

Natural Experiments in Macroeconomics

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April 10, 2015

Outline

- 1 Introduction
- 2 Verification: The Permanent Income Hypothesis
- 3 Quantification: The Fiscal Multiplier
- 4 Identification: Fundamental Causes of Economic Growth
- 5 Conclusion

Why Natural Experiments in Macroeconomics?

- Establishing *causality* is major challenge in economics
 - Conditional correlations not enough
 - Example: New Keynesian models vs. real business cycle models
 - * match similar facts
 - * but different welfare implications
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- Laboratory or field experiments in applied microeconomics
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 - Mostly unavailable to macroeconomists:
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- Natural experiments as alternative to field or laboratory experiments

Definition of Natural Experiment

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 - ... a *historical episode* that provides ...
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- Examples for natural experiments:
 - specific policy interventions (e.g. changes in the tax law)
 - broader historical episodes (e.g. fall of Communism)
 - “natural” natural experiments (e.g. rainfall, earth quakes, etc.)

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 - “natural” natural experiments (e.g. rainfall, earth quakes, etc.)
- Crucial: control and treatment group should be comparable along all dimensions except treatment (quasi-randomness)

This Chapter: Natural Experiments in Macroeconomics

- Focus on three different applications of natural experiments in three literatures
 - 1 “Verification”: verify underlying model premises
⇒ Permanent Income Hypothesis
 - 2 “Quantification”: quantify specific policy parameters
⇒ Fiscal multiplier
 - 3 “Identification”: identify causal mechanisms outside conventional models
⇒ Fundamental causes of growth

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 - 3 “Identification”: identify causal mechanisms outside conventional models
⇒ Fundamental causes of growth
- Common themes:
 - Simple econometric techniques (OLS, IV, regression discontinuity, fixed-effects estimator)
 - Difficulty is to *identify episode with quasi-random variation*, state *identifying assumption*, and *deal with flaws* in nature’s design

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Verification: The Permanent Income Hypothesis

- Permanent Income Hypothesis (PIH, Friedman 1957) as reply to Keynesian consumption theory:
 - *rational and forward looking agents*
 - consumption = “permanent income” (annuity value of current income + current assets + expected value of future income)

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 - *rational and forward looking agents*
 - consumption = “permanent income” (annuity value of current income + current assets + expected value of future income)
- Forward looking behavior implies ...
 - 1 temporary income shocks are smoothed over entire life-cycle: small consumption reaction
 - 2 preannounced income changes affect consumption *at announcement* and not *at implementation*

Consumption Response to Unanticipated Shock

- In case of quadratic utility and one-time temporary income shock:

$$\Delta C_{i,t+1} = \frac{r}{1+r} [Y_{i,t+1} - Y_{i,t}] \approx \text{small value}$$

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- Kreinin (1961): Restitution payments to Israeli households
- Imbens et al. (2001), Kuhn et al. (2011): Consumption of lottery winners
- Fuchs-Schündeln (2008): permanent shock of German reunification
- All studies find evidence in line with PIH

Consumption Response to Anticipated Income Change

- Test null that $\beta = 0$ in the following reduced-form regression

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- Often unclear whether income change was expected or unexpected
 - * studies using macro data (Ludvigson and Michaelides 2001, Carroll and Summers 1991): use instruments to approach this problem
 - * more than two dozen studies using micro data: use natural experiment in which we know income change was expected

Clearly Established Randomness in Treatment

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→ week of payment receipt depends on 2nd to last digit of SSN
- Preannounced: households received letter in advance (in 2001)
- Johnson et al. (2006), Agarwal et al. (2007), Parker et al. (2013)
→ Studies find *violation* of PIH ($\beta > 0$)

The “Narrative Approach”: Browning and Collado (2001)

- Consumption growth of Spanish workers
- Treatment group = “bonus” workers receiving double income in June and December; control group = “non-bonus” workers
- Randomness of assignment argued through historical account of payment scheme
- Result: PIH holds

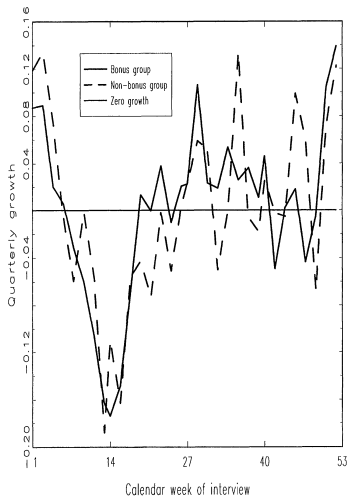


FIGURE 9. TOTAL EXPENDITURE

Different Control Groups, Matching Methods, and Placebo Exercises

- Different control groups: e.g. Agarwal and Qian (2014) analyze unique cash pay-out by Singaporean government
 - control group 1: foreigners living in Singapore
 - control group 2: exploit variation in amount of pay-out

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- Propensity score matching
 - use propensity score matching to account for systematic observable differences between control and treatment groups
- Placebo exercises
 - specify synthetic placebo treatments
 - baseline estimate should be well above median placebo treatment effect
 - e.g. Abdallah and Lastrapes (2012) analyze relaxation of borrowing constraint among Texan homeowners
 - * placebo treatment: reform at same point in time in each of the other US states (one by one)

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- Result: liquidity constraints can help reconcile theory and evidence
- BUT: often still significant response to preannounced income change by unconstrained households \Rightarrow violation of rational expectations or need for model extension?

Overview of PIH Studies

	Small	Large
Regular	Aaronson, Agarwal, and French (2012) 0.03%	Browning and Collado (2001) 2.61%
	Parker (1999) 0.00038 %	Hsieh (2003) 4.79%
	Parker (1999) 0.82%	Paxson (1993) -
	Shea (1995) 0.0009%	Souleles (1999) 1.24%
Irregular	Agarwal, Liu, and Souleles (2007) 0.22%	Souleles (2000) 5.24%
	Agarwal and Qian (2014) 0.04%	
	Broda and Parker (2014) 0.31%	
	Coulibaly and Li (2006) 0.56%	
	Johnson, Parker, and Souleles (2006) 0.10%	
	Parker, Souleles, Johnson, and McClelland (2013) 0.46%	
	Scholnick (2013) 0.45%	
Souleles (2002) 0.01%		
Stephens (2008) 0.35%		

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→ Households tend to behave consistent with PIH *when stakes are high*

Summary of PIH literature

- Liquidity constraints matter
- Evidence for near-rationality
 - Reaction to large income changes in line with PIH
 - Excessive reaction to small income changes (\neq PIH)
 - Hsieh (2003) gives direct evidence that size matters: same consumers react according to PIH when faced with large income change, but not when faced with small income change

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Quantification: The Fiscal Multiplier

- Fiscal multiplier β = size of output change associated with change in fiscal instrument

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- Identifying assumption: $Cov[\Delta F_{t+1}, \epsilon_{t+1}] = 0$
- Challenge: reverse causality/endogeneity of ΔF_{t+1}
 - Automatic stabilizers $\Rightarrow Cov[\Delta F_{t+1}, \epsilon_{t+1}] < 0$
 - Procyclical government spending $\Rightarrow Cov[\Delta F_{t+1}, \epsilon_{t+1}] > 0$

Natural Experiments and the Fiscal Multiplier

Natural Experiments can help establishing exogeneity of ΔF_{t+1} :

- PIH literature and size of multiplier (papers analyzing 2001 and 2008 episodes)
- Geopolitical events / defense spending (Ramey and Shapiro 1998; Ramey 2011)
- Local fiscal multiplier: instrumenting for ΔF_{t+1}
 - Census error of closure (Serrato and Wingender 2014)
 - Displacement of local Italian officials in case of Mafia infiltration (Acconcia et al. 2014)
 - Changes in congressional committee chairmanships (Cohen et al. 2011)

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Proximate vs. Fundamental Causes of Growth

- **“Identification”**: use natural experiments to identify fundamental causes of growth.
- Why are some countries rich and others poor?
- Conventional growth models are a mapping from a vector of parameters ϕ_i for country i to a level of its output per capita:

$$F(\phi_i) \rightarrow Y_{i,t}$$

- ⇒ $F(\cdot)$, describes process by which societies accumulate proximate causes of growth: technology, human-, and physical capital.
- ⇒ Fundamental causes generate cross-country variation in ϕ_i .

Fundamental causes of growth

Natural experiments have produced evidence of 3 fundamental causes:

- 1 Institutions:** rules, regulations, policies that affect incentives to invest in technology, physical capital & human capital
- 2 Social structure:**
 - network of *social ties* that affects diffusion of info, ability to enforce contracts
 - *class structure*
- 3 Culture:** persistent and shared beliefs and values that help a group overcome the free-rider problem
- 4** (*Luck and Multiple Equilibria*)

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Effect of Institutions on Growth

- Strong prior that institutions, protection of property rights important for growth.
- But: direction of causality unclear. For example,

$$\log Y_i = \alpha + \beta R_i + X_i' \gamma + \epsilon_i$$

need $\text{cov}(R_i, \epsilon_i) = 0$ to identify β , but income per capita (Y) and property rights (R) are likely to be jointly determined

- Acemoglu, Johnson, and Robinson (2001): European colonization as a natural experiment
 - Former colonies differ widely in level of development and quality of institutions (US vs. Congo)
 - Idea: mortality rates of European settlers explain part of variation. Higher health costs of European settlement (Congo) lead to lower presence of settlers and worse (“extractive”) institutions
- ⇒ Quasi-random variation in R_i

Institutions and Growth (AJR 2001)

- Estimates of β positive and highly significant.
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 - Borders between many African countries drawn randomly: identical cultures exposed to different institutions
- ⇒ No evidence for effect of institutions: at the border, exogenous variation in institutions not associated with higher wealth.

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- ⇒ But: influence of African governments may be weak in remote regions.

Persistent Effects of Sub-national Extractive Institutions

Does removing extractive institutions reverse their adverse effects?

- Partially but not fully.
- Lots of evidence from other natural experiments that bad institutions have long-term effects that transmit themselves through social structure, distribution of political power, or altered preferences (Banerjee and Iyer (2005), Iyer (2010), Dell (2010), Alesina and Fuchs-Schündeln (2007)).

Determinants and Dynamics of Institutions

1. Shocks to the political balance of power

- Brueckner and Ciccone (2011): use rainfall shocks in African countries to identify a positive effect of transitory recessions on democratization
- Caselli and Tesei (2015): use shocks to commodity prices to identify a negative effect of higher resource rents in autocratic countries on democratization.

2. Political Mobilization, Street Protests

- Acemoglu, Hassan, and Tahoun (2014): use daily variation in protest activity during Egypt's Arab Spring to estimate direct effect of street protests on stock market valuation of firms connected to group currently in power and to their political rivals.
- ⇒ Finding: large effect of larger protests on returns of connected firms but not on that of rivals.
- Interpretation: popular mobilization reduces the ability of elites capture excess rents.

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Effect of Social Ties on Growth

- Key idea: economic success of an entity, be it an individual, a household, or a geographic region depends on its position in the social structure of the market place → having the “right” social ties lead to economic growth
- Identifying a causal link between social ties and aggregate outcomes requires exogenous variation in:
 - A economic value of social ties and
 - B in the formation of these ties across geographic regions

Burchardi and Hassan (2013):

- Fall of Berlin Wall generates exogenous variation in value of ties (A)
 - Separation of East and West was believed to be permanent
- ⇒ West Germans were maintaining social ties to East Germans for purely non-economic reasons

- Migrations post WWII provide exogenous variation in location of individuals with social ties (B): East German expellees were settled in regions with least wartime destruction.
- Main specification:

$$Y_r^{95} - Y_r^{89} = \beta T_r^{89} + Z_r' \gamma + \epsilon_r$$

with Y_r income per capita in region r and T_r share of population with ties to East.

- Instrument T_r with wartime destruction.
- Finding: large positive effect of social ties on regional economic growth, firm investment, entrepreneurial activity.
- Interpretation: causal link between social ties and economic growth

Effect of Social Ties on Trade

- Parsons and Vezina (2014): use quasi-random allocation of Vietnamese refugees across US states post 1975 as an instrument for size of Vietnamese population today, show large effect on trade with Vietnam.
 - Cohen, Gurun, Malloy (2014): show similar results for Japan, using location of Japanese internment camps during WWII as an instrument.
 - Burchardi, Chaney, Hassan (2015) look at entire history of settlement in US, use differences in arrival times between 1880 and 1990 as instrument for ethnic composition of US counties today.
- ⇒ Key finding: ethnic composition of US counties has large causal impact on their international FDI, trade.

Internal Social Structure and Growth

Assess effect of internal relationship between groups on economic outcomes

- Dippel (2014): uses quasi-random forced integration of Native American tribal bands into reservations.
- ⇒ Mixed reservations have worse economic outcomes because of more dysfunctional political institutions
- Acemoglu, Hassan, and Robinson (2011): Russian regions in which Holocaust most severely reduced size of middle class have worse political and economic outcomes today.

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 - ⇒ Interpretation: shock to size of middle class has permanent effect because it reduces core constituency for property rights policies

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Trust and Civic Capital

Civic capital = “those persistent and shared beliefs and values that help a group to overcome the free rider problem in the pursuit of socially valuable activities” as in Guiso et al. (2011)

- Idea: Some norms and beliefs better suited to economic growth than others. E.g. most commercial transactions involve element of trust.
- Such beliefs change only slowly over time and transmitted across generations

Trust and Growth

- Tabellini (2010) and Guiso, Sapienza and Zingales (2008) use the fact that some Western European countries = union of heterogeneous historical political entities, instruments current measures of civic capital with distant political history.
- ⇒ Find that early self-rule and early constraints on executive are associated with higher civic capital and better economic outcomes today.
 - Main issue: cannot separate effect of culture from sub-national variation in institutions, social structure.
- Algan and Cahuc (2010): use data from descendants of migrants into the US to build long time series of trust in countries around the world, show large effect of trust on growth in a dif-in-diff, while controlling for institutions.
- Gorodnichenko and Roland (2010): cultural traits are inherited, use genetic distance to the UK as instrument.

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- ⇒ Large effect of culture on growth

Determinants and Dynamics of Civic Capital

1. Historical Institutions

- Becker et al. (2011): consider 5 Eastern European countries that were under Habsburg rule until World War I. Use RD design to show that individuals on Habsburg side of border are more trusting of police today.

2. History of Violence

- Nunn and Wantchekon (2011): link trust in Africa to history of slave trade. Areas most affected had history of neighbors selling each other into slavery.
- ⇒ 1 σ increase in exposure to slave trade leads to 0.2 σ decrease in various measures of trust of neighbours.

3. Climate

- Durante (2010): In regions with more variable climate more civic capital needed to survive.
- ⇒ Significant association between trust and climatic variables in Europe

Comments

- Entire literature about reduced-form relationship between $Y_{i,t}$ and ϕ_i , essentially ignores 50 years of growth theory. Room for intellectual arbitrage.
- ⇒ Potentially emulate some recent developments in urban economics: hybrid of structural identification and natural experiments.
- Convincing evidence that institutions, social structure, and culture are key drivers of economic growth.
- However, effects of the three fundamental causes often not convincingly disentangled.
- Know little about dynamics of social structure, more about dynamics of institutions, culture.
- Effects of macroeconomic shocks on these three fundamental causes may be of first-order importance.

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Argue that historical episode provides quasi-random variation necessary to identify causal effects
- Common features of successful papers:
 - Clearly stated identifying assumption
 - * Which aspect of experiment exploited?
 - * What does reader need to believe?
 - * Why can reverse causality be ruled out?
 - * Potential omitted factors?
 - Supporting evidence
 - Use of additional methods to support causal interpretation
 - * Placebo treatments
 - * Robustness checks
 - Analysis of quantitative implications

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- *Teaching slides will be available on our websites.*