

Natural Experiments in Macroeconomics

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Usefulness of 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
 - ↔ Especially troubling when one wants to give policy advice!
- Laboratory or field experiments in applied microeconomics
 - Researcher influences environment, i.e. random assignment of agents into *treatment* and *control* group
 - Mostly unavailable to macroeconomists (too costly, too far-reaching consequences of experiment)
- Natural experiments as alternative to field or laboratory experiments

Definition of Natural Experiment

- A *natural experiment* is
 - ... a historical episode that provides ...
 - 1 observable
 - 2 quasi-random
 - ... variation in treatment subject to a *plausible identifying assumption*
- "Natural" because not consciously designed
- Different types of natural experiments:
 - policy intervention (e.g. changes in the tax law)
 - entire historical episodes (e.g. fall of Communism)
 - "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 Paper: Natural experiments as a method in macroeconomics

- Focus on three lines of literature
 - 1 "Verification": verify underlying model premises
⇒ tests of PIH hypothesis
 - 2 "Quantification": quantify specific policy effects
⇒ fiscal multiplier
 - 3 "Identification": identify causal mechanisms outside conventional models
⇒ fundamental causes of growth
- Common themes:
 - Simple econometric methods (OLS, IV, regression discontinuity, fixed-effects estimator)
 - Difficulty is to *identify episode* with quasi-random variation and *deal with flaws*

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)

- 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 Temporary Shock

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

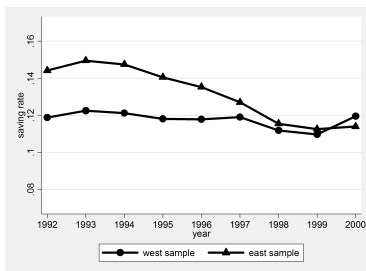
$$\Delta C_{i,t+1} = \frac{r}{1+r} [Y_{i,t+1} - Y_{i,t}] \approx \text{small value}$$

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

Consumption Response to Permanent Shock: German Reunification

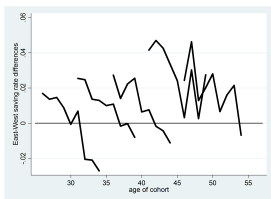
- German Reunification as large, permanent income shock for East Germans (Fuchs-Schündeln, 2008)
- Incorporate this natural experiment into a structural life-cycle model
 - need to specify and estimate income process, utility function, etc.
 - possible to analyze quantitative importance of different components of life-cycle model
 - ⇒ importance of precautionary savings

German Saving Rates after Reunification



Source: Own calculations based on German Socio-Economic Panel

Cohort-Age Profile of East-West Differences, 1992-2000



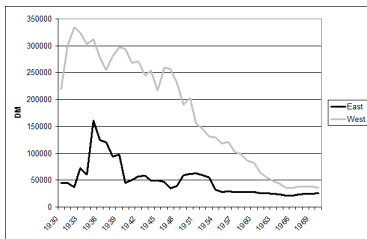
Three features:

- 1 East has higher saving rate for every cohort
- 2 East-West difference larger for older cohorts
- 3 Difference declining over time for each cohort

Model of German Reunification

- Build life-cycle model which features
 - Retirement saving motive
 - Precautionary saving motive
 - Changing demographics over life cycle
- Estimated/calibrated model inputs:
 - East and West cohort profiles of income growth
 - East and West income risk
 - East and West cohort profiles of household size
 - Assume same risk aversion and discount factor in East and West
 - Exogenous East cohort wealth levels in 1990

Household Wealth Levels at Reunification



Source: Own calculations based on German Socio-Economic Panel

Model Results

- Calibrated model can match the three features of saving rate differences:
 - East wealth levels at reunification too low given new economic environment, leading to high saving rates
 - especially true for older households, who have less (relative) wealth at reunification
 - only precautionary saving motive gives relatively fast convergence of saving rates
 - demographics would lead to opposite predictions (given large household size and low fertility rates in East past reunification)
- One of few papers combining natural experiment and structural modelling

Consumption Response to Anticipated Income Change

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

$$\Delta C_{i,t+1} = \alpha + \beta \cdot \Delta Y_{i,t+1}^{expected} + \gamma' \Delta X_{i,t+1} + \epsilon_{i,t+1}$$

- Two challenges:

- Identifying assumption: $Cov[\Delta Y_{i,t+1}^{expected}, \epsilon_{i,t+1}] = 0$
- 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

- Clear randomness in timing: 2001 Federal Income Tax Rebates and 2008 Economic Stimulus Payments in US
→ 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 and control group both receive same annual income, but different monthly disbursement over year:
 - Treatment group = receives double income in June and December (“bonus” workers)
 - Control group = receives same income every month (“non-bonus” workers)
- Randomness of assignment argued through historical account of payment scheme
- Result: PIH holds

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

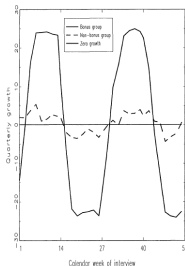


FIGURE 2. QUARTERLY EARNINGS GROWTH

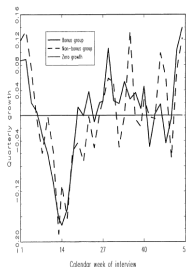


FIGURE 9. TOTAL EXPENDITURE

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
- 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)

The Presence of Liquidity Constraints

- Binding liquidity constraints: households cannot adjust consumption at announcement of income increase
- Methods to deal with presence of liquidity constraints:
 - 1 Analyze consumption reaction to preannounced income *decrease*: Souleles (2000)
 - 2 Split sample into potentially constrained and most likely unconstrained households
 - 3 Analyze consumption over payment cycle (Gelman et al. 2014, Mastrobuoni and Weinberg 2009, Shapiro 2005, Stephens 2006, Stephens 2003)
- 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?

Classification: Size and regularity of income changes

- **Size:** equivalent variation between two types of hypothetical consumers:
 - 1 "rational": smoothes extra amount over the course of a year (approx. to PIH behaviour)
 - 2 "hand-to-mouth": consumes extra amount in month of receipt
- "Large" change if equivalent variation is more than 1 percent (similar to Chetty, 2012)
- **Regularity** : Occurs several times over the life cycle

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%		

→ Households tend to behave consistent with PIH *when stakes are high*:
Near-rationality

Direct Evidence for Role of Size

- Hsieh (2003) analyzes data on Alaskan households who get
 - (1) tax refunds ("small") and
 - (2) payments from Alaska's Permanent Fund ("large")⇒ The *same* households react in hand-to-mouth fashion to small change and in rational way to large change

- Scholnick (2013) analyzes reaction of credit card spending to income changes (of different sizes)
⇒ The larger the change the smaller the reaction

Summary of PIH literature

- Liquidity constraints matter

- Excessive reaction to small income changes (\neq PIH)
⇒ near-rationality as likely explanation

- Reaction to large income shocks is in line with PIH

Fiscal Multiplier

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

$$\Delta Y_{t+1} = \alpha + \beta \Delta F_{t+1} + \gamma \Delta X_{t+1} + \epsilon_{t+1}$$

- Identifying assumption: $Cov[\Delta F_{t+1}, \epsilon_{t+1}] = 0$
- Challenge: reverse causality/endogeneity of ΔF_{t+1}
 - Automatic stabilizers $\Rightarrow Cov[\Delta F_{t+1}, \epsilon_{t+1}] < 0$
 - Pro-cyclical government spending $\Rightarrow Cov[\Delta F_{t+1}, \epsilon_{t+1}] > 0$
- Typically, VAR approaches are used to deal with endogeneity (Blanchard and Perotti, 2002; Mountford and Uhlig, 2009)

PIH Studies and the Fiscal Multiplier

- Intimate link between literature on PIH and question of the size of multiplier (esp. in papers analyzing 2001 and 2008 episodes)
- However, four important caveats:
 - 1 change at announcement vs. at implementation
 - 2 rebate exogenous from individual perspective, but endogenous for economy as a whole
 - 3 partial equilibrium vs. general equilibrium
 - 4 expenditure on non-durables vs. total spending
- PIH studies find large spending response of households at receipt: 60 to 90 percent of payments are spent

Military News Shocks

- Idea: Geopolitical events leading to large military expenditures are plausibly exogenous
- Ramey and Shapiro (1998) and Ramey (2011) identify major military news shocks through “narrative approach”:
 - 1 World War II
 - 2 Korean War
 - 3 Vietnam War
 - 4 Carter-Reagan build-up after the Soviet invasion of Afghanistan
 - 5 September 11, 2001
- Timing the news shock is not trivial (based on newspapers)
- Caveat: events might affect other variables that influence GDP
→ often argued for WWII, but less for other episodes

Military News Shocks - VAR approach

- Ramey (2011) employs two approaches:
 - 1 use dummies in VAR approach
 - 2 construct a defense news variable that measures the change in expected net present value of military spending
- Findings:
 - Traditional VAR approaches might fail to identify anticipation effects (therefore different outcomes than studies with news shocks)
 - Fiscal multiplier between 1.1 and 1.2, but only between 0.6 and 0.8 if WWII is excluded

Local Fiscal Multiplier

$$\Delta Y_{i,t+1} = \alpha + \beta \Delta \hat{F}_{i,t+1} + \gamma' \Delta X_{i,t+1} + \delta_i + \eta_t + \epsilon_{i,t+1}$$

- Different multiplier: local spending financed by federation is windfall income from point of view of locality
- Inclusion of regional (δ_i) and year (η_t) fixed effects
⇒ control for national fiscal and monetary policies
- Potential endogeneity of $\Delta \hat{F}_{i,t+1}$ remains challenge:
use of instruments

Instrumental Variables

- First stage regression involving instrument $I_{i,t}$

$$\Delta F_{i,t+1} = \kappa + \theta I_{i,t} + \zeta' \Delta X_{i,t+1} + \epsilon_{i,t+1}$$

- Serrato and Wingender (2014) use the fact that
 - federal spending at local level is tied to population size
 - census "error of closure": difference between census population estimates and extrapolations between census years
- For "error of closure" to be a valid instrument
 - it has to predict fiscal spending: easy to show
 - exclusion restriction has to hold

Exclusion Restriction

- Arguing about exclusion restriction is key to these papers
- Following strategies often used:
(examples from Serrato and Wingender 2014)
 - detailed description of the situation constituting the experiment
 - exploit timing
(no effect of "error of closure" on growth up to two years after census)
 - provide further suggestive evidence
(no geographical correlation of error of closure)
 - theoretical insights into which biases to expect
(e.g. if classical measurement error is present)
 - include control variables

Local Fiscal Multiplier Literature

- Other IV papers using natural experiments:
 - Acconcia et al. (2014): displacement of local Italian officials in case of Mafia infiltration
 - Cohen et al. (2011): changes in congressional committee chairmanships
- Other IV papers not relying on natural experiments:
Nakamura and Steinsson (2014), Chodorow-Reich et al. (2012), Wilson (2012), Clemens and Miran (2012), Kraay (2012, 2014)
→ "grey zone" of what constitutes a natural experiment
- Regression discontinuity approach: Corbi et al. (2014)

Results on Local Fiscal Multiplier

- Local fiscal multipliers range consistently between 1.5 and 2
- Local fiscal multipliers are ...
 - ... larger than standard multiplier (windfall income)
 - ... 5 to 15 times larger than OLS estimates
 - OLS estimates downward biased due to automatic stabilizers or countercyclical fiscal policy

The Fundamental Causes of Growth

- Previous sections: validity and magnitude of causal relationships
 - This section: what kind of models *should* we be writing
 - **“Identification”**: use natural experiments to identify fundamental causes of growth.
 - Why are some countries rich and others poor?
- ⇒ Use natural experiments to find determinants of economic outcomes outside of standard models

Why are some countries rich and others poor?

- Empirical work in this area is very diverse
- ⇒ Useful to lay out a rough theoretical framework to fix ideas
- Typical production function:

$$Y_t = K_t^\alpha H_t^\beta (A_t L)^{1-\alpha-\beta}$$

- ⇒ Output per capita is a function of technology and the intensity of physical and human capital per worker
- ⇒ Causal relationship: better technology and more capital/education per worker makes a country richer
- ⇒ Need to understand the process by which countries accumulate capital and technology

Solow-Swan Model

- A_t grows at an exogenous rate g and households invest income into physical/human capital

$$\dot{X}_t = s_X Y_t - \delta_X X_t$$

for $X = K, H$ and $s_K + s_H < 1$.

- It follows that output per effective labor is equal to:

$$y = \left(\frac{s_K}{g + \delta_K} \right)^{\frac{\alpha}{1-\alpha-\beta}} \left(\frac{s_H}{g + \delta_H} \right)^{\frac{\beta}{1-\alpha-\beta}}$$

- ⇒ Causal relationship: better technology and saving more for investment in human/physical capital makes a country richer

Proximate versus fundamental causes of growth

- Solow-Swan Model helps to understand *how* growth happens
- It helps less for understanding *why* people in the United States have better technology or invest more in physical capital and education than poorer countries
- Formally, think of mapping from a vector of parameters ϕ_i for country i to a level of its output per capita:

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

⇒ Proximate causes operate within $F(\cdot)$, fundamental causes generate cross-country variation in ϕ

Fundamental causes of growth

- In this section: use natural experiments to identify and understand three (or four) fundamental causes:
 - 1 Institutions
 - 2 Social structure
 - 3 Culture
 - 4 (*Luck and Multiple Equilibria*)

Institutions and Political Economy

- Has received great deal of attention from empiricists
- Direction of causality unclear: better institutions \Leftrightarrow growth
- For example, in the structural equation

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

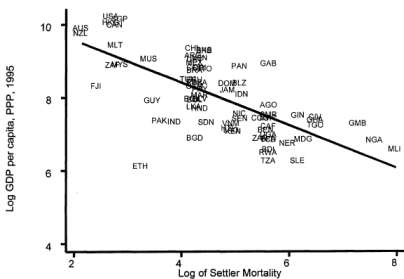
we need $\text{cov}(R_i, \epsilon_i) = 0$ to identify β , but income per capita (Y) and property rights (R) are likely to be jointly determined

- Use natural experiments to get exogenous variation in R_i

Institutions and Growth

- Acemoglu, Johnson, and Robinson (2001): consider the European colonization as a natural experiment
 - Former colonies differ widely in level of development and quality of institutions (US vs. Congo)
 - Idea: mortality rates for settlers explain part of variation
- \Rightarrow Higher health costs (Congo) lead to lower presence of settlers and thus worse institutions

Institutions and Growth



Institutions and Growth

- This relationship delivers quasi-random variation in R_t
- ⇒ Mortality rates affect GDP per capita today only through effect on institutions
- Estimates of β positive and highly significant
- ⇒ Matching quality of property rights in Nigeria with that in Chile would eventually increase its GDP per capita by a factor of 7

Institutions and Growth

- Main identifying assumption: conditional on controls, settlers' mortality rates affect GDP today only through institutions
- Two concerns:
 - 1 Omitted variables correlated with historical mortality rates could be correlated with present-day GDP: places that were hard to settle historically may suffer from lower growth because they're difficult to live in today
 - 2 Effect of settlement may be transmitted through mechanisms correlated with property rights: settlers may have imported culture or social ties to Europe

Institutions versus Culture

- Michalopoulos and Pappaioannou (2013) use a regression discontinuity approach and data on light intensity to address the second concern
- ⇒ Borders between many African countries drawn randomly: identical cultures exposed to different institutions
- ⇒ Quasi-random experiment: 200 historic homelands partitioned between two modern-day countries

Institutions versus Culture

- Main specification for $(p, e, i) = (\text{pixel}, \text{ethnicity}, \text{country})$:

$$y_{p,e,i} = \alpha + \beta IQL_i^{HIGH} + f(BD_{p,e,i}) + \gamma PD_{p,e,i} + X'_{p,e,i} \Phi + \eta_e + \epsilon_{p,e,i}$$

⇒ $y_{p,e,i} = 1$: (p, e, i) is lit and $IQL_i^{HIGH} = 1$: institutional quality high

- Identifying assumption: at the border, institutions change discretely while other factors influence y continuously

⇒ β measure effect of better institutions at country border

Institutions versus Culture

- In contrast to AJR (2001) no effect of institutions at the border

⇒ β not significantly different from zero:

- Interpretation: at the border, exogenous variation in national institutions not associated with higher wealth (more light)

⇒ Omitted factors (culture, social structure, remoteness) might explain strong association between institutions and wealth

Institutions and the Business Cycle

- Acemoglu et al. (2003): countries with worse institutions have more volatile business cycles and more economic crises
 - Key: instrument institutional quality with settler mortality rates
- ⇒ Higher mortality rates → more “extractive” institutions
- Conclusions:
 - 1 Bad macro policies are often a symptom of institutional problems and ...
 - 2 ... often not the primary mediating channel through which institutions affect macro stability

Institutions and Conflicts

- Michalopoulos and Papaioannou (2011): further application of quasi-randomly drawn African borders by uninformed Europeans
 - Data: pre-colonial locations and post-colonial partitioning of ethnic groups
- ⇒ Key result: partitioned homelands had a 30% higher likelihood of political violence
- ⇒ More conflicts also associated with worse economic outcomes and lower provision of public goods

Persistent Effects of Historical Institutions

Main question: does replacing bad institutions reverse adverse economic effects?

- Banerjee and Iyer (2005): long-term impact of colonial land revenue systems in British India
- Experiment: abolition of direct taxes on agricultural income in 1947
- ⇒ Earlier: taxes were collected through either British officials or native landlords
- Finding: districts with landlord system perform poorly
- Identifying assumption: choice of revenue system orthogonal to characteristics of annexed districts
- Interpretation: Landlord-based system limits capacity for collective action

Persistent Effects of Historical Institutions

- Iyer (2010): long-term effect of direct vs indirect British colonial rule
- Experiment: end of colonial rule in 1947
- ⇒ Earlier: the British administered "British India" directly, but "Princely States" only indirectly through Kings
- Key idea: instrument direct rule by "Doctrine of Lapse" → the British annexed princely states whose rulers died without heirs
- Identifying assumption: instrument orthogonal to other characteristics determining annexation (rich vs poor areas e.g.)
- ⇒ Negative effect of direct British rule on the provision of public goods, education, and health care

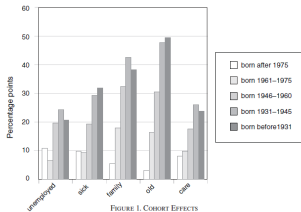
Persistent Effects of Historical Institutions

- Dell (2010): long-term impact of mita forced labor system in Peru and Bolivia from 1573 to 1812
- ⇒ Villages in certain areas had to send 1/7 of adult males to mines
- Regression discontinuity design: exact location of mita boundary quasi-random within 50 km band
- ⇒ Other influences on household consumption vary smoothly at the border
- Finding: mita had negative, persistent effect on consumption most likely transmitted through public goods provision and education

Persistent Effects of Historical Institutions

- Alesina and Fuchs-Schündeln (2007): long-term effect of institutions on preferences
- Experiment: German separation and unification
- ⇒ Key question: how does living 45 years under communism affect individuals' economic preferences
- Identifying assumption: other local factors do not affect preferences
- Findings: East Germans much more likely to favor strong governments

Persistent Effects of Historical Institutions - AFS 2007



Percentage points by which an East German is more likely to favor state intervention than a West German of the same cohort.

Persistent Effects of Historical Institutions

Main conclusion:

- Extractive institutions have long-lasting effects even after abolition
 - Transmission through effect on distribution of political power, social structure, or some other mechanism
- ⇒ Remaining challenge for future work: go beyond causal identification and identify channel of persistence

Determinants and Dynamics of Institutions

- Brueckner and Ciccone (2011): relate GDP per capita to measure of democratization in sub-Saharan Africa
- Key: use rainfall as instrument for GDP per capita
- Identifying assumption: other relevant determinants of democratization orthogonal to rainfall
- Result: negative and highly significant coefficient on GDP per capita
- Interpretation: transitory recessions associated with democratization

Determinants and Dynamics of Institutions

- Chaney (2013): data on pre-modern Egypt Nile floods
- Result: in years with deviant floods, religious leaders less likely to be replaced and more evidence of popular unrest
- Interpretation: political power of religious leaders increases, because economic crises increased capacity to coordinate revolt

Determinants and Dynamics of Institutions

- Hornbeck and Naidu (2014): data on Great Mississippi Flood
- Idea: flood = shock to oppressive racial institutions
- Identifying assumption: flooded and non-flooded areas with same characteristics would have developed similarly absent the flood
- Result: immediate and persistent out-migration of black laborers in flooded areas which led to modernized production in affected areas

Determinants and Dynamics of Institutions

- Caselli and Tesei (2015): data on commodity exporting countries
- Idea: change in world price of oil exogenous to local political system
- Main specification: relate one-year change in quality of political institution to lagged price change of main export good
- Finding: positive price shocks tip balance of power in favor of ruling elite

Determinants and Dynamics of Institutions

- Acemoglu, Hassan, and Tahoun (2014): use daily financial data to measure real-time effects of popular mobilization

- Main specification:

$$R_{it} = I'_{it}\beta + (P_t \times I'_{it})\gamma + X'_i\delta_t + \delta_t + \eta_s + \epsilon_{it}$$

- I_{it} : vector of dummies reflecting connections to incumbent and other two power groups
- γ : measures effect of number of protesters (P_t) on relative valuation of firms connected to (non-)incumbent group

Determinants and Dynamics of Institutions

- Finding: large effect of protests on returns of firms connected to incumbent group, but no effect on valuation of their rivals

- Identifying assumptions:

- 1 No omitted variables correlated with daily returns and number of protesters
- 2 No reverse causality: differential in daily returns affects intensity of protests

- Interpretation: popular mobilization restricts connected firms to capture excess rents

Social Structure

- Key idea: economic success depends on position in social structure
- Example: well-connected individuals provide social collateral for economic transactions → social ties lead to economic growth
- Empirical challenge: identifying a causal link between social ties and growth requires exogenous variation in:
 - Economic value of social ties and
 - the formation of these ties across geographic regions

Social Ties and Growth

Burchardi and Hassan (2013):

- Use fall of Berlin Wall to identify causal effect of social ties growth
 - Separation in 1961 was believed to be permanent
- ⇒ Social ties maintained for purely non-economic reasons
- ⇒ Fall of Berlin Wall generates exogenous variation in value of ties

Burchardi and Hassan (2013)

- 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.

- Consistent estimate of β requires exogenous variation in regional distribution of social ties
- ⇒ True due to migration after World War II: regional destruction in 1946 provides exogenous source of variation in distribution of social ties
- Key identifying assumptions:
 - 1 No omitted variables drives destruction and changes in income growth post 1989
 - 2 Destruction in 1989 affects growth only through effect on settlement of migrants with ties to East

Burchardi and Hassan (2013)

- Finding: regions with more migrants from East experienced higher growth post 1989
- Interpretation: causal link between social structure and economic growth
- Crucial question: is this link a micro or macro phenomenon

TABLE II
WARMS DESTRUCTION, SOCIAL TIES, AND INCOME GROWTH

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Share Housing Destroyed '46	-0.019*** (0.004)	-0.020*** (0.004)		-0.020*** (0.005)	-0.021*** (0.004)	-0.020*** (0.005)
Distance East (100km)	-0.005*** (0.001)	-0.005*** (0.001)	-0.005*** (0.001)		-0.004*** (0.001)	-0.005*** (0.001)
Income 1989 (p.c., log)	0.042*** (0.011)	0.047*** (0.012)	0.043*** (0.014)	0.048*** (0.014)	0.025* (0.015)	0.047*** (0.013)
Income '89-'85 (p.c., log)		-0.026 (0.024)	-0.020 (0.024)	-0.032 (0.026)	-0.029 (0.026)	-0.026 (0.024)
Rubble '46 (m ³ p.c.)			-0.044*** (0.013)			
Migration from East '91-'95						-0.006 (0.210)
R ²	0.918	0.920	0.904	0.988	0.931	0.920

Social Ties and Trade

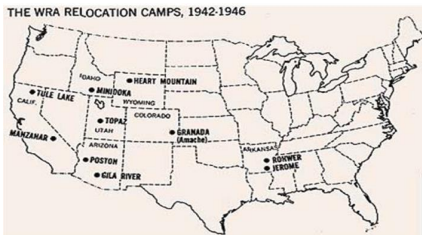
- Central puzzle: distance and borders have strong negative effect on trade (even controlling for measurable barriers to trade)
 - Rauch and Trindade (2002): effect of ethnic Chinese networks on trade
- ⇒ Chinese ethnic network facilitates trade
- Similar results in Combes, Lafourcade, and Mayer (2005) and Garmendia, Llano, Minondo, and Requena (2012)
 - Main conclusion: traditional gravity equations fail because they ignore social ties
 - Main problem: potential endogeneity or reverse causality

Social Ties and Trade

- Parsons and Vezina (2014): after war US imposed trade embargo (until 1995) on Vietnam and evacuated 130,000 citizens
- Refugees quasi-randomly allocated to US states
- Regress exports to Vietnam on Vietnamese migrants in 1995 (instrumented by allocation in 1975)
- Identifying assumption: initial allocation uncorrelated with other factors affecting exports to Vietnam
- Finding: doubling Vietnamese population share increases exports to Vietnam by 20%

Social Ties and Trade

- Cohen et al. (2014): forced relocation of ethnic Japanese into “camps” during WW2
- ⇒ exogenous shock to location of Japanese across MSAs



Social Ties and Trade

- After WW2: residents released and many re-settled close to camps
 - Finding: relocation had persistent effect on regional distribution of JP-US population (62% than average MSA)
- ⇒ Higher probability that a given firm in these MSAs trades with Japan
- External validity of results to more general migrations uncertain

Social Ties and Trade

- Burchardi et al. (2015): entire history of US settlements
- Strategy: use differences in arrival times as instrument for present-day ethnic composition of counties
- Identifying assumption: # of migrants from origin country unrelated to within-US variation of attractiveness to migrants
- Finding: local composition of ethnic networks have causal impact on trade and investment of US firms

Internal Social Structure and Institutions/Growth

- Dippel (2014): formation of Native American reservations
- Some reservations received constituents of previously independent sub-tribal bands
- Mixed reservations have worse economic outcomes
- Key: instrument likelihood of mixing independent bands with mining activity in tribe's homeland
- Interpretation: adverse economic effects explained by more dysfunctional political institutions in mixed reservations

Internal Social Structure and Institutions/Growth

- Acemoglu et al. (2011): mass-murder of Russian Jews by Nazis
 - Before WW2 Jews over-represented in middle class
- ⇒ Murder represents shock to size of middle class
- Findings: counties with higher reduction of middle class have worse political and economic outcomes today
 - Interpretation: size shock transmitted through higher support for preservation of communism

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 that norms and beliefs drive growth has long tradition
 - Basic idea: culture and civic capital change only slowly over time
 - Prime example: trust
- ⇒ Most commercial transactions involve element of trust

Trust and Growth

- Tabellini (2010): some Western European countries = union of heterogeneous historical political entities
- ⇒ Studies variation in value added across 69 regions within countries
- Instruments current civic capital using literacy in 1880 and executive constraints between 1600 and 1850
 - Identifying assumption: historical instruments affect present-day only through civic capital
 - Finding: distant political history affects current economic performance within countries

Trust and Growth

- Algan and Cahuc (2010): not a natural experiment
 - Use inherited trust of descendants of US immigrants to generate time series of trust for origin countries
- ⇒ Relate changes in GDP to changes in inherited trust:

$$\underbrace{Y_{it}}_{\text{GDP per cap}} = \alpha + \underbrace{\beta S_{it}}_{\text{avg. trust}} + \underbrace{\gamma X_{it}}_{\text{controls}} + \eta_c + \eta_t + \epsilon_{it}$$

- Finding: effect of trust positive and quantitatively large

Trust and Growth

TABLE I—INHERITED TRUST IN 1935 AND 2000

Country of origin	Dependent variables			
	(1) Inherited trust in 1935		(2) Inherited trust in 2000	
	Coeff	Standard error	Coeff	Standard error
	Swedish ancestors - 1935 : Reference			
Sweden			0.052***	(0.004)
Africa	-0.231***	(0.004)	-0.243***	(0.007)
Austria	-0.031***	(0.004)	0.102***	(0.011)
Belgium	0.073***	(0.013)	0.134***	(0.021)
Canada	-0.024**	(0.010)	0.078**	(0.015)
Czech Republic	0.006	(0.008)	-0.052**	(0.009)
Denmark	0.045***	(0.002)	0.157***	(0.004)
Finland	-0.032***	(0.003)	0.172***	(0.003)
France	0.040***	(0.004)	-0.047***	(0.010)
Germany	0.024***	(0.001)	-0.004	(0.008)
Hungary	0.023***	(0.004)	0.020*	(0.011)
India	-0.041***	(0.009)	-0.376***	(0.012)
Ireland	0.030***	(0.003)	-0.025*	(0.012)
Italy	-0.022*	(0.012)	-0.086***	(0.016)
Mexico	0.101***	(0.014)	-0.125***	(0.015)
Netherlands	-0.039***	(0.003)	0.051***	(0.005)
Norway	0.156***	(0.001)	0.113***	(0.003)
Poland	0.047***	(0.014)	-0.052***	(0.015)
Portugal	0.004	(0.009)	0.002	(0.017)
Russia	0.171***	(0.012)	-0.068***	(0.007)
Spain	-0.052***	(0.009)	0.042**	(0.015)
Switzerland	0.058***	(0.002)	0.102***	(0.007)
United Kingdom	0.043***	(0.001)	0.003	(0.007)
Yugoslavia	0.303***	(0.010)	-0.018	(0.016)

Trust and Growth

- Gorodnichenko and Roland (2010): not a natural experiment
- Idea: cultural traits inherited
- Instrument culture with genetic distance of population to most individualist countries (US,UK)
- Finding: large effect of culture on growth

Trust and Financial Development

- Key idea: trust affects growth through financial development
- ⇒ Financial contracts are trust intensive: handing over of cash to a stranger in the hopes of receiving a return in the future
- ⇒ Higher levels of trust might lead to more sophisticated financial systems and in turn to higher economic growth

Trust and Financial Development

- Guiso et al. (2004): variation in civic capital within Italy
- Idea: social capital inherited → level of civic capital in region of origin still influences behavior
- Strategy: relate household's use of financial instruments to level of civic capital in region of origin
- Findings: households from regions with higher social capital more likely to use checks, invest in stocks, etc.
- Interpretation: civic capital affects financial development

Determinants and Dynamics of Trust

What determines dynamics of state variable trust?

- Literature has used natural experiments to identify three factors:
 - 1 Historical institutions
 - 2 Experiences of violence and conflict
 - 3 Climate

Historical Institutions

- Becker et al. (2011): consider 5 Eastern European countries that were under Habsburg rule until end of WW I
- ⇒ Habsburg empire had reputation of effective bureaucracy
- ⇒ Descendants of residents of areas formerly under Habsburg rule had longer history of “good” institutions than present-day countrymen
- Strategy: regression-discontinuity design
- Findings: individuals close to former Habsburg side more trusting of police and less likely to bribe officials

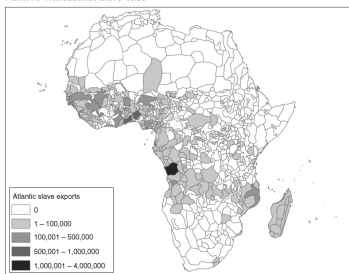
Violence and Conflict

- Nunn and Wantchekon (2011): link trust to history of slave trade
- Idea: European demand for African slaves created distrust
- Structural equation:
$$\text{trust}_{j,e,d,i} = \alpha_i + \beta \times \text{slave exports}_e + X'_{j,e,d,i} \Gamma + X'_{d,i} \Omega + X'_e \Phi + \epsilon_{j,e,d,i}$$

(individual j , ethnicity e , district d , country i)
- Instrument exports with distance of e from coast
- Identifying assumption: distance to coast uncorrelated with other factors affecting trust
- Finding: slave trade $\uparrow 1\sigma \rightarrow$ trust of neighbours $\downarrow 0.2\sigma$

Violence and Conflict

Panel A. Transatlantic slave trade



Violence and Conflict

TABLE 1—OLS ESTIMATES OF THE DETERMINANTS OF TRUST IN NEIGHBORS

Dependent variable:	Slave exports (thousands)	Exports/area	Exports/historical pop	ln (1 + exports)	ln (1 + exports/area)	ln (1 + exports/historical pop)
Trust of neighbors	(1)	(2)	(3)	(4)	(5)	(6)
Estimated coefficient	-0.00068 [0.00014] (0.00015) {0.00013}	-0.019 [0.0005] (0.0005) {0.0005}	-0.531 [0.147] (0.147) {0.165}	-0.037 [0.014] (0.014) {0.015}	-0.159 [0.034] (0.034) {0.034}	-0.743 [0.187] (0.187) {0.212}
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
District controls	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	20,027	20,027	17,644	20,027	20,027	17,644
Number of ethnicities	185	185	157	185	185	157
Number of districts	1,257	1,257	1,214	1,257	1,257	1,214
R ²	0.16	0.16	0.15	0.15	0.16	0.15

Climate

- Durante (2010): link civic capital to environmental factors
 - Idea: earliest societies would develop culture of cooperation and trust where necessary for survival
- ⇒ Regions with volatile climatic conditions
- Using long-term climate data: 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.

Multiple Equilibria

- Growth models with non-convexities might produce multiple equilibria
- ⇒ Mapping between GDP and ϕ_i not unique
- Murphy et al. (1989): monopolistic competition and fixed costs of production lead to "good" and "bad" equilibrium
- ⇒ Example of coordination failure
- Natural experiments have not yet been used to test this hypothesis

Multiple Equilibria

- Juhasz (2014): data on 19th-century France
- Idea: show causal effect of temporary trade protection during wars on long-run location of cotton industry in France
- Experiment: differential effect on shipping costs from UK to French regions
- Identifying assumption: regions would have developed similarly absent effect of continental blockade
- Finding: more protected regions increased capacity in cotton spinning (new technology)
- Interpretation: non-convexities in adoption of new technologies

Multiple Equilibria

- Bleakely and Lin (2012): urban economics
- Idea: many cities in North America formed in places with natural obstacles like waterfalls
- ⇒ Places attracted transportation services and commerce
- ⇒ No longer advantage today → technological progress generated temporary positive shock to locational fundamentals
- ⇒ But: no evidence for relative decline
- Interpretation: existence of multiple equilibria in location of cities

This chapter

- Use of natural experiments in macroeconomics to:
 - 1 Verify model premises
 - 2 Quantify policy parameters
 - 3 Identify causal mechanisms
- Fundamental challenge in use of natural experiments:
Argue that historical episode provides quasi-random variation necessary to identify causal effects

Conclusion

- 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
- Future research: Combine natural experiments and structural models