Economics 270c
Graduate Development Economics

Professor Ted Miguel
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Graduate Development Economics

Lecture 7 – March 3, 2009

Macroeconomic growth empirics

Lecture 1: Global patterns of economic growth and development (1/20)

Lecture 2: Inequality and growth (1/27)

The political economy of development

Lecture 3: History and institutions (2/3)

Lecture 4: Corruption (2/10)

Lecture 5: Patronage politics (2/17)

Lecture 6: Democracy and development (2/24)

Lecture 7: War and Economic Development (3/3)

Lecture 8: Economic Theories of Conflict (3/10) – Guest lecture by Gerard Padro

Human resources

Lecture 9: Human capital and income growth (3/17)

Lecture 10: Increasing human capital (3/31)

Lecture 11: Labor markets and migration (4/7)

Lecture 12: Health and nutrition (4/14)

Lecture 13: The demand for health (4/21)

Other topics

Lecture 14: Environment and development (4/28)

Lecture 15: Resource allocation and firm productivity (5/5)

Additional topics for the development economics field exam

-- Ethnic and social divisions

-- The Economics of HIV/AIDS

- Prerequisites: Graduate microeconomics, econometrics

- Grading:
  Four referee reports – 40%
  → Third referee report due today, Mar. 3, 2009
  → Fourth referee report due in two weeks, Mar. 17, 2009

  Two problem sets – 20%
  Research proposal – 30%
  Class participation – 10%
  No final exam

- All readings are available online (see syllabus)

- Additional references on syllabus

Lecture 7 outline

(1) An overview of violence and economic development

(2) Why do wars occur when they are so destructive?
Powell (2006)

(3) Does civil war have economic causes?

Miguel, Satyanath, and Sergenti (2004)

(4) What are the economic legacies of war?

Davis and Weinstein (2002)

(5) Next week: theoretical models of poverty and armed conflict (Chassang and Padro-i-Miquel 2008)

(1) Violence and economic development

- Since 1980 about 60% of all countries have had at least one year of armed civil conflict, with at least 25 battle deaths (PRIO/Uppsala dataset)

- Rates are particularly high in less developed regions: approximately 70% in Asia, Sub-Saharan Africa

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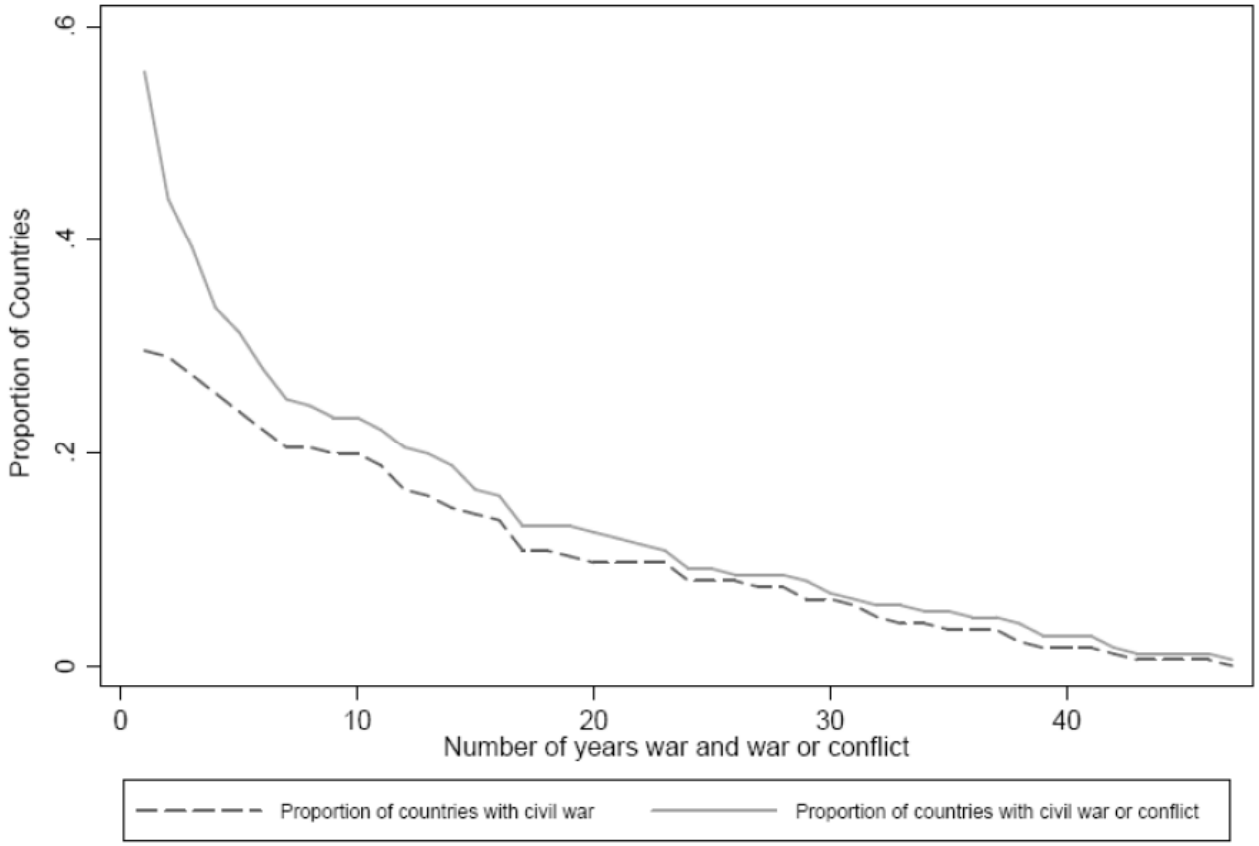
- Rates are particularly high in less developed regions: approximately 70% in Asia, Sub-Saharan Africa

- The use or threat of force is a central political economy issue in many less developed countries. Wars can destroy capital, reduce human capital accumulation, and impact both formal and informal institutions (norms, “culture”, etc.)

Figure 1: The distribution of civil war or conflict years across countries, 1960-2006



Sources: Data based on UCDP/PRIO armed conflict database database (Gleditsch, et al. 2002; Harbom and Wallensteen 2007). Civil wars are those internal conflicts that count more than 1,000 battle deaths in a single year. Civil war or conflict includes cases with at least 25 battle deaths in a single year.

Figure 2: Proportion of countries with an active civil war or civil conflict, 1960-2006

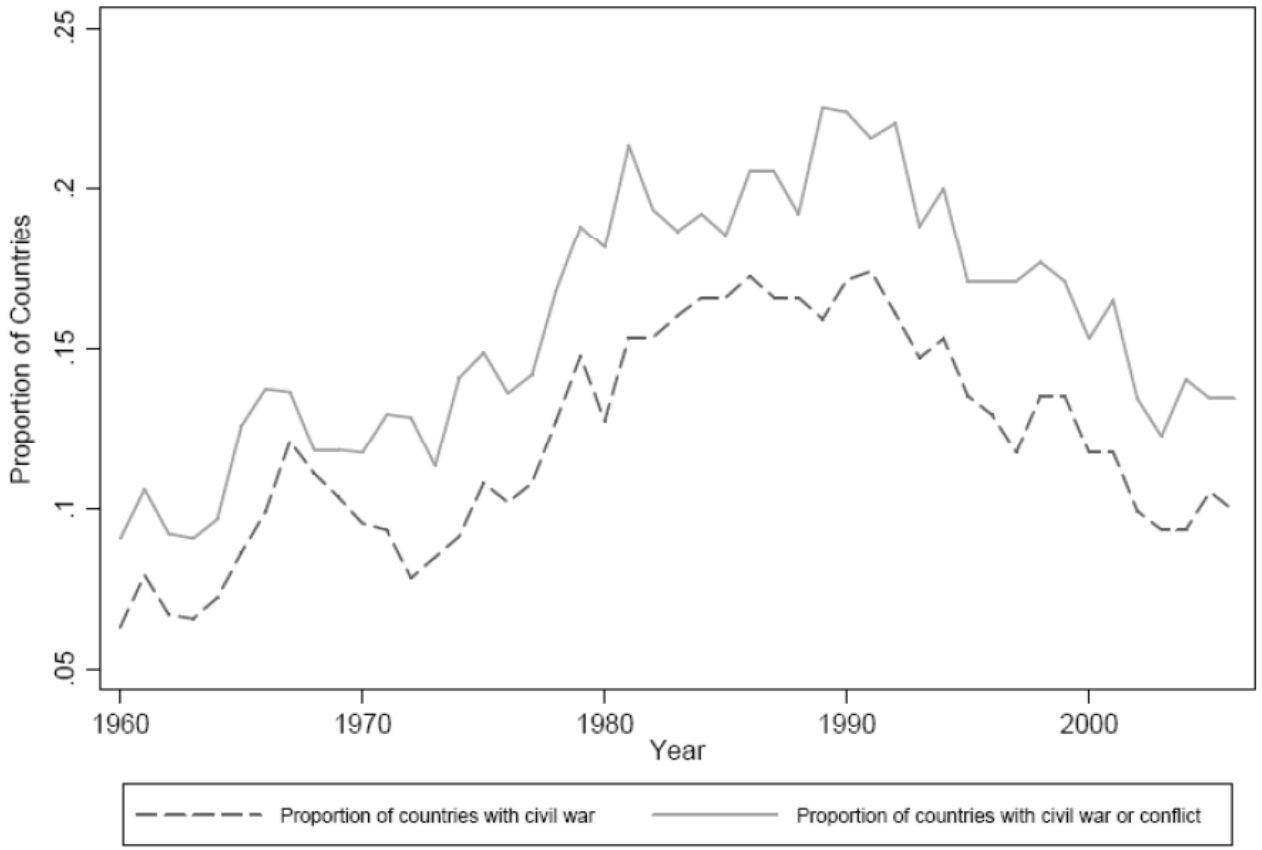


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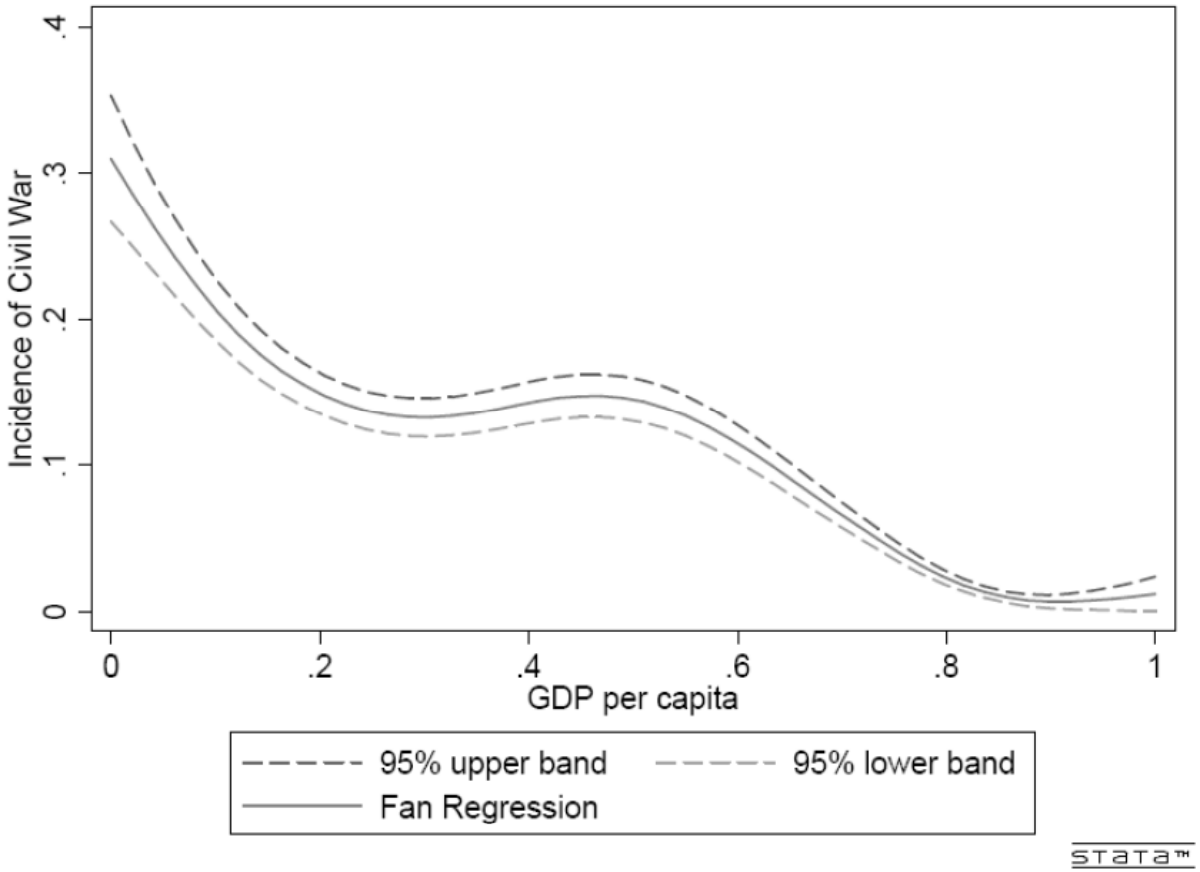
Figure 3: Incidence of civil war by country income per capita, 1960-2006



Sources: Figure displays the results of a Fan regression of the incidence of civil war on GDP per capita (bandwidth=0.3, bootstrapped standard errors). Population and GDP data are drawn from the World Development Indicators (World Bank 2008). Civil war incidence is drawn from the UCDP/PRIO armed conflict database (Gleditsch, et al. 2002; Harbom and Wallensteen 2007).

(1) Violence and economic development

- Studying the causes and consequences of civil war is central to international relations / political science, but until recently was ignored within development economics

- Leading undergraduate textbooks (Ray, Todaro) ignore the issue of war, conflict

  -- Few Ph.D. development economics syllabuses in leading programs touch on the issue

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- Leading development economists (Jean Dreze, Paul Collier) have increasingly pointed to civil war as a (the?) major cause of economic underdevelopment today (e.g. World Bank 2003 “Breaking the Conflict Trap”)

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- What is the “industrial organization” of armed groups?

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- Why do civil wars last so long? (e.g., Colombia, Sri Lanka, Sudan)
- What trade-offs between civilian vs. military production?
- How can peace be structured to prevent future conflict?
- What is the “industrial organization” of armed groups?
- What is war’s impact on later development? Physical capital, human resources, technology, “institutions” …

(2) Powell (2006, *International Organization*)

- Focuses on the two questions:
  -- Why do civil wars occur when they are so destructive?
  -- Why do civil wars last so long?

- Builds on earlier work by Fearon (1995, 2003)

(2) Powell (2006, *International Organization*)

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- Explanations for why the Coase Theorem breaks down :

  (1) Informational problems (e.g., relative strengths)

  (2) Commitment problems* (need self-enforcing deals)

  (3) Non-rational explanations (crazy rulers, ideology, a taste for revenge or violence? Fehr and Schmidt 1999)

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- Powell shows that commitment problems are particularly important in dynamic settings where there are likely to be future shifts in relative power → deals renegotiated

  -- This holds both for bargaining across sides to a conflict, as well as bargaining among one side's factions (e.g., civilian vs. military leaders)

(2) Powell (2006, *International Organization*)

- A simple take-it-or-leave it offer game in which two sides are bargaining over a pie (e.g., territory, oil rents), [0,1]
- Baseline side *A* controls territory [0,q], *B* controls (q,1]

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- Timing: *B* offers a new split *x* (A gets [0,x], B gets (x,1])
  -- *A* can accept, reject, or go to war
  -- If war, *A* wins all territory with probability *p*, *B* with *1-p*
  -- Fighting destroys fraction of the pie *d*
  -- If the offer is rejected, *B* can pass (status quo) or fight

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- Side *A* fights if EU (war) > EU (B's offer):

$$\{p(1-d) + (1-p)(0)\} = p(1-d) > x$$

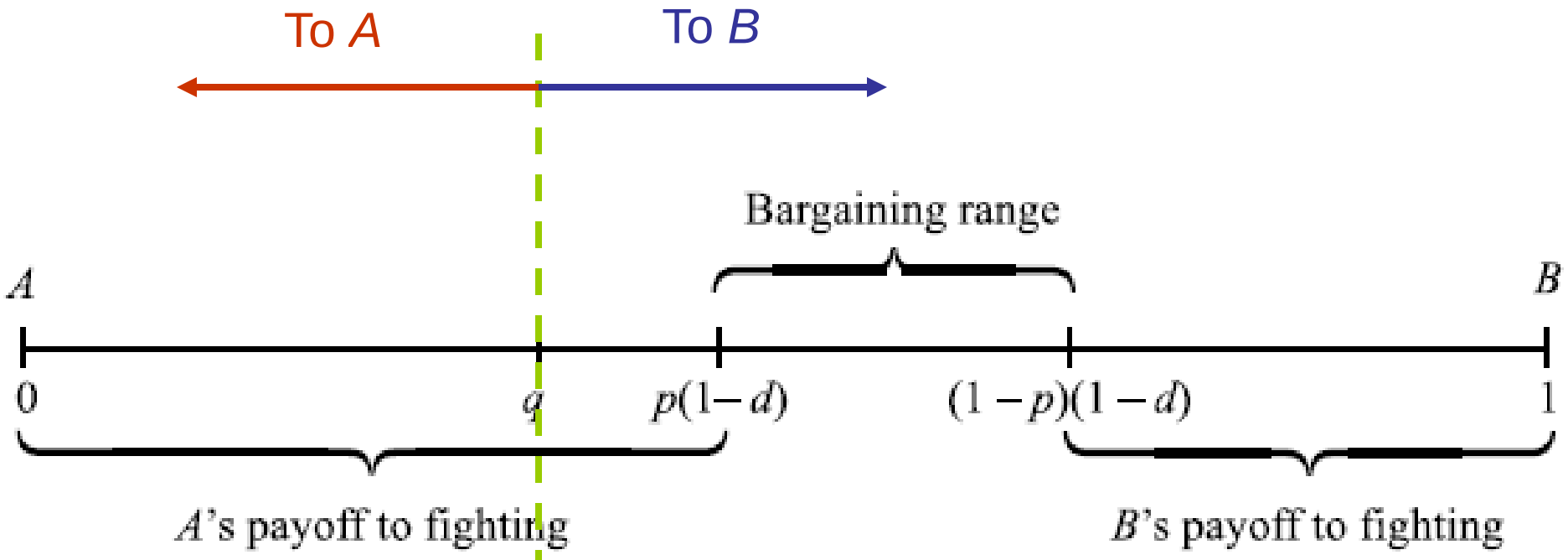

FIGURE 1. *The bargaining problem*

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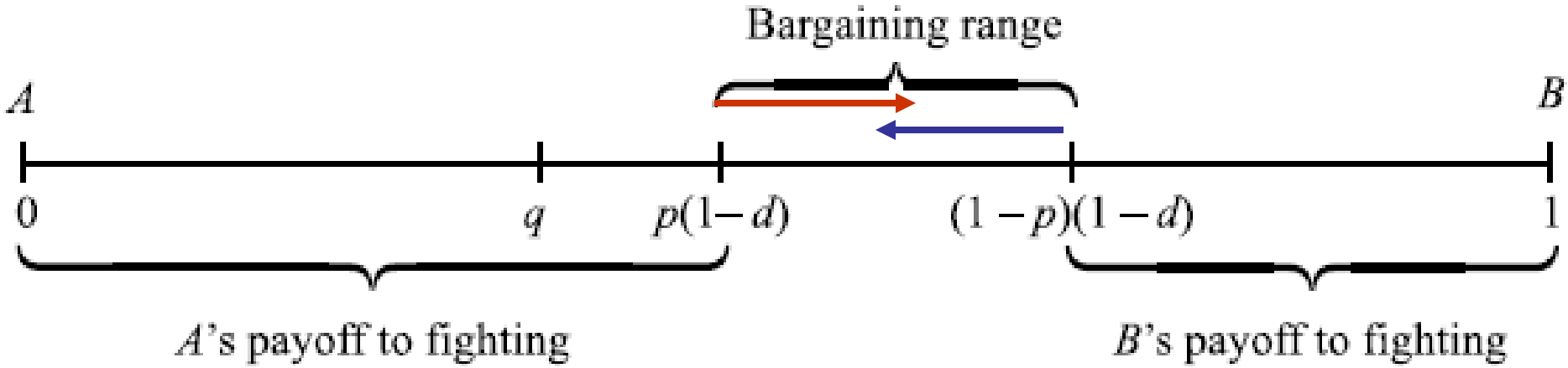
- This can break down with imperfect information if side *A* thinks its odds of winning are p_A and side *B* thinks its own chance of winning is r_B and $p_A + r_B > 1$. There is a risk the bargaining set will be reduced to the empty set



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- Sides can always agree to the lottery with winning odds equivalent to war and without the efficiency costs – but there is an incentive to renege on an unfavorable lottery outcome (if no enforcement)

(2) Powell (2006, *International Organization*)

- Now imagine a dynamic two period extension
- Two sides, now called *1* and *2*
- The key departure from the static theory is that:
  Probability that side *1* wins in period 1 = p

  Probability that side *1* wins in period 2 = $p + \Delta > p$

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- E.g., Iran vs. U.S. 2009 (pre-bomb) or 2012 (post-bomb), or China vs. U.S. as Chinese military power grows

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- The key insight: if side *2* (currently strong) fights now it has a good chance at the whole pie in both periods, before side *1* can negotiate a better deal in the future (a pre-emptive war of sorts)

  -- Side *1* may not be able to offer enough today (no more than the entire current pie) to deter this attack, if it cannot credibly lock-in future transfers to side *2*

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- Similar logic applies to first-strike advantage: attacking first gives a temporary increase in winning odds (relative to waiting). First strike advantages may allow a side to capture strategically important areas (e.g., high ground)

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  -- Related Acemoglu & Robinson (2001), Fearon (2003)

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- Imagine side *2* is a unitary actor, but side *1* is not

  -- Side *1* is composed of two factions, α and β, where α is currently in power. The faction in power decides about war and peace and determines the allocation of income across factions. Let α's odds of remaining in power be higher during war (r') than during peace (r, s.t. $r < r'$)

  -- Both factions need to receive at least share λ of total side income to avoid fighting among themselves

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- It is possible that no *x* in the earlier bargaining range (with unitary actors) leads faction α to settle. For an extreme case, imagine $r \rightarrow 0$ and $\lambda \rightarrow 0$ (faction α is likely to lose power during peace, and faction β will give them very little). Then the ruling faction chooses war $\forall x$ if $p[r'(1-\lambda)(1-d) + (1-r')\lambda(1-d)] > 0$

(2) Powell (2006, *International Organization*)

- In contrast in the unitary actor case there was peace for all $x > p(1-d)$. Why can't peace be achieved here?

- Settling rather than fighting shifts the future distribution of power against α. If faction β could credibly commit to split future income more equally with (by changing laws or institutions) to make α as well as off as they would be with war, then war could be avoided.

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- Possible solutions:
  -- Strong institutions (laws, constitutions, power-sharing)
  -- Transfer secure assets (Swiss bank accounts, land)
  -- Third parties (U.N. blue helmets) enforce deals

(3) Violence and economic development

- Recall that since 1980 about 60% of all countries have had at least one year of armed civil conflict, with at least 25 battle deaths (PRIO/Uppsala dataset)

- Are these conflicts largely the cause of their poverty, or the consequence of poverty? (Or both – or neither?)

  -- Endogeneity and omitted variables are key issues in the estimation of these relationships

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- Today focus on two of the questions from earlier today:

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- Today focus on two of the questions from earlier today:

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(3) Miguel, Satyanath, Sergenti (2004, *JPE*)

- What is the impact of income shocks on the likelihood of civil war in Africa during 1981-1999?

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- Builds on earlier work by Collier and Hoeffler (1998), and Fearon and Laitin (2003, *APSR*)

  -- “Greed versus grievance” debate: are armed groups primarily driven by private economic returns (e.g., looting, diamonds) or by ideological motivations?

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  -- “Greed versus grievance” debate: are armed groups primarily driven by private economic returns (e.g., looting, diamonds) or by ideological motivations?

- Of course these two explanations are not mutually exclusive, and both could apply to some degree in particular cases. Finding a link between poverty and violence does not resolve the debate

(3) Miguel, Satyanath, Sergenti (2004, *JPE*)

- The two central econometric identification problems:

  (1) Endogeneity: civil wars (or the risk of future civil war) can affect economic conditions, through investment, trade, population displacement, destruction of capital

  (2) Omitted variable bias: countries with effective institutions (or leaders) may both have better economic outcomes and be more peaceful

(3) Miguel, Satyanath, Sergenti (2004, *JPE*)

- MSS (2004) try to deal with these concerns in turn:

  (1) Endogeneity:

  -- Use rainfall shocks as IVs for economic growth rates. This is reasonable in largely agrarian societies where most households rely on rain-fed agriculture

  -- Rainfall is clearly exogenous to civil conflict

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  -- Rainfall is clearly exogenous to civil conflict

  -- Is the exclusion restriction credible? How else could rainfall affect civil war, other than through economic growth rates? Some prefer the reduced form results to the IV results

  -- Other work (Bruckner and Ciccone 2008) uses commodity price shocks, results similar but weaker

(3) Miguel, Satyanath, Sergenti (2004, *JPE*)

- MSS (2004) try to deal with these concerns in turn:

  (2) Omitted variable bias:

  -- Include country fixed effects and country specific time trends in most specifications, to capture levels (and trend) differences across countries

(3) Miguel, Satyanath, Sergenti (2004, *JPE*)

- Use standard cross-country income data, with all of its flaws and likely measurement error. This is another potential rationale for the IV approach, to reduce the attenuation bias

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- PRIO/Uppsala conflict database – focus on the lower 25 death conflict threshold. This seems most appropriate for most (small) African countries

- 743 observations. Some interesting cases – e.g., Democratic Republic of Congo – are missing too much economic data to be included. 27% of country-year cases had conflict. 38 conflicts started during the period

(3) Miguel, Satyanath, Sergenti (2004, *JPE*)

- Global Precipitation Climatology Project (GPCP) monthly rainfall data since 1979, uses both satellite and rainfall gauge data

- Focus on year to year changes in rainfall for the country as a whole. This has the strongest first stage predictive power for economic growth rates – stronger than, say, using an indicator for extreme rainfall shocks only

TABLE 2

RAINFALL AND ECONOMIC GROWTH (First-Stage)

Dependent Variable: Economic Growth Rate, t

EXPLANATORY VARIABLE	ORDINARY LEAST SQUARES				
	(1)	(2)	(3)	(4)	(5)
Growth in rainfall, t	.055***	.053***	.049***	.049***	.053***
	(.016)	(.017)	(.017)	(.018)	(.018)
Growth in rainfall, $t-1$	.034**	.032**	.028**	.028*	.037**
	(.013)	(.014)	(.014)	(.014)	(.015)
Growth in rainfall, $t+1$				.001	
				(.019)	
Growth in terms of trade, t					−.002
					(.023)
Log(GDP per capita), 1979		−.011			
		(.007)			
Democracy (Polity IV), $t-1$		.0000			
		(.0007)			
Ethnolinguistic fractionalization		.006			
		(.044)			
Religious fractionalization		.045			
		(.044)			
Oil-exporting country		.007			
		(.019)			
Log(mountainous)		.001			
		(.005)			
Log(national population), $t-1$		−.009			
		(.009)			
Country fixed effects	no	no	yes	yes	yes
Country-specific time trends	no	yes	yes	yes	yes
R^2	.02	.08	.13	.13	.16
Root mean square error	.07	.07	.07	.07	.06
Observations	743	743	743	743	661

TABLE 3

RAINFALL AND CIVIL CONFLICT (Reduced-Form)

	DEPENDENT VARIABLE	
EXPLANATORY VARIABLE	Civil Conflict ≥25 Deaths (OLS) (1)	Civil Conflict ≥1,000 Deaths (OLS) (2)
Growth in rainfall, t	−.024	−.062**
	(.043)	(.030)
Growth in rainfall, $t-1$	−.122**	−.069**
	(.052)	(.032)
Country fixed effects	yes	yes
Country-specific time trends	yes	yes
R^2	.71	.70
Root mean square error	.25	.22
Observations	743	743

TABLE 4

ECONOMIC GROWTH AND CIVIL CONFLICT

	Dependent Variable: Civil Conflict ≥25 Deaths						Dependent Variable: Civil Conflict ≥1,000 Deaths
Explanatory Variable	Probit (1)	OLS (2)	OLS (3)	OLS (4)	IV-2SLS (5)	IV-2SLS (6)	IV-2SLS (7)
Economic growth rate, t	−.37	−.33	−.21	−.21	−.41	−1.13	−1.48*
	(.26)	(.26)	(.20)	(.16)	(1.48)	(1.40)	(.82)
Economic growth rate, $t-1$	−.14	−.08	.01	.07	−2.25**	−2.55**	−.77
	(.23)	(.24)	(.20)	(.16)	(1.07)	(1.10)	(.70)
Log(GDP per capita), 1979	−.067	−.041	.085		.053		
	(.061)	(.050)	(.084)		(.098)		
Democracy (Polity IV), $t-1$	.001	.001	.003		.004		
	(.005)	(.005)	(.006)		(.006)		
Ethnolinguistic fractionalization	.24	.23	.51		.51		
	(.26)	(.27)	(.40)		(.39)		
Religious fractionalization	−.29	−.24	.10		.22		
	(.26)	(.24)	(.42)		(.44)		
Oil-exporting country	.02	.05	−.16		−.10		
	(.21)	(.21)	(.20)		(.22)		
Log(mountainous)	.077**	.076*	.057		.060		
	(.041)	(.039)	(.060)		(.058)		
Log(national population), $t-1$	.080	.068	.182*		.159*		
	(.051)	(.051)	(.086)		(.093)		
Country fixed effects	no	no	no	yes	no	yes	yes
Country-specific time trends	no	no	yes	yes	yes	yes	yes
R^2	…	.13	.53	.71	…	…	…
Root mean square error	…	.42	.31	.25	.36	.32	.24
Observations	743	743	743	743	743	743	743

In the second main result, we find that the impact of economic growth shocks on the incidence of major conflicts is remarkably—and perhaps surprisingly—similar for African countries with a wide range of institutional, political, social, and economic characteristics. There are compelling theoretical reasons to expect to find strong effects; for instance, given an adverse economic growth shock, countries with stronger democratic institutions (and, similarly, wealthier countries) may be better able to negotiate compromises among social groups to avert unrest, whereas such negotiations may more often break down in ethnically or religiously fragmented societies (Benhabib and Rustichini 1996; Easterly and Levine 1997). However, the interactions between economic growth (current and lagged) and a measure of democracy (regression 1 of table 5) and between growth and per capita income levels in 1979 (regression 2) are not significantly related to civil conflict; nor are the two interaction terms jointly significant in either case.[24]

TABLE 5

INTERACTIONS BETWEEN ECONOMIC GROWTH AND COUNTRY CHARACTERISTICS

Dependent Variable: Civil Conflict ≥25 Deaths

	IV-2SLS				
EXPLANATORY VARIABLE	(1)	(2)	(3)	(4)	(5)
Economic growth rate, t	−1.20	.92	−9.9	−.99	−1.85
	(1.43)	(2.62)	(22.9)	(1.26)	(1.81)
Economic growth rate, $t-1$	−2.86*	−3.01*	−6.4	−2.37**	−2.97**
	(1.46)	(1.70)	(6.1)	(1.04)	(1.39)
Economic growth rate, t × democracy (Polity IV), $t-1$	.01				
	(.21)				
Economic growth rate, $t-1$ × democracy (Polity IV), $t-1$	−.10				
	(.16)				
Economic growth rate, t × log(per capita income, 1979)		−1.98			
		(2.70)			
Economic growth rate, $t-1$ × log(per capita income, 1979)		.58			
		(1.09)			
Economic growth rate, t × ethnolinguistic fractionalization			12.1		
			(30.1)		
Economic growth rate, $t-1$ × ethnolinguistic fractionalization			5.1		
			(8.1)		
Economic growth rate, t × oil-exporting country				−2.8	
				(6.9)	
Economic growth rate, $t-1$ × oil-exporting country				3.2	
				(3.1)	
Economic growth rate, t × log(mountainous)					.39
					(.83)
Economic growth rate, $t-1$ × log(mountainous)					.23
					(.62)
Country fixed effects	yes	yes	yes	yes	yes
Country-specific time trends	yes	yes	yes	yes	yes
Root mean square error	.33	.34	.41	.32	.32
Observations	743	743	743	743	743

(3) Miguel, Satyanath, Sergenti (2004, *JPE*)

- Possible implications for public policy: government and foreign aid should react rapidly to the threat of economic downturns in poor countries (e.g., droughts, commodity price falls). Small amounts of aid up front (“prevention”) could be much cheaper than the post-war “cure”

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- Should young men be the main beneficiaries of such transfers, since they pose the greatest threat of engaging in violence?

(3) Micro-data collection in conflict settings

- An effort to collect data systematically across countries (both “pre”, during, and post conflict”) could have high returns – think of the LSMS or DHS “movements”

  -- Necessary to test theories on conflict causes

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  -- Necessary to test theories on conflict causes

- There are many difficulties to doing so:

  (1) Some surveys would rely upon retrospective data that might suffer from bias due to ex post rationalization

  (2) Samples would exclude those killed (or emigrated) during the conflict → “selection bias” / “survivor bias”

  (3) Current ideology / knowledge may reflect political indoctrination received during the war, leading the analysis to overstate the role of ideology

  (4) Data collection may be dangerous

(3) Micro-data collection in conflict settings

- Directions for future data collection:
- Need surveys on combatants and civilians

- More data on multiple armed groups, to estimate cross-group relationships (e.g., many rebel groups in Congo, Sudan, Iraq)

- More information on the structure of armed groups, their operations, organization, incentives, wages

- Others?

(4) Davis and Weinstein (2002, *AER*)

- Study one of the most notorious cases of war-related destruction: the bombing of Japan (by the U.S.) during WWII, including the two atomic bombs

- How do heavily bombed cities compare to others, in terms of their post-war population growth? 1945-1965

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- How do heavily bombed cities compare to others, in terms of their post-war population growth? 1945-1965

- Why do some cities grow, and not others?

  (1) Increasing returns → temporary population shifts could have permanent effects on population distribution

  (2) Random growth theory

  (3) Locational fundamentals → post-war recovery back to pre-war population patterns

(4) Davis and Weinstein (2002, *AER*)

- Sample of 303 Japanese cities with pre-war population over 30,000. Annual data 1925-1965

- Exceptional city-level data on damage from U.S. bombing: proportion of buildings destroyed, proportion of residents dead / missing

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- Exceptional city-level data on damage from U.S. bombing: proportion of buildings destroyed, proportion of residents dead / missing

  -- Over 300,000 civilians killed, over 40% of population of the 66 cities targeted by the U.S. were made homeless by the bombing, 2.2 million buildings destroyed

- Data on public sector reconstruction expenditures (not a great predictor of recovery, actually, since untouched rural areas got lots of assistance)

(4) Davis and Weinstein (2002, *AER*)

- Econometric identification issues:

  -- Lots of variation across cities: approximately 80% of cities untouched, some for historical reasons (e.g., Kyoto), some to temporarily "save" for atomic weapons (e.g., Niigata), some out of range of U.S. bombers (e.g., Sapporo)

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  -- Bombing is not random – did the U.S. bomb cities with the best population (and economic?) growth prospects?

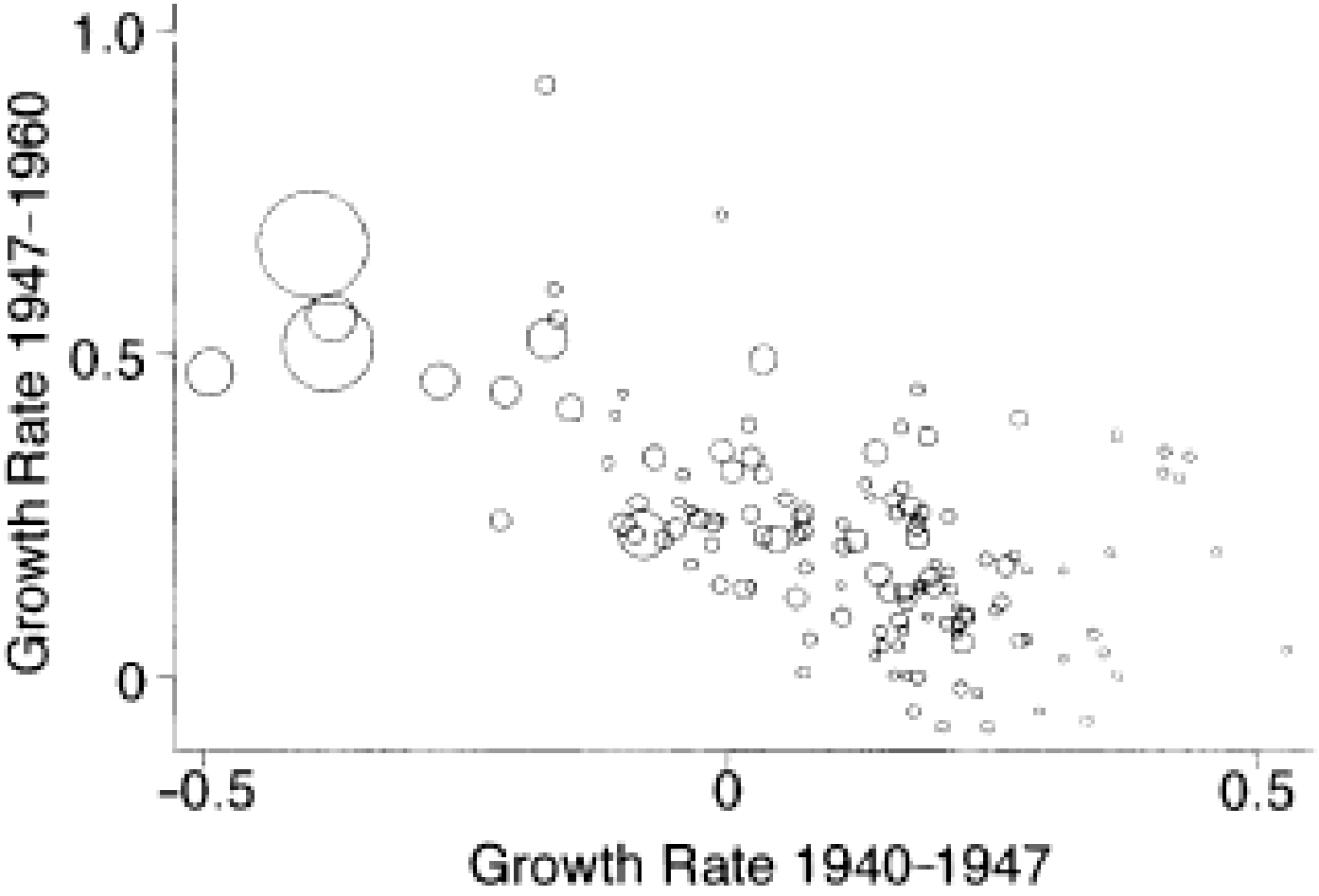

FIGURE 1. EFFECTS OF BOMBING ON CITIES WITH MORE THAN 30,000 INHABITANTS

Note: The figure presents data for cities with positive casualty rates only.

Let S_{it} be city i's share of total population at time t, and let s_{it} be the natural logarithm of this share. Suppose further that each city has an initial size Ω_i and is buffeted by city-specific shocks ε_{it}. In this case we can write the size of any city at any point in time as,

$$s_{it} = \Omega_i + \varepsilon_{it}. \tag{1}$$

We can model the persistence in these shocks to population shares as:

$$\varepsilon_{it+1} = \rho\varepsilon_{it} + \nu_{it+1}. \tag{2}$$

The parameter $\rho \in [0, 1]$, and the innovation, ν_{it}, is an independently and identically distributed error term.

We examine the evolution of this system by first-differencing equation (1). This yields

$$s_{it+1} - s_{it} = \varepsilon_{it+1} - \varepsilon_{it}. \tag{3}$$

If we substitute equation (2) into equation (3), we then obtain

$$s_{it+1} - s_{it} = (\rho - 1)\nu_{it} + [\nu_{it+1} + \rho(1 - \rho)\varepsilon_{it-1}]. \tag{4}$$

The key parameter is ρ, which tells us how much of a temporary shock is dissipated in one period. If $\rho = 1$, then all shocks are permanent and city size follows a random walk.[19] In this

TABLE 3—TWO-STAGE LEAST-SQUARES ESTIMATES OF IMPACT OF BOMBING ON CITIES (INSTRUMENTS: DEATHS PER CAPITA AND BUILDINGS DESTROYED PER CAPITA)

	Dependent variable = growth rate of population between 1947 and 1960		Dependent variable = growth rate of population between 1947 and 1965
Independent variable	(i)	(ii)	(iii)
Growth rate of population between 1940 and 1947	−1.048	−0.759	−1.027
	(0.097)	(0.094)	(0.163)
Government reconstruction expenses	1.024	0.628	0.392
	(0.387)	(0.298)	(0.514)
Growth rate of population between 1925 and 1940		0.444	0.617
		(0.054)	(0.092)
R^2:	0.279	0.566	0.386
Number of observations:	303	303	303

Note: Standard errors are in parentheses.

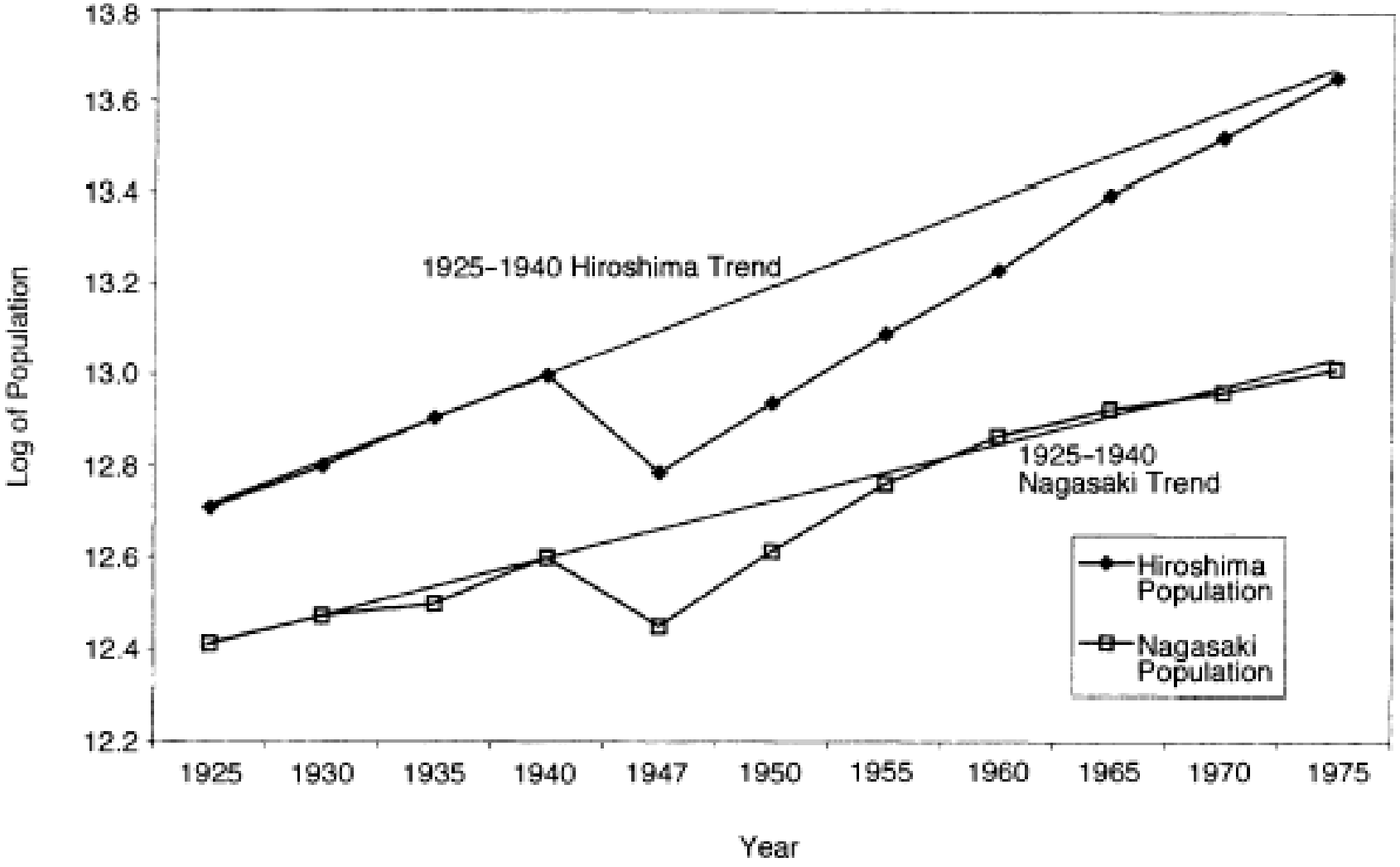

FIGURE 2. POPULATION GROWTH

(4) Davis and Weinstein (2002, *AER*)

- Japan cities recovered rapidly from massive bombing

  -- So did Germany (Brakman et al 2004), and Vietnam (Miguel and Roland 2006). We find recovery also in per capita consumption levels post-war

  -- Argues strongly against “poverty trap” type models

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- But these are all economic “success stories”, with strong central government institutions. What are the economic legacies of war in Africa, where state institutions are weaker? The legacies of civil wars?

  -- These questions are difficult to answer due to data selection bias: there are no reliable data on war damage or impacts in countries like Somalia or Congo

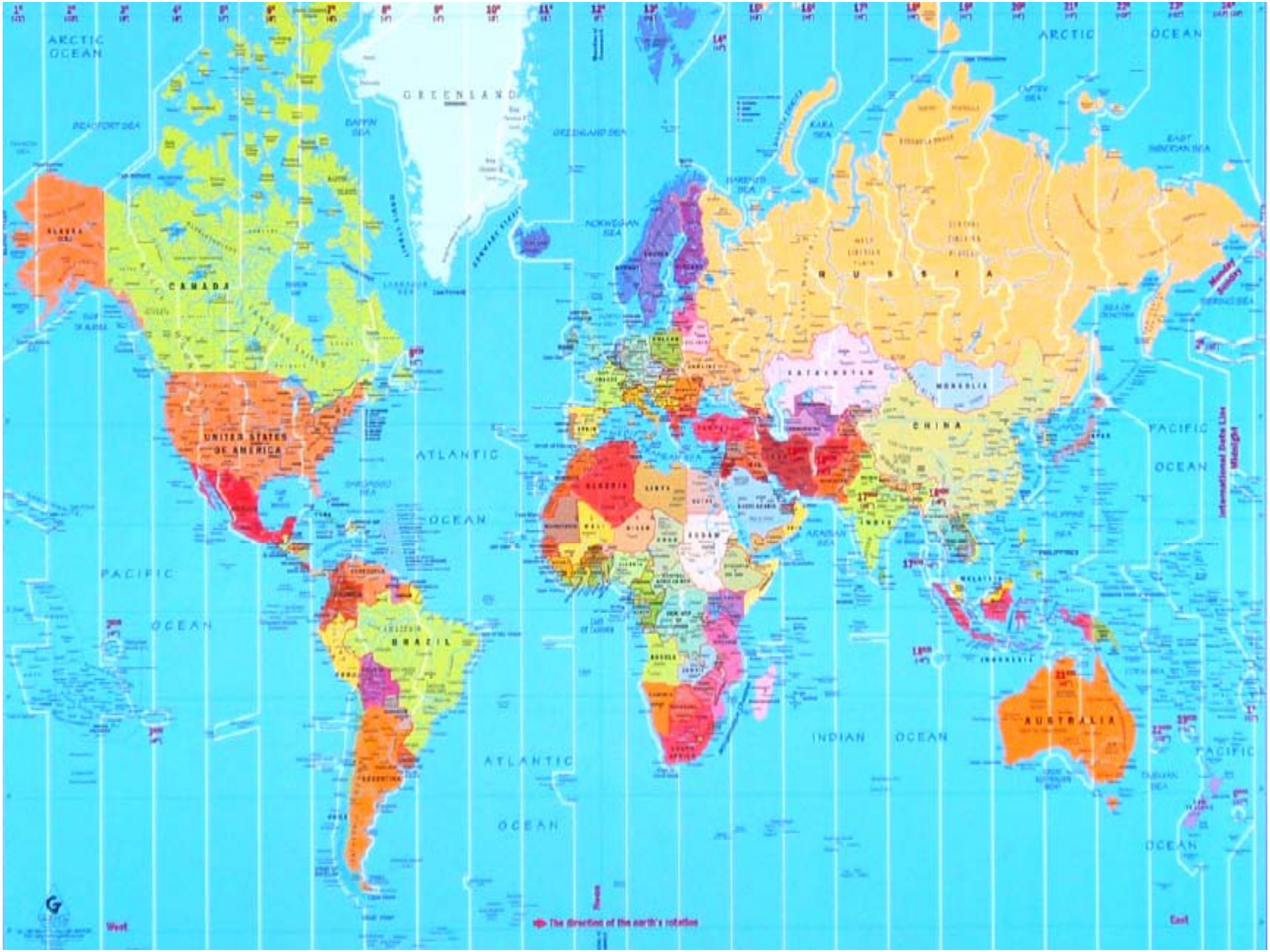
Whiteboard #1

Whiteboard #2

Whiteboard #3

Whiteboard #4

Whiteboard #5


ARCTIC OCEAN
GREENLAND
BEAUFORT SEA
BAFFIN SEA
GREENLAND SEA
NORWEGIAN SEA
BARENTS SEA
KARA SEA
EAST SIBERIAN SEA
ALASKA (U.S.)
CANADA
RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
UNITED STATES OF AMERICA
ATLANTIC OCEAN
PACIFIC OCEAN
BRAZIL
INDIA
INDONESIA
AUSTRALIA
INDIAN OCEAN
International Date Line
Midnight
West
East
The direction of the earth's rotation