

Economics 742 Lecture 6: Fiscal Multipliers and Aggregation I

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Fiscal Multipliers and Aggregation

1. Fiscal Multipliers: Government Programs
 - 1.1 Parker, Souleles, Johnson, and McClelland (2013)
 - 1.2 Mian and Sufi (2012)
2. Local Multipliers
 - 2.1 Shoag (2012)
 - 2.2 Suarez-Serrato and Wingender (2016)
 - 2.3 Nakamura and Steinsson (2014)
3. Local Multipliers and Aggregation: Nakamura and Steinsson (2014)
4. What Have We Learned?: Chodorow-Reich (2018)

Fiscal Multipliers

- What is the effect of gov't spending on economic activity?
- Summarize as *multiplier*: effect of \$1 of spending on GDP.

$$\frac{\Delta Y_{t,t-1}}{Y_{t-1}} = \alpha + \beta \frac{\Delta G_{t,t-1}}{Y_{t-1}} + \varepsilon_t$$

- Note different from *elasticity*, which is sometimes reported (e.g. Ramey papers) and smaller.

$$\frac{\Delta Y_{t,t-1}}{Y_{t-1}} = \alpha + \beta \frac{\Delta G_{t,t-1}}{G_{t-1}} + \varepsilon_t$$

- Difference from other literatures we have discussed:
 - One number people are after. More cohesive lit.
 - “Shock” here is better-defined.
- Difficulty: spending correlated with economic conditions.
 - Look for “random” spending orthogonal to economy.
 - But get LATE for this type of spending.

Fiscal Multipliers: Approaches

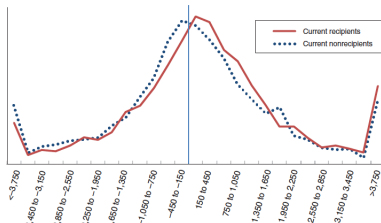
1. Output effects of exogenous changes in government spending.
 - Military spending is most popular (wars orthogonal to macroeconomy).
 - Fiscal shocks, transfer shocks, etc. also used.
2. Structural VARs.
3. Micro Analysis of Government Programs.
 - Get at MPC but not aggregate multiplier.
 - Analogous to firm effect but not aggregate effect of bank shock.
4. Regional Variation to measure “local multipliers.”
 - Will cover quickly. Want to give you idea of variation used.

Parker et al. (2013): Timing of Tax Rebate Checks

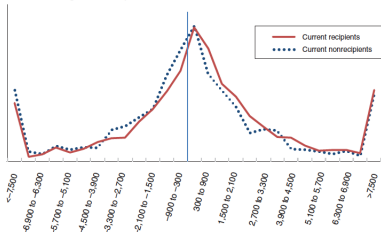
- Timing of disbursement of 2008 stimulus payments to tax filers based on last two digits of SSN.
 - Work with BLS to add questions about payments to consumer expenditure survey.
 - Compare people who just received check to those who are about to receive check.
- Within three months of receipt
 - 12-30% of stimulus payments spent on nondurables.
 - Adding durables gives 50-90% spent in 3 months.
 - Stronger for elderly, low-income, and homeowners.
 - Aggregates to partial equilibrium effect of 1.3-2.3% increase in consumption.
- Generally similar to previous work on 2001 stimulus payments.

Parker et al. (2013): Timing of Tax Rebate Checks

Panel A. Change in nondurable expenditure



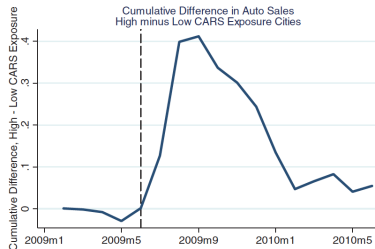
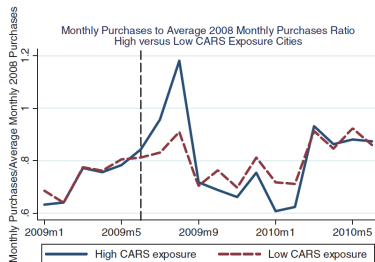
Panel B. Change in total expenditure



Mian and Sufi (2012): Cash For Clunkers

- In July-August 2009, government gave \$3,500-\$4,500 credit to car buyers who traded in a low fuel-efficiency “clunker.”
- Use variation across cities in the number of “clunkers” available to be traded to analyze effects.
 - Very clean. No pre-trends in auto purchases before.
- Large increase in purchases:
 - 1 SD increase in clunkers/purchases in pre-period \Rightarrow 2/3 SD increase in car purchases during program.
 - 370,000 aggregate effect.
- However, most of effect is “pulling forward” of purchases that would have occurred without program.
 - Cities show no differences in cumulative July 2009 - July 2010 purchases based on number of “clunkers” available.

Mian and Sufi (2012): Cash For Clunkers



Local Multipliers

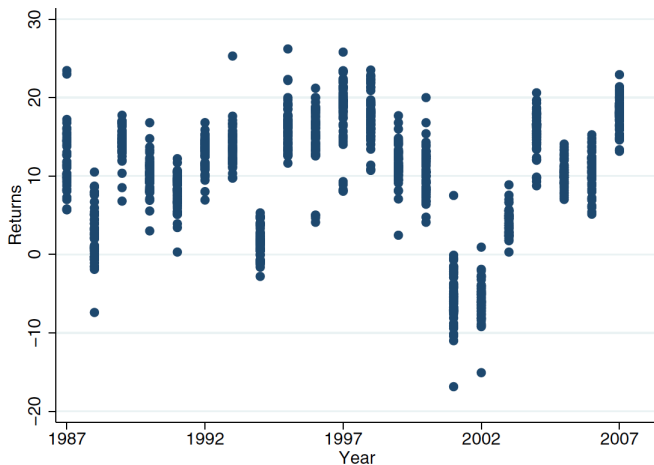
- Recently, work to assess multiplier (and its cyclical) using regional variation.
 - Add a time fixed effect.
 - All identification from across regions within a time period.
- Several papers find similar magnitudes: multiplier $\approx 1.5 - 2$.
 - Use different interesting sources of variation we will discuss.
- Then will tackle what a local multiplier is relative to a “national” multiplier.
 - Will begin discussion of aggregation with this part of Nakamura and Steinsson’s (2014) local multipliers paper.

Shoag (2012): State Pension Portfolio Windfalls

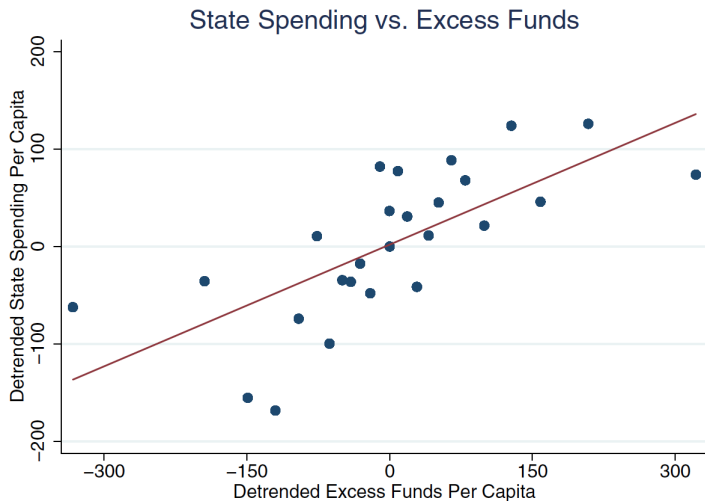
- U.S. states administer large defined-benefit pension plans.
 - Each state has a fund that invests differentially.
 - State must pay gap between return on fund and pension liabilities.
 - Excess returns on each state's portfolio are highly correlated with non-pension state spending.
- Uses these excess returns as an instrument for state spending
 - Both cross-sectional and time-series variation.
 - Dispels concern that portfolio composition correlated with state characteristics through in-state bias.
 - Finds multiplier of 2.12, one job created by \$35k in spending.
 - Stronger in recessions, concentrated in non-tradable industries.

Shoag (2012): Excess Return Variation

Figure 2: Distribution of Returns

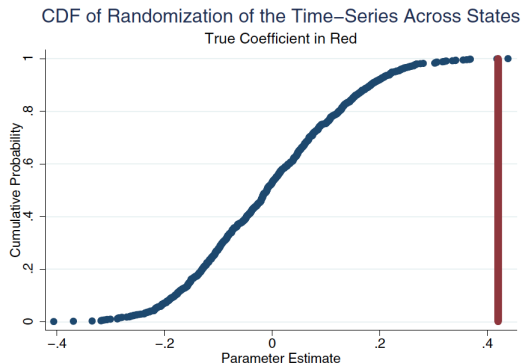


Shoag (2012): First Stage



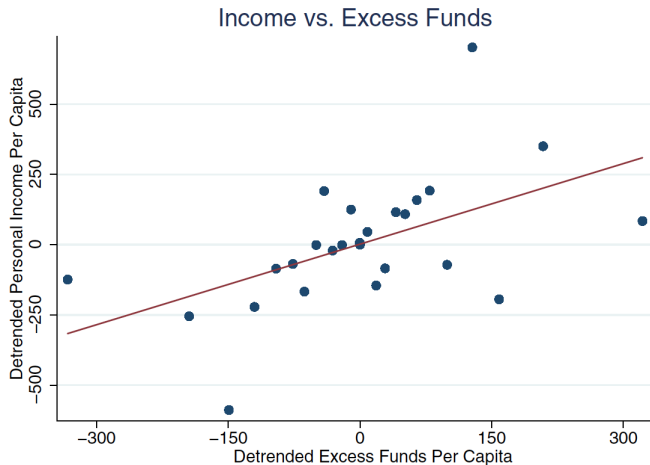
Shoag (2012): First Stage Permutation Test

- Placebo/permutation test shows significance visually:
 - Randomly re-assign time series of excess funds across states.
 - For each draw, regress excess funds on state spending.
 - Plot CDF of estimates relative to true estimate.

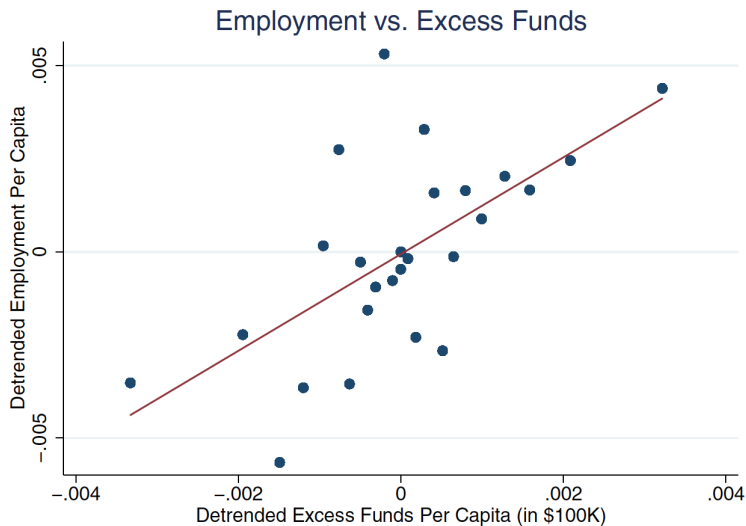


Shoag (2012): Reduced Form For Multiplier

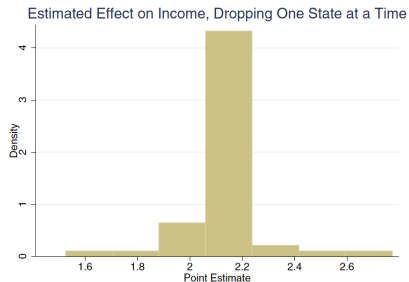
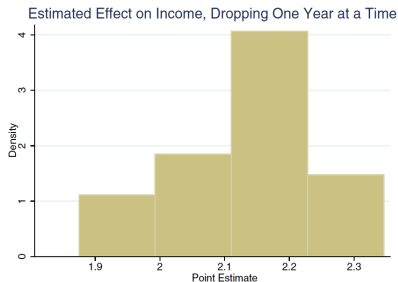
- Reduced form shows instrument on outcome.
- IV estimate just rescales this, so nice to show non-parametrically.



Shoag (2012): Reduced Form For Employment



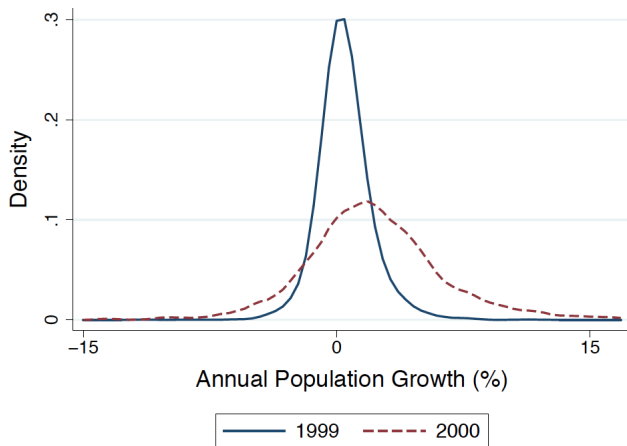
Shoag (2012): Distribution of Multiplier Estimates



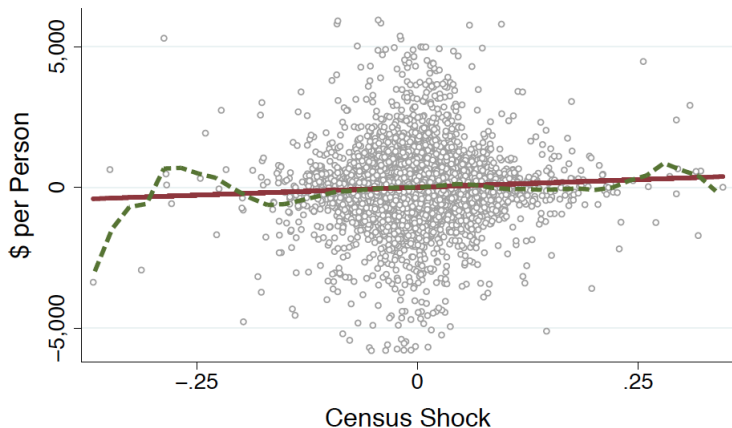
Suarez-Serrato and Wingender (2016): Census Resets

- Many federal programs index spending to population.
 - Every 10 years based on census, update annually based on estimates between censuses (smooth changes).
 - Sharp changes in funding when census comes out due to errors in intercensal estimates.
- Use these errors as instrument for federal funds.
 - Different agencies update in different years, so gives multiple years of variation per census.
 - Looks random
- Find multiplier of 1.5-1.7, one job created by \$30k spending.
 - 15x larger than OLS.

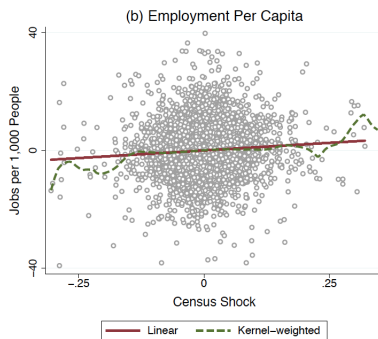
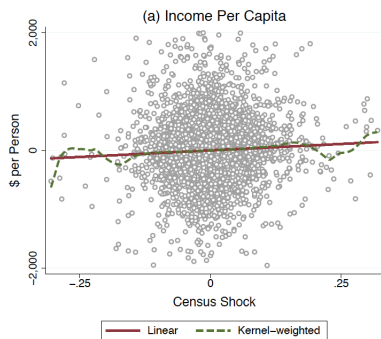
Suarez-Serrato and Wingender (2016): Variation



Suarez-Serrato and Wingender (2016): First Stage

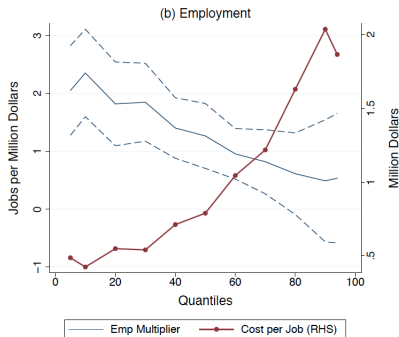
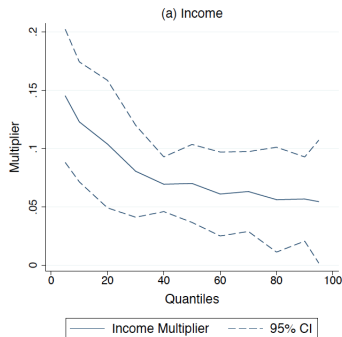


Suarez-Serrato and Wingender (2016): Reduced Form



Suarez-Serrato and Wingender (2016): Census Resets

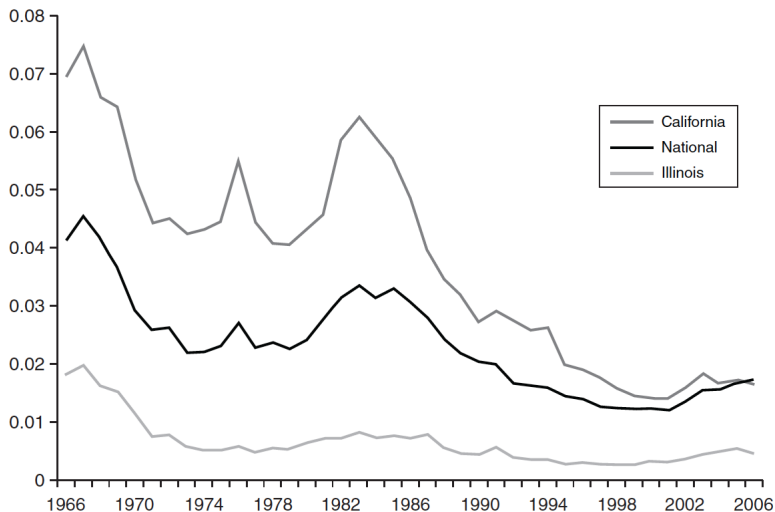
- Use IV quantile regression to look at heterogeneity across regions within years based on income and employment.



Nakamura and Steinsson (2014): Local Military Spending

- First Half: Use local variation in incidence of military buildup to estimate local multiplier.
 - Comparing effect of spending due to buildup in one state *relative* to another on *relative* output.
- Using popular military buildup variation from VAR literature in cross-section leads to better identification.
 - VAR: Military buildups exogenous to state of economy.
 - Cross-State: Military buildups orthogonal to relative economic state of states that get disproportionate military spending.
- Instrument constructed two ways:
 - Interact national procurement with state or region dummy.
 - Military spending share-shift.
- Multiplier: 1.5-1.7 (over 2 with Bartik but noisier)

Nakamura and Steinsson (2014): Variation



Nakamura and Steinsson (2014): Main Result

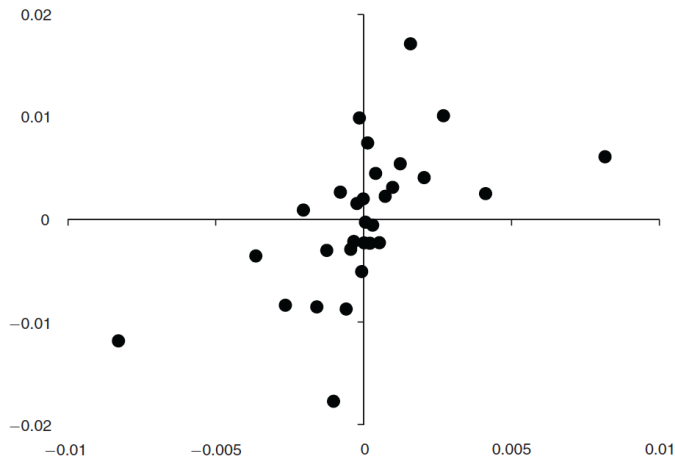


FIGURE 3. QUANTILES OF CHANGE IN OUTPUT VERSUS PREDICTED CHANGE IN MILITARY SPENDING

Nakamura and Steinsson (2014): Multiplier Coefficients

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

- Biannual lag.

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

- Find larger multiplier in times of economic slack.

Chodorow-Reich (2018): Meta Analysis

- Chodorow-Reich provides a “meta analysis” of many local multiplier papers beyond what I survey here.
 - Some use ARRA variation.
 - Others historical or in other countries.
 - Some report spending to create a job. Translates into a multiplier using a production function.
- Median multiplier is 1.8, mean is 2.1

Aggregation

- I am going to spend the last 1 1/2 lectures of this part of the class discussing aggregation.
 - How to translate macro-relevant micro estimates into macro figures.
- To obtain identification, we often use variation that holds a lot constant.
 - In other words, partial equilibrium.
 - Example: Time fixed effect in local multiplier regressions.
 - How do we get to general equilibrium.
- Today, start with aggregation of local multipliers. More general treatment next class.

Nakamura and Steinsson (2014): Local Multiplier Model¹

- Second half: model of a currency union to understand what exactly a local multiplier measures.
 - Source of much confusion prior to this paper.
 - Shows value of simple model in empirical macro.
 - Currency union model commonly used with regional data.
- Idea: Treat states as small open economies in monetary union.
 - They estimate “open economy relative multiplier.”
 - Use model to contrast this to “closed economy aggregate multiplier” that is focus of literature.
- Multiplier is not a deep parameter.
 - Depends on preferences, technology, frictions, government spending and how financed.
 - So consider many model permutations.

¹These slides draw on Emi Nakamura and Jon Steinsson's slides.

Nakamura and Steinsson (2014): Surprising Insights

- Complaint: local multiplier reveals little about agg multiplier.
 - States do not pay for spending (so multiplier higher?).
 - Relative response of monetary and tax policy does not inform aggregate.
- Nakamura and Steinsson argue estimating local multiplier is *not* only a disadvantage.
 - Relative monetary and fiscal policy pinned down.
 - This neutralizes channels that make it difficult to distinguish between macro models, making the open economy relative multiplier a useful diagnostic tool.
 - Example of point of Nakamura and Steinsson (2017) we discussed in lecture 1.

Nakamura and Steinsson (2014): Model Structure

- Standard NK model with Calvo pricing.
 - CES preferences over continuum of goods.
 - Government spending also has CES demand.
 - Taxes uniform across union (consider lump sum and labor).
 - Follows AR(1) process.
 - Taylor Rule for monetary policy (consider multiple policies).
- Two regions
 - Each region produces continuum, home bias parameter.
 - New feature in monetary union is *Backus-Smith condition*:

$$\frac{U_c(C_t^*, L_t^*)}{U_c(C_t, L_t)} = \frac{P_t^*}{P_t} \equiv Q_t$$

- *Risk sharing condition* due to complete financial markets, A-D securities have same price across union.

NS (2014): Comparing Models With Separable Preferences

$$U(C_t, L_t) = \frac{C_t^{1-1/\sigma}}{1-1/\sigma} - \chi \frac{L_t^{1+1/\nu}}{1+1/\nu}$$

TABLE 6—GOVERNMENT SPENDING MULTIPLIER IN SEPARABLE PREFERENCES MODEL

	Closed economy aggregate multiplier	Open economy relative multiplier
<i>Panel A. Sticky prices</i>		
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
<i>Panel B. Flexible prices</i>		
Constant income tax rates	0.39	0.43
Balanced budget	0.32	0.43

- Open economy multiplier invariant to agg policy because difference out fixed union-wide monetary and fiscal policies.

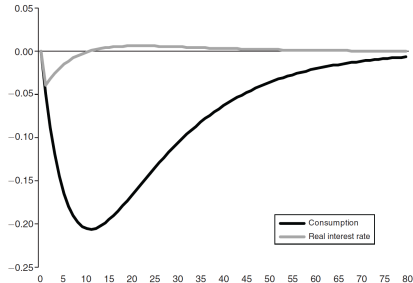
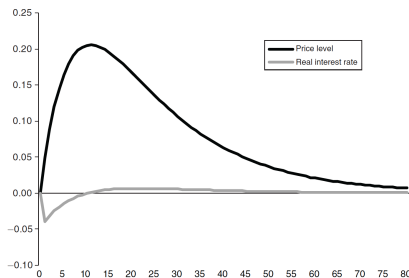
NS (2014): Intuition With Separable Preferences

- “Volcker-Greenspan” policy where real rate r responds more than one-for-one to inflation leads to lower agg multiplier.
 - Gov’t spending \Rightarrow inflation \Rightarrow aggressive $\uparrow r$, partially offsetting gov’t spending.
 - Similar to fixed vs. floating in Mundell-Fleming.
- Constant real rate r policy gives multiplier of one.
 - Real rate constant \Rightarrow no C “crowding out” G to offset.
- Constant nominal rate i gives large multiplier
 - Analogous to ZLB: $G \uparrow \Rightarrow E[\pi] \uparrow \Rightarrow \downarrow$ long-run $r \Rightarrow C$ “crowds in” G .
 - Multiplier to ∞ when i constant forever.

NS (2014): Intuition With Separable Preferences

- Open econ rel mult < 1
 - Local government spending crowds out private spending.
 - Local gov't spending $\uparrow \Rightarrow$ local prices rise and "real exchange rate" q_t rises \Rightarrow local consumption \downarrow by Backus-Smith.
- In mon union, nominal rate is constant. But intuition differs from ZLB.
 - Here very long-run r rises. In ZLB, long-term r_t falling is key to big multiplier.
 - In mon union, short run differences in prices reverse.
 - Local $G \uparrow \Rightarrow$ short-run rel inflation \Rightarrow short-run $r \downarrow$.
 - After rel prices peak, expect rel deflation \Rightarrow long run $r \uparrow$ above very-long-run level.
 - Consumption falls despite low real rates in short-run because of expected of high long-run real rate.

NS (2014): Intuition With GHH Preferences



NS (2014): Comparing Models With GHH Preferences

$$U(C_t, L_t) = \frac{\left(C - \chi L_t^{1+1/\nu} / (1 + 1/\nu)\right)^{1-1/\sigma}}{1 - 1/\sigma}$$

TABLE 7—GOVERNMENT SPENDING MULTIPLIER IN GHH MODEL

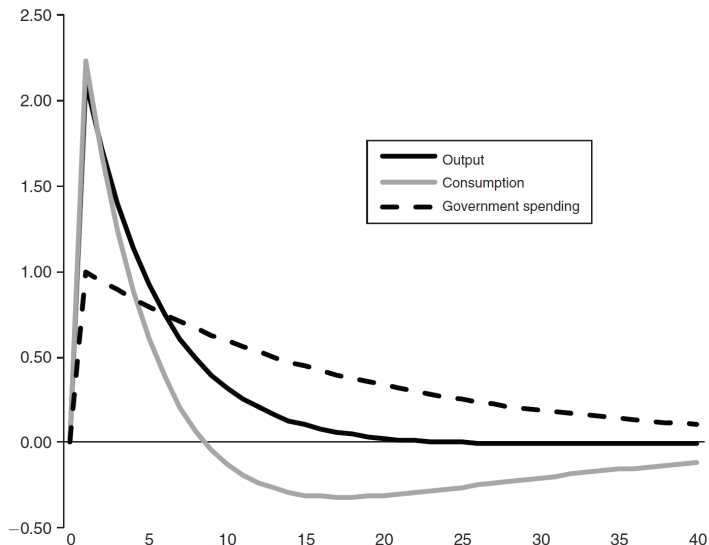
	Closed economy aggregate multiplier	Open economy relative multiplier
<i>Panel A. Sticky prices</i>		
Volcker-Greenspan monetary policy	0.12	1.42
Constant real rate	7.00	1.42
Constant nominal rate	∞	1.42
Constant nominal rate ($\rho_g = 0.50$)	8.73	2.04
<i>Panel B. Flexible prices</i>		
Constant income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

- Local multiplier moment favored by GHH NK Model.

NS (2014): Intuition With GHH Preferences

- $C - L$ complementarity \Rightarrow consume more when output is high.
- $G \uparrow \Rightarrow$ local output \uparrow (home bias) $\Rightarrow C \uparrow$ (trade deficit).
- Eventually previous intuition takes hold.
 - Consumption falls below long-run level even though output declines smoothly (trade surplus).
- Closed economy agg multiplier
 - With aggressive mon policy, weaker because no wealth effect on labor supply.
 - However, at ZLB it is stronger.

NS (2014): Intuition With Separable Preferences



NS (2014): Incomplete Markets and Federal Financing

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

- Federal financing \Rightarrow net transfer.
 - Short run wealth effect increase consumption
 - Long run wealth effect reduces labor supply.
 - Small effects here, depends on size of transfer (G persistence).

Nakamura-Steinsson (2014): Take Aways

- Local multiplier differences out monetary and tax policy.
 - Aggregate multiplier depends on policy, particularly monetary.
 - Local multiplier is larger if monetary policy “leans against the wind.”
 - Allows us to test between models. Data favors NK model with labor-consumption complementarity. In these models, demand shocks have strong effects.
- Identified reduced-form empirical work and structural model working in concert.
 - Identification gives new credible facts and moments to match.
 - Structural model provides interpretation of these facts, but weakened without strong empirical work to guide it.

Chodorow-Reich (2018): Lessons From Local Multipliers

- Chodorow-Reich (2018) provides a nice survey article on local multipliers.
- Local multipliers are unique in four ways:
 1. Do not allow monetary policy response.
 2. May induce “expenditure switching” resulting from output price changes.
 3. May induce local spending on other regions’ output due to income effect.
 4. Almost always involve increase in spending without change in taxes today or in future.
- Argument:
 - 4 is small (0.2 at most).
 - 2 and 3 make local multiplier smaller than aggregate multiplier.
 - Thus local multiplier is rough lower bound for “closed economy ZLB deficit-financed aggregate multiplier,” which is ≈ 1.7 .

C-R (2018): Relationship to Deficit-Financed Local Mult

- $\beta^{xs,transfer} \Delta G_t = \beta^{xs,deficit} \Delta G_t + \beta^{transfer} V$ where:
 - $\beta^{xs,transfer}$ be the cross-sectional transfer multiplier.
 - $\beta^{xs,deficit}$ be the deficit spending multiplier.
 - $\beta^{transfer}$ the transfer multiplier
 - ΔG_t be the change in spending.
 - $V = \int_0^\infty e^{-rt} \Delta G_t dt$ be present value of transfer.
- Under Ricardian equivalence βV is small if increase in spending is transient and local economy not too closed.
 - Transient: Low NPV of future taxes.
 - Not too closed: Local output not super sensitive to local consumption.
- When Ricardian equivalence fails, $\beta^{transfer} \rightarrow 0$.
- Quantitatively, outside financing raises multiplier by 0.05 to 0.2 (citing Nakamura-Steinsson and Farhi-Werning).

C-R (2018): Relationship to Closed Economy ZLB Mult

- Now hold monetary policy fixed (ZLB).
- Expenditure switching:
 - When gov't purchases local output, local prices rise, shifting expenditure towards other regions.
 - Terms of trade effect makes local multiplier smaller than closed economy multiplier.
- Income effects:
 - Intuition: Increase in demand by local agents “leaks” abroad.
 - Ex: Hand to mouth agents spend on both local and non-local goods, but in closed economy must spend on local.
 - Identical effect for GHH prefs.
 - Again, makes local multiplier smaller.
- Chodorow-Reich concludes lower bound for closed economy ZLB multiplier is 1.7.