Identification in Macroeconomics

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State of Empirical Macro

- Key empirical questions same as 80 years ago:
  - What are the causes of recessions?
  - How does monetary and fiscal policy affect the economy?
  - Why do some countries grow faster than others?
- Wildly different views about these questions
  - Why do we not know the answers to these question?
- Crucial reason: Identification in macro is hard
  - Limited **convincing** evidence

Monetary Policy in the Great Recession

- Monetary policy is endogenous
  - Not just a little endogenous
  - Fed employs hundreds of PhD economists to make policy as endogenous as possible
- Fed lowered rates aggressively in 2008
  - Did so for a reason! (e.g., housing collapse and financial crisis)
  - OLS regression of output on interest rates does not capture effects of monetary policy
  - It captures combined effects of monetary policy and factors causing Fed to act

Two Key Arguments

- Much of the most influential empirical work in macro involves the creation of **portable statistics**
- **Identified moments** (causal effects / responses to structural shocks) are often powerful diagnostic tools to distinguish important classes of models

Strands of Empirical Work in Macro

- Direct causal inference
  - Identify plausibly exogenous variation in some policy (i.e., a natural experiment)
  - Regress outcomes of interest on exogenous policy variation
- More structural modes of inference
  - Use a set of moments to discriminate between models
  - GMM estimation of a structural model
  - Full information DSGE estimation

Direct Causal Inference in Macro

Two challenges:

- Convincing natural experiments few and far between
- Rarely see exactly the experiment we want (external validity)

External Validity in Macro

1. Term structure of shocks heterogeneous
   - Some only affect short run
   - Some affect short and long run
   - Some only affect longer run (e.g., when monetary policy at ZLB)
   - Responses to these are **very** different in standard models

External Validity in Macro

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   - Multiplier in normal times
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2. Fiscal shock depend on monetary response (and vice versa)
   - Multiplier in normal times
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3. Policy response depends on state of the economy
   - Degree of slack in the economy
   - How open the economy is

External Validity in Macro

- Even very clean natural experiments only give partial answers to how future policy actions will affect economy
- One response: Gather direct evidence on every different case
  - May not be feasible
- Surely we can learn from experiments we have about other cases!
  - How? By extrapolation using theory
  - By using experiments we have to discriminate between models. And using favored models to extrapolate to other cases of interest

The Power of Portable Statistics

- Structural inference in macro often take following form:
  - Use a set of moments to discriminate between models
  - I.e., affect posterior over space of models
- **Portable statistics** are particularly valuable:
  - Statistics that can be used over and over again to discipline and test different models
- Example: Equity premium
  - Mehra-Prescott 85 used it to evaluate one class of models
  - Generation of researchers has since used this same statistic to evaluated a host of new models

Different Types of Portable Statistics

Several types of portable statistics can be highly informative:

- Micro moments
- Macro moments

- Simple unconditional moments
- **Identified moments**

Micro Moments

Moments constructed from micro data on behavior of individuals and firms

Examples:

- Frequency or price change and related statistics
  (Bils-Klenow 04, Nakamura-Steinsson 08, Klenow-Kryvtsov 08)
  - Informative about models of price setting
  - Indirectly informative about effectiveness of monetary and fiscal policy

- Changes in shopping time and quantity and quality of food intake at retirement (Aguiar-Hurst 05)
  - Informative about competing models of life-cycle consumption and savings

Macro Moments

Moments constructed from aggregate data on equilibrium outcomes

Example:

- Real wages and hours worked
  - Past 200 years have seen substantial increases in real wages, while hours worked have been stable or fallen
  - Rules out models without income effects
  - Motivates use of "balanced-growth preferences" (King-Plosser-Rebelo 88, Boppart-Krusell 18)

Different Types of Moments

- Simple unconditional moments
  - Means, variances, covariances
- **Identified moments**
  - Causal effects estimates (e.g., IV regression coefficients)
  - Response to an identified structural shock

Identified Moments

Simple Moment Matching in Macro

Rich tradition of using simple micro and macro moments:

- RBC literature (Kydland-Prescott 82, King-Rebelo 99)
- Shimer puzzle literature (Shimer 05)
- Misallocation literature (Hsieh-Klenow 09)
- Exchange rate disconnect (Meese-Rogoff 83, Itskhoki-Mukhin 17)
- "Wedges" literature (Chari-Kehoe-McGrattan 08, Shimer 09)

Simple statistics can often yield powerful inference

Simple Moments vs. Identified Moments

Question: Distinguish between RBC and New Keynesian Model

- RBC approach:
  - Match unconditional means, variances, covariances
- Impulse response matching:
  - Match response to identified monetary shocks (Rotemberg-Woodford 97, Christiano-Eichenbaum-Evans 05)
  - Match response to identified productivity shocks (Gali 99, Basu-Fernald-Kimball 06)

Identified Moment: MPC

- Estimates of marginal propensity to consume are identified moments (e.g., Johnson-Parker-Souleles 06, Parker et al. 13)
- Don't correspond directly to a deep structural parameter
- Yet is still a powerful diagnostic tool for important classes of models
  - Simple complete markets models can't match these
  - Angeletos et al. 01: adding self-control problems helps match this
  - Kaplan-Violante 14: uninsurable risk/borrowing constraints/illiquid assets helps match this

Partial Identification

Any given set of identified moments typically:

- Consistent with several models (but not all models)
- I.e., partially identify model space

Point-identifying correct model unrealistic:

- Several models being consistent with a statistic not grounds for throwing out statistic
- Think in reverse: If statistic provides evidence against an important class of models, statistic is useful.

Cross-Sectional Identification in Macro

- Increasingly important:
  - Mian and Sufi (2014)
  - Nakamura and Steinsson (2014)
  - Autor, Dorn, and Hanson (2013)

- Key challenge:
  - How to go from regional responses to aggregate responses
  - Cross-sectional responses don't directly answer key aggregate questions
  - GE effects absorbed by time fixed effects
  - Common to do "back-of-envelope" calculation

Cross-Sectional Identification in Macro

- Important insight:
  - Cross-sectional responses often powerful diagnostic tools to distinguish between models
- Approach:
  - Use cross-sectional responses as moments in estimation of structural models
  - Use favored structural model to answer aggregate questions
- Example: Fiscal stimulus ...

Fiscal Stimulus: Aggregate Evidence

- Barro-Redlick 11 use evidence from wars:
  - Government purchases multiplier of 0.6-0.7
  - Most identification from WWI, WWII, Korean War
  - Conceptually: Use wars as instrument for spending
  - Potential violations of exclusion restriction: patriotism, rationing, etc.
- Blanchard-Perotti 02 use SVAR:
  - Peak output response of 1.3 after 15 quarters
  - Very large standard errors
  - Highly sensitive to sample period, controls

    (see, e.g., Gali et al. 07, Ramey 11, 16)

Fiscal Stimulus: Aggregate Evidence

- Additional weakness of evidence:
  - Highly sensitive to monetary reaction
- Monetary reaction to fiscal shock:
  - Normal time: “leans against the wind”
  - At ZLB: Not able to lean against the wind
- Aggregate multiplier may be very different at ZLB

  (See Ramey-Zubairy 17, Miyamoto et al. 17 for direct evidence)
- Telling apart RBC model and NK model crucial
  - Both can yield multipliers around 0.7 in normal times
  - But NK model implies much bigger multipliers at ZLB

Fiscal Stimulus: Cross-Sectional Evidence

- Explosion of work post Great Recession:
  - Chodorow-Reich et al. 12, Wilson 12, Shoag 15, Nakamura-Steinsson 14, Acconcia et al. 14, Dupor-Mehkari 16, etc.
- Survey by Chodorow-Reich 17
- Estimates of local fiscal multiplier cluster at 1.5-2.0

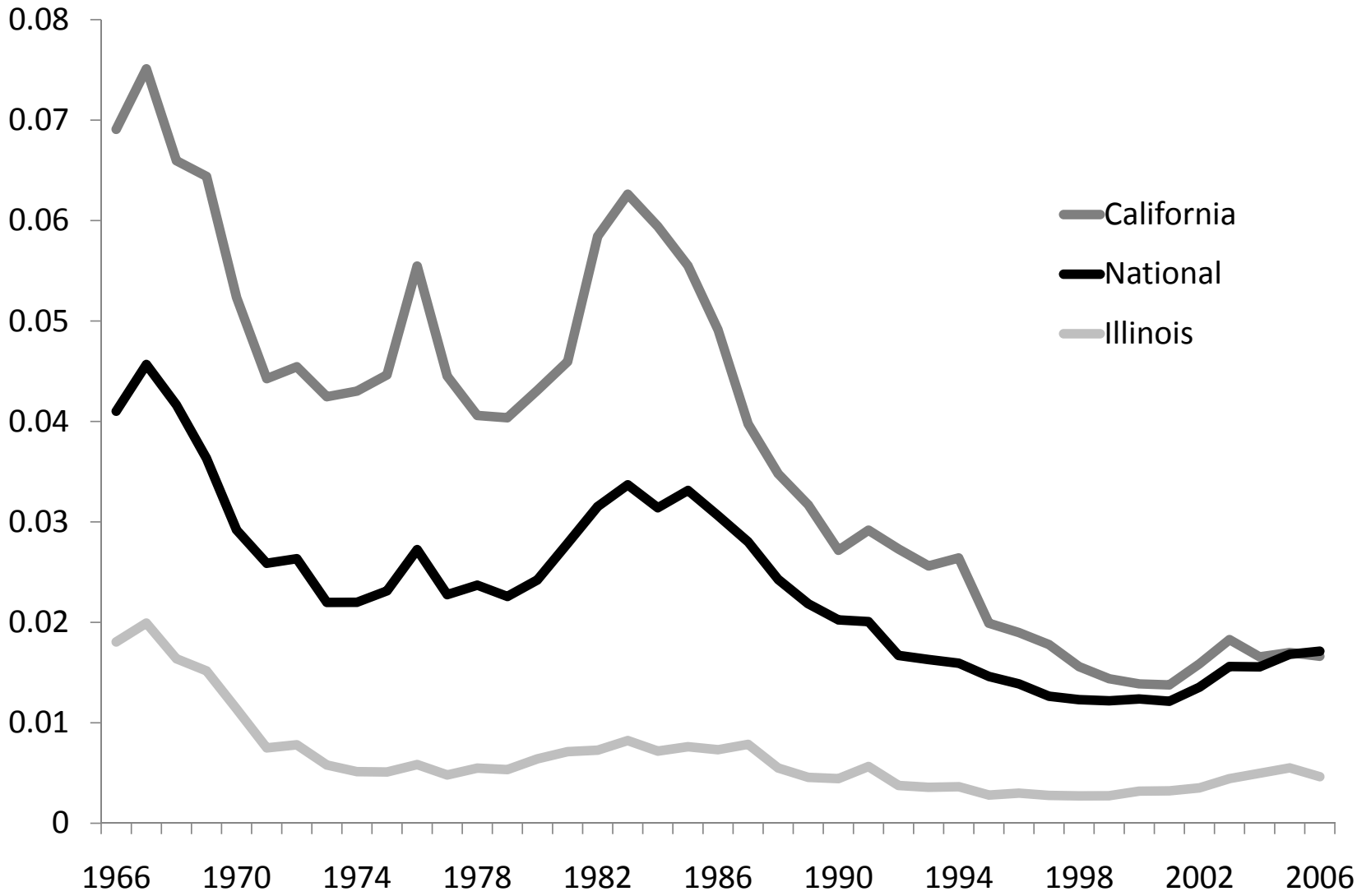

Figure: Prime Military Contracts as a Fraction of State GDP

TABLE I
The Effects of Military Spending

	Output		Output defl. state CPI		Employment		CPI		Pop.
	State	Region	State	Region	State	Region	State	Region	State
Prime Military Contracts	1.43	1.85	1.35	1.91	1.28	1.76	0.03	-0.26	-0.10
	(0.36)	(0.58)	(0.36)	(0.65)	(0.29)	(0.62)	(0.18)	(0.45)	(0.17)
Num. Obs.	1989	390	1989	390	1989	390	1785	350	1989

What Do We Learn?

- Local multiplier not the same as aggregate multiplier:
  - States don't have to pay for spending (financed federally)
  - Spillovers to other states
  - Monetary policy doesn't respond in cross-section

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- One reaction:
  - Local multiplier estimate not so useful
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    (which is aggregate multiplier)
- Different reaction:
  - Perhaps relative multiplier is a powerful statistic in distinguishing between competing models (e.g., RBC vs. New Keynesian)
  - Aggregate multiplier is actually not very strong on that front

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.

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.

What Do We Learn?

- Plain vanilla RBC model inconsistent with regional multiplier
- Plain vanilla NK model inconsistent with regional multiplier
- "Ultra Keynesian" model consistent with regional multiplier

- "Ultra Keynesian" model implies large aggregate effects of fiscal stimulus when monetary policy is constrained

A Moment Is a Moment?

- If your strategy is match moments between theory and data ...

  ... why pick complicated identified moments? ...

  ... why not pick simple moments (like variances and covariances)? ...

  ... identifying structural shocks is often complicated and controversial ...

  ... why go through the bother? ...

  ... after all, a moment is a moment!

Why Use Identified Moments?

- Unconditional moments typically sensitive to relative variance of all structural shocks in the model
- If you ignore some structural shock, estimation will be biased

- Identified moments focus on parameters having to do with a particular structural shock — particular subset of causal mechanisms
- Identified moments can be invariant to relative variance of other shocks and in some cases parameters in other "blocks" of the model (these can be treated as nuisance parameters)

Conclusion

Portable statistics often highly influential

Two uses of causal effects evidence in macro:

- Direct evidence on questions of interest
- Moments for structural estimation
  - Often powerful diagnostic tools to distinguish between models
  - Why? Because they focus on specific mechanisms

Appendix

Identified Moments

- We use term **identified moment** as a shorthand for:
  - A target statistic (i.e., **moment**) obtained as a response to an **identified** structural shock (i.e., causal effect)

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