Lecture 1: Cross-Sectional Government Expenditure Multipliers

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Run the same regression in the data and in the model

- Sometimes you will hear economists dodging questions of identification (remember, not the same as inference) by saying they are *running the same regression in the data and in the model*
- ... and therefore, they claim, the data "supports the model"
- This of course does not have to be true. Example
- Go to the data.
  - Measure GDP_{exp} using the expenditure approach
  - Measure GDP_{inc} using the income approach
  - run the regression in the data $GDP_{exp,t} = \beta_0 + \beta_1 GDP_{inc,t} + u_t$
  - You will estimate $\hat{\beta}_0 = 0$, $\hat{\beta}_1 = 1$
- Go to the model.
  - Measure GDP_{exp} using the expenditure approach in model simulated data
  - Measure GDP_{inc} using the income approach in model simulated data
  - run the regression in model-simulated data $GDP_{exp,t} = \alpha_0 + \alpha_1 GDP_{inc,t} + e_t$
  - You will estimate $\hat{\alpha}_0 = 0$, $\hat{\alpha}_1 = 1$
- This "success" would occur in every possible structural model where budget constraints hold
- You learned **nothing** by doing this
- You identified no set of parameters. This moment is uninformative.

Run the same regression in the data and in the model

- Argument that your identified moment/ portable statistic/causal effect rejects something meaningful
- What subset of models cannot get the number that you obtain in the data?
- Is that a generic failure or it depends on specific calibrations of your structure in other blocks?
- Are the models rejected reasonable priors to have?
- What did you learn by your model estimation?

When you can answer those questions, you have a great paper.

Objectives of this section

- We will go over the determinants of the multiplier in closed economy
  Follow Woodford (2011) “simple analytics” paper
- Learn to bridge the aggregate and open-economy multipliers
  Use Chodorow-Reich (2019), Nakamura Steinsson (2014), Farhi Werning (2016)
- Core question: Can we learn something from geographic cross-sectional fiscal spending multipliers?
- Then we will revisit the question of transfer financed versus local deficit financed multipliers. Use Pinardon-Touati (2025))

Of Multipliers and Parameters

- Macroeconomists oftentimes interested in two types of objects
  - Invariant structural parameters (there can be heterogeneity in these)
  - non-structural elasticities: functions of parameters, prices, equilibrium outcomes
- Caveat: Complicate models: structural parameter $\rightarrow$ elasticities
- Caveat II: Simplify models: elasticities $\rightarrow$ structural parameter
- Example: The MPC is not a structural parameter.
- Under standard preferences, the Frisch elasticity of labor supply is a structural parameter

Of Multipliers and Parameters

- In our models the multiplier is **NOT** an structural parameter
- Implications of that: In principle
  - Depend on policy regimes (lean against the wind)
  - Depend on how is financed (taxes vs. transfers from abroad)
  - Depend on the real interest rate (crowding out)
- There is not **ONE** multiplier
- Need to be more precise in what you are estimating *I am estimating the no-monetary policy response, transfer-financed spending multiplier*

Multipliers in the Neoclassical Model

- Suppose

$$\max_{C_t, H_t} \sum_{t=0}^{\infty} \beta^t \left[u(C_t) - v(H_t) + \Gamma(G_t) \right]$$
$$Y = f(H_t)$$
$$Y_t = C_t + G_t$$

- All prices flexible. All markets competitive
- No capital. No durables. No assets in net supply
- The government picks G (not the household!)
- Taxation in lump-sum taxes
- What is the effect of increases in G_t on Y_t

Multipliers in the Neoclassical Model

Intratemporal optimization yields

$$\frac{v'(H_t)}{u'(C_t)} = \frac{W_t}{P_t}$$

Profit maximization yields

$$f'(H_t) = \frac{W_t}{P_t}$$

Combined yield

$$\frac{v'(H_t)}{u'(C_t)} = f'(H_t)$$

Multipliers in the Neoclassical Model

Rearrange

$$\frac{v'(H_t)}{f'(H_t)} = u'(C_t)$$

- RHS: marginal utility of consumption
- LHS: Marginal disutility of producing output.

Use the production function and the resource constraint $Y = C + G$ And the production function $Y = f(H)$

$$u'(Y_t - G_t) = \tilde{v}'(Y_t)$$

Multipliers in the Neoclassical Model

$$u'(Y_t - G_t) = \tilde{v}'(Y_t)$$

Then the multiplier $\frac{dY}{dG}$ is given by

$$\frac{dY}{dG} = \frac{\eta_u}{\eta_u + \eta_{\tilde{v}}}$$

Where

- $\eta_u > 0$ is the negative of the elasticity of u' $(-\bar{Y}u''/u')$
- $\eta_{\tilde{v}} > 0$ is the elasticity of $\tilde{v}'$ $(\bar{Y}\tilde{v}''/\tilde{v}')$

That is, the multiplier is between zero and one.

Multipliers in the Neoclassical Model

$$\frac{dY}{dG} = \frac{\eta_u}{\eta_u + \eta_{\tilde{v}}}$$

- Multiplier between zero and one
- Government spending “crowds-out” private spending
- Government consumes some stuff
- Households are poorer. Negative wealth effects.
- Consume less normal goods (leisure and consumption), so work (and produce) more!
- Multiplier is small iff
  - there is more crowding out
  - Disutility of producing more output rises fast
  - Households have large elasticity of intertemporal substitution

Multipliers in the Neoclassical Model

- Suppose G is temporarily high today. What happens to the real rate?

$$u'(C_t) = \beta R_t u'(C_{t+1})$$

- There is crowding out, R_t must be high today. (notional interest rate).
- Notional interest rate. The interest rate that maintains assets in zero net supply and induces the observed path of consumption

Multipliers in the Neoclassical Model

- No mention of whether taxes occur today or the future
- It does not show up in any first order condition.
- Irrelevant. Ricardian equivalence
- Depends on lots of assumptions, including lump-sum taxes.
- What it says: Variation in the timing of lump-sum taxes is irrelevant
- What it does not say: Government spending does not matter for output. Obviously it does! $dY/dG > 0$. *Please remember that. The whole department and the profession are counting on you, and I will be judged by my colleagues if you forget.*

Multipliers in the Neoclassical Model

- Same environment. News in period t about G_{t+1}. No change in G_t
- What is the reaction of Y_t?

Multipliers in the Neoclassical Model

- Same environment. News in period t about G_{t+1}. No change in G_t
- What is the reaction of Y_t?
- Nothing. There is no link between periods.
- Household knows it will be poorer tomorrow. Nothing it can do about it
- Think of Robinson Crusoe. Output will increase tomorrow of course.

Multipliers in the Neoclassical Model

- Shock to G_t but in a world with capital accumulation
- Multiplier smaller or larger?

Multipliers in the Neoclassical Model

- Shock to G_t but in a world with capital accumulation
- Multiplier smaller or larger?
- Smaller. You have more margins to adjust. C, I, N
- In our models the solution is to adjust all of them by less

Multipliers in the Neoclassical Model

- Same environment with capital. No G_t but news about G_{t+1}.
- What happens to Y_t?

Multipliers in the Neoclassical Model

- Same environment with capital. No G_t but news about G_{t+1}.
- What happens to Y_t?
- In $t+1$ will work more. That raises MPK_{t+1}.
- Therefore invest in t so that K_{t+1} is higher
- Higher effect on Y_t

Does it matter what the government does with the G?

Two options

- Throws the goods in the ocean (or buys tanks and blows them up in some foreign country)
- Provides services that households would have bought in the marketplace (childcare, daycare, transportation, education)

When is the multiplier higher?

Does it matter what the government does with the G?

- Multiplier higher if the government engages in "wasteful" spending
- It's all about wealth effects in this model
- Buys tanks $u(C_t) - v(H_t) + \Gamma(G_t)$. Higher G reduces C, increases u', raising H.
- Alternative extreme assumption. $u(C_t + G_t)$. Reallocations of C_t vs G_t do not change u'. So H_t does not change.

Multipliers in the NK Model

- Let's move to the NK model
- No capital. Sticky prices. Flexible wages
- Firms set prices. Commit to meet demand

$$f'(H_t) \neq \frac{W_t}{P_t}$$

- Then what determines labor demand?

Multipliers in the NK Model

- Let's move to the NK model
- No capital. Sticky prices. Flexible wages
- Firms set prices. Commit to meet demand

$$f'(H_t) \neq \frac{W_t}{P_t}$$

- Then what determines labor demand?
- Product demand!
- Pump up wages to hire more workers since households **are** on their labor supply schedule

Multipliers in the NK Model

Mechanics of the NK model multipliers

- Total demand must hold $Y_t = C_t + G_t$
- G_t is exogenous
- Dynamics of Y depend on the dynamics of C.
- What determines C?

$$u'(C_t) = \beta R_t u'(C_{t+1})$$

- Key variable: the real interest rate

Multipliers in the NK Model

$$u'(C_t) = \beta R_t u'(C_{t+1})$$

- What determines the real interest rate?

Multipliers in the NK Model

$$u'(C_t) = \beta R_t u'(C_{t+1})$$

- What determines the real interest rate?
- Monetary policy and price setting behavior (due to inflation expectations and the Fisher equation)
- The response of monetary policy is a crucial determinant of NK multiplier
- Imagine a policy in which the central bank implements $R_t = R$
- Then $C_t = C_{t+1}$. So $\frac{dY}{dG} = 1$ because $\frac{dC}{dG} = 0$

Multipliers in the NK Model

$$u'(C_t) = \beta R_t u'(C_{t+1})$$

Imagine now a Taylor rule

- Fiscal stimulus is inflationary (someone tells me why)
- interest rates go up
- Consumption today goes down
- Multiplier is less than one

Notice that the NK model has no trouble predicting $dC/dG < 0$ and $dY/dG < 1$.

Multipliers in the NK Model

- What happens if $i_t = 0$ (the Zero Lower Bound)
- G is just as Inflationary
- nominal interest rates do not react
- real rates **decrease**
- $\frac{dC}{dG} > 0$. so $\frac{dY}{dG} > 1$

Main messages

- Can have multipliers of the same magnitude in both models.
- Monetary policy reaction function is key in the NK model
- The mechanisms are crucially different though
  - In the neoclassical model, all about wealth effects
  - In the NK model, demand determination, price stickiness, and central bank reaction functions are crucial.

Farhi and Werning (2016)

- Consider a model where $i_t = \bar{i}$ for $t \leq T$, then $i_t = \bar{r}_t$
- Suppose the economy goes back to steady state

$$c_t = \int_t^T (i_{t+s} - \pi_{t+s} - \bar{r}_{t+s})ds$$

- Again: In the NK model g affects c via its effects on π and i. Not directly.

Farhi and Werning (2016) On null hypotheses

For a sequence of log-deviations g_{t+s}, can write the solution of the model as

$$c_t = \tilde{c}_t + \int_0^\infty \alpha_s^c g_{t+s}$$

$$y_t = \tilde{y}_t + g_t + \int_0^\infty \alpha_s^c g_{t+s}$$

The relevant null hypothesis changes on what you are testing.

- Consumption multipliers equal to zero
- Output multipliers equal to one

Summary

In closed economy:

- In the RBC, the closed economy, lump-sum tax, no capital multiplier $\in [0, 1]$
- Depends on preference elasticities.
- In the NK model: Monetary policy conduct is key.
- The closed economy, Taylor Rule, lump-sum tax, out of the ZLB, no capital multiplier in the NK $\in [0, 1]$
- Can have the same multiplier in both models
- Cannot tell if the world is Keynesian just by looking at this multiplier

Nakamura Steinsson (2014)

Data

- Military procurement data by U.S. State and year.
  - DD-350 military procurement forms
  - Records purchases $> 10k$ before 1983 and $> 25k$ thereafter.
- GDP growth, employment growth, inflation by U.S. State and year.
  - How well are these measured?

Variation

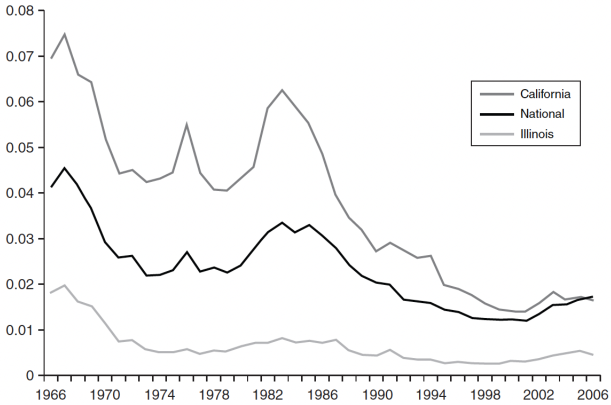


FIGURE 1. PRIME MILITARY CONTRACT SPENDING AS A FRACTION OF STATE GDP

Source: Nakamura Steinsson (2014)

Why military spending?

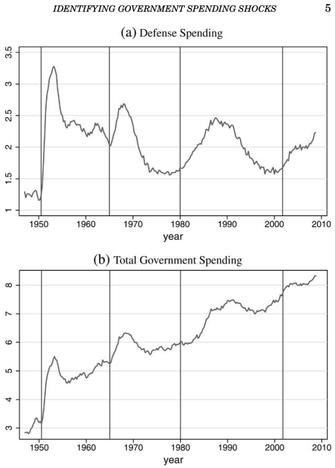


FIGURE I
Real Government Spending Per Capita (in thousands of chained dollars, 2005)

Source: Ramey (2011)

Why military spending?

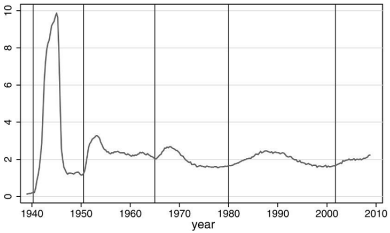


FIGURE II
Real Defense Spending Per Capita, Including WWII (in thousands of chained dollars, 2005)

Source: Ramey (2011)

Specification

- Second stage:

$$\frac{Y_{it} - Y_{it-2}}{Y_{it-2}} = \alpha_i + \gamma_t + \beta \frac{G_{it} - G_{it-2}}{G_{it-2}} + \epsilon_{it}$$

- First stage (I):

$$\frac{G_{it} - G_{it-2}}{G_{it-2}} = \delta_i + \theta_t + \sum_k \zeta_k \mathbb{1}(i = k) \frac{G_t - G_{t-2}}{G_{t-2}} + \eta_{it}$$

- First stage (II):

$$\frac{G_{it} - G_{it-2}}{G_{it-2}} = \delta_i + \theta_t + \zeta \left(s_i \frac{G_t - G_{t-2}}{G_{t-2}} \right) + \eta_{it}$$

Identification: Shares or Shocks?

Our identifying assumption is that the United States does not embark on military buildups-such as those associated with the Vietnam War and the Soviet invasion of Afghanistan-because states that receive a disproportionate amount of military spending are doing poorly relative to other states.

Results

TABLE 2—THE EFFECTS OF MILITARY SPENDING

	Output		Output defl. state CPI		Employment		CPI	Population
	States	Regions	States	Regions	States	Regions	States	States
Prime military contracts	1.43	1.85	1.34	1.85	1.28	1.76	0.03	−0.12
	(0.36)	(0.58)	(0.36)	(0.71)	(0.29)	(0.62)	(0.18)	(0.17)
Prime contracts plus military compensation	1.62	1.62	1.36	1.44	1.39	1.51	0.19	0.07
	(0.40)	(0.84)	(0.39)	(0.96)	(0.32)	(0.91)	(0.16)	(0.21)
Observations	1,989	390	1,989	390	1,989	390	1,763	1,989

Notes: Each cell in the table reports results for a different regression with a shorthand for the main regressor of interest listed in the far left column. A shorthand for the dependent variable is stated at the top of each column. The dependent variable is a two-year change divided by the initial value in each case. Output and employment are per capita. The regressor is the two-year change divided by output. Military spending variables are per capita except in Population regression. Standard errors are in parentheses. All regressions include region and time fixed effects, and are estimated by two-stage least squares. The sample period is 1966–2006 for output, employment, and population, and 1969–2006 for the CPI. Output is state GDP, first deflated by the national CPI and then by our state CPI measures. Employment is from the BLS payroll survey. The CPI measure is described in the text. Standard errors are clustered by state or region.

Results

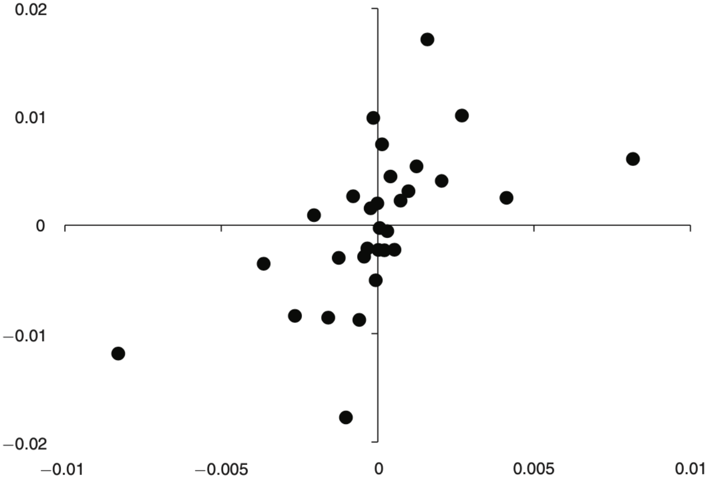


FIGURE 3. QUANTILES OF CHANGE IN OUTPUT VERSUS PREDICTED CHANGE IN MILITARY SPENDING

Notes: The figure shows averages of changes in output and predicted military spending (based on our first-stage regression), grouped by 30 quantiles of the predicted military spending variable. Both variables are demeaned by year and state fixed effects.

Results

TABLE 3—ALTERNATIVE SPECIFICATIONS FOR EFFECTS OF MILITARY SPENDING

	1. Output level instr.		2. Employment level instr.		3. Output per working age		4. Output OLS	
	States	Regions	States	Regions	States	Regions	States	Regions
Prime military contracts	2.48	2.75	1.81	2.51	1.46	1.94	0.16	0.56
	(0.94)	(0.69)	(0.41)	(0.31)	(0.58)	(1.21)	(0.14)	(0.32)
Prime contracts plus military compensation	4.79	2.60	2.07	1.97	1.79	1.74	0.19	0.64
	(2.65)	(1.18)	(0.67)	(0.98)	(0.60)	(1.00)	(0.19)	(0.31)
Observations	1,989	390	1,989	390	1,785	350	1,989	390
	5. Output with oil controls		**6. Output with real int. controls**		**7. Output LIML**		**8. BEA employment**	
	States	Regions	States	Regions	States	Regions	States	Regions
Prime military contracts	1.32	1.89	1.40	1.80	1.95	2.07	1.52	1.64
	(0.36)	(0.54)	(0.35)	(0.59)	(0.62)	(0.66)	(0.37)	(0.98)
Prime contracts plus military compensation	1.43	1.72	1.61	1.59	2.21	1.90	1.62	1.28
	(0.39)	(0.66)	(0.40)	(0.84)	(0.67)	(1.02)	(0.42)	(1.16)
Observations	1,989	390	1,989	390	1,989	390	1,836	360

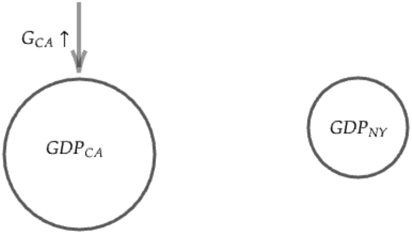
What could go wrong?

- What problems do the instrument(s) solve?
- What problems remain?
- What would you like to see?

Intuition of the OEM

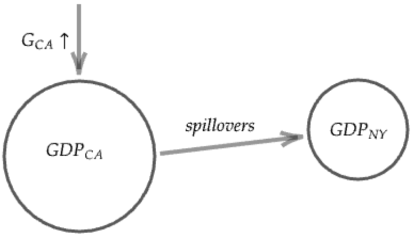
Intuition of the OEM

Intuition of the OEM



Ideally this is what we would like to measure $\frac{\Delta GDP_{CA} - \Delta GDP_{NY}}{\Delta G_{CA}}$

Intuition of the OEM



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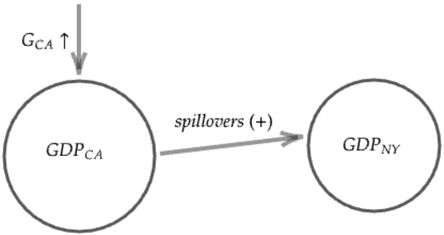

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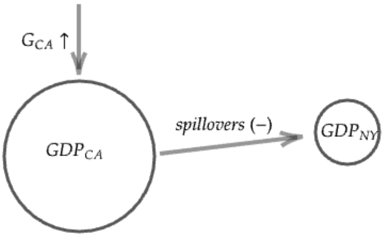

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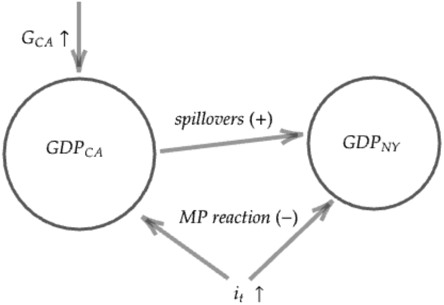

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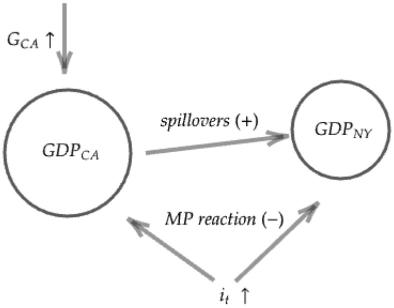
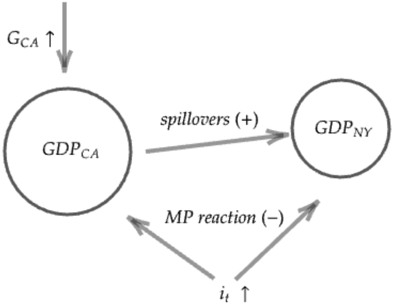


$$OEM = \frac{\Delta GDP_{CA} - \Delta GDP_{NY}}{\Delta G_{CA}}$$

Intuition of the OEM



$$OEM = \frac{\Delta GDP_{CA} - \Delta GDP_{NY}}{\Delta G_{CA}}$$

Time fixed effects control for MP reaction. They do not control for across-state spillovers (SUTVA)

Results from the Open Economy Model

TABLE 6—GOVERNMENT SPENDING MULTIPLIER IN SEPARABLE PREFERENCES MODEL

	Closed economy aggregate multiplier	Open economy relative multiplier
Panel A. Sticky prices		
Volcker-Greenspan monetary policy	0.20	0.83
Constant real rate	1.00	0.83
Constant nominal rate	∞	0.83
Constant nominal rate ($\rho_g = 0.85$)	1.70	0.90
Panel B. Flexible prices		
Constant income tax rates	0.39	0.43
Balanced budget	0.32	0.43

Notes: The table reports the government spending multiplier for output deflated by the regional CPI for the model presented in the text with the separable preferences specification. Panel A presents results for the model with sticky prices, while panel B presents results for the model with flexible prices. The first three rows differ only in the monetary policy being assumed. The fourth row varies the persistence of the government spending shock relative to the baseline parameter values. The fifth and sixth rows differ only in the tax policy being assumed.

Source: Nakamura Steinsson (2014)

Results from the Open Economy Model

TABLE 7–GOVERNMENT SPENDING MULTIPLIER IN GHH MODEL

	Closed economy aggregate multiplier	Open economy relative multiplier
Panel A. Sticky prices		
Volcker-Greenspan monetary policy	0.12	1.42
Constant real rate	7.00	1.42
Constant nominal rate	∞	1.42
Constant nominal rate ($\rho_g = 0.50$)	8.73	2.04
Panel B. Flexible prices		
Constant income tax rates	0.00	0.30
Balanced budget	−0.18	0.30

Notes: The table reports the government spending multiplier for output deflated by the regional CPI for the model presented in the text with the GHH preferences specification. Panel A presents results for the model with sticky prices, while panel B presents results for the model with flexible prices. The first three rows differ only in the monetary policy being assumed. The fourth row varies the persistence of the government spending shock relative to the baseline parameter values. The fifth and sixth rows differ only in the tax policy being assumed.

Source: Nakamura Steinsson (2014). Question: Why is the multiplier = ∞

Results from the Open Economy Model

TABLE 8—GOVERNMENT SPENDING MULTIPLIERS IN INCOMPLETE MARKETS MODEL

	Closed economy aggregate multiplier	Open economy relative multiplier
Panel A. Sticky prices		
Baseline model (complete markets)	0.20	0.83
Incomplete markets, locally financed	0.18	0.84
Incomplete markets, federally financed	0.18	0.90
Panel B. Flexible prices		
Baseline model (complete markets)	0.39	0.43
Incomplete markets, locally financed	0.39	0.41
Incomplete markets, federally financed	0.39	0.40

Notes: The table reports the government spending multiplier for output deflated by the regional CPI for a version of the model presented in the text with separable utility in which the only financial asset traded across regions is a noncontingent bond. Panel A presents results for the model with sticky prices, while panel B presents results for the model with flexible prices.

Source: Nakamura Steinsson (2014)

Question

- The open-economy relative multiplier is 2.04 with GHH preferences
- The closed-economy constant-nominal rate multiplier is 8.73
- Both experiments keep rates constant (time-series vs. cross-section)

Why are they not equal?

Question

How can you have a constant nominal rate policy?

How about Sargent and Wallace?

Nakamura and Steinsson 2014

- The open-economy multiplier is a useful moment
- Lets us to reject subsets of the model space
- Cannot reject some others. That's how progress looks like.
  - My thoughts: *We learned about the structure of the economy using the geographic cross-sectional multiplier in ways is not possible to do with the aggregate multiplier. In that dimension the cross-regional multiplier is a better moment than the aggregate multiplier.*
- It seems however that the answer to the question:
  - *What can we learn about the aggregate multiplier when we see the geograhic cross-sectional multiplier.*
- is "it depends" on what you mean by **the** aggregate multiplier.

Chodorow-Reich (2019)

SUTVA Violation: Financing

- Who pays for spending
- In closed economy, it is always locally-financed
- In open economy model (OEM), it depends
  - Financed locally (taxes vs. deficit)
  - ROW transfer
- OEM with complete markets: completely irrelevant
  - For any set of transfers devised by the government, there is an insurance transfer that undoes it.
- With incomplete markets: now we are talking. It matters who pays

$$\text{Locally financed } \mathcal{M}^G = \text{Transfer-financed } \mathcal{M}^G - \mathcal{M}^T$$

SUTVA Violations: Financing

- Foreign transfer financing is the empirically relevant case
  Spending happens locally, but financed at the federal level *OEM – PF*
- How much of the effect happens through the transfer?
  Size of the transfer is key. Increasing on ρ_g
- Two effects in NK models (you know these from before)
  - SR: sticky prices, transfers increase demand-determined output
    - How much in relative terms? Decreasing in openess α. Less open economies concentrate demand locally
  - In the LR prices adjust, world looks neoclassical. Effects given by wealth effects
    - *H* relatively wealthier, works less. Increasing in elasticity of labor supply $1/\phi$
  - How to weight these effects?
    - Parameters that dictate speed of price adjustment. Mainly the slope of the Phillips curve κ

SUTVA Violations: Financing

- Chodorow-Reich 2019: Illustrative case in the Cole-Obstfeld case
  $\sigma = \eta = \gamma = 1$
- In that case:

$$(7) \qquad \beta_h^{transfer,\,nominal} V = \left(\frac{1-\alpha}{\alpha}\right)\left(\frac{r}{r+\rho}\right)\Delta G_{s,\,t},$$

- For $\alpha = 0.3$, $\rho = 0.8$, $r = 0.03$, then $\beta_h^{transfer,nominal} = 0.07$
- OEM - PF multipliers ≈ 1.5. So SUTVA violation is small.
- Nominal expenditure jumps but prices do not. so $\beta_h^{transfer,nominal} = \beta_h^{transfer,output}$ on impact.
- Going forward: prices adjust, transfer buys less goods. wealth effects impose negative pressure
  SUTVA violation less than 0.07

SUTVA violations: Financing

- Now let's consider deviations from Ricardian Equivalence
  - Let's say failure of Ricardian Equivalence comes >0 share of HtM hh's
- Away from Ricardian Equivalence, the form of local financing matters
  - Higher taxes today
  - Higher debt today
- SUTVA violations are zero if deficit-financed
- SUTVA violations are larger if tax financed

CR 2019: *For non-Ricardian agents, there is an exact analog between having agents in future periods pay for current spending and having agents in other areas pay for current spending.*

SUTVA violations: Expenditure Switching

- The case of financing convered most of this.
- In open regions, increases in local demand create relative price differences
- Diminished demand for local varieties
- Decreases the value of the OEM

SUTVA violations: Migration + Investment

- Migration pumps up OEM multipliers
- Migration concerns rise with the persistence of spending
- Same can be said about K, not only L
- SUTVA + external validity concerns

Pinardon-Touati (2025)

Motivation

- Government debt may adversely affect private sector via **financial crowding out effect**

$$\boxed{\frac{\partial \text{ Output}}{\partial \text{ Gvt debt}}} = \boxed{\text{Effect if no constraint on financing supply}} - \boxed{\textbf{Crowding out}}$$

Debt-financed multiplier

↑ government debt demand
⇒ ↓ supply of corporate debt
⇒ ↓ corporate investment & output

- Challenges to empirical quantification:
  - Government debt: 1 is **endogenous**; 2 affects firms via **multiple channels**

- **This paper:** Quantify **crowding out effect** of **local government bank debt** on corporate credit, investment and output
  - Local government bank debt is large and growing:
    - Over 1990-2019, local government debt-to-GDP ↑ from **12%** to **22%** (G20 countries)
    - **80%** of local government debt = bank debt
  - Identification strategy to isolate financial crowding out

Main findings

Setting: France over 2006-2018

1. **Existence:** Local government loans crowd out corporate loans
2. **Quantification:** $\uparrow$ € 1 local government loans $\Rightarrow$ $\downarrow$ **€ 0.2** aggregate output
3. **Determinants:** More severe when borrowing from more **constrained banks**

   $\rightarrow$ Mode of financing of government debt matters

$$\boxed{\frac{\partial \text{ Output}}{\partial \text{ Gvt debt}}} = \boxed{\text{Effect if no constraint on financing supply}} - \boxed{\textbf{Crowding out}}$$

Debt-financed multiplier		What we know (≈1.5)		**0.2**

Methodology

Data: French credit registry over 2006-2018

- **Identification:** causal reduced-form evidence
  - $\uparrow$ Local government borrowing from a given bank

    $\Rightarrow$ $\downarrow$ Corporate loans by that bank?

    $\Rightarrow$ $\downarrow$ Investment for that bank's borrowers?

$\rightarrow$ Isolate crowding out

- **Aggregation:** model
  - Estimated cross-sectional effects $\Rightarrow$ Aggregate output loss?
  - Effect on aggregate investment & distribution of investment across firms

Related literature

- **Government debt crowding out corporate debt** (Friedman 1978, Elmendorf Mankiw 1999, Greenwood Hanson Stein 2010, Hubbard 2012, Graham Leary Roberts 2014, Krishnamurthy Vissing-Jorgensen 2015, Williams 2018); financial repression & state-owned banks (Acharya Drechsler Schnabl 2014, Becker Ivashina 2017, Huang Pagano Panizza 2020, Hoffmann Stewen Stiefel 2021)
  – **Causal evidence of crowding out + effect on aggregate corporate debt & output**

- **Fiscal multipliers:** transfer- or cash windfall-financed (e.g., Cohen Coval Malloy 2011, Nakamura Steinsson 2014, Auerbach Gorodnichenko Murphy 2019, reviews in Chodorow-Reich 2019, Ramey 2019); debt-financed (Clemens Miran 2012, Adelino Cunha Ferreira 2017, Dagostino 2018)
  – **Debt-financed multipliers < Cash windfall-financed multipliers**

- **Effect of banks' constraints on corporate credit supply & firms' outcomes** (e.g., Kashyap Lamont Stein 1994, Paravisini 2008, Khwaja Mian 2008, Sufi 2009, Ivashina Scharfstein 2010, Chodorow-Reich 2014, Drechsler Savov Schnabl 2017, Chakraborty Goldstein MacKinlay 2018, Herreño 2021)
  – **Implications for transmission of bank-financed fiscal spending**

Identification strategy

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$$\underbrace{\Delta C_{fbt}}_{\Delta \text{ corporate credit}} = d_{ft} + \beta \underbrace{\Delta C^{gov}_{bt}}_{\Delta \text{ local gvt credit}} + \varepsilon_{fbt}$$

f=firm, b=bank, t=year

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  - Local government debt endogenous to corporate credit demand
- **Challenge #2: Other shifts in banks' corporate credit supply**
  - ΔC^{gov}_{bt} and ΔC_{fbt} simultaneously determined

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  - (A2) *BankExposure* orthogonal to other bank-level credit supply shocks

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  - No sorting on characteristics correlated to both local gvt debt demand and corporate credit supply (Borusyak Hull Jaravel 2021)

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$\Rightarrow$ Balanced bank covariates

$\Rightarrow$ Shift-share specific tests (Goldsmith-Pinkham Sorkin Swift 2020, Borusyak Hull Jaravel 2021)

- 1 Balance municipality-level covariates, 2 Specific exposure shares, 3 Leave-out adjustments More

Effect on firm×bank-level credit

	Credit growth		
	(1)	(2)	(3)
BankExposure	-0.164	-0.723**	-0.853***
	(0.191)	(0.310)	(0.311)
Controls	–	–	✓
Firm×Time FE	–	✓	✓
Observations	2,731,110	2,731,110	2,731,110
R-squared	0.00	0.54	0.54

Banks exposed to higher demand for local gvt loans disproportionately cut corporate loans

$\uparrow$ **€ 1 local government loans** $\Rightarrow$ $\downarrow$ **€ 0.54 corporate loans**

Effect on investment

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$$\Delta Y_{ft} = \beta \underbrace{FirmExposure_{ft}}_{\sum_b \omega_{bf,t-1} BankExposure_{bt}} + \gamma_{mst} + \kappa \hat{d}_{ft} + \delta \mathbf{X}_{ft} + \varepsilon_{ft}$$

- *FirmExposure* to crowding out via its banks

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- *FirmExposure* to crowding out via its banks
- Municipality×Industry×Time FE:
  - Firms subject to similar local-level increase in local govt debt
  - Firms in same industry

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  - Firms in same industry
- Include $\hat{d}_{ft}$ FE estimated at the within stage
  (Cingano Manaresi Sette 2016 and Jiménez Mian Peydró Saurina 2019)
- Include additional firm-level controls (incl. firm FE)

Firm-level effects

	Effect of exposure to local government debt shocks			
	gr(credit)		gr(capital)	
	(1)	(2)	(3)	(4)
FirmExposure	-1.050***	-1.403***	-0.465***	-0.455***
	(0.261)	(0.324)	(0.079)	(0.110)
Firm controls	✓	✓	✓	✓
Municipality×Industry×Time FE	✓	✓	✓	✓
Firm FE	–	✓	–	✓
Observations	807,979	780,138	785,314	757,023
R-squared	0.95	0.97	0.43	0.57

- Negative effect on investment
- **$\uparrow$ € 1 local government debt $\Rightarrow$ $\downarrow$ € 0.30 investment**

Model

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- **Firms:**
  - Mass 1 of intermediate input firms $f \in [0, 1]$ assigned to each bank
    - Produce $Y_{fb} = e^{z_{fb}} K_{fb}^{\alpha} L_{fb}^{1-\alpha}$
    - Capital financed by bank loans at rate r_b^c [here $K_{fb} = C_{fb}$, in the paper $K_{fb} = C_{fb} + E_{fb}$]
  - Competitive final goods producers $Y = \left(\int_b \int_f Y_{fb}^{\frac{\sigma-1}{\sigma}} dfdb \right)^{\frac{\sigma}{\sigma-1}}$

  $\Rightarrow$ $\log C_{fb} = (\sigma - 1) z_{fb} + \log Y - (1 - \alpha)(\sigma - 1) \log w + \epsilon^c \log r_b^c$ with $\epsilon^c = -(1 + \alpha(\sigma - 1))$

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- **Eqm:** firm & bank maximization + market clearing $\Rightarrow C_b^{corp}, C_b^{gov}, C^{corp}, C^{gov}$ as function of z_{fb}, Z_b^{gov}

Cross-sectional and aggregate crowding out

Crowding out: Effect of a local gvt debt demand shock on corporate credit, investment & output

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Aggregate crowding out:

$$\Delta C^{corp} = \underbrace{(1 + \kappa^{GE})}_{\text{GE feedback}} \quad \underbrace{\chi}_{\substack{\text{Direct effect} \\ \text{of crowding out}}} \quad Z^{gov}$$

- χ = direct effect of crowding out
  - $\chi = \frac{\epsilon^c}{\epsilon^s - \epsilon^c} < 0 \rightarrow |\chi| \downarrow$ in ϵ_s & $\uparrow$ in $|\epsilon_c|$
- κ^{GE} = GE feedback
  - $\kappa^{GE} > 0$ (amplification) or $\kappa^{GE} < 0$ (dampening) depending on σ, ψ, α

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Cross-sectional and aggregate crowding out

Crowding out: Effect of a local gvt debt demand shock on corporate credit, investment & output

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$$\boxed{\frac{\partial\ \text{Output}}{\partial\ \text{Gvt debt}}} = \boxed{\text{Effect if no constraint on financing supply}} - \boxed{\textbf{Crowding out}}$$

0.2

Extensions | Allocative efficiency | Back