multiplier

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A7 Aggregate and log-levels

Cumulative government investment multiplier

A8 Alternative GDP detrending

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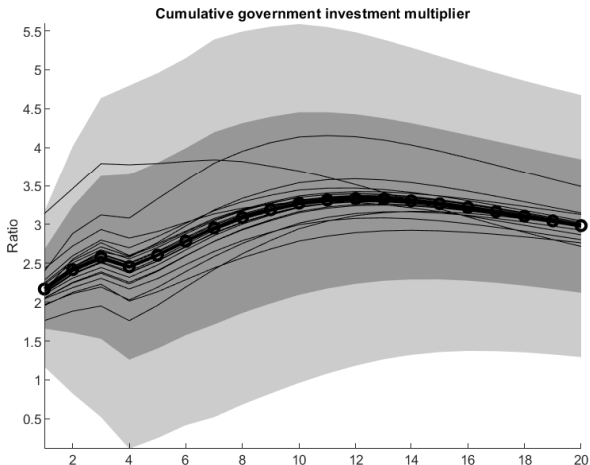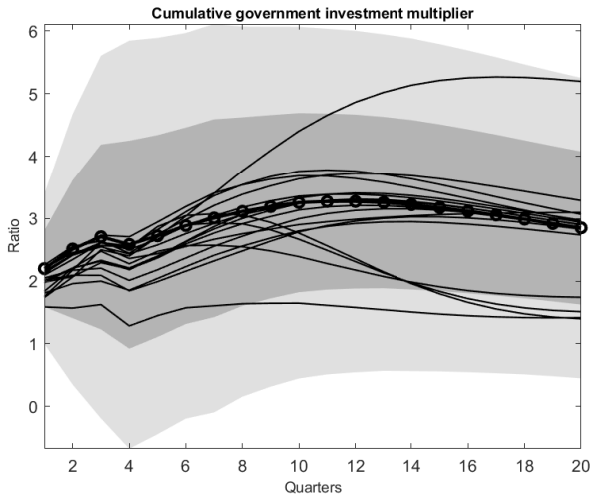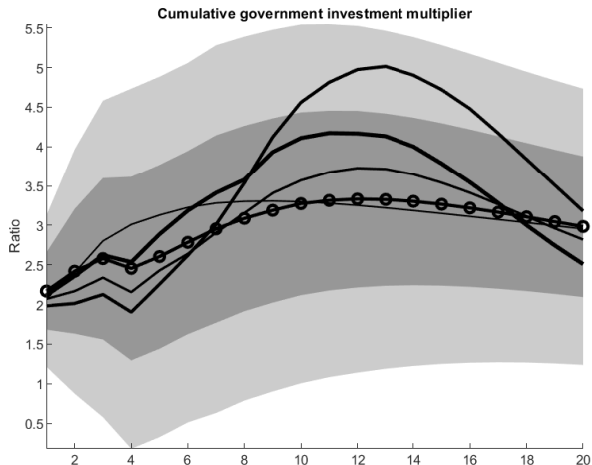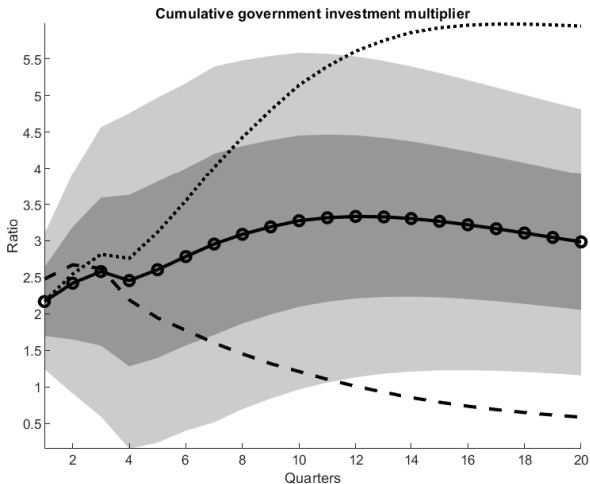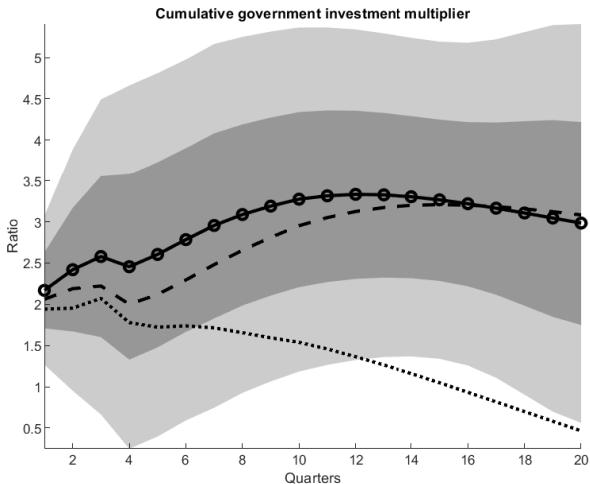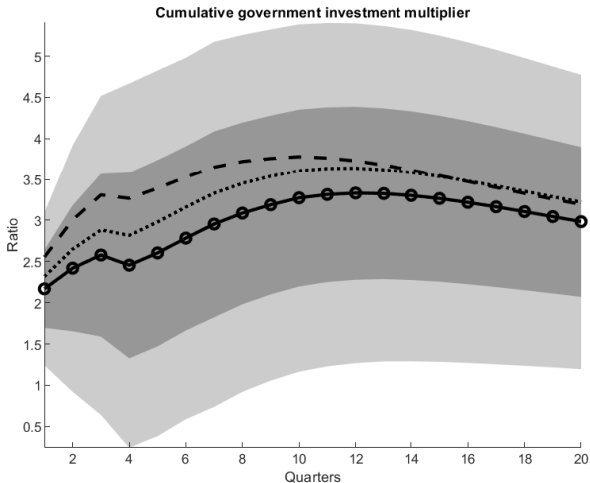
A9 Dropping dummies

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A10 After Fall of the Wall

Cumulative government investment multiplier

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A11 Fiscal foresight

Cumulative government investment multiplier

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