Some Topics in Economic Growth

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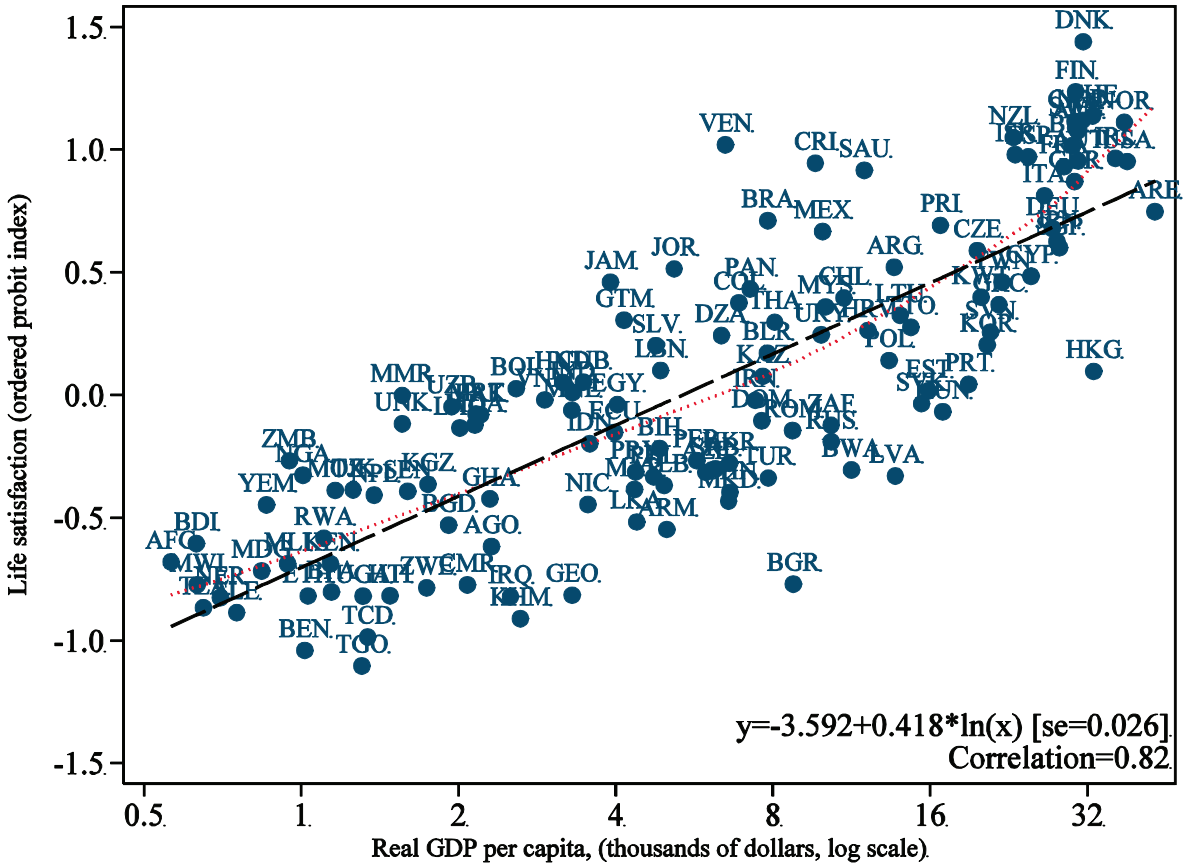
Is economic growth important?

- Economic growth is defined as the growth of the (real) GDP.
- We always look at GDP as the primary object of macroeconomic study and macroeconomic policies.
  - Economic growth is measured by the growth of (per-capita) GDP.
  - Business cycles are defined by the fluctuations in GDP.
  - We tend to implicitly make the judgment that "high GDP is good."
- Why?

Is economic growth important?

Figure 4. Life Satisfaction and Real GDP per Capita: Gallup World Poll



Source: Stevenson and Wolfers (2008), from WP version.

- GDP is related to something we care about, for example, happiness.
- But why?

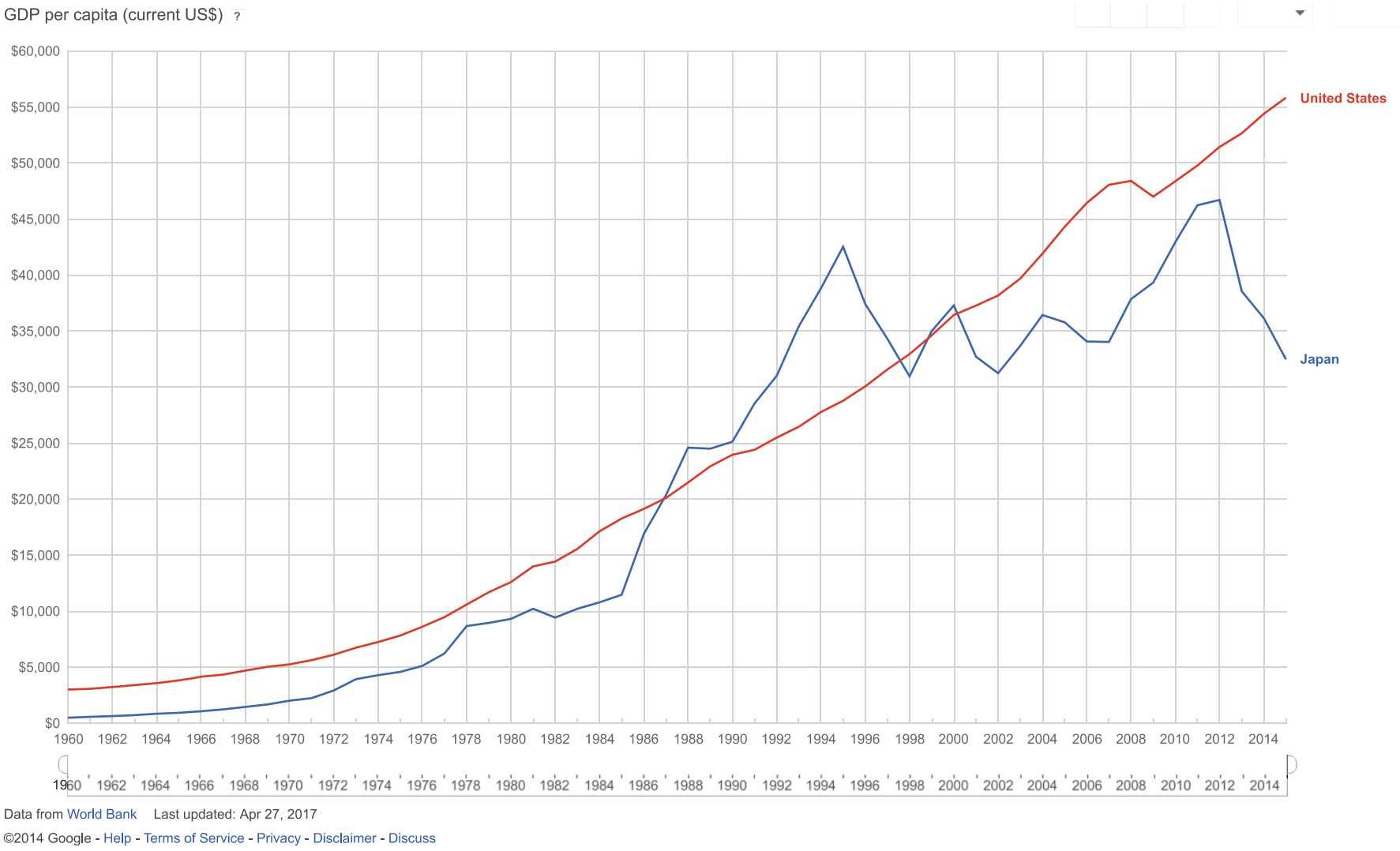
Is economic growth important?

- GDP equals income. Income equals consumption and saving. High income enables high level of consumption. Saving is future consumption. If happiness comes from consumption, GDP is linked to welfare. (There is a theoretical foundation for this—see Weitzman 2003).
- High income (probably) means you don't have to work very hard and enjoy leisure. Consumption and leisure are the usual ingredients of utility function (Jones and Klenow 2011).
- GDP measures the value added traded in the market. What is special about trading in the market, as opposed to household production or gift exchanges with neighbors? Perhaps because in the market a higher degree of division of labor can be achieved?

Is economic growth important?

- Other possible reasons why GDP is correlated with happiness.
  - Low unemployment during the period of high GDP may itself be valuable—the joy of "self-realization" by having a job.
  - Wealthier is healthier and live longer (Pritchett and Summers 1996).
  - Higher education may itself be valuable.
  - Democracy, freedom, etc. may themselves be valuable.
  - These things are a bit difficult to quantify (but still worthwhile thinking).
- The basis for our implicit judgment lies in how GDP is translated into happiness at the individual level.

Real per capita GDP: US versus Japan



The "magic" of natural log transformation

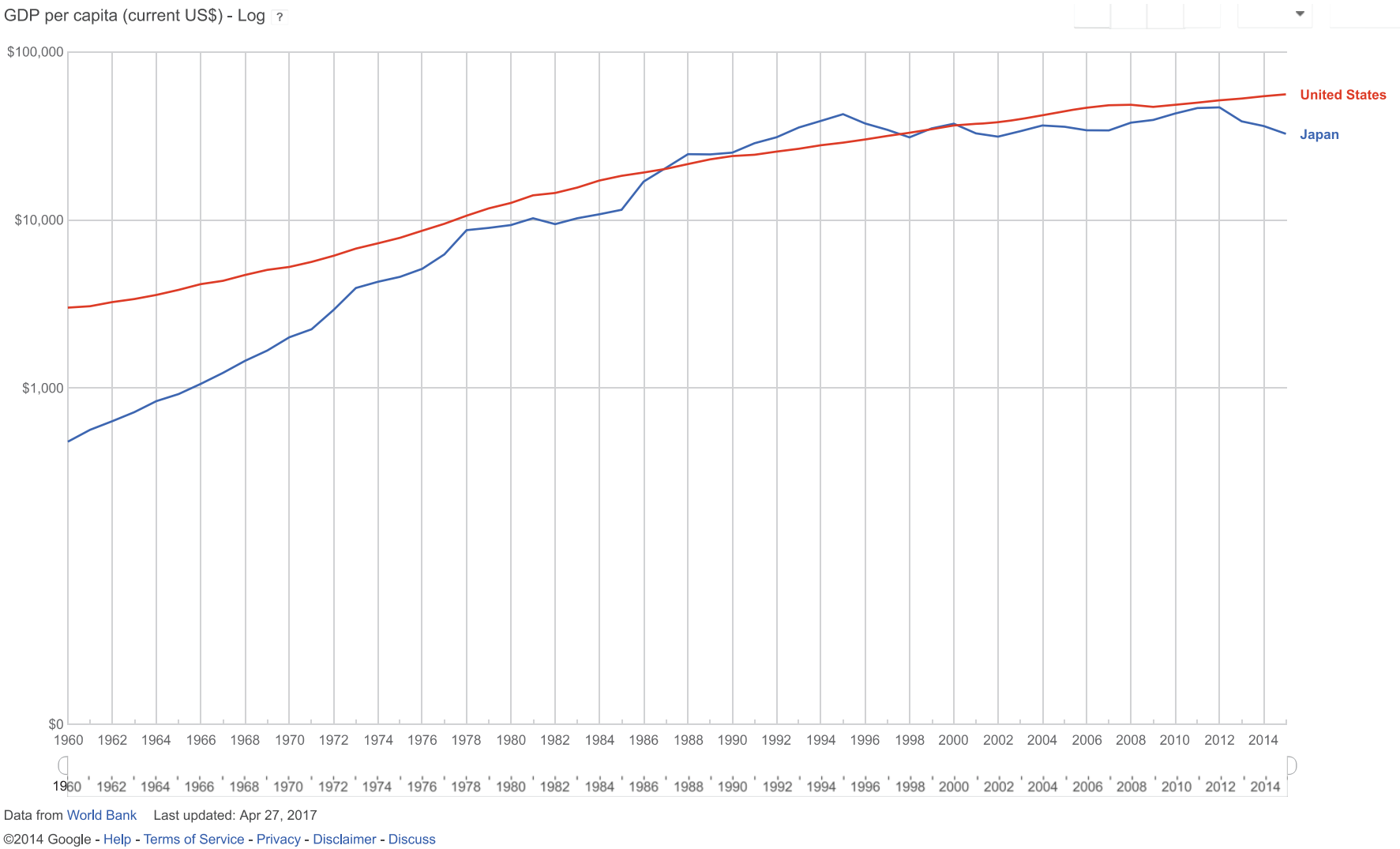
- Consider a variable $X(t)$ that varies over time.
- Let $\dot{X}(t) \equiv dX(t)/dt$ be the slope of $X(t)$ with respect to t.
- Then the growth rate of $X(t)$ is represented as $\dot{X}(t)/X(t)$.
- Two facts:
  - The derivative of a composite function: when $y = f(x)$ and $z = g(y)$, $dz/dx = dg(f(x))/dx = g'(f(x)) \cdot f'(x)$.
  - $d\log(x)/dx = 1/x$.

$\Rightarrow$

$$\frac{d\log(X(t))}{dt} = \frac{d\log(X)}{dX}\bigg|_{X=X(t)} \frac{dX(t)}{dt} = \frac{1}{X(t)}\dot{X}(t) = \frac{\dot{X}(t)}{X(t)}.$$

- Thus, transforming a time series by the natural log function and looking at the slope, we can analyze the growth rate.
- For example, if the slope is constant in a graph with log vertical axis, it means that the growth rate is constant.

Real per capita GDP: US versus Japan (log scale)



Background

- Consider the Neoclassical production function:

$$Y(t) = A(t)K(t)^{\alpha}L(t)^{1-\alpha},$$

where $Y(t)$ is GDP, $K(t)$ is capital stock, and $L(t)$ is labor. $A(t)$ is the total factor productivity (TFP).

- Per capita GDP can be expressed as

$$\frac{Y(t)}{L(t)} = A(t)\left(\frac{K(t)}{L(t)}\right)^{\alpha}.$$

(Sometimes called the "development accounting.") Thus, it consists of two parts: $A(t)$ and $K(t)/L(t)$.

Growth accounting

- One method of decomposing the factors of economic growth is the growth accounting.
- Using the natural log,

$$\begin{aligned}\log(Y(t)) &= \log(A(t)K(t)^{\alpha}L(t)^{1-\alpha}) \\ &= \log(A(t)) + \alpha\log(L(t)) + (1-\alpha)\log(K(t)).\end{aligned}$$

- Using the previous results,

$$\frac{\dot{Y}(t)}{Y(t)} = \frac{\dot{A}(t)}{A(t)} + \alpha\frac{\dot{K}(t)}{K(t)} + (1-\alpha)\frac{\dot{L}(t)}{L(t)}.$$

Thus we can decompose the GDP growth into the contributions of technology, capital, and labor. In practice, we use this equation to measure $\dot{A}(t)/A(t)$ for a given α.

Growth accounting

	GDP growth (%)	TFP cont.	K cont.	L cont.
1960–70	4.0	1.9	0.8	1.2
1970–80	2.7	0.2	0.9	1.5
1980–90	2.6	1.0	0.8	0.7
1960–90	3.1	1.1	1.2	0.9

(Source: Jones (1998))

Background

- Various empirical studies have attributed a large fraction of economic growth in advanced countries to the growth in A_t.
- Also the international income differences.
- Theoretically, in many growth models (Solow model, Ramsey model, and some endogenous growth models), the growth in A_t is the engine of growth.
- Thus, it is important to develop "the theory of TFP."

An empirical illustration

- A version of Baily, Hulten, and Campbell (1992) decomposition of industry productivity change

  Industry productivity growth
  $=$ Within firm growth
  $+$Reallocation across existing firms ($+$ covariance term)
  $+$Entry and exit

- Foster, Haltiwanger, and Krizan's (2001) measurement of U.S. manufacturing plants productivity (1977-87): within 48%, reallocation 36%, and net entry 26%.

"Within": Innovation and technology adoption

- A firm can increase productivity by innovating and/or adopting new technologies.
- R&D-based endogenous growth theory:

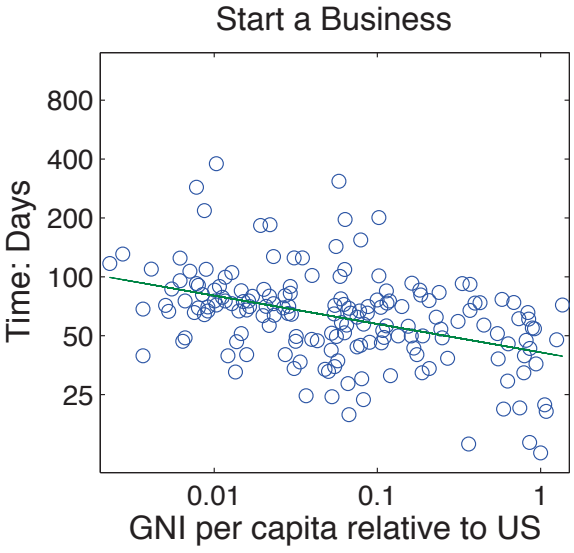
$$\frac{\dot{A}(t)}{A(t)} = f(\text{R\&D investment}).$$

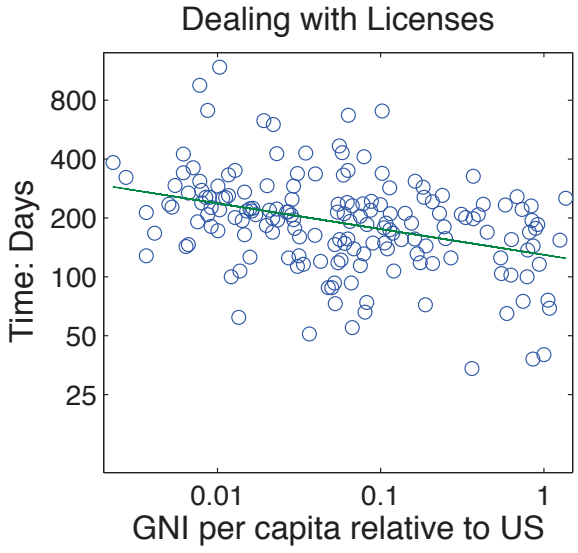
- Question: What influences the equilibrium R&D investment?
  - Human capital: Mukoyama (2004)
  - Institutions (property rights, contractual environment, etc.): Mukoyama and Popov (2016)
  - Market size: Rivera-Batiz and Romer (1991)
  - Competition: Mukoyama (2003)
  - Various policies, such as subsidies to R&D, patent policy
- How can we enhance innovation and adoption of new technologies?
- Role of firm organization, management, etc. Bloom et al. (2013)

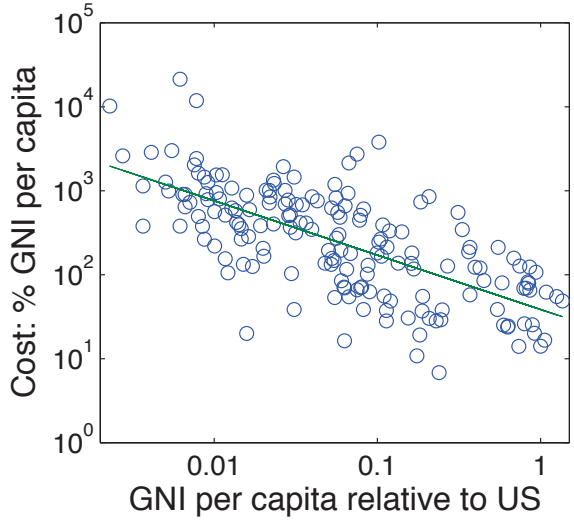
"Between": Reallocation

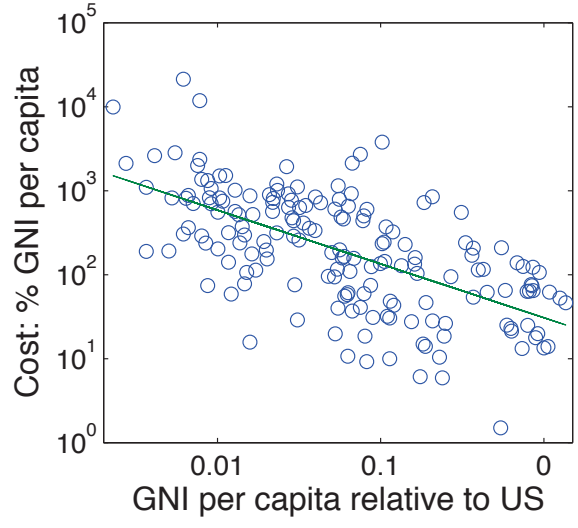
- Reallocation is important for productivity growth.
- But there are many countries that intentionally impose barriers to reallocation.
- Data: "Doing Business" dataset: `http://www.doingbusiness.org`
  - Measures various aspects of the ease of doing business.
  - Some are directly linked to the issue of reallocation, such as the procedures required to start a business, hiring and firing costs etc.
  - Example: in the U.S. it takes 6 days to register a firm. In Brazil, 119 days. In Suriname, 694 days.

Barriers to reallocation



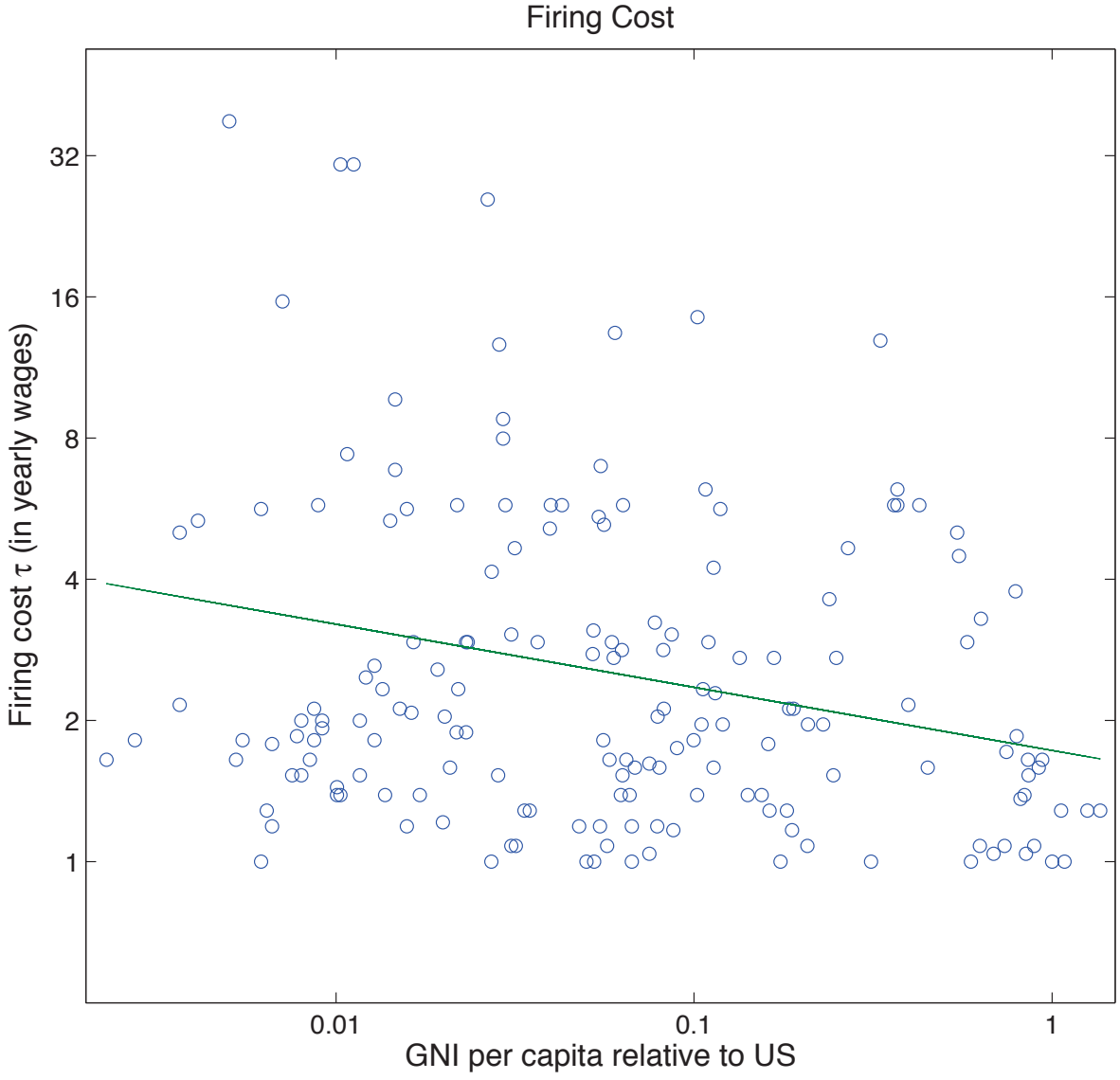






Source: Moscoso Boedo and Mukoyama (2012)

Barriers to reallocation



Source: Moscoso Boedo and Mukoyama (2012)

What are the consequences of these barriers?

- It seems that a high-barrier country corresponds to a poor country. One natural interpretation is that the barriers reduce productivity.
- Moscoso Boedo and Mukoyama (2012) build a Hopenhayn (1992)-style industry dynamics model with entry and exit, and evaluate the effect of entry costs and firing costs on aggregate productivity. Moving these costs from the U.S. level to the average level of low-income countries reduces the TFP by 27%–34%.
- Mukoyama and Osotimehin (2016) build an endogenous growth model with creative destruction, and evaluate the effect of firing taxes. The overall reallocation of labor is reduced by the firing taxes, and productivity falls in both *level* and *growth rate*.

Why do they impose these barriers?

- A large part of these costs are imposed by the government (many procedures to register a firm, for example).
- They seem like "bad policies," reducing the aggregate productivity and income.
- Then why do they impose these barriers?
- One reason: there is a subset of the economy who can gain from these policies.
  - Current incumbents gain from high entry costs.
  - Currently employed workers may gain from high firing costs.
- Mukoyama and Popov (2014) builds a political economy model where industry incumbents and potential entrants lobby for the level of entry barriers. There can be multiple steady states due to politics-economics feedback:large political power of incumbents $\rightarrow$ high entry barriers $\rightarrow$ large political power of incumbents.

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