Economics 210c/236a
Fall 2011

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LECTURE 4
The Effects of Fiscal Changes: Government Spending

September 21, 2011

I. Introduction

Theoretical Considerations (I)

A traditional Keynesian model (sticky prices and demand-determined output in the short run; consumption determined largely by current income; small supply-side effects; etc.)

Increases in G (or decreases in T) cause Y, C, and r to rise; I falls.

Theoretical Considerations (II)

A neoclassical model with lump-sum taxation (flexible prices; permanent-income consumers; …)

- Changes in T have no effects (Ricardian equivalence).
- The effects of changes in G work through wealth and substitution effects. For example, an increase in G means lifetime private resources are lower, leading to a fall in leisure (and so an increase in labor supply) and a fall in consumption.

Theoretical Considerations (III)

News of a future rise in G in a neoclassical model with lump-sum taxation

- Wealth effects cause immediate falls in consumption in leisure.
- Since output is higher and C is lower (and G hasn't yet changed), I is higher.
- When the change in G occurs, C and L don't change discontinuously. So I falls sharply.
- …

Theoretical Considerations (IV)

Adding "GHH preferences" to a neoclassical model with lump-sum taxation

- Now the marginal utility of consumption is higher when people are working more.
- As a result, a rise in G has opposing effects on C: the fall in wealth acts to push it down, but the rise in L acts to push it up.

…

Theoretical Considerations (V)

Adding distortionary taxes to a neoclassical model

- Now T matters.
- For example: A temporary increase in G financed by a temporary increase in labor taxation creates incentives to shift labor supply away from the period when G is high. So Y can fall in response to the increase in G.

II. Hall, "By How Much Does GDP Rise If the Government Buys More Output?"

Hall's Regression

$$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = a + b\frac{G_t - G_{t-1}}{Y_{t-1}} + e_t,$$

where Y is real GDP and G is real government military purchases (and the data are annual).

Table 1. Ordinary Least Squares Estimates of Government Purchases Multipliers for Military Spending[a]

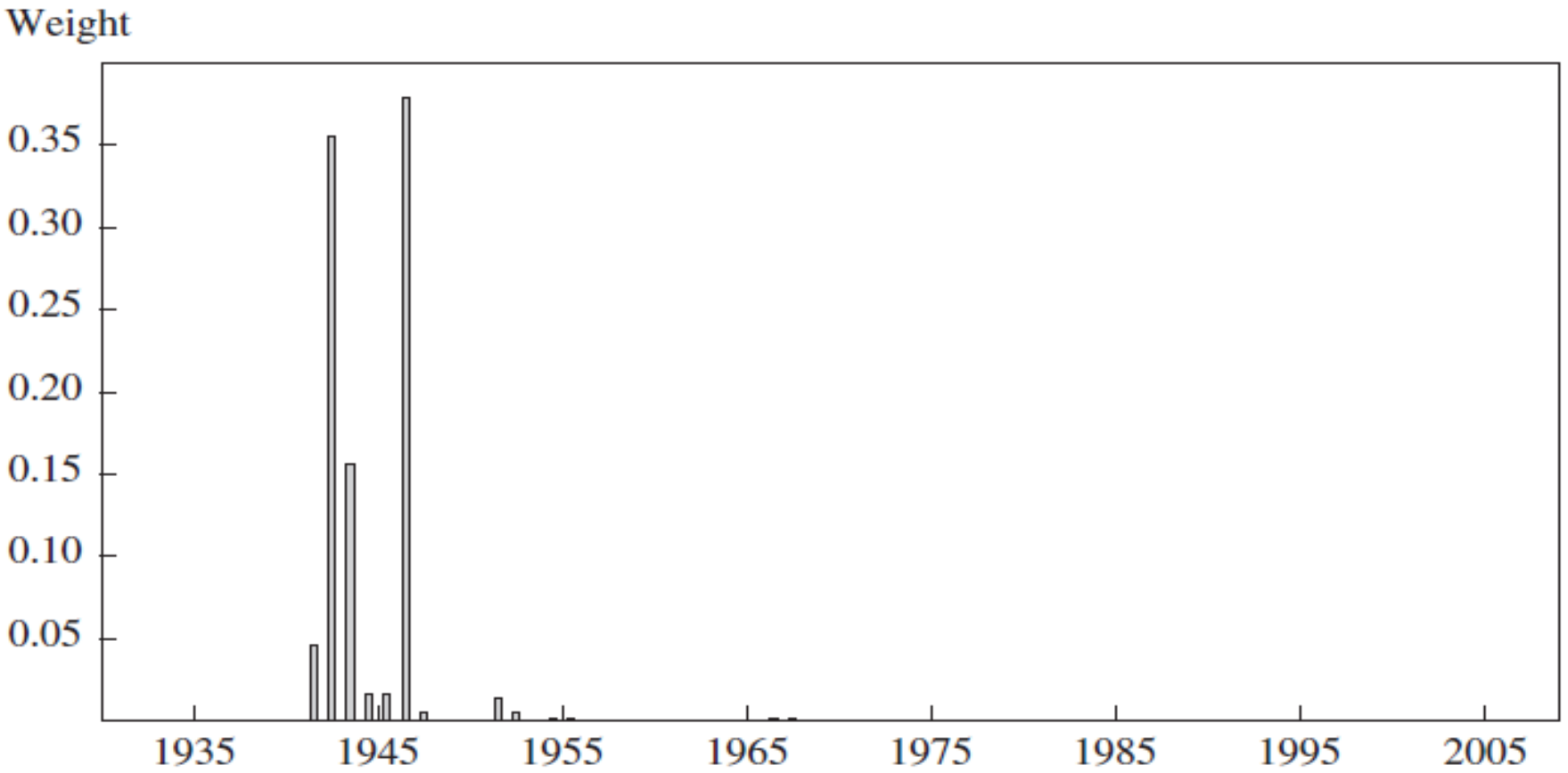
Period	*GDP multiplier*	*Consumption multiplier*
1930–2008	0.55	–0.05
	(0.08)	(0.03)
1948–2008	0.47	–0.12
	(0.28)	(0.10)
1960–2008	0.13	–0.09
	(0.65)	(0.29)
1939–48	0.53	–0.05
	(0.07)	(0.02)
1949–55	0.48	–0.18
	(0.56)	(0.05)
1939–44	0.36	–0.11
	(0.10)	(0.03)
1945–49	0.39	–0.04
	(0.08)	(0.05)

Source: Author's calculations.

a. Numbers in parentheses are standard errors.

From: Hall, "By How Much Does GDP Rise If the Government Buys More Output?"

Figure 1. Annual Weights Implicit in OLS Estimates of Output and Consumption Multipliers[a]



Source: Authorís calculations.

a. Each weight derives from the square of military spending in that year.

From: Hall, "By How Much Does GDP Rise If the Government Buys More Output?"

III. Ramey, "Identifying Government Spending Shocks: It's All in the Timing"

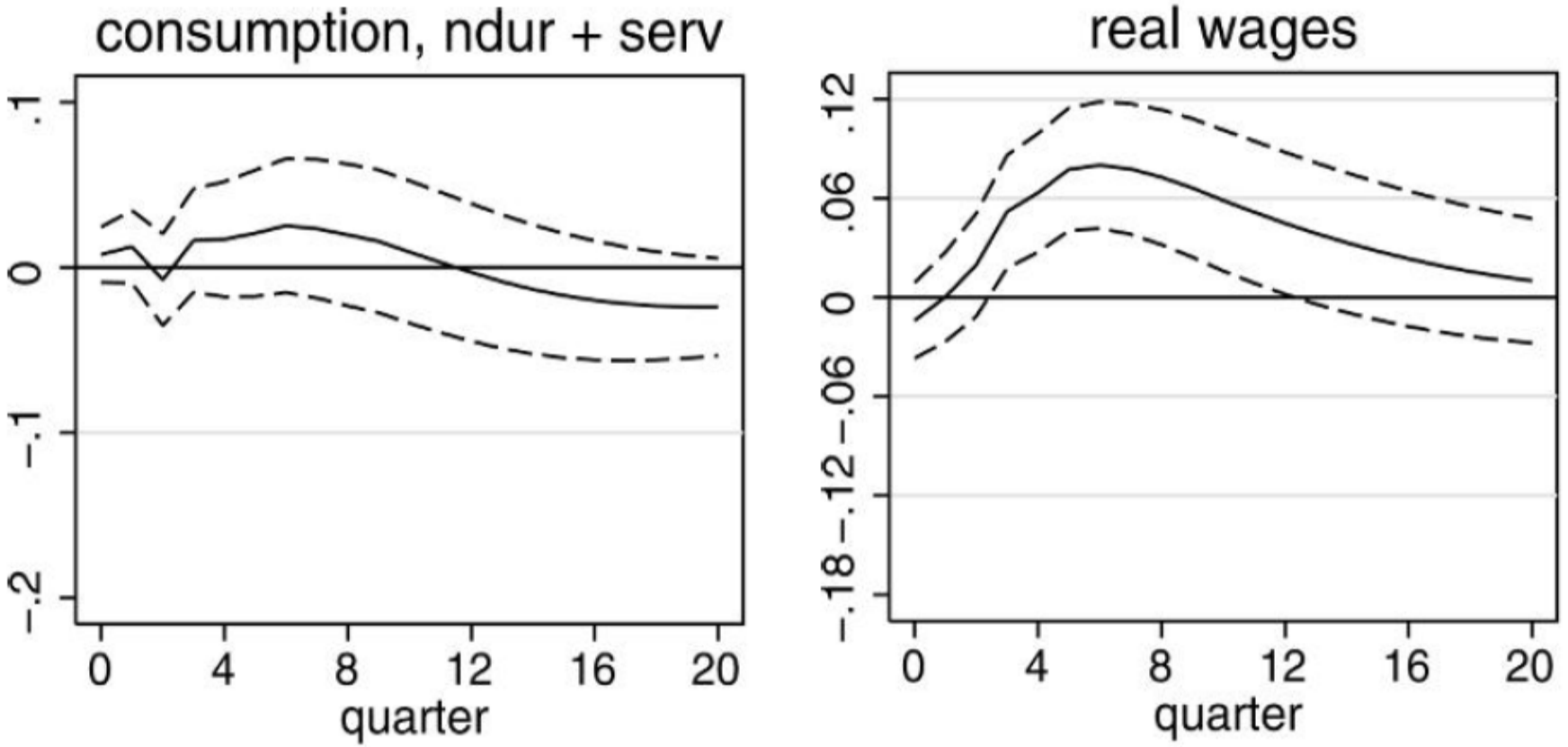


FIGURE IV

Comparison of Identification Methods: Response to a Government Spending Shock (Standard error bands are 68% confidence intervals)

From: Ramey, "Identifying Government Spending Shocks: It's All in the Timing"

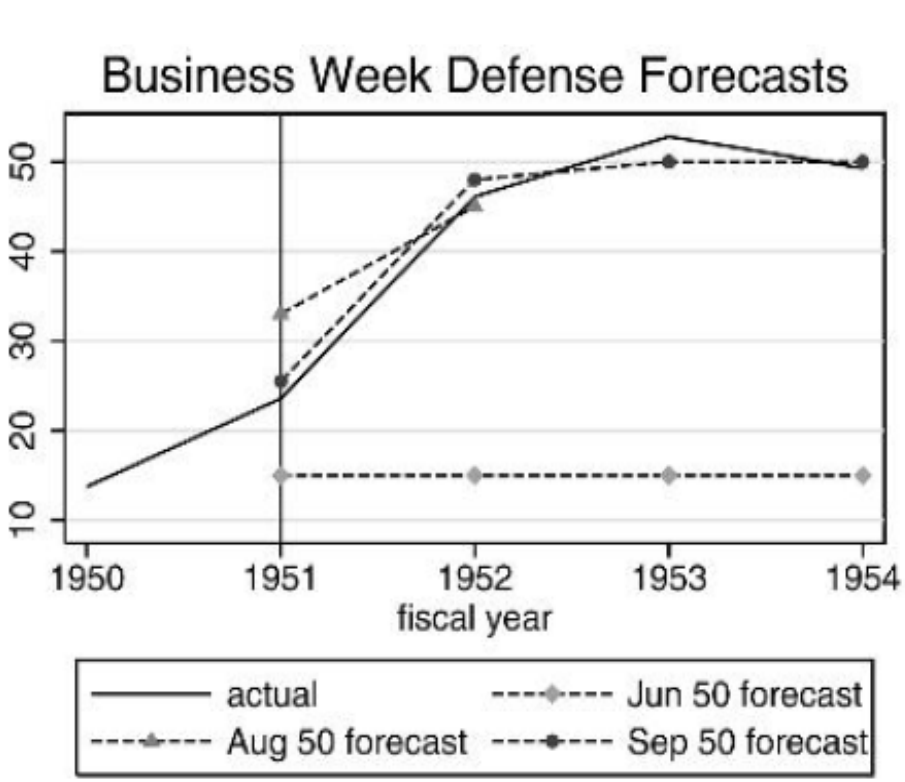
TABLE I

GRANGER CAUSALITY TESTS

Hypothesis tests	p-value in parenthesis
Do war dates Granger-cause VAR shocks? 1948:1–2008:4	Yes (0.012)
Do one-quarter ahead professional forecasts Granger-cause VAR shocks? 1981:3–2008:4	Yes (0.032)
Do four-quarter ahead professional forecasts Granger-cause VAR shocks? 1981:3–2008:4	Yes (0.016)
Do VAR shocks Granger-cause war dates? 1948:1–2008:4	No (0.115)

Notes. VAR shocks were estimated by regressing the log of real per capita government spending on 4 lags of itself, the Barro–Redlick tax rate, log real per capita GDP, log real per capita nondurable plus services consumption, log real per capita private fixed investment, log real per capita total hours worked, and log compensation in private business divided by the deflator for private business. Except for the professional forecasts, 4 lags were also used in the Granger-causality tests. For the professional forecaster test, the VAR shock in period t is regressed on either the forecast made in period t-1 of the growth rate of real federal spending from t-1 to t for the forecast made in period t-4 of the growth from t-4 to t. The professional forecast regressions were estimated from 1981:3 to 2008:4 because this forecast was only available for that period. The war dates are a variable that takes a value of unity at 1950:3, 1965:1, 1980:1, and 2001:3.

From: Ramey, "Identifying Government Spending Shocks: It's All in the Timing"



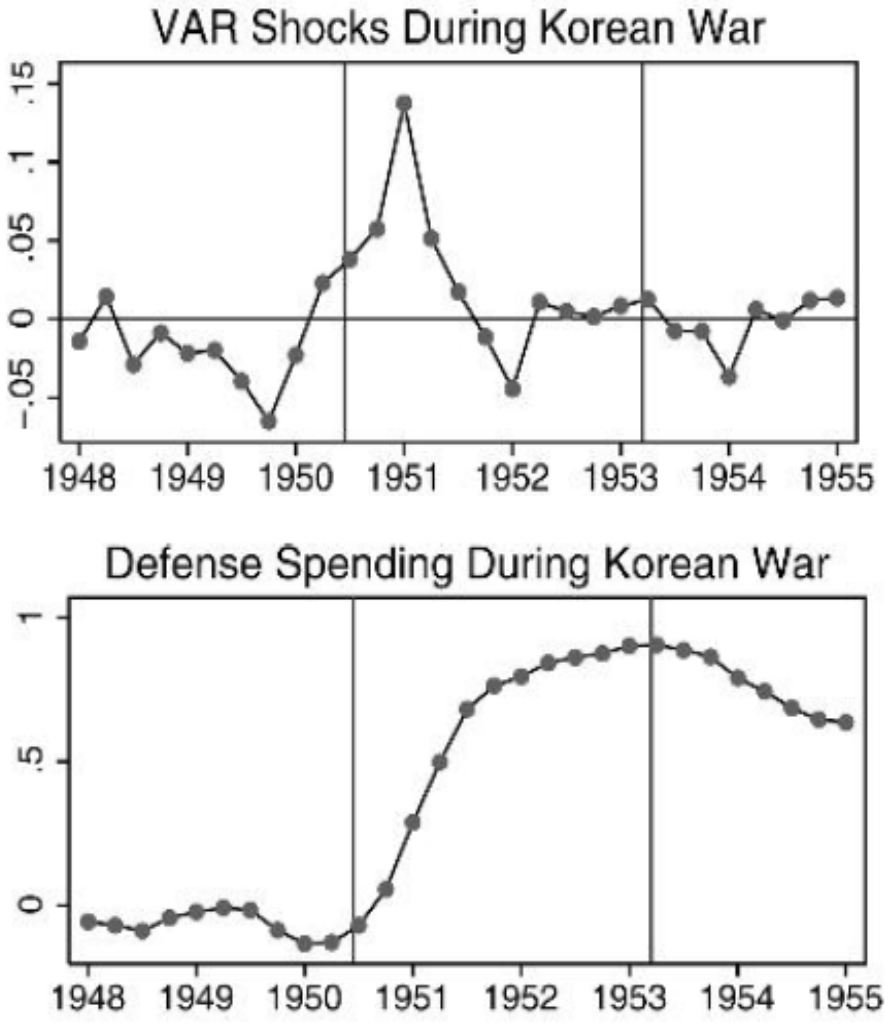


FIGURE V

Comparison of VAR Defense Shocks to Forecasts: Korea and Vietnam

From: Ramey, "Identifying Government Spending Shocks: It's All in the Timing"

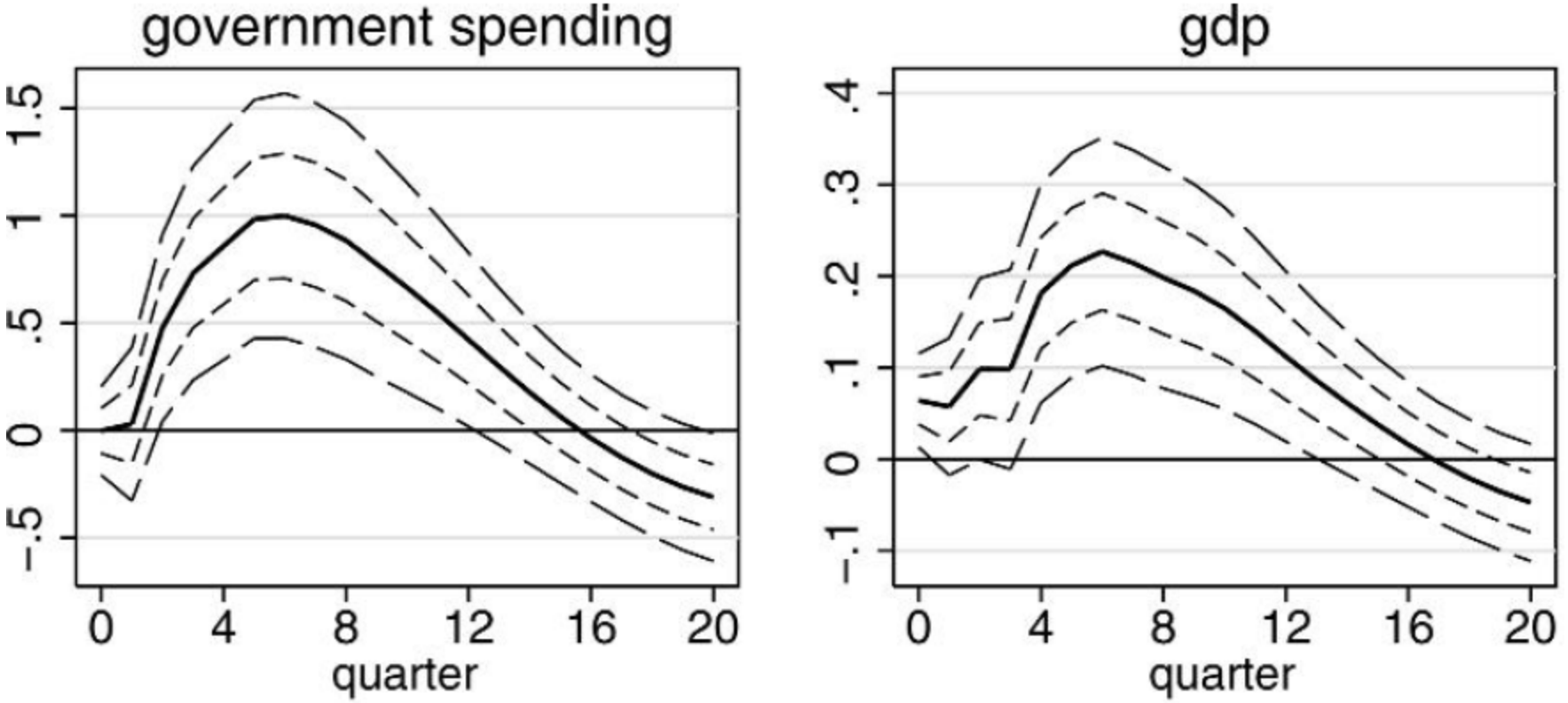
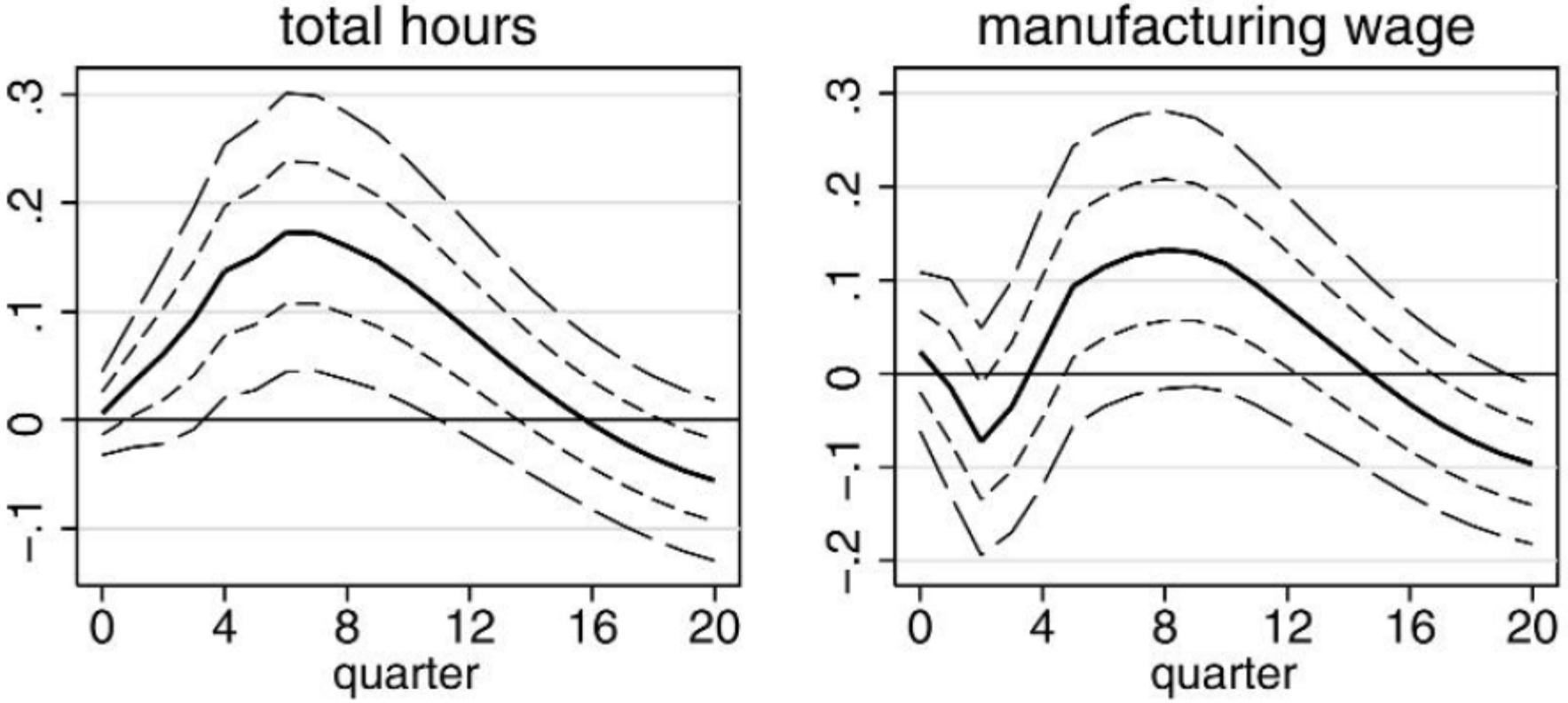


FIGURE X

The Effect of an Expected Change in Defense Spending, 1939–2008 (Both 68% and 95% standard error bands are shown)

From: Ramey, "Identifying Government Spending Shocks: It's All in the Timing"



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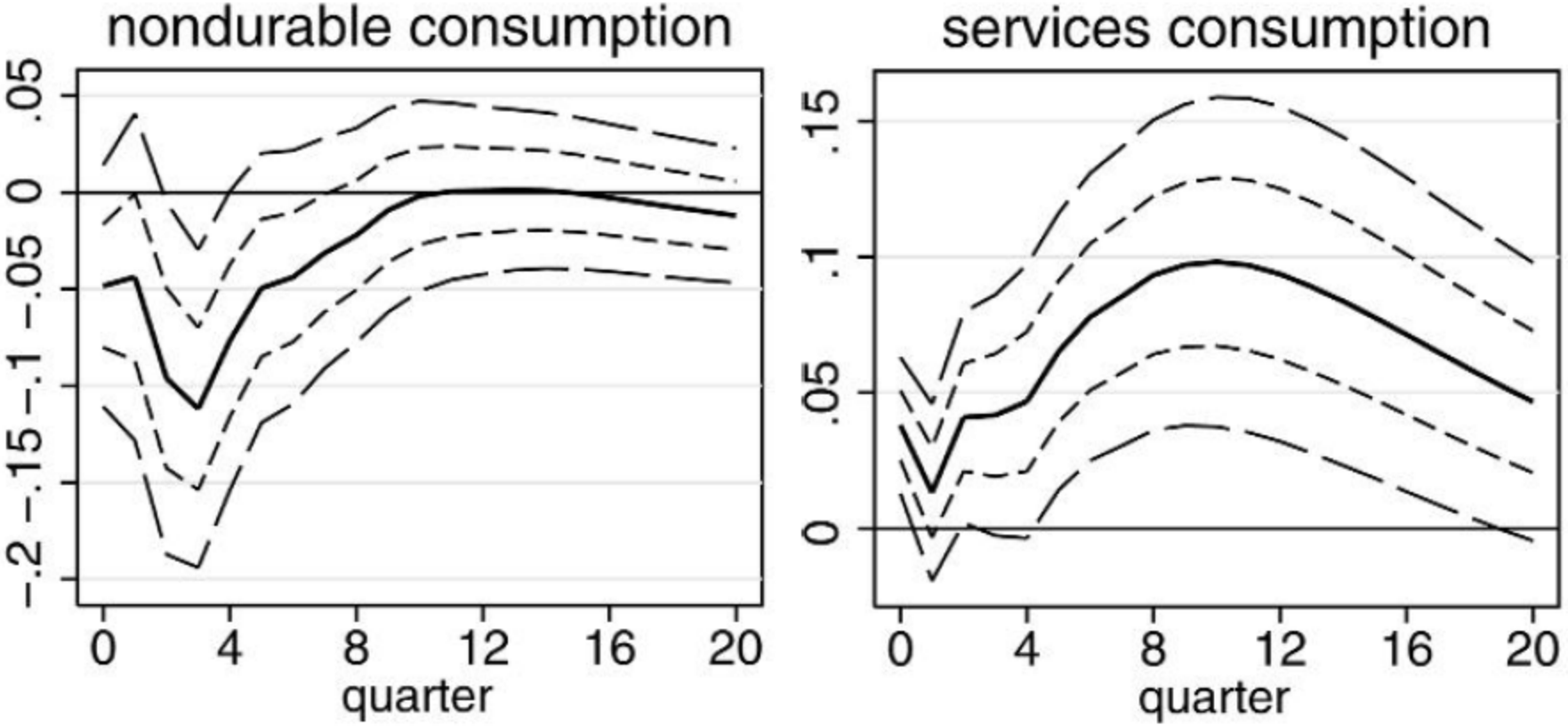

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From: Ramey, "Identifying Government Spending Shocks: It's All in the Timing"

IV. Overview of State-Based Studies of the Impact of Fiscal Changes

How does monetary policy affect the fiscal multiplier?

Open Economy Relative Multiplier

- Multiplier: Effect of G on Y
- Relative: How relative G in a state or region affects relative Y or employment
- Open Economy: Are effects of spending in a state felt in the state?

How Does the Open Economy Relative Multiplier Compare with the Closed Economy Aggregate Multiplier?

- Impact of monetary policy
- State spillovers
- Impact of Ricardian equivalence and crowding out

V. Chodorow-Reich, Feiveson, Liscow, and Woolston, "Does State Fiscal Relief During Recessions Increase Employment? Evidence from the American Recovery and Reinvestment Act"

Data

- ARRA FMAP spending by state
- Employment by state

C-R,F,L,W Specification

$$(1) \quad \frac{E_1^s - E_0^s}{N^s} = \beta_0 + \beta_1 \frac{Aid^s}{N^s} + \beta_2 Controls^{\,s} + \varepsilon^s$$

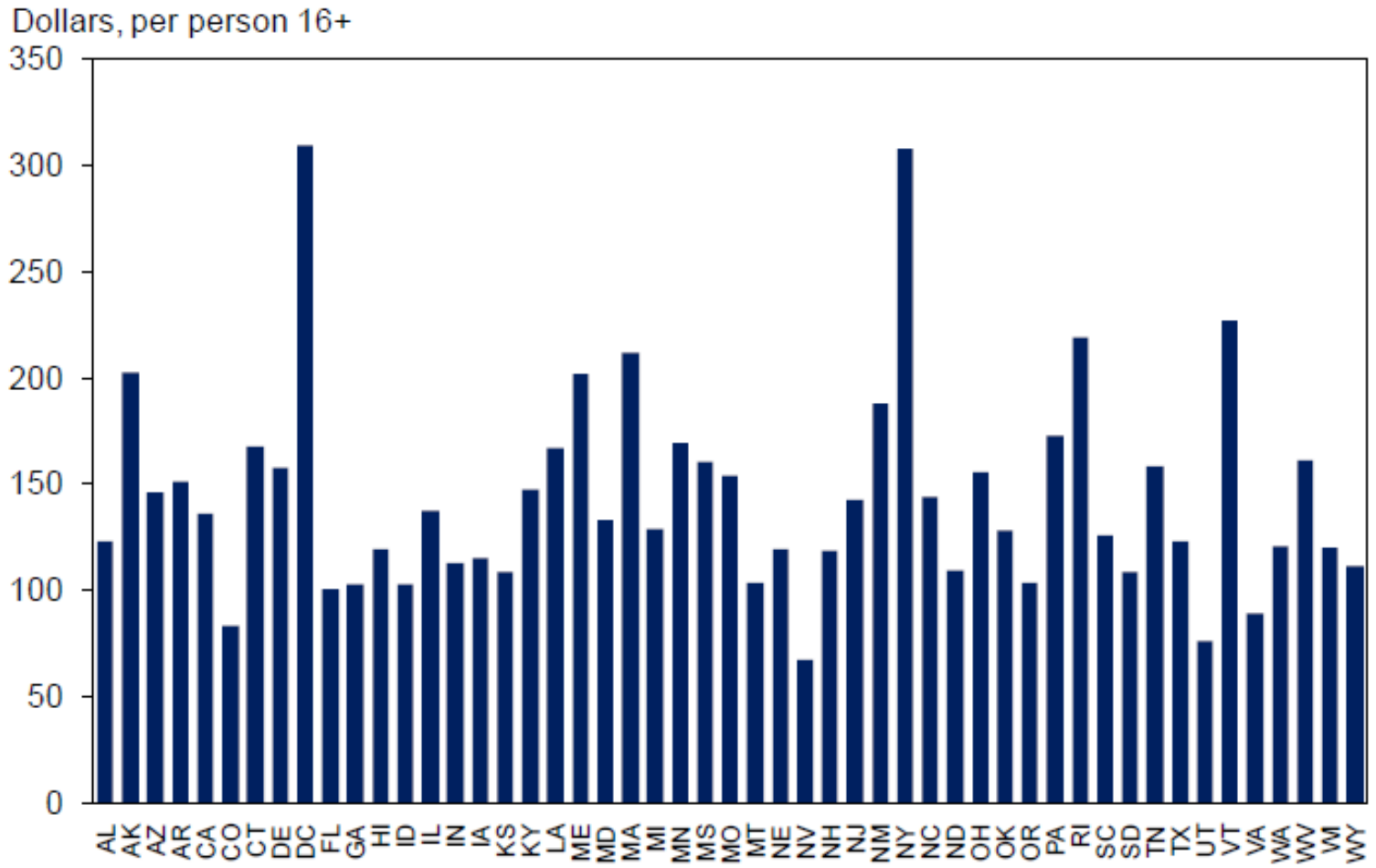
Where:

E_s is employment in state s
N_s is the population aged 16+ in state s
AID_s is state fiscal relief received by state s
Controls are state- and region-specific variables

IV Approach

- Instrument is Medicaid spending in 2007.
- Idea is that some states got more ARRA FMAP funds just because they had more generous systems before the recession.

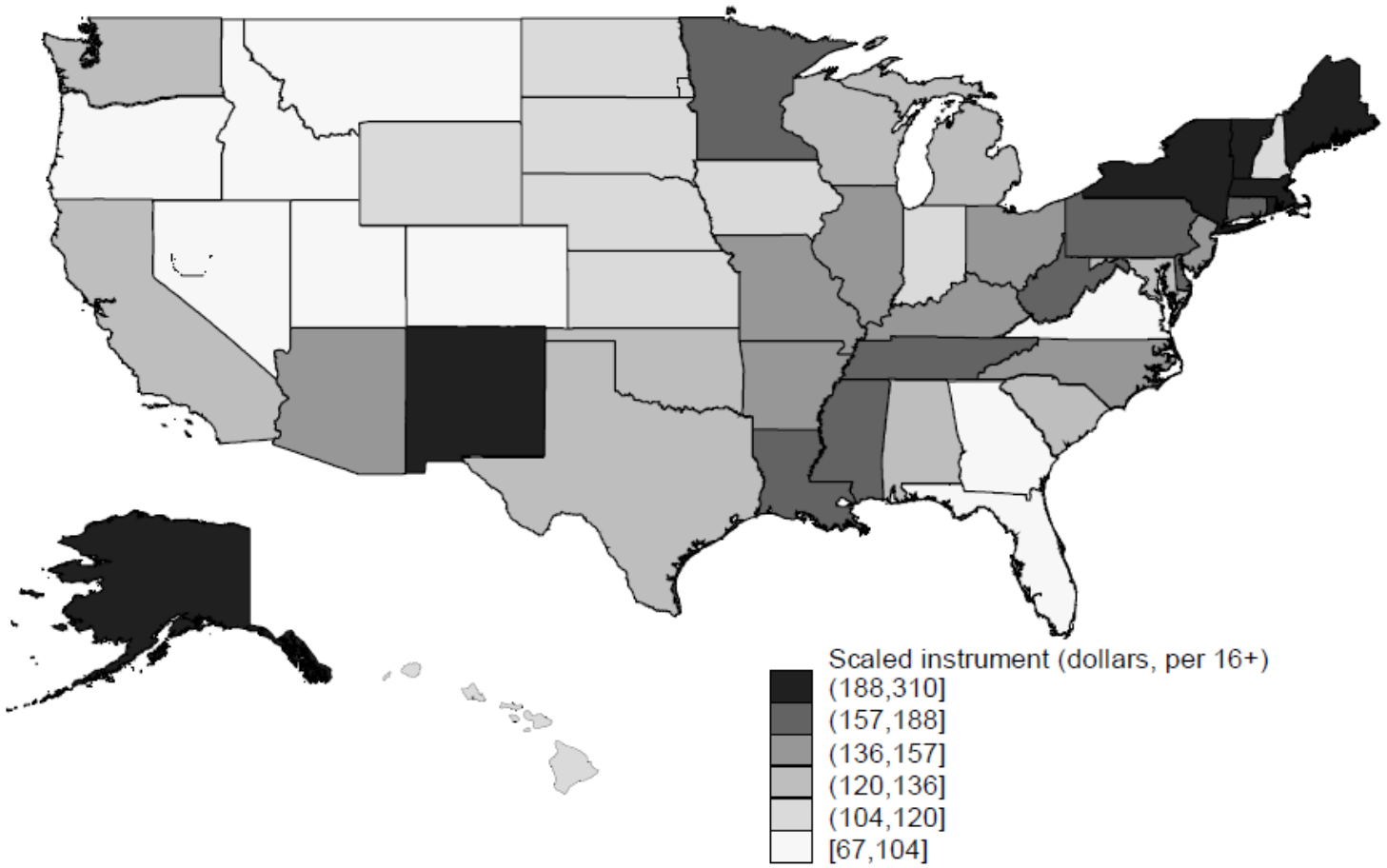
Figure 1: Value of Scaled Instrument/Simulated FMAP Payouts



Note: The value of the scaled instrument is 0.062 * state's fiscal year 2007 Medicaid spending * 21/12.
See text for full details. Data are from the Center for Medicaid Services, Data Compendium, Table VII.1.

From: Chodorow-Reich, Feiveson, Liscow, and Woolston

Figure 2: Value of Scaled Instrument/Simulated FMAP Payouts



Note: The value of the scaled instrument is 0.062 * state's fiscal year 2007 Medicaid spending (per person 16+) * 21/12. See full text for details. Data are from the Center for Medicaid Services, Data Compendium, Table VII.1.

From: Chodorow-Reich, Feiveson, Liscow, and Woolston

Control Variables

- Region dummies
- Employment in manufacturing
- Lagged state employment
- Union share and Kerry vote share

Table 2: First Stage Regressions

	(1)	(2)	(3)	(4)
2007 Medicaid spending (instrument)	0.18***	0.15***	0.16***	0.15***
	(0.01)	(0.01)	(0.01)	(0.01)
Region fixed effects?		X	X	X
Vote share Kerry		X	X	X
Union share		X	X	X
GDP per person 16+		X	X	X
Employment in manufacturing		X	X	X
State population		X	X	X
Lagged total employment change May 2008 to Dec 2008			X	
Lagged government, health, and education employment change May 2008 to Dec 2008				X
Observations	51	51	51	51
R-squared	0.84	0.93	0.93	0.93
Mean of dependent variable	250.23	250.23	250.23	250.23

Notes: The outcome variable for each regression is total FMAP outlays per individual 16+ in a state, through June 30, 2010. The variable is measured in $100,000 per person 16+. See text and data appendix for sources. Note that "government" excludes federal government employees. Robust standard errors are in parentheses.

* significant at the 10% level. ** significant at the 5% level. *** significant at the 1% level.

From: Chodorow-Reich, Feiveson, Liscow, and Woolston

Table 3: Total Employment Baseline Results

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Total FMAP payout per person 16+ ($100,000)	2.94**	1.88	0.82	4.72***	4.61***	2.83***
	(1.35)	(1.83)	(1.06)	(1.31)	(1.57)	(1.01)
Vote share Kerry (2004), percent/10,000		0.28	2.1		-0.79	1.14
		(2.02)	(1.57)		(1.59)	(1.14)
Union share, percent/10,000		-4.26	-2.93		-6.00**	-4.29**
		(3.60)	(2.17)		(2.91)	(2.01)
GDP per person 16+ ($1,000,000)		0.01	-0.03		-0.01	-0.04
		(0.07)	(0.06)		(0.06)	(0.05)
Employment in manufacturing, percent/10,000		-10.05***	-6.61***		-9.75***	-6.83***
		(3.05)	(2.39)		(2.82)	(2.12)
State population 16+, billions		-0.43***	-0.33***		-0.46***	-0.36***
		(0.12)	(0.08)		(0.10)	(0.08)
Lagged total employment change May 2008 to Dec 2008			0.42*			0.37**
			(0.21)			(0.17)
Region fixed effects?		X	X		X	X
Observations	51	51	51	51	51	51
Mean of dependent variable * 1,000	-18.76	-18.76	-18.76	-18.76	-18.76	-18.76

Note: The outcome variable for each regression is the seasonally adjusted change in total non-farm employment per individual 16+ in a state, from December 2008 to July 2009. The main variable of interest is total ARRA FMAP payouts through June 30, 2010. Specifications (4) - (6) instrument total ARRA FMAP payouts with pre-recession Medicaid spending as described in the text. See text and data appendix for sources. Robust standard errors are in parentheses.

* significant at the 10% level. ** significant at the 5% level. *** significant at the 1% level.

Table 6: Transmission Mechanism

	Rainy Day Fund, change 2008 to 2009 (IV)			Rainy Day Fund, change 2009 to 2010 (IV)		
	(1)	(2)	(3)	(4)	(5)	(6)
Total FMAP payout per person 16+ ($100,000)	-0.26	0.01	-0.14	-0.04	0.08	0.04
	(0.18)	(0.23)	(0.21)	(0.09)	(0.18)	(0.17)
Region fixed effects?		X	X		X	X
Indudes lagged employment?			X			X
Exdudes Alaska?	X	X	X	X	X	X
Missing DC?	X	X	X	X	X	X
Observations	49	49	49	49	49	-17.84
Mean of dependent variable (*100,000)	-29.22	-29.22	-29.22	-17.84	-17.84	-17.84

Note: The outcome variable for (1) - (3) is change in a state's rainy day fund, in $100,000, per person 16+, from fiscal year 2008 to fiscal year 2009. The outcome variable for (4) - (6) is the change in a state's rainy day fund, in $100,000, per person 16+, from fiscal year 2009 to fiscal year 2010. Data are from the National Association of State Budget Officers (NASBO) Fiscal Survey of the States. The fiscal 2008 rainy day fund data come from the Fall 2009 Fiscal Survey, and the fiscal 2009 and 2010 rainy day fund data come from the Spring 2010 Fiscal Survey. All specifications exclude DC due to missing data. They also drop Alaska, an outlier in terms of the change in the state rainy day fund. Robust standard errors are in parentheses.

* significant at the 10% level. ** significant at the 5% level. *** significant at the 1% level.

From: Chodorow-Reich, Feiveson, Liscow, and Woolston

VI. Nakamura and Steinsson, "Fiscal Stimulus in a Monetary Union: Evidence from U.S. Regions"

Data

- Defense procurement by state
- GDP and employment by state
- Also aggregate to 10 regions. Why?

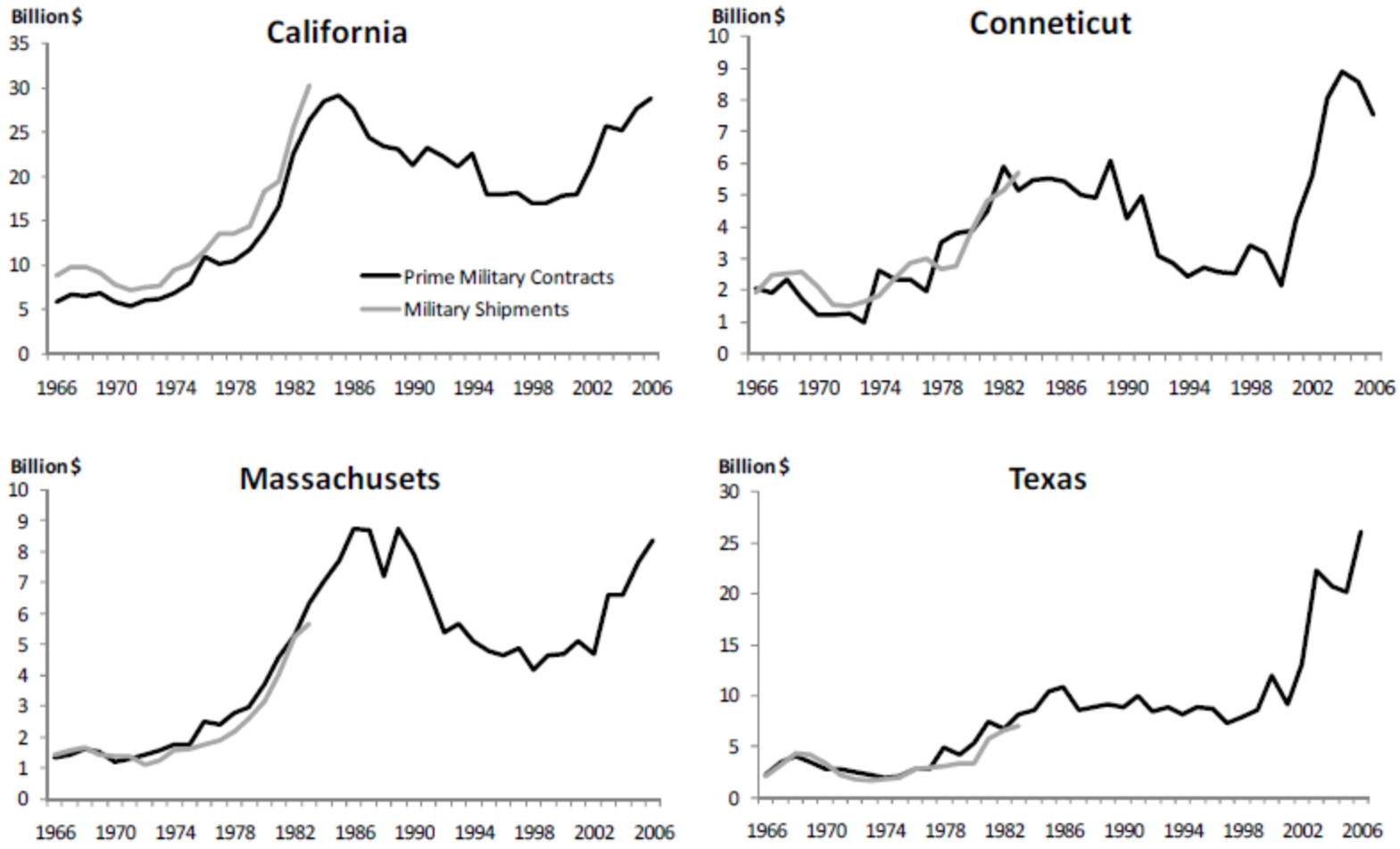


Figure II
Prime Military Contracts and Military Shipments

From: Nakamura and Steinsson, "Fiscal Stimulus in a Monetary Union"

Nakamura and Steinsson's Specification

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

Where:

Y_{it} is output in state i in period t
G_{it} is government procurement in state i in period t
α_i are state fixed effects
γ_t are year fixed effects

IV Approach

- Instrument is national defense spending interacted with a state dummy variable.
- Create predicted state procurement based on national defense and use that in the output regression.
- Alternative variable (Bartik instrument) is G_i/Y_i in base period times G_t.

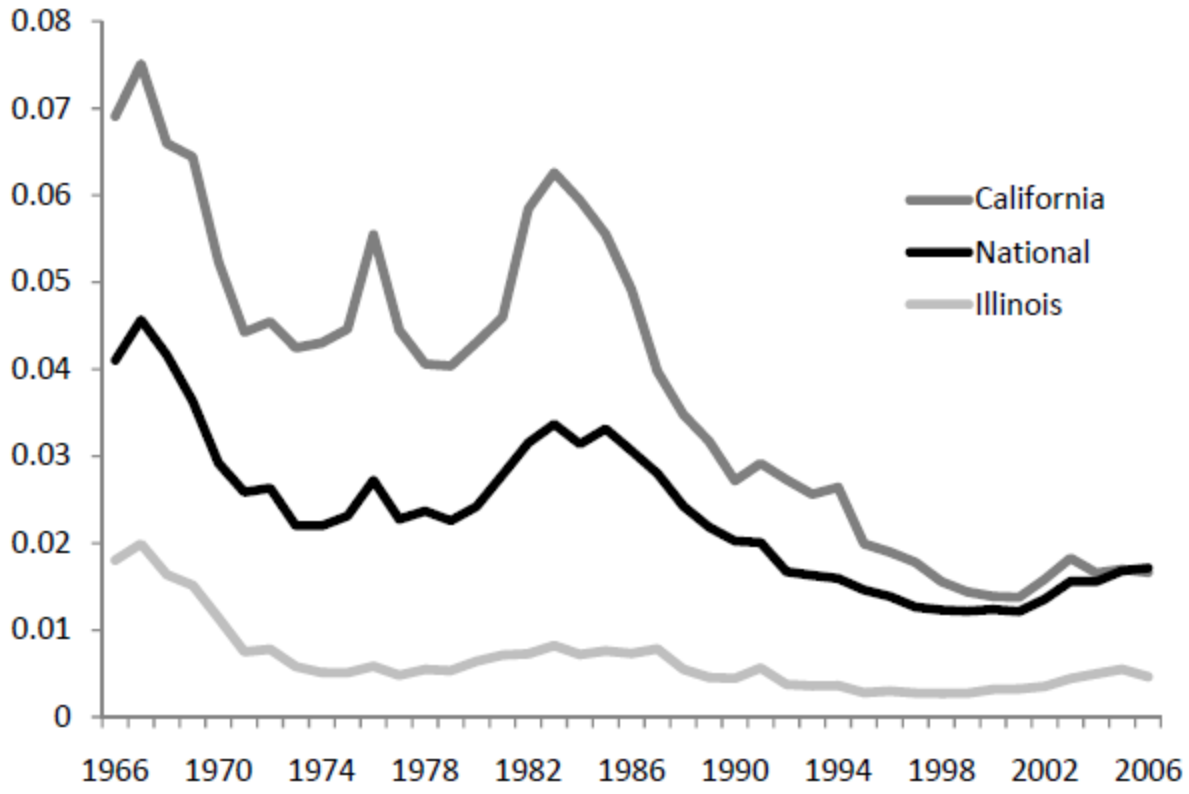


Figure I
Prime Military Contract Spending as a Fraction of State GDP

From: Nakamura and Steinsson, "Fiscal Stimulus in a Monetary Union"

TABLE II
The Effects of Military Spending

	Output		Output defl. State CPI		Employment		CPI		Population
	States	Regions	States	Regions	States	Regions	States	Regions	States
Prime Military Contracts	1.43	1.85	1.35	1.85	1.28	1.76	0.03	-0.14	-0.12
	(0.36)	(0.58)	(0.36)	(0.71)	(0.29)	(0.62)	(0.18)	(0.65)	(0.17)
Prime Contracts plus Military Compensation	1.61	1.62	1.36	1.45	1.39	1.51	0.19	0.06	0.07
	(0.40)	(0.84)	(0.39)	(0.88)	(0.32)	(0.90)	(0.16)	(0.41)	(0.21)
Num. Obs.	1989	390	1989	390	1989	390	1785	350	1989

The dependent variable is stated at top of each column. Each cell in the table reports results for a different regression with the main regressor of interest listed in the far left column. Standard errors are in parentheses. Military spending variables are per capita except in Population regression. 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.

From: Nakamura and Steinsson, “Fiscal Stimulus in a Monetary Union”

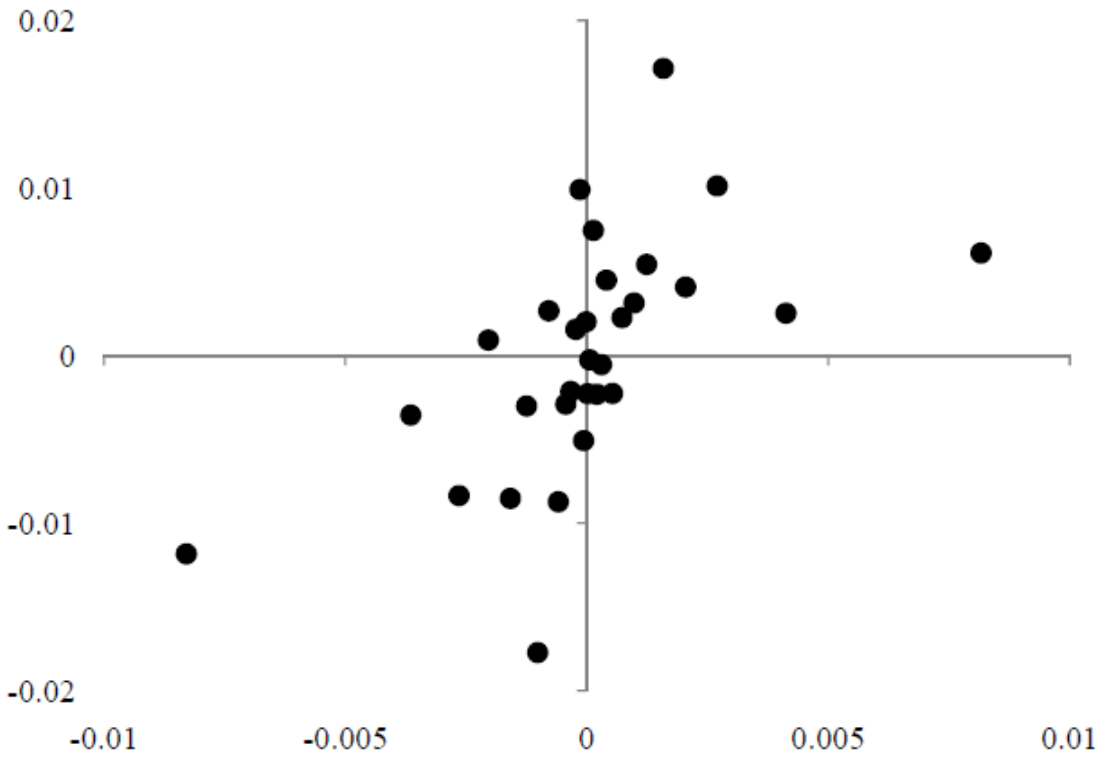


FIGURE III
Quantiles of Change in Output Versus Predicted Change in Military Spending

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.

From: Nakamura and Steinsson, "Fiscal Stimulus in a Monetary Union"

TABLE III

Alternative Specifications for Effects of Military Spending

	Output Level Instr.		Employment Level Instr.		Output per Working Age		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 Comp.	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)
Num Obs.	1989	390	1989	390	1785	350	1989	390

	Output w/ Oil Controls		Output w/ Real Int. Contr.		Output LIML		BEA Employment	
	States	Regions	States	Regions	States	Regions	States	Regions
Prime Military Contracts	1.32	1.89	1.40	1.76	1.95	2.07	1.52	1.64
	(0.36)	(0.53)	(0.34)	(0.78)	(0.62)	(0.66)	(0.37)	(0.98)
Prime Contracts plus Military Comp.	1.43	1.72	1.52	1.38	2.21	1.90	1.62	1.28
	(0.39)	(0.66)	(0.37)	(1.05)	(0.67)	(1.02)	(0.42)	(1.16)
Num Obs.	1785	350	1938	380	1989	390	1836	360

The dependent variable is stated at top of each column. Each cell in the table reports results for a different regression with the main regressor of interest listed in the far left column. Standard errors are in parentheses. Specifications: 1) and 2) Use national military spending scaled by fraction of military spending in the state in 1966-1971 relative to the average fraction as the instrument for state spending; 3) Constructs per-capita output using the working age population, which is available starting in 1970; 4) OLS estimates of the benchmark specification; 5) Adds the price of oil interacted with state dummies as controls; 6) Adds the real interest rate interacted with state dummies as controls; 7) LIML estimate of baseline specification; 8) Estimates the employment regression using the BEA employment series, which starts in 1969. All specifications include time and regions fixed effects in addition to the main regressor of interest. Standard errors are clustered by state or region depending on the specification.

TABLE V

Effects of Military Spending in High Versus Low Unemployment Periods

	Output		Employment	
	States	Regions	States	Regions
β_h	3.54	3.27	1.85	2.20
	(1.51)	(1.60)	(0.85)	(1.53)
$\beta_l - \beta_h$	-2.80	-1.85	-0.75	-0.57
	(1.49)	(1.91)	(0.89)	(1.61)

The dependent variable is stated at top of each column. Standard errors are in parentheses. The two regressors are 1) change in military spending and 2) change in military spending interacted with a dummy indicating whether the national unemployment rate is below its median value over the sample period. This yields the effect of spending during high unemployment periods (β_h) and the difference between the effect of spending during low and high unemployment periods ($\beta_l - \beta_h$). All regressions include region and time fixed effects, and are estimated by two stage least squares. The sample period is 1966-2006. Output is state GDP. Employment is from the BLS payroll survey. All variables are per capita.

From: Nakamura and Steinsson, "Fiscal Stimulus in a Monetary Union"

TABLE VI

Government Spending Multiplier in Separable Preferences Model

	Closed Economy Agg. Multiplier	Open Economy Rel. Multiplier
Panel A: Sticky Prices		
Volcker-Greenspan Monetary Policy	0.22	0.85
Constant Real Rate	1.00	0.85
Constant Nominal Rate	-0.39	0.85
Constant Nominal Rate (ρ_g=0.85)	1.70	0.90
Panel B: Flexible Prices		
Constant Income Tax Rates	0.39	0.43
Balanced Budget	0.30	0.43

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.

From: Nakamura and Steinsson, "Fiscal Stimulus in a Monetary Union"

TABLE VII

Government Spending Multiplier in GHH Model

	Closed Economy Agg. Multiplier	Open Economy Rel. Multiplier
Panel A: Sticky Prices		
Volcker-Greenspan Monetary Policy	0.15	1.48
Constant Real Rate	7.00	1.48
Constant Nominal Rate	-0.64	1.48
Constant Nominal Rate (ρ_g=0.50)	8.73	2.09
Panel B: Flexible Prices		
Constant Income Tax Rates	0.00	0.30
Balanced Budget	-0.25	0.30

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.

From: Nakamura and Steinsson, "Fiscal Stimulus in a Monetary Union"