14.452 Economic Growth: Lecture 1, Questions and Evidence

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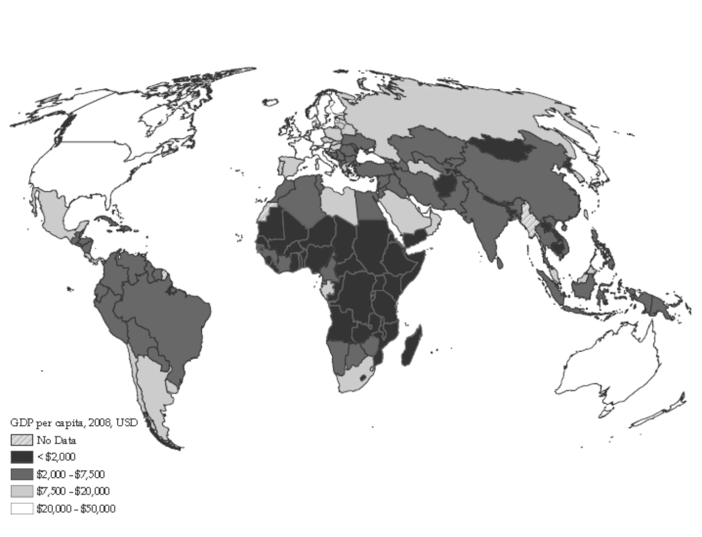
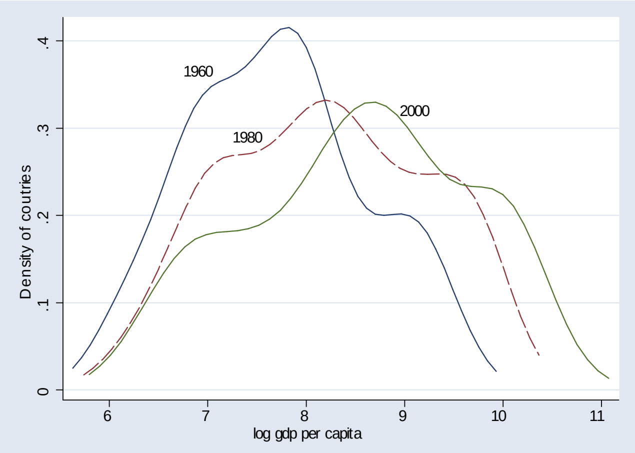
Cross-Country Income Differences



Cross-Country Income Differences (continued)

- There are very large differences in income per capita and output per worker across countries today, and they may have grown over the last 70 years.



Productivity Differences

- Theory is easier to map to data when we look at output (GDP) per worker.
- Moreover, key sources of difference in economic performance across countries are national policies and institutions.
- The next Figure looks at the unweighted distribution of countries according to (PPP-adjusted) GDP per worker
    - "workers": total economically active population according to the definition of the International Labour Organization.
- Overall, two important facts:
    1. Large amount of inequality in income per capita and income per worker across countries.
    2. Slight but noticeable increase in inequality across nations (though not necessarily across individuals in the entire world).

Productivity Differences (continued)

Figure: Distribution of log GDP per worker (PPP-adjusted).

Economic Growth and Income Differences

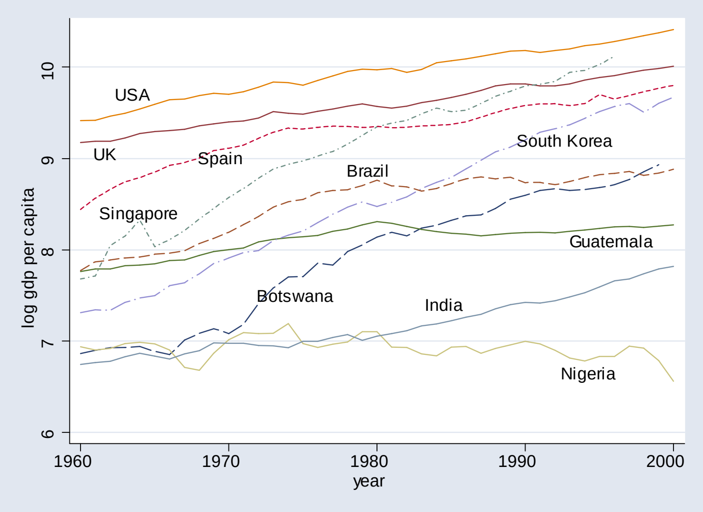


Figure: The evolution of income per capita 1960-2000.

Economic Growth and Income Differences

- Why is the United States richer in 1960 than other nations and able to grow at a steady pace thereafter?
- How did Singapore, South Korea and Botswana manage to grow at a relatively rapid pace for 40 years?
- Why did Spain grow relatively rapidly for about 20 years, but then slow down? Why did Brazil and Guatemala stagnate during the 1980s?
- What is responsible for the disastrous growth performance of Nigeria?
    - Central questions for understanding how the capitalist system works and the origins of economic growth.
    - Central questions also for policy and welfare, since differences in income related to living standards, consumption and health.
- Our first task is to develop a coherent framework to investigate these questions and as a byproduct we will introduce the workhorse models of dynamic economic analysis and macroeconomics.

Persistence of Prosperity

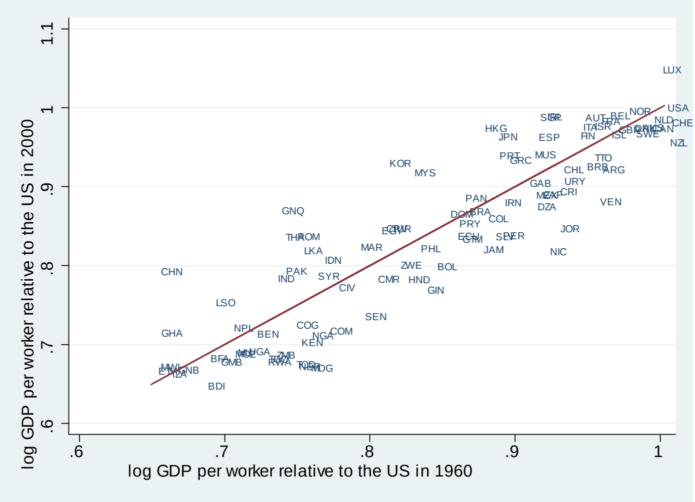


Figure: Log GDP per worker in 1960 and 2000.

Over Longer Periods Persistence and Divergence

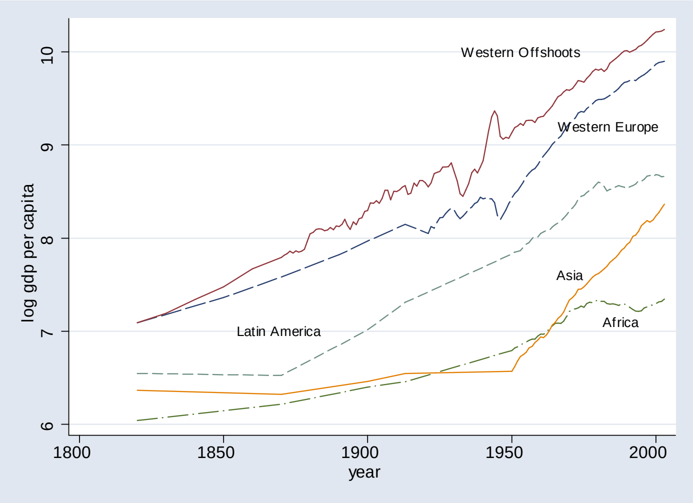


Figure: Evolution of GDP per capita 1820-2000.

Growth in the Last 200 Years

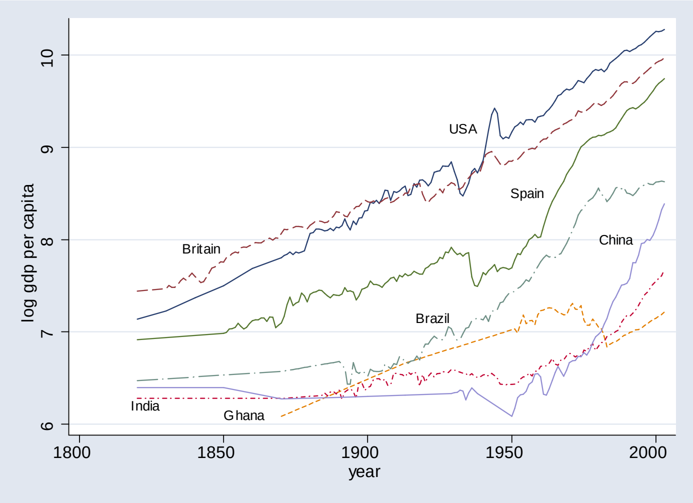


Figure: Evolution of income per capita in various countries.

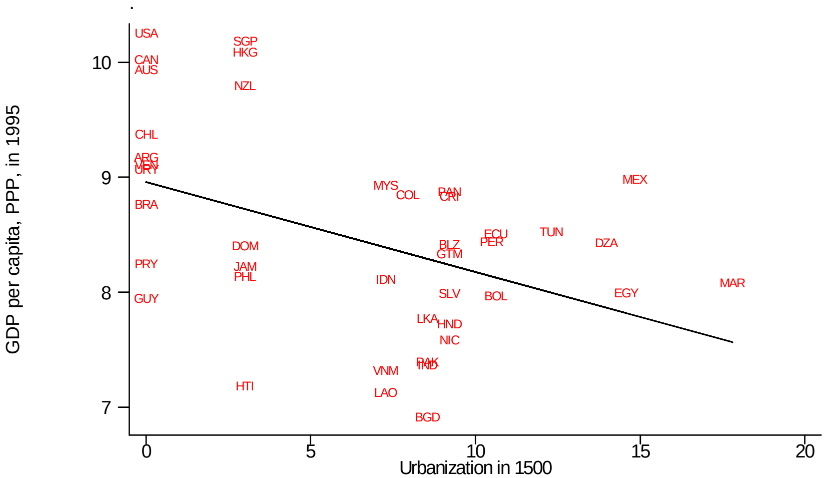
From Correlates to Fundamental Causes

- Correlates of economic growth, such as physical capital, human capital and technology, will be our first topic of study.
- But these are only *proximate causes* of economic growth and economic success:
  - why do certain societies fail to improve their technologies, invest more in physical capital, and accumulate more human capital?
- Return to Figure above to illustrate this point further:
  - how did South Korea and Singapore manage to grow, while Nigeria failed to take advantage of the growth opportunities?
  - If physical capital accumulation is so important, why did Nigeria not invest more in physical capital?
  - If education is so important, why our education levels in Nigeria still so low and why is existing human capital not being used more effectively?
- The answer to these questions is related to the *fundamental causes* of economic growth.

Persistence and Reversal

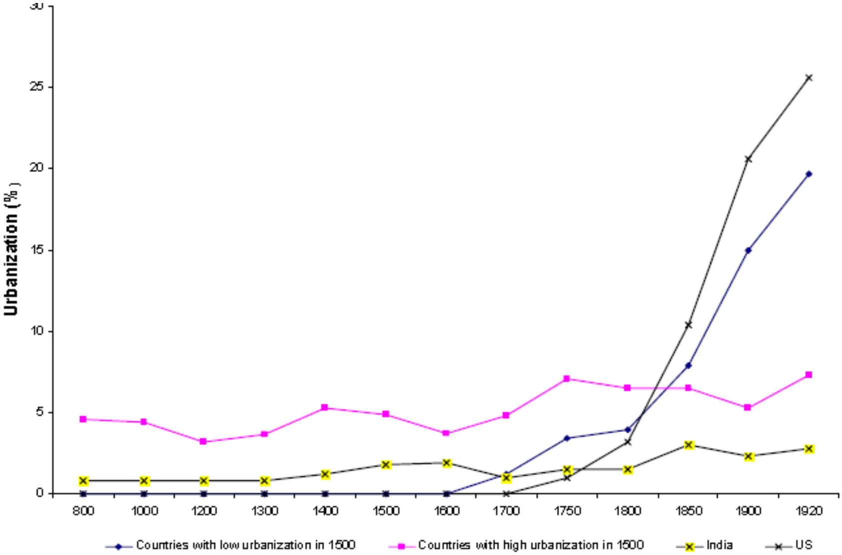
- But is there persistence even if we go further? If yes, this might suggest there are important "unchanging" factors affecting growth at the country level (such as geography).
- If, on the other hand, this persistence breaks down during periods of fundamental institutional change, this would put the spotlight on institutions.
- How to approximate prosperity/GDP before national accounts? Some proxies:
  - Urbanization: before industrial times only more prosperous places (and those with agricultural surplus) could support large urban areas.
  - Population density: similar justification.
- Focusing on the sample of former colonies, we do in fact see a sharp reversal from before colonization to today.

Reversal of Fortune in Urbanization



Reversal of Fortune in Population Density

Reversal of Fortune: Timing



Institutions and Growth

- What about direct evidence of the effect of institutions of growth?
- Three types of evidence have been presented in the literature:
    1. Country-level evidence on the long-run effects of institutions, exploiting potentially exogenous sources of variation (e.g., Acemoglu, Johnson and Robinson, 2001).
    2. Within-country evidence on the long-run effects of institutional features that three across localities within a country (e.g., Dell, 2010).
    3. Growth regressions, focusing on shorter periods (such as decades or even shorter periods).
- Even though growth regressions are the most problematic from a variety of viewpoints (as we will discuss later), since they connect to some of the issues we will discuss in this course, I now provide evidence using a modified version of growth regressions.

The Effects of Democracy on Growth

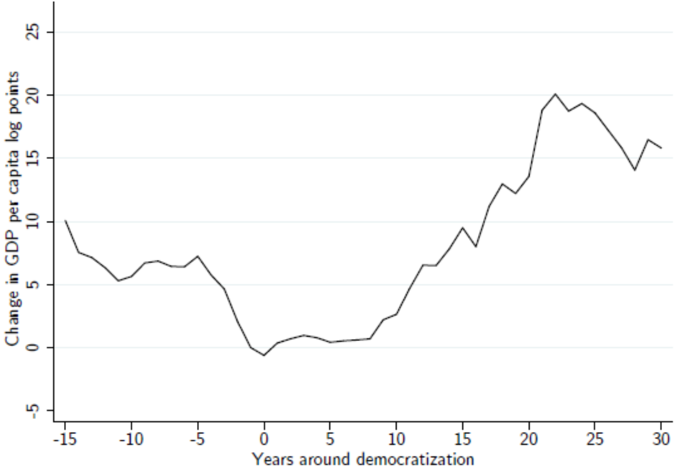
- Democracy is a key aspect of political institutions of a society.
- Much controversy on its merits, and many popular writings and some economists emphasize its weaknesses and distortions (which are indeed many). Relatedly, the conventional wisdom appears to be That democracy is not good for economic growth and main fact be bad.
- Is this true?
- Let me share results from Acemoglu, Naidu, Restrepo and Robinson (2014) attempting to answer these questions.

Challenges of Estimating the Effect of Democracy

- Measuring democracy—create a dichotomous measure of democracy, minimizing measurement error.
- Not comparing apples and oranges—models that country fixed effects.
- Dynamics—allow for mean reversion in income per capita exploiting our annual data.
- Sources of exogenous variation.

Importance of Dynamics

- Democratizations are more likely to happen when nondemocracies are having economic difficulties:



Method I: Panel Data

- Consider the following linear panel data model at annual frequency:

$$y_{ct} = \beta D_{ct} + \sum_{j=1}^{p} \gamma_j y_{ct-j} + \alpha_c + \delta_t + \varepsilon_{ct}.$$

- Here y_{ct} is the log of GDP per capita in country c at time t, and D_{ct} is the dichotomous measure of democracy in country c in year t.
- In addition α_c denote a full set of country fixed effects, the δ_t denote a full set of year fixed effects, and ε_{ct} is the error term.
- Note that this specification has level on the RHS rather than growth (does that matter?)
- It also imposes that democracy does not have a permanent effect on growth (does this matter?).
- Crucially, none of the intermediating variables like education or investment are controlled for on the right-hand side.

Results: Importance of Dynamics Again

Table: The dependent variable is the log of GDP per capita.

	(1)	(2)	(3)	(4)	(5)
Democracy	-10.112	0.973	0.651	0.787	0.887
	(4.316)	(0.294)	(0.248)	(0.226)	(0.245)
log GDP first lag		0.973	1.266	1.238	1.233
		(0.006)	(0.038)	(0.038)	(0.039)
log GDP second lag			-0.300	-0.207	-0.214
			(0.037)	(0.046)	(0.043)
log GDP third lag				-0.026	-0.021
				(0.028)	(0.028)
log GDP fourth lag				-0.043	-0.039
				(0.017)	(0.034)
$p-$value remaining lags					[0.565]
Long-run effect of democracy		35.59	19.60	21.24	22.01
$p-$ value long-run effect		[0.011]	[0.023]	[0.003]	[0.004]
Persistence of GDP		0.973	0.967	0.963	0.960
Unit-root test adjusted $t-$stat		-4.791	-3.892	-4.127	-6.991
$p-$ value (rejects unit root)		[0.000]	[0.000]	[0.000]	[0.000]
Observations	6,934	6,790	6,642	6,336	5,688
Countries	175	175	175	175	175

Inspecting the Residuals: The Case of Korea

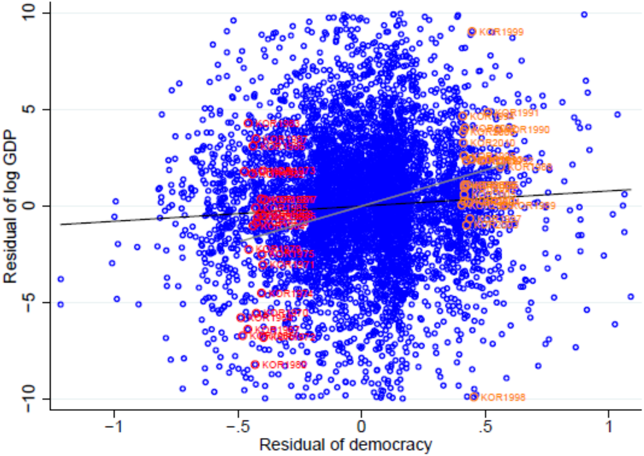
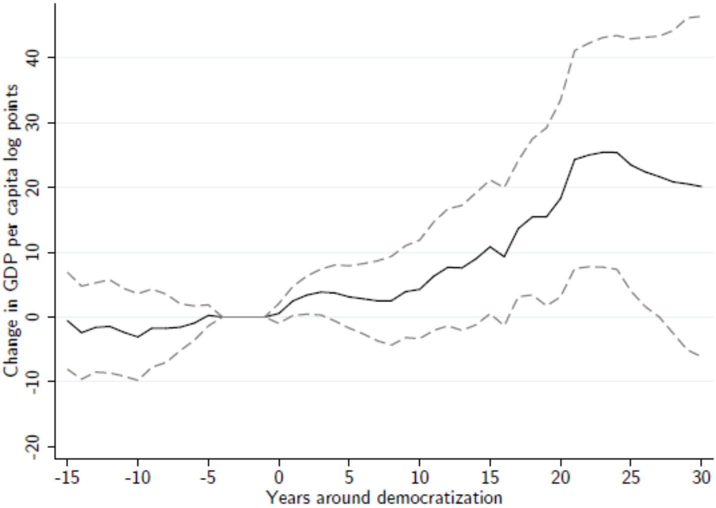
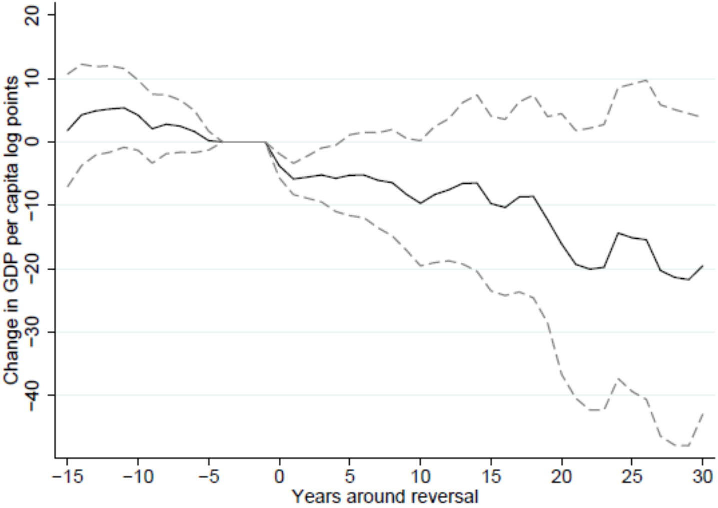


Figure: Red: Korean before democracy. Orange: Korea after democracy.

Semi-Parametric Estimates: Democratizations



Semi-Parametric Estimates: Reversal in Democracy



Instrumental Variables

- So far, the strategy for identifying the effect of democracy on future economic outcomes has been to condition on observables.
- Alternative is to use an instrumental-variables (IV) strategy exploiting a source of variation that is less likely to be contaminated with omitted variable biases.
- There is no perfect instrument for democracy, but a plausibly exogenous source of variation still provides useful estimates for triangulatingthe effect of democracy.
- Democracy spreads within (culturally homogeneous) areas, reminiscent of democratization waves.
- Here exploit regional democratization waves.

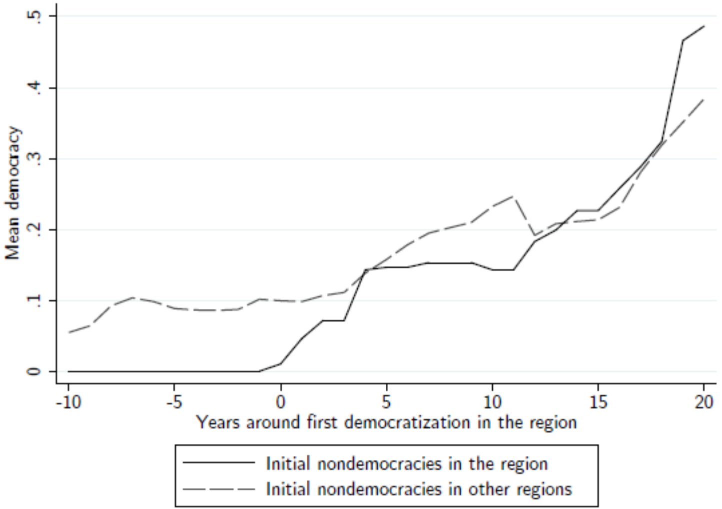
IV Strategy

- Let R_c denote the geographic region of country c.
- Construct the set of countries $I_c = \{c' : c' \neq c, R_{c'} = R_c, D_{c't_0} = D_{ct_0}\}$, countries in the same region ith the same political history, i.e., $D_{c't_0} = D_{ct_0}$.
- Then construct the instrument

$$Z_{ct} = \frac{1}{|I_c|} \sum_{c' \in I_c} D_{c't}.$$

- Here, Z_{ct} is the jack-knifed average of democracy in a region $\times$ initial regime cell, which leaves out the own-country observation.

First Stage



Mean democracy
0
.1
.2
.3
.4
.5
-10
-5
0
5
10
15
20
Years around first democratization in the region
Initial nondemocracies in the region
Initial nondemocracies in other regions

IV Estimates

Table: 2SLS effects of democracy on GDP using regional democratization waves as instrument.

Covariates:	(1)	GDP in 1960 quintiles× year effects (2)	Soviet dummies (3)	Regional unrest, GDP & trade (4)	Spatial lag of GDP (5)	Spatial lags of DGP and democracy (6)
Democracy	1.149	1.125	1.292	1.107	1.335	0.989
	(0.554)	(0.689)	(0.651)	(0.656)	(0.536)	(0.537)
Long-run effect of democracy	31.521	35.226	35.723	25.016	37.482	27.952
	(17.425)	(23.846)	(19.997)	(17.157)	(17.836)	(16.966)
Observations	6,309	5,496	6,309	6,309	6,181	6,181
Countries in sample	174	148	174	174	173	173
Exc. Instruments F-stat.	33.2	16.8	26.7	16.7	17.5	12.7

Mechanisms

Table: Effects of democracy on potential channels. Within estimates.

Dependent variable:	Log of investment share in GDP (1)	Log of TFP (2)	Index of economic reforms (3)	Log of trade share in GDP (4)	Log of tax share in GDP (5)	Log of primary enrollment (6)	Log of secondary enrollment (7)	Log of child mortality (8)	Dummy for unrest (9)
Democracy	2.391	-0.205	0.687	0.689	3.311	1.042	1.345	-0.253	-7.832
	(1.114)	(0.276)	(0.348)	(0.676)	(1.409)	(0.338)	(0.610)	(0.063)	(2.185)
Long-run effect of democracy	9.112	-2.883	5.580	5.445	16.062	21.908	18.960	-34.264	-11.944
	(4.255)	(3.858)	(2.883)	(5.253)	(6.650)	(7.624)	(8.622)	(10.747)	(3.329)
Effect of democracy after 25 years	9.089	-2.738	5.359	5.303	15.864	18.892	18.057	-21.400	-11.944
	(4.245)	(3.648)	(2.753)	(5.126)	(6.574)	(6.321)	(8.146)	(5.124)	(3.329)
Persistence of outcome process	0.738	0.929	0.877	0.873	0.794	0.952	0.929	0.993	0.344
	(0.020)	(0.012)	(0.012)	(0.011)	(0.016)	(0.008)	(0.013)	(0.001)	(0.030)
Observations	5,665	3,879	4,692	5,738	4,511	3,714	2,883	6,084	5,646
Countries in sample	169	107	150	172	131	166	158	173	171

Mechanisms (continued)

Table: Effects of democracy on potential channels. 2SLS estimates.

Dependent variable:	Log of investment share in GDP (1)	Log of TFP (2)	Index of economic reforms (3)	Log of trade share in GDP (4)	Log of tax share in GDP (5)	Log of primary enrollment (6)	Log of secondary enrollment (7)	Log of child mortality (8)	Dummy for unrest (9)
Democracy	2.211	-0.941	3.224	5.512	8.088	1.757	4.116	-0.715	-5.569
	(2.852)	(0.667)	(0.863)	(2.005)	(3.021)	(0.721)	(1.626)	(0.164)	(5.682)
Long-run effect of democracy	8.440	-12.738	23.775	40.589	38.609	36.693	57.072	-95.728	-8.471
	(10.705)	(8.854)	(6.215)	(13.580)	(14.330)	(15.505)	(21.698)	(26.347)	(8.577)
Effect of democracy after 25 years	8.419	-12.167	23.156	39.817	38.159	31.611	54.252	-58.625	-8.471
	(10.681)	(8.380)	(6.039)	(13.375)	(14.121)	(12.863)	(20.267)	(13.123)	(8.577)
Persistence of outcome process	0.738	0.926	0.864	0.864	0.791	0.952	0.928	0.993	0.343
	(0.020)	(0.012)	(0.012)	(0.012)	(0.017)	(0.008)	(0.013)	(0.001)	(0.030)
Exc. instruments F-stat.	21.7	27.7	43.7	21.5	31.8	12.1	10.4	26.3	28.6
Hansen p-value	[0.29]	[0.06]	[0.22]	[0.09]	[0.69]	[0.09]	[0.12]	[0.02]	[0.84]
Observations	5,640	3,871	4,670	5,714	4,489	3,710	2,879	6,057	5,619
Countries in sample	168	107	149	171	130	164	156	172	170

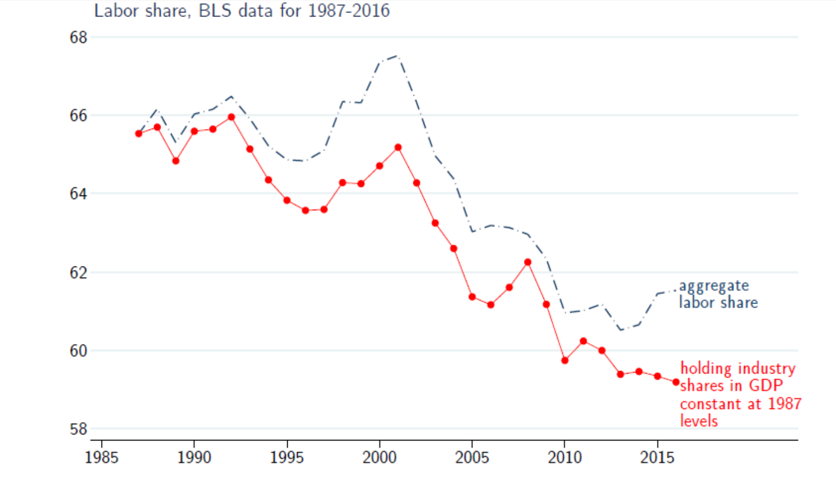
Summary

- A range of different strategies yield positive and large effects of democracy on future GDP per capita, indicating roughly that a country that democratizes becomes 20-30% richer than it would otherwise be in the next 20 years.
- This effect does not appear to be related to other confounding effects or country-specific trends potentially impacting both democracy and growth.
    - But important to control for GDP dynamics (and of course country fixed effects).
    - We will see later that many "cross-country regressions" do not do this, sometimes leading to unreliable or unstable results.

Other Major Issues

- Big changes in the structure of growth and distribution in industrialized economies over the last four decades.
  1. Large changes in the labor share of national income.
  2. Huge increases in inequality.
  3. Productivity slowdown (while some people think we are living in the most innovative age of human history).

Labor Share Declines: The US



Labor Share Declines: Quite Pervasive across Countries

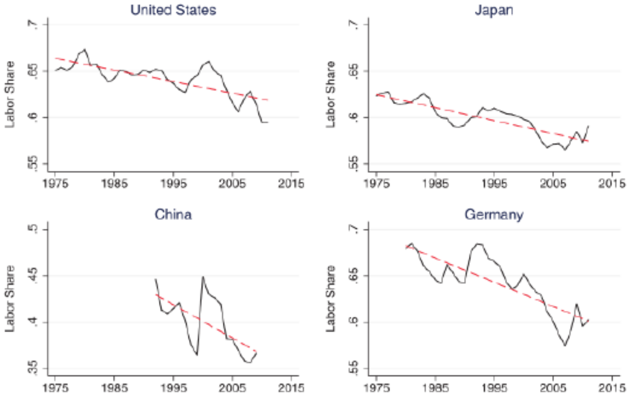
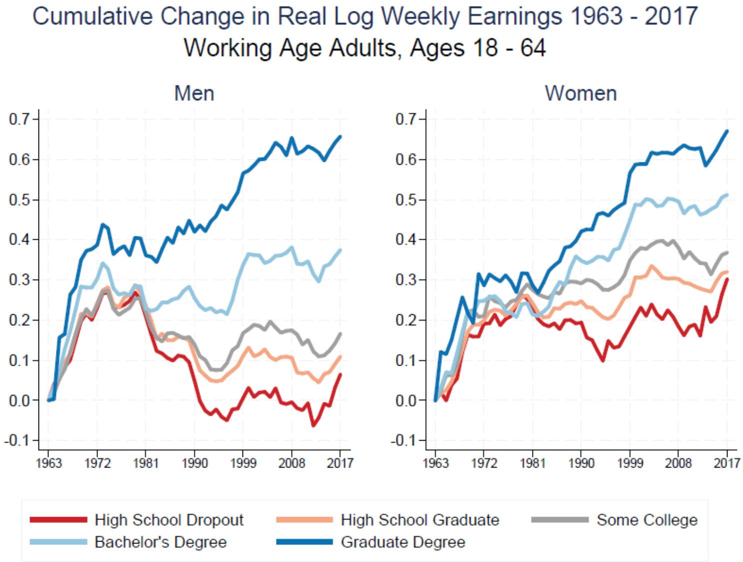


Figure II

Declining Labor Share for the Largest Countries

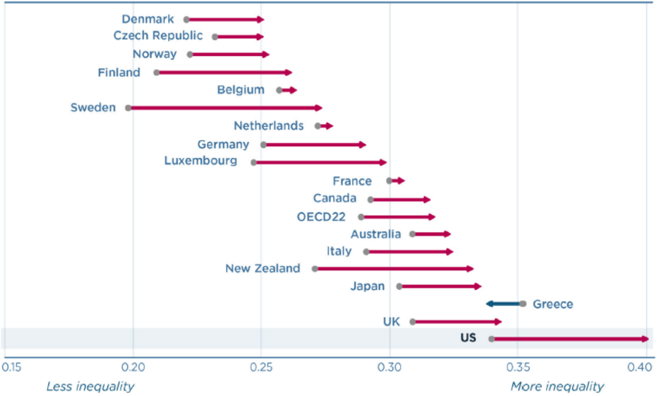
figure shows the labor share and its linear trend for the four largest economies in the world from 1975.

Surge in Inequality: The US



Surge in Inequality: Other Countries

Figure 1: Change in Gini coefficient, 1985 to 2013

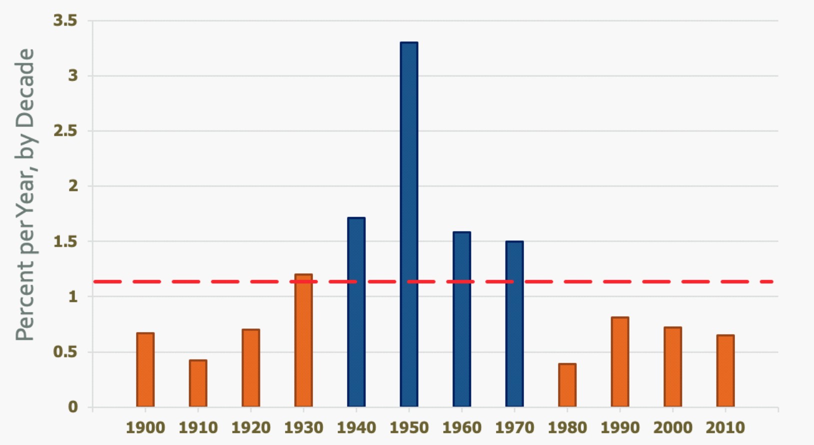


Note: 1985 data refer to 1985 or closest available year. 2013 data refer to 2013 or nearest available year. The Gini coefficient measures how equally income is distributed across a population, from 0 (perfectly equal) to 1 (all income to one person).

Source: Organization for Economic Cooperation and Development (OECD), "In It Together: Why Less Inequality Benefits All."

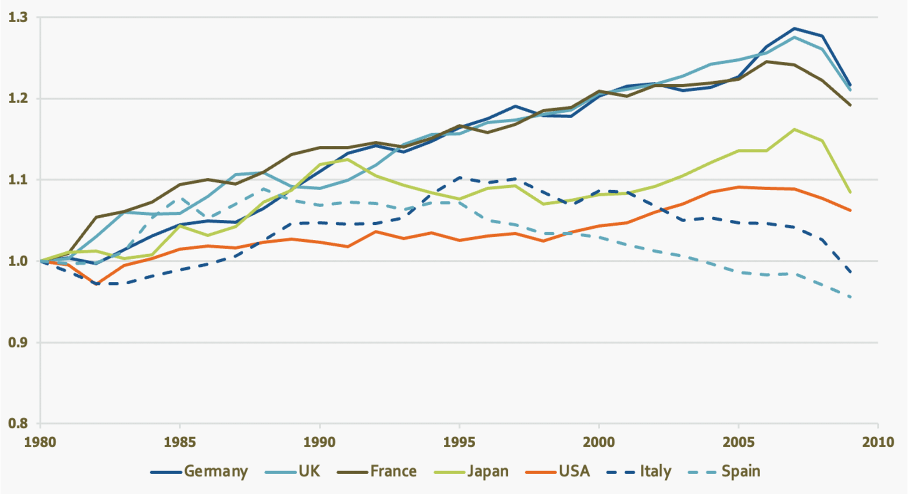
Productivity Slowdown: The US

- US TFP trends—annualized TFP growth across decades, US non-farm private business sector (Gordon, 2018):



Productivity Slowdown: Other Countries

- TFP growth since 1980 across selected OECD countries:



Rest of the Course

- In the rest of the course, we will introduce several workhorse models of economic growth used in macroeconomics and other fields more broadly (as well as some applications of techniques of dynamic economic analysis utilized even more widely).
- Three objectives:
  - Build practice and skills in the analysis of dynamic economic models.
  - Obtain intuition and insight about sources and causes of differences in long run economic performance across countries and changes in growth patterns.
  - Start thinking about how to map some of these ideas to data and perhaps reinterpret the data (when necessary).