

How does one grow an economy?



Recent “wisdom” on growth

2019:

- <http://www.worldbank.org/en/news/immersive-story/2019/01/08/storm-clouds-are-brewing-for-the-global-economy>

2020:

- <https://www.worldbank.org/en/publication/global-economic-prospects>
- <https://openknowledge.worldbank.org/bitstream/handle/10986/33044/211469-Ch01.pdf>

How can we think about economic growth and its determinants?

- Short run, middle run and long-run factors
- Not unlike growing crops
- Factors:
 - type of seeds, soil, geography
 - Labour, fertilizers, weeding, pruning,
 - Weather, rain, sun, insects etc..
 - Prices (output, inputs), etc..
- All these factors matter, though their importance may matter depending on the time and frequency

How can we think about economic growth and its determinants?

- Short run, middle run and long-run factors also exist when thinking of economic growth:
- “Long-run” factors: Production function, technology, inputs (fixed and variables), institutions
- “Middle run” factors: trade, governance, regulations, private sector, structural elements
- “shorter run”: prices (inflation, exchange rates, taxes, etc..), trading partners, investments, budgets.
- All these factors matter, though their importance may matter depending on the time and frequency

How can we think about economic growth and its determinants?

- First, let's think of growth modeling.
- 1) Neo-classical growth model: the Solow Growth model
- 2) Endogenous Growth: i.e. technological progress is not exogenous: Romer and the role of knowledge
- 3) Testing models with the empirical reality.
- Not easy to do, both in the long-term and short-term: No magic solution.

How can we think about economic growth and its determinants?

- Growth modeling:
- 1) Production function
- 2) factors of production: inputs
- 3) Assumptions about the factors of production
- 4) What happens in equilibrium?
 - What is the equilibrium?
 - How does it change with changes in parameters
- 5) What are the implications of the theory for empirical analysis?



DEVELOPMENT ECONOMICS

GÉRARD ROLAND



ALWAYS LEARNING

Chapter 4

Economic Growth

PEARSON

INTRODUCTION

- *Economic growth* measures only growth in economic production.
- *Economic development* measures overall improvements in living standards and in the quality of life.
- Economic development cannot take place without economic growth.
- What are the *determinants* of economic growth?
- Why are some countries rich and others poor?
- *Capital accumulation* only explains part of the differences in economic growth across countries.
- Recently, economists have been paying special attention to the role of determinants like *geography and institutions*.

Let's go back to ECON 313 material

- Prof. Chemin's slides

GROWTH AND FACTORS OF PRODUCTION: some terms

Factors of Production

- A firm generates output by combining *factors of production* (e.g. labor, capital, land) to produce output.
- To what extent do more primary factors such as *labor* and *capital* allow for more production?
- *Intermediate inputs*, like raw materials, are not part of the “*value added*” by a firm. More specifically, to avoid double counting, *value added* is defined as the value of output minus the value of inputs.
- *GDP* (the most common measure of production in an economy) equals the sum of value added across the economy.
- To a large extent, the *productivity* of each factor depends on the quantity of the other factor.
- *Factor abundance* is the relative availability of the different factors of production. Which factor of production is more abundant in developed economies? In developing economies?

GROWTH AND FACTORS OF PRODUCTION

The Production Function

- The *production function* is an equation of the joint effect of the factors of production on output:

$$Y_t = F(K_t, L_t) \quad (1)$$

- The Cobb-Douglas production function:

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha} \quad 0 \leq \alpha \leq 1 \quad (2)$$

- K_t is the *stock of capital* at year t , L_t the amount of labor and Y_t output (e.g., GDP). A_t is a scale factor that links units of labor and capital to dollars of output.
- This production function exhibits *constant returns to scale*. (e.g., if we multiply each factor of production by a number, output is also multiplied by that number).
- *Increasing/decreasing returns of scale*: If labor and capital are multiplied by x , then output is multiplied by *more/less* than x .

GROWTH AND FACTORS OF PRODUCTION

Factor productivity

- *Factor productivity* measures the contribution of each factor of production to output.
- *Average labor productivity* is obtained by dividing national output by total employment in the economy:

$$\frac{Y_t}{L_t} = A_t K_t^\alpha L_t^{1-\alpha} = A_t \left(\frac{K_t}{L_t} \right)^\alpha \quad (3)$$

- K_t / L_t is known as *capital intensity*, (i.e., the amount of capital per worker)

GROWTH AND FACTORS OF PRODUCTION

- *Marginal productivity* is the increase in output caused by an additional unit of labor or capital.
- The *marginal productivity of labor* is:

$$MPL = \frac{\partial Y_t}{\partial L_t} = A_t K_t^\alpha (1 - \alpha) L_t^{1-\alpha-1} = (1 - \alpha) A_t \left(\frac{K_t}{L_t} \right)^\alpha \quad (4)$$

- The *marginal productivity of capital* is:

$$MPK = \frac{\partial Y_t}{\partial K_t} = A_t \alpha K_t^{\alpha-1} L_t^{1-\alpha} = \alpha A_t \left(\frac{L_t}{K_t} \right)^{(1-\alpha)} = \alpha A_t \left(\frac{K_t}{L_t} \right)^{-(1-\alpha)} \quad (5)$$

- Note both labor and capital exhibit *diminishing marginal productivity* (factors are in the denominators).
- Also, the *MPL with respect to capital* is positive. Adding an extra worker in a highly mechanized firm adds more output than adding the same worker in a less mechanized firm. Adding more mechanization makes existing workers more productive.

GROWTH AND FACTORS OF PRODUCTION

Factor Shares

- *Factor shares* are the proportions of national income used to pay for the capital and labor in production.
- In theory, in a competitive economy a factor is paid its marginal productivity. Labor will be added as long as the MPL exceeds the *wage* rate. Capital will be added as long as the MPK is higher than the *opportunity cost* of capital, the *interest rate*.
- Thus, $MPL = W$ and $MPK = R$.
- A *useful result* from the *Cobb-Douglas* production function is that, in equilibrium, the factor shares are:

$$\frac{MPK.K_t}{Y_t} = \alpha \qquad \frac{MPL.L_t}{Y_t} = (1 - \alpha)$$

- In advance economies the share of capital is about 1/3 of total income while the share of labor is approximately 2/3.

GROWTH AND FACTORS OF PRODUCTION

Growth Accounting

- **Growth accounting** estimates the percentage of an economy's growth rate that can be explained using the growth rate of the labor force, the growth rate of the capital stock, and *residual factors*.
- In the Cobb Douglas function, replace A_t with e^{at} to assume that A_t growth at constant rate a over time:

$$Y_t = e^{at} K_t^\alpha L_t^{1-\alpha} \quad (9)$$

- Take logs of both sides:

$$\text{Log } Y_t = at + \alpha \log K_t + (1 - \alpha) \log L_t \quad (10)$$

- Differentiate wrt time to obtain growth rates:

$$\frac{d \log Y}{dt} = a + \alpha \frac{d \log K_t}{dt} + (1 - \alpha) \frac{d \log L_t}{dt} \Rightarrow$$
$$g_Y = a + \alpha g_K + (1 - \alpha) g_L$$

GROWTH AND FACTORS OF PRODUCTION

$$g_y = a + \alpha g_K + (1-\alpha) g_L$$

- *Growth in national output* is decomposed among:
 1. the growth rate of capital multiplied by weight (factor share) α
 2. the growth rate of labor multiplied by weight $(1-\alpha)$
 3. Parameter a , the *growth rate of total factor productivity (TFP)*
- Example: China between 2000 and 2005 where average $g_y = 9.5$, $\alpha = .5$, $g_K = 12.6$, and $g_L = 1.0$. Therefore, TFP:
$$9.5 - (.5 * 12.6) - (.5 * 1) = 2.7$$
- TFP is defined as the part of an economy's growth rate that *cannot be explained with the growth of labor and capital stock*.
- TFP is often associated with *technological progress*, but may also be due to other things, such as *institutional reforms*.
- TFP usually explains a big share of an economy's growth rate, and is the *biggest source of variation* for cross-country growth differences.

How can we think about economic growth and its determinants?

- Growth modeling:
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- 2) factors of production: inputs
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 - What is the equilibrium?
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THE NEO-CLASSICAL SOLOW GROWTH MODEL

- "*Neoclassical*" *growth model* assumes competitive markets and a diminishing marginal product of capital.
- Links production function with *savings, investment, population growth, and technical change*
- Divide both sides of Cobb Douglas function by L_t :

$$Y_t/L_t = A K_t^\alpha L_t^{(1-\alpha-1)} = A (K_t/L_t)^\alpha$$

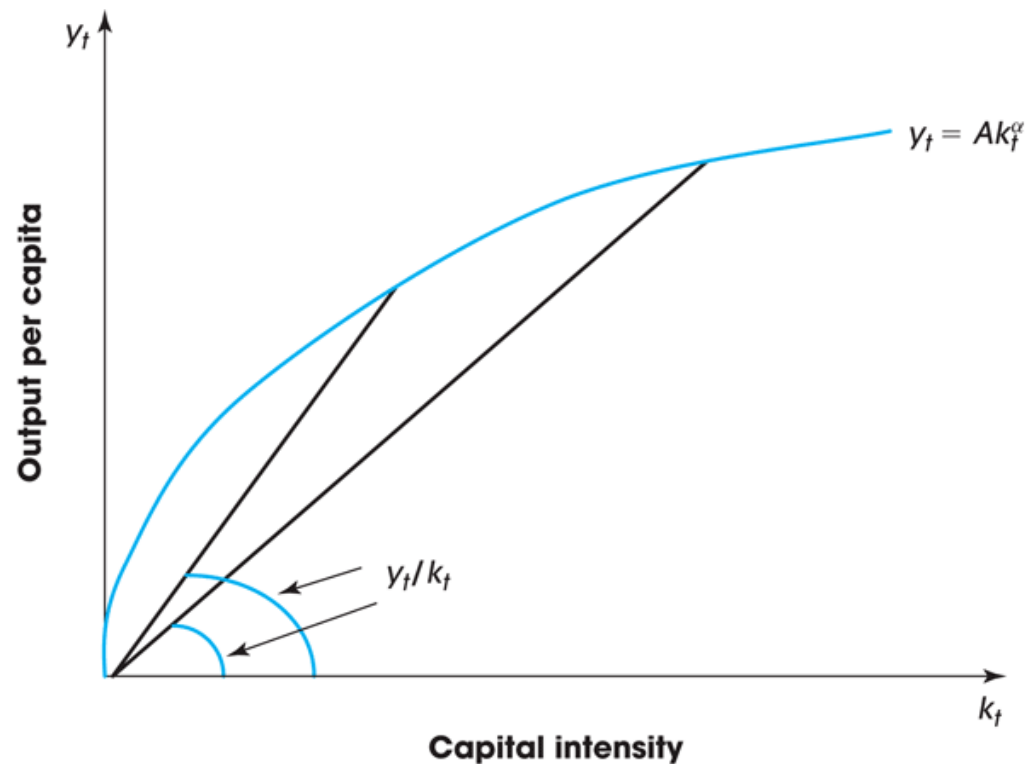
or, if $y_t = Y_t/L_t$ and $k_t = K_t/L_t$ the above is expressed:

$$y_t = A k_t^\alpha \quad (11)$$

- Labor productivity increases with capital intensity, or, in other words, at a given labor force *income per capita increases with capital accumulation*.

THE NEO-CLASSICAL SOLOW GROWTH MODEL

Figure 4.1. The Solow Model.



Output per capita y_t is expressed as a function of capital intensity (capital per worker). The slope y_t/k_t represents average productivity of capital. This slope decreases as capital intensity increases, meaning that average capital productivity decreases as capital intensity increases.

How can we think about economic growth and its determinants?

- Growth modeling:
- 1) Production function
- 2) factors of production: inputs
- 3) Assumptions about the factors of production
- 4) What happens in equilibrium?
 - Two types of equilibrium?
 - 1) in a given period: macro identities
 - 2) over time: steady state

THE NEO-CLASSICAL SOLOW GROWTH MODEL: equilibrium in given period

- National Income is allocated between *consumption* and *saving*:

$$Y_t = C_t + S_t \quad (12)$$

- Define savings rate (s) where:

$$S_t = s Y_t \quad (13)$$

- Capital stock increases through *capital investment* (assuming δ is *depreciation* rate):

$$I_t = K_{t+1} - K_t + \delta K_t \quad (14)$$

$$K_{t+1} = (1 - \delta)K_t + I_t \quad (14)'$$

- Assume closed economy (no trade) and no government, then:

$$Y_t = C_t + I_t \quad \text{so} \quad I_t = S_t \quad (15 \text{ and } 16)$$

- When an economy is in *macroeconomic equilibrium*, then

$$S_t = sY_t = I_t = K_{t+1} - K_t + \delta K_t \quad (17)$$

- Rearranging terms to find *capital accumulation*:

$$K_{t+1} = (1 - \delta) K_t + sY_t \quad (18)$$

THE NEO-CLASSICAL SOLOW GROWTH MODEL: equilibrium over time

- Labor increases with the population growth rate of n :

$$L_t = L_{t-1} (1 + n) \quad (19)$$

- Divide capital stock equation by L_t :

$$K_{t+1}/L_t = (1-\delta) K_t/L_t + sY_t/L_t \quad (20)$$

- Replacing notation:

$$(1 + n) k_{t+1} = (1-\delta) k_t + sA k_t^\alpha \quad (21)$$

- Capital intensity in period $t+1$ is a function of capital intensity in the previous period, the savings rate (+), the depreciation rate (-), and the population growth rate (-).
- Relationship between left and right of (21) are shown in Figure 4.2 and by the "**steady state**" equation:

$$k^* = \left(\frac{sA}{n + \delta} \right)^{\frac{1}{1-\alpha}} \rightarrow y^* = \frac{1}{A^{1-\alpha}} \left(\frac{s}{n + \delta} \right)^{\frac{\alpha}{1-\alpha}} \quad (22)$$

THE NEO-CLASSICAL SOLOW GROWTH MODEL: equilibrium over time

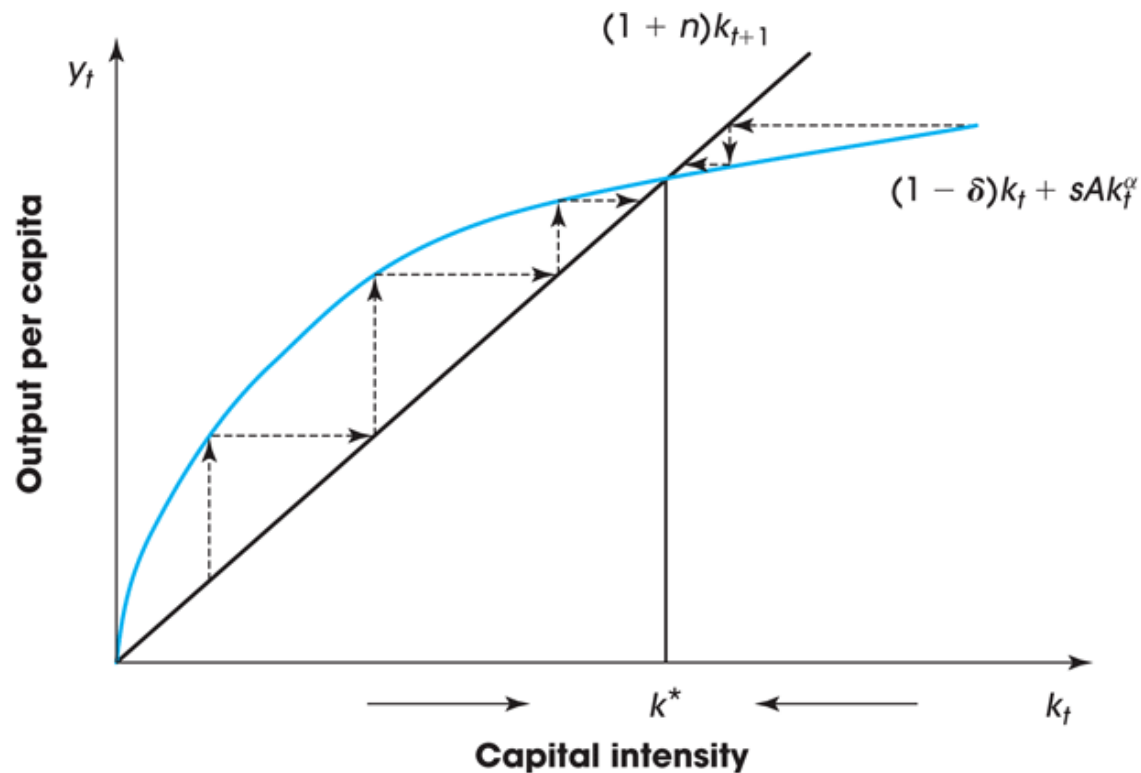
- Replacing notation:

$$(1 + n) k_{t+1} = (1 - \delta) k_t + sA k_t^\alpha \quad (21)$$

- Capital intensity in period $t+1$ is a function of capital intensity in the previous period, the savings rate (+), the depreciation rate (-), and the population growth rate (-).
- Assume we are at a given k_t at the end of the period
- What happens when left of equation (21) < right of (21) ?
 - k_{t+1} will increase
- What happens when left of equation (21) > right of (21) ?
 - k_{t+1} will decrease
- What happens when left = right? k_{t+1} does not change

THE NEO-CLASSICAL SOLOW GROWTH MODEL

Figure 4.2. Steady State in the Solow Model.



If capital intensity is below or above steady state capital intensity k^* , the economy adjusts and moves along the arrows, with output per capita and capital intensity varying until the steady state k^* is reached.

THE NEO-CLASSICAL SOLOW GROWTH MODEL

– The Steady State in the Solow Growth Model

- At given rates of savings, population growth, and depreciation, the steady state is reached where the *growth of capital intensity and productivity (income per capita) is zero.*
- *Transition growth paths:*
 - If $(1 + n) k_t > (1 - \delta) k_t + sA k_t^\alpha$ capital intensity falls, capital is *"diluted"* because total investment (savings) cannot overcome population growth and depreciation.
 - If $(1 + n) k_t < (1 - \delta) k_t + sA k_t^\alpha$ capital intensity rises because investment is high enough to overcome population growth and depreciation.
- The production function assumes *diminishing marginal product* of capital. Assuming similar functions, therefore, poor countries that start out with lower capital intensity have the *potential to grow faster than rich countries.*

THE NEO-CLASSICAL SOLOW GROWTH MODEL: equilibrium over time

- Steady state equilibrium is then found using equation 21 when
- $k_{t+1} = k_t = k^*$
- Use above in equation 21, solve for the steady state capital intensity. Once found, put the value into the production function and you will find the steady state output per capita:

(22)

$$k^* = \left(\frac{sA}{n + \delta} \right)^{\frac{1}{1-\alpha}} \rightarrow y^* = \frac{1}{A^{1-\alpha}} \left(\frac{s}{n + \delta} \right)^{\frac{\alpha}{1-\alpha}}$$

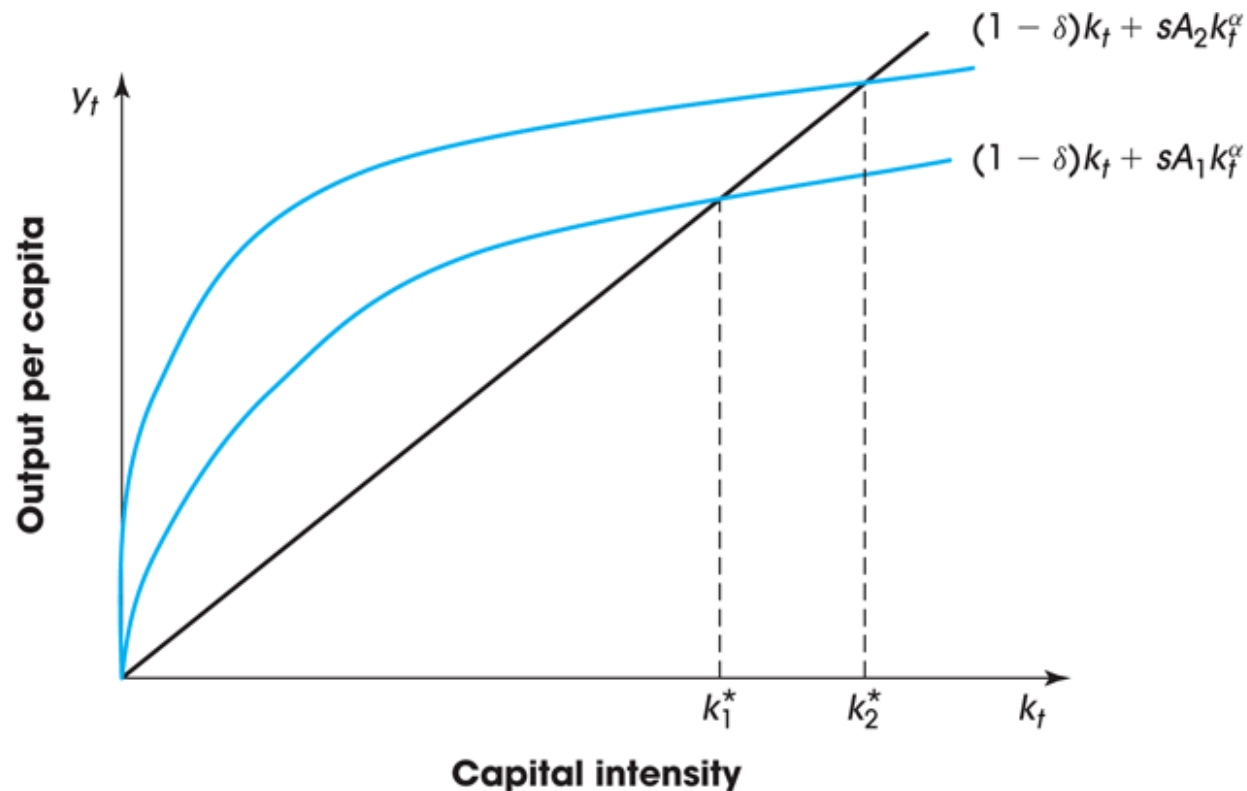
- Note Typo here y^* should be $= A^{(1/(1-\alpha))} (s / (n + \delta))^{\alpha/(1-\alpha)}$

THE NEO-CLASSICAL SOLOW GROWTH MODEL

- What drives per capita growth in the steady state if capital intensity k^* no longer changes?
- **Technological Progress and the Steady State**
 - Figure 4.3: An increase in TFP from A_1 to A_2 (represented by an *upward shift in the production function*) acts to increase capital intensity, and, therefore, output per person.
 - Absent new *TFP shocks*, the economy will settle into a new steady state at k^*_2
 - In the Solow Model, these *positive shocks to TFP* are usually thought of as *exogenous*.
 - The possibility of *new technology diffusion* increases the growth potential of developing economies.

THE NEO-CLASSICAL SOLOW GROWTH MODEL

Figure 4.3. Technological Progress in the Solow Model.



Technological progress in the economy leads to a shift from A_1 to A_2 , which leads to an increase in steady state capital intensity from k_1^* to k_2^* .

THE NEO-CLASSICAL SOLOW GROWTH MODEL

The Effect of Different Savings Rates

- An increase in the savings rate leads to an increase in per capita output in the steady state.
- Historically, many *high-savings Asian economies* also grew rapidly. High investment rates also encourage *adoption of new technology*.
- On the other hand, China, the Soviet Union, and other *centrally-planned economies* invested at a high rate, but growth sputtered as *government directed investment was often wasted*.
- In general, economists agree that while high rate of savings and investment is important, the *efficiency of investment* is just as important.

THE NEO-CLASSICAL SOLOW GROWTH MODEL **with Human Capital**

– Differences in Human Capital

- *Human capital* is the skills, talents, and knowledge embodied in the people (i.e. education).
- Modify the Solow Model to incorporate h , the level of human capital (*average years of schooling* for instance):

$$Y_t = AK_t^\alpha (hL_t)^{1-\alpha} = (Ah^{1-\alpha})K_t^\alpha L_t^{1-\alpha} \quad (23)$$

- And the steady state income per capita increases:

$$y^* = \left[(h^{1-\alpha})A \right]^{\frac{1}{1-\alpha}} \left(\frac{s}{n + \delta} \right)^{\frac{\alpha}{1-\alpha}} = hA^{\frac{1}{1-\alpha}} \left(\frac{s}{n + \delta} \right)^{\frac{\alpha}{1-\alpha}} \quad (24)$$

- Differences in *human capital can explain much cross-country variation* in growth and development, and human capital is a better predictor than investment rates.
- However, education does not account for a large part of growth variation, and some highly educated nations lag in development.
- Moreover, like most factors, the *direction of causality* between human capital and economic growth is unclear.

THE NEO-CLASSICAL SOLOW GROWTH MODEL: Implications

– Determinants of Growth

- *Physical Capital: Investment*
- *Human capital* is the skills, talents, and knowledge embodied in the people (i.e. education).
- Countries investing more in capital (both physical and human) will end up with higher capital intensity in steady state.
- Higher Capital intensity leads to higher income per labour.
- In steady state, the income grows at rate of labour force and the rate of human capital augmentation.
- To get additional growth, one needs some assumptions about TFP but this will be “outside” the model, i.e. exogenous

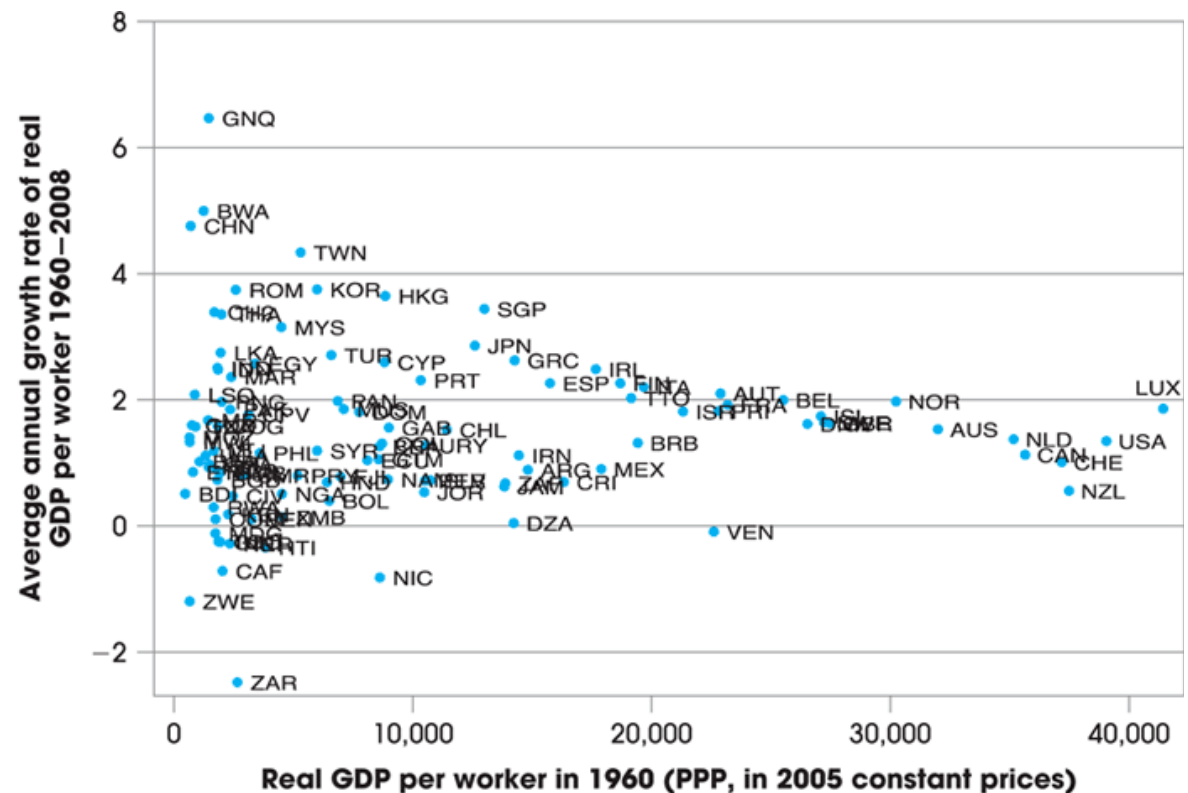
THE NEO-CLASSICAL SOLOW GROWTH MODEL

– Income Convergence

- The most important prediction of the Solow model is *income convergence*: poor countries should *catch-up* in terms of income per capita to rich countries.
- Assumes *all else being equal* (savings, depreciation, but especially similar production functions i.e., technology)
- A *greater marginal product of capital (return)* means that poor countries have the potential to grow faster than rich countries.
- There is *not much evidence of this convergence* in the data (Figure 4.4). Results, at best, are mixed. Some countries have successfully converged, others have drifted further behind.
- Most variation appears to be embodied in TFP (technology development and adoption) which is *exogenous to the Solow Model*. How can we *endogenously* explain differences in technological change across countries?

THE NEO-CLASSICAL SOLOW GROWTH MODEL

Figure 4.4. Growth of Income Per Worker (1960–2008) and 1960 Initial GDP Per Worker.



There is no negative relation between GDP per capita in 1960 and growth of GDP per capita between 1960 and 2008. If there were convergence, countries that were poorer in 1960 would have had higher rates of growth. On the contrary, poorer countries have had volatile growth, with some experiencing a lower growth than rich countries and some having a higher growth.

Source: Alan Heston, Robert Summers, and Bettina Aten, Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, May 2011: http://pwt.econ.upenn.edu/php_site/pwt_index.php.

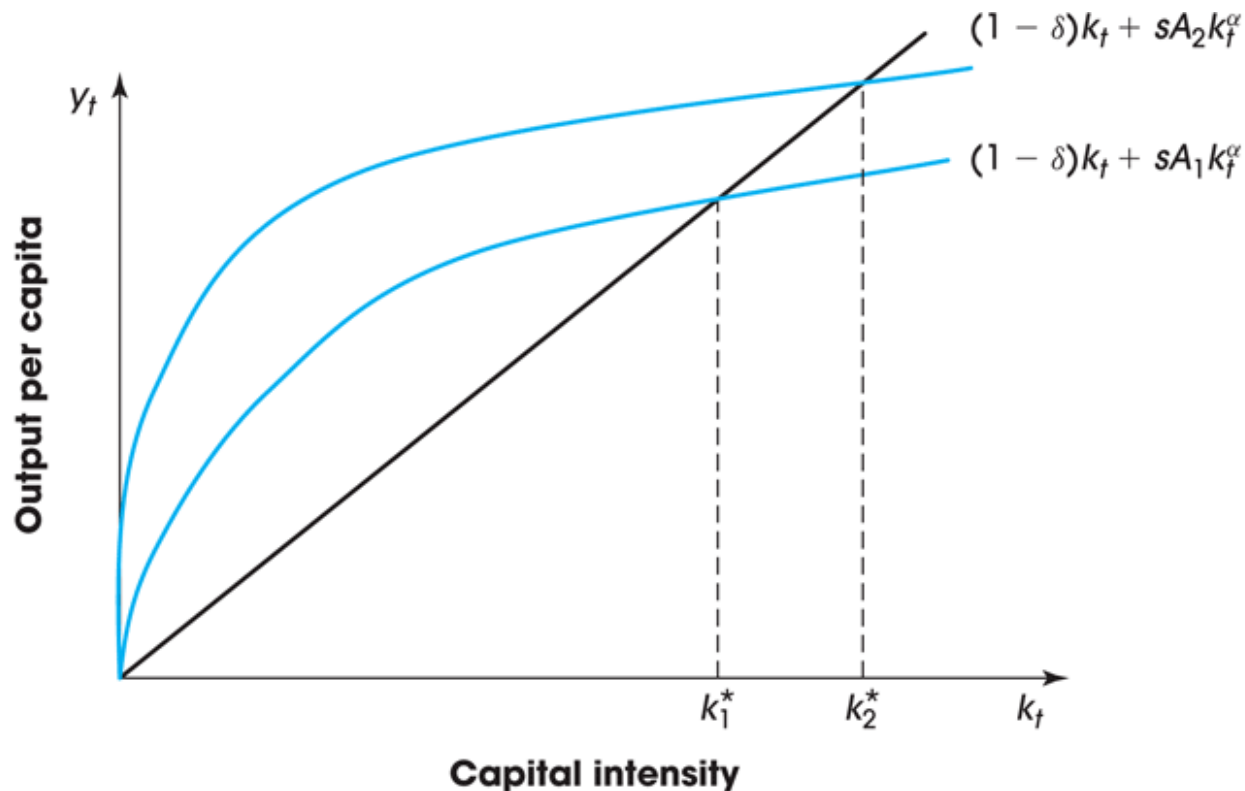
THE NEO-CLASSICAL SOLOW GROWTH MODEL: Implications

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THE NEO-CLASSICAL SOLOW GROWTH MODEL

Exogenous Technological Progress in the Solow Model: A goes up



Technological progress in the economy leads to a shift from A_1 to A_2 , which leads to an increase in steady state capital intensity from k_1^* to k_2^* .

ENDOGENOUS GROWTH THEORY

Endogenous growth theory suggests that growth is generated by *endogenous technical change* resulting from innovation.

Boundless Knowledge-Based Growth

- Assuming constant technological change, *potential for growth can be boundless* surmounting even limits to resources.
- Technology depends on *knowledge*, and the more knowledge there is in an economy, the higher the growth rate.
- Unlike human capital, human *knowledge* is not embodied in people but can be *transmitted across time and space*.
- Technology and knowledge develop through *economic incentives* communicated through *the market* and, sometimes, through government policy.
- Knowledge can *spillover, grow and accumulate indefinitely*. It is only constrained by the number of people producing it.

ENDOGENOUS GROWTH THEORY

– Knowledge as a Non-Rival Good

- Knowledge is a *non-rival good* and can still be consumed by the seller even after it is sold.
- Knowledge is also an *excludable good*. A seller can exclude others from its consumption.
- Enforced *property rights* (such as patents and copyrights), for example, prevent access to knowledge.
- Such exclusions can be important because people and firms need to have an incentives (*monopoly rents*) to invest in research and development.
- *Imperfect competition is necessary* to encourage growth. (Recall that the Solow model assumes perfect competition.)
- A *balance* must be struck between granting temporary *monopoly rights and promoting competition* over the long run.

ENDOGENOUS GROWTH THEORY

– Basic Equations of the Romer Model

- Labor is divided between the productive sector (Y) and the research sector (A):

$$L_t = L_{Yt} + L_{At} \quad (25)$$

where human capital is the *stock of knowledge* at time t (A_t) times productive labor L_{Yt} at time t.

- The production function:

$$Y_t = K_t^\alpha (A_t L_{Yt})^{1-\alpha} \quad (26)$$

- Since knowledge (A_t) depends on the allocation of labor to research, it is *endogenous* to the model and can vary over time.
- The increment of knowledge is given by the stock of knowledge multiplied by the labor force in the research sector and a parameter θ that can represent, say, the *efficiency of research*:

$$g_{At} = \Delta A_t / A_{t-1} = \theta * L_{At}$$

$$\Delta A_t = A_{t-1} \theta * L_{At}$$

ENDOGENOUS GROWTH THEORY

– Basic Equations of the Romer Model

- Why does one pay attention to knowledge? Because it might change the production function
- Under the Solow, we have production per labor to be

- $y_t = A k_t^\alpha$ With $\alpha < 1$

- But now depending on knowledge conditions, we have

- $y_t = A k_t^{\alpha+\beta}$

- With $\alpha + \beta$ could be less than 1, equal to 1 or even greater than 1, depending on knowledge production conditions (i.e. θ from the previous page).

ENDOGENOUS GROWTH THEORY

– The Romer Model: differences with Solow

- In the Romer Model, *imperfect competition is necessary* for innovation and growth, while the Solow model assumes perfect competition.
- *Innovation is endogenous* in the Romer model, depending on stock of knowledge and the R&D needed to build that knowledge. Innovation is exogenous in the Solow model.
- Romer predicts that rich countries should grow faster than poor countries because of a higher stock of knowledge (i.e., *divergence*). Solow predicts that countries with low capital intensity should grow faster (convergence).
- Note the basic Romer model *ignores possibilities of trade and technology transfer* between rich and poor countries.
- Are the protection of *intellectual property rights (IPR)* beneficial for poor countries?

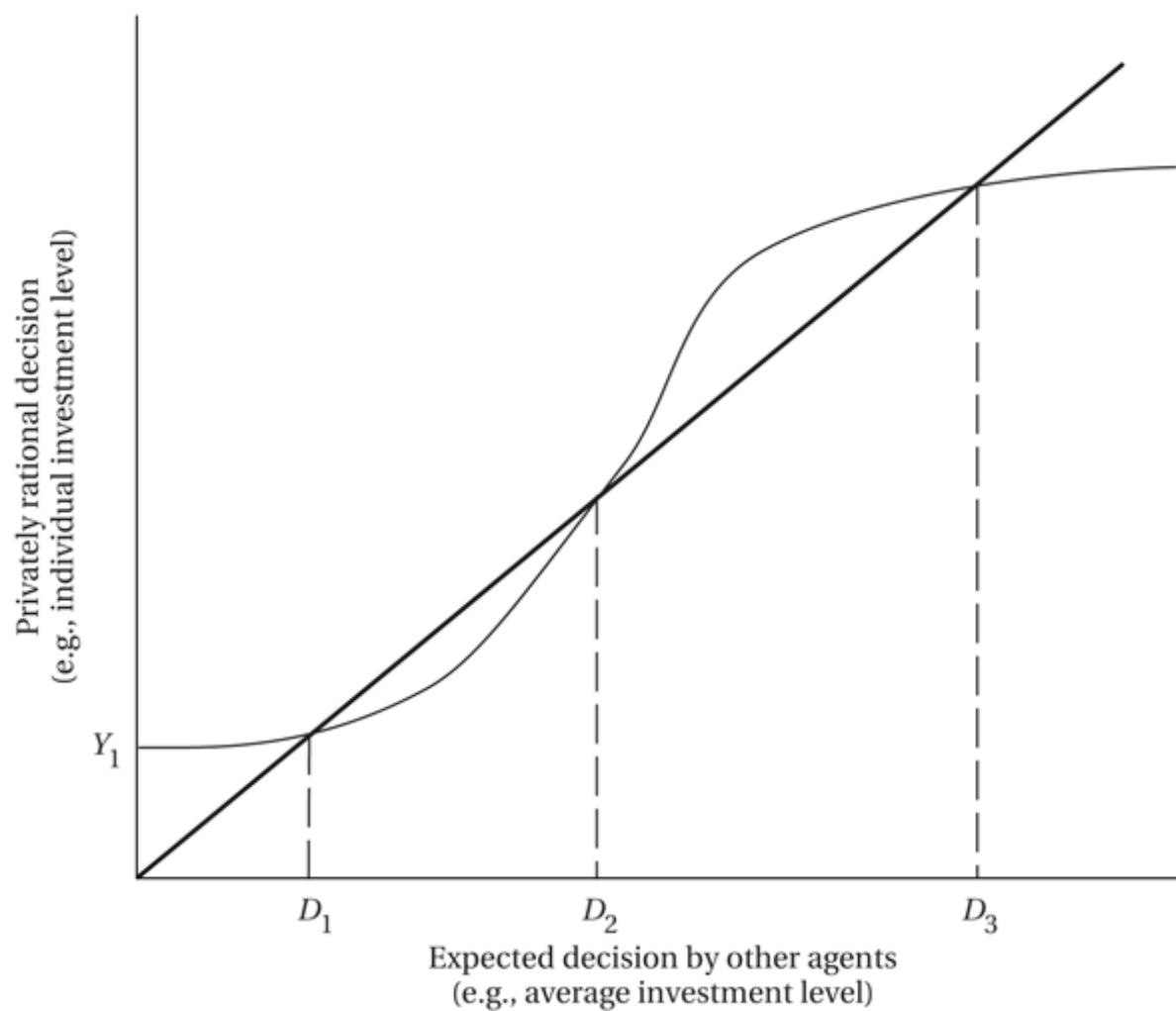
ENDOGENOUS GROWTH THEORY

- **The Romer Model is also about complementarities**
- **Complementarities in production: the level of skills of others influences your own.**
- **Actions of others influence your own and vice versa**
- **If so, then coordination can be important**
- **Coordination failures may arise**

Underdevelopment as a Coordination Failure

- A newer school of thought on problems of economic development
- Coordination failures occur when agents' inability to coordinate their actions leads to an outcome that makes all agents worse off.
- This can occur when actions are **complementary**, i.e.,
- Actions taken by one agent reinforces incentives for others to take similar actions
- This circumstance can, under some circumstances, lead to **multiple equilibria**

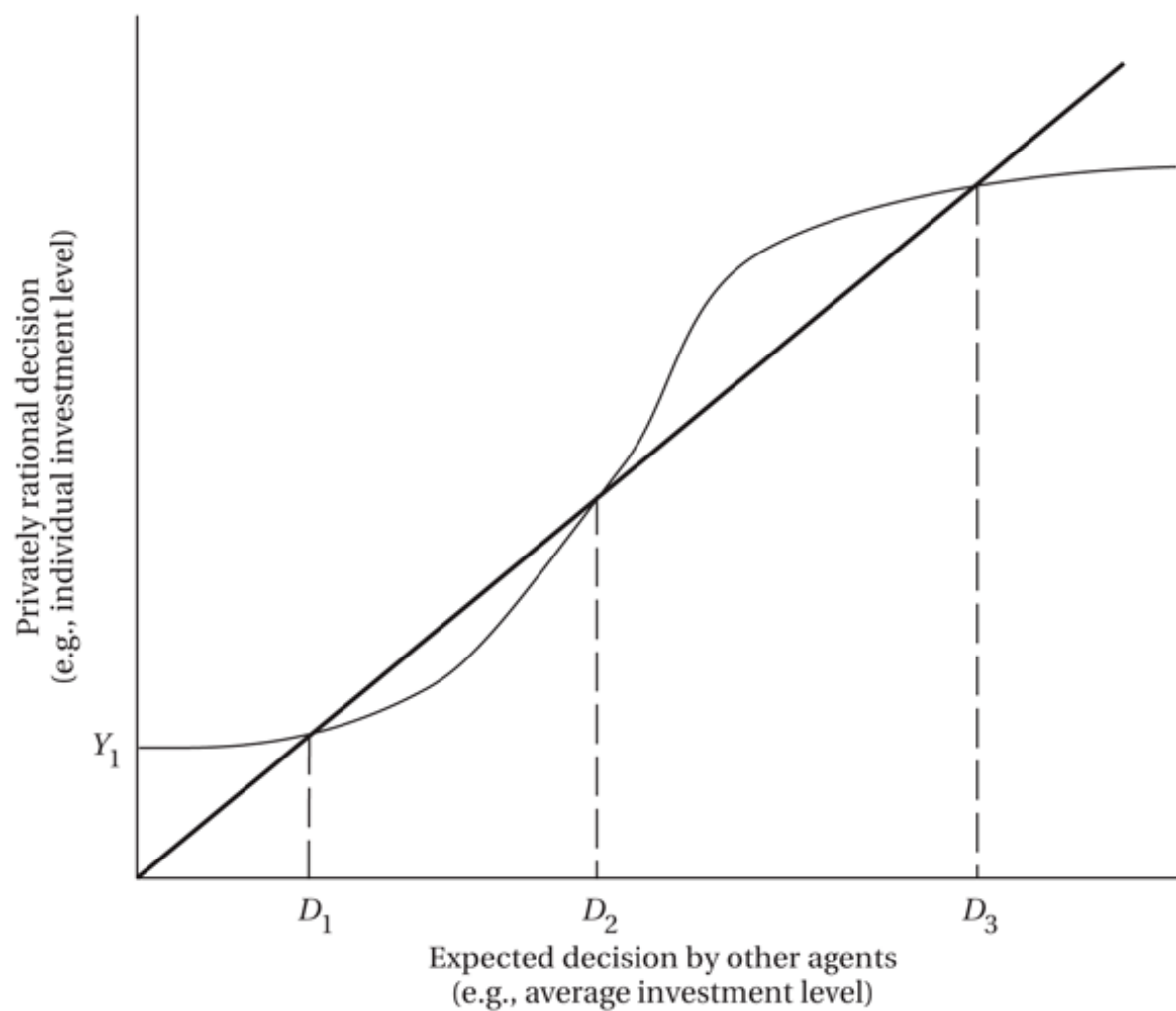
Multiple Equilibria



Multiple Equilibria: A Diagrammatic Approach

- Often, these models can be diagrammed by graphing an S-shaped function and the 45° line
- Equilibria are
 - Stable: function crosses the 45° line from above
 - Unstable: function crosses the 45° line from below

Multiple Equilibria



Starting Economic Development: The Big Push

- Sometimes market failures lead to a need for public policy intervention
- The Big Push:
- Conditions for Multiple Equilibria
- A big push may also be necessary when there are:
 - Intertemporal effects
 - Urbanization effects
 - Infrastructure effects
 - Training effects

Why the Problem Cannot be Solved by a Super-Entrepreneur

- Super Entrepreneur might be able to internalize the externalities
- But:
 - Capital market failures
 - Cost of monitoring managers- Asymmetric Information
 - Communication failures
 - Limits to knowledge
 - Lack of any empirical evidence that would suggest this is possible

In a Nutshell: Big Push Mechanisms

- Raising total demand
- Reducing fixed costs of later entrants
- Redistributing demand to later periods when other industrializing firms sell
- Shifting demand toward manufacturing goods (usually produced in urban areas)
- Help defray costs of essential infrastructure (a similar mechanism can hold when there are costs of training, and other shared intermediate inputs)

Besides big push, Further Problems of Multiple Equilibria

- Inefficient Advantages of Incumbency
- Behavior and Norms
- Linkages
- Inequality, Multiple Equilibria, and Growth

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH

What drives the main differences in economic growth between rich and poor countries?

- Output per worker (*labor productivity*) is highly correlated with long-term growth.
- Table 4.1: In 1988 Canada's productivity was about 94% of the U.S. level. The *capital-output ratio* (K/Y) and *TFP* (A) level were about the same between the countries. Most of the difference is explained by lower *human capital ratio* (H/L) in Canada.
- The same is generally true with West European economies.
- Between the developed and developing economies *differences in TFP seems to be the main factor.*
- What drives this difference in TFP?

Table 4.1. Decomposition of Productivity Differences (Ratios to the United States).

Country	Contribution from			
	Y/L	$(K/Y)^{\alpha/(1-\alpha)}$	H/L	A
United States	1.000	1.000	1.000	1.000
Canada	0.941	1.002	0.908	1.034
Italy	0.834	1.063	0.650	1.207
West Germany	0.818	1.118	0.802	0.912
France	0.818	1.091	0.666	1.126
United Kingdom	0.727	0.891	0.808	1.011
Hong Kong	0.608	0.741	0.735	1.115
Singapore	0.606	1.031	0.545	1.078
Mexico	0.433	0.868	0.538	0.926
Argentina	0.418	0.953	0.676	0.648
USSR	0.417	1.231	0.724	0.468
India	0.086	0.709	0.454	0.267
China	0.060	0.891	0.632	0.106
Kenya	0.056	0.747	0.457	0.165
Zaire (today Congo)	0.033	0.499	0.408	0.160
Average, 127 Countries	0.296	0.853	0.565	0.516
Standard Deviation:	0.268	0.234	0.168	0.325

Differences in measures of accumulation of physical and human capital explain only a small part of the differences in output per worker between the poorest countries in the world and the United States. The largest discrepancy is explained by differences in total factor productivity.

Source: Robert E. Hall and Charles I. Jones, "Why Do Some Countries Produce So Much More Output per Worker than Others?" *The Quarterly Journal of Economics* 114, no. 1 (1999): 91.

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH

What drives the main differences in economic growth between rich and poor countries?

- Output per worker (*labor productivity*) is highly correlated with long-term growth.
- Table 4.1: In 1988 Canada's productivity was about 94% of the U.S. level. The *capital-output ratio* (K/Y) and *TFP* (A) level were about the same between the countries. Most of the difference is explained by lower *human capital ratio* (H/L) in Canada.
- The same is generally true with West European economies.
- Between the developed and developing economies *differences in TFP seems to be the main factor*.
- What drives this difference in TFP?

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH

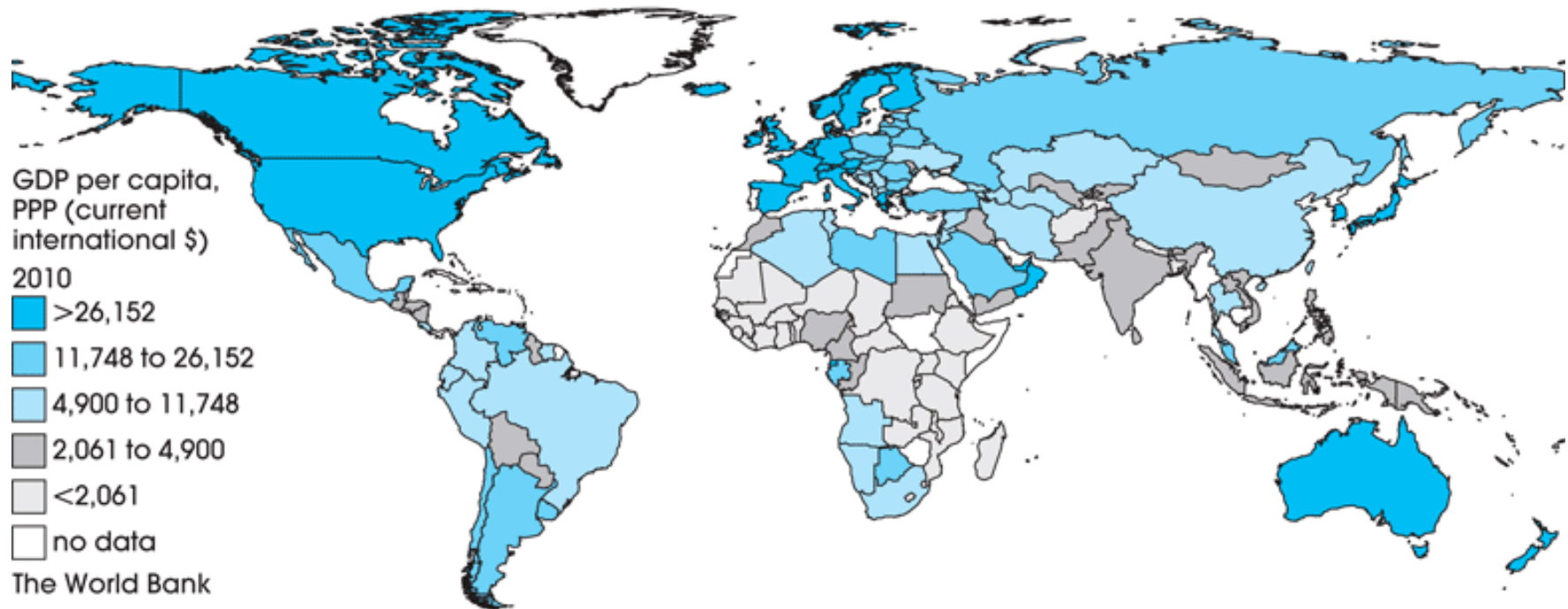
- No overall convergence
- But no developed country's growth has taken off markedly.
- Perhaps no Romer-type over all the production cycle
- Savings in physical and human capital matter,
- But Solow residuals are high.
- What are the factors explaining differences in TFP
 - Geography (Sachs) or Institutions (North)?
- A growing consensus is that *countries with stronger institutions develop faster.*

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH: **a role for geography?**

- Two geographic factors influencing growth: *distance from the equator and geographical isolation*
- Rich countries tend to be located in temperate zones, poor countries in the tropics:
 - tropical *disease* (malaria, sleeping sickness),
 - intense *heat* makes hard labor (farming, construction) difficult,
 - *rainfall volatility* affects agricultural productivity and flooding.
- Landlocked areas tend to be underdeveloped:
 - *lower population density* means less challenges and cooperation in using resources,
 - lack of access to trade and outside influences (e.g., *high transportation cost*).

FACTS ABOUT THE DEVELOPMENT GAP

Figure 1.2. GDP Per Capita in 2010 (Purchasing Power Parity in Dollars)



The world's poorest countries are concentrated in Africa.

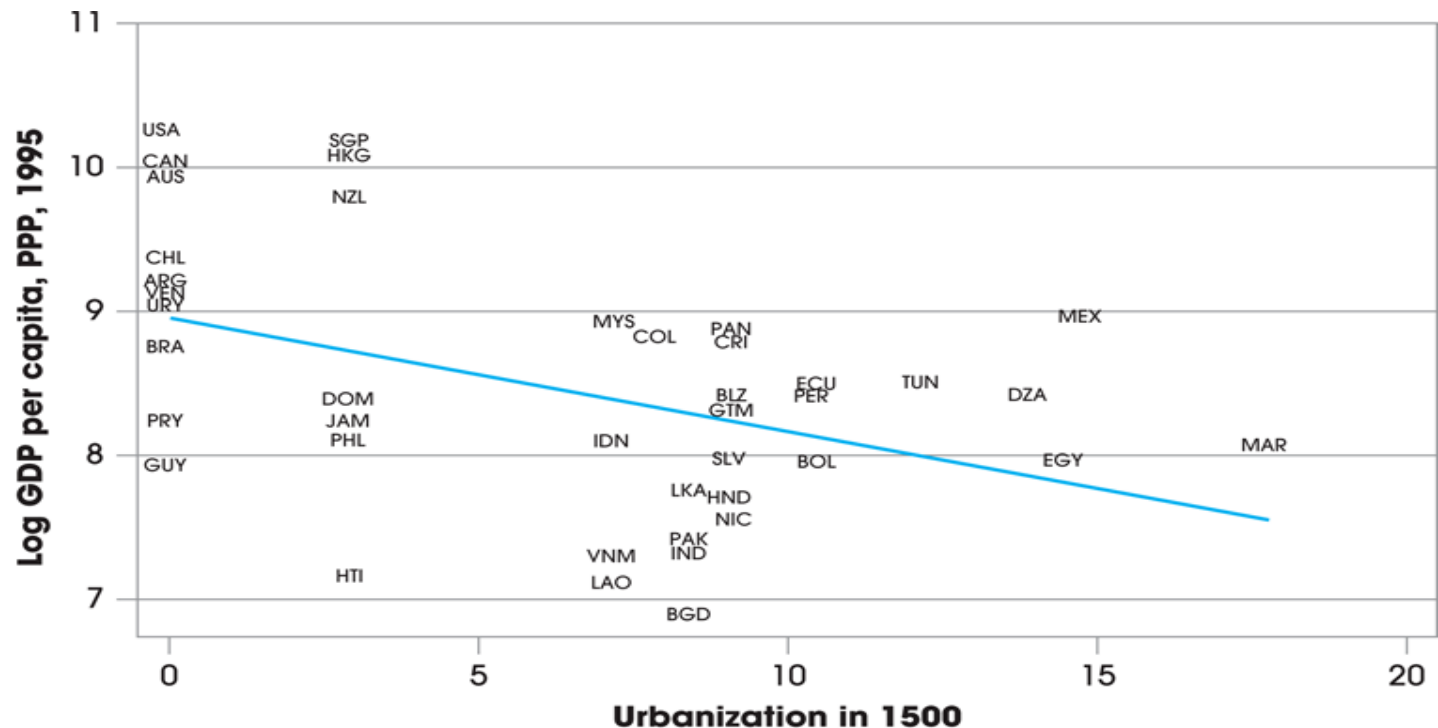
Source: The World Bank, World Development Indicators, <http://databank.worldbank.org>.

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH

- But geography cannot be the only determining factor
- Societies in tropics have not always been poor (e.g., Egypt, Aztecs, Inca, etc.)
- Acemoglu, Johnson, and Robinson found negative correlation between *urbanization in 1500 (proxy for development)* and income per capita now.

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH

Figure 4.5.
Log GDP Per
Capita in
1995
among
Former
European
Colonies
and
Urbanization
Rate in
1500.



There is a negative correlation between economic development in 1500 (represented by urbanization rates measured by historians) and modern economic development as measured by log GDP per capita in 1995. If geography were the main cause of underdevelopment, we should, instead, see a positive correlation.

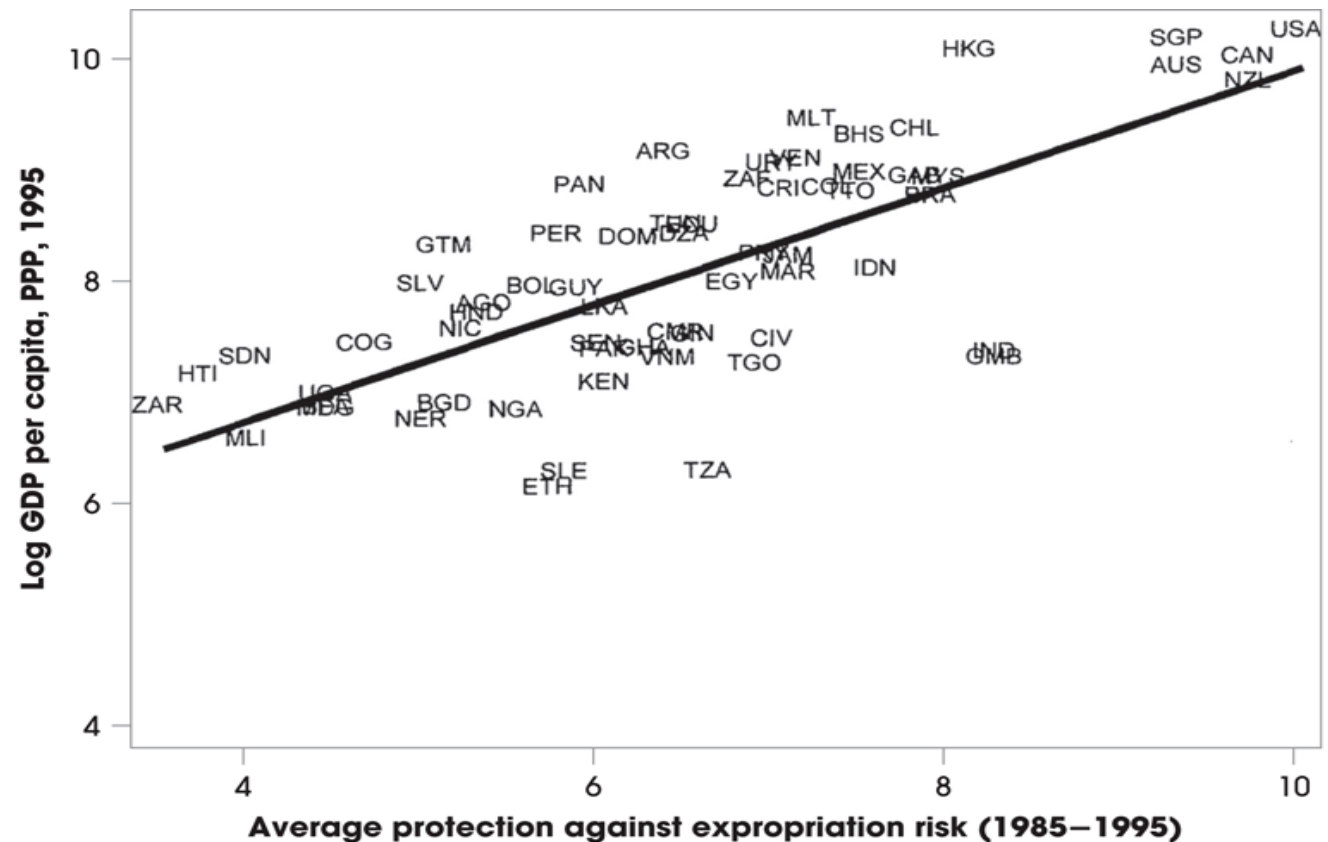
Source: Daron Acemoglu, Simon Johnson, and James A. Robinson, "Reversal of Fortune: Geography and Institutions in the Making of Modern World Income Distribution," *The Quarterly Journal of Economics* 117, no. 4 (November 2002): 1231–1294.

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH: **A role for institutions?**

- Douglass North wrote (modern) seminal analysis arguing that *institutions* are key to understanding why some countries developed earlier than others.
- Since then, much empirical analysis has shown a *strong causal link from institutional quality to long term growth*.
- Another paper by Acemoglu, et. al. shows that protection from *expropriation risk* enhances growth (Figure 4.6).
- Used *instrumental variable technique* to establish causation. *Extractive or predatory institutions* established where settler mortality was high (e.g., Peru, Mexico, Congo, etc.) while more efficient institutions established where settler mortality was low (e.g., North America, New Zealand, etc.).
- Most of the current research in development economies tries to understand the role of institutions and their effects.

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH

Figure 4.6.
Average
Protection
against Risk
of
Expropriation
and Log GDP
Per Capita.

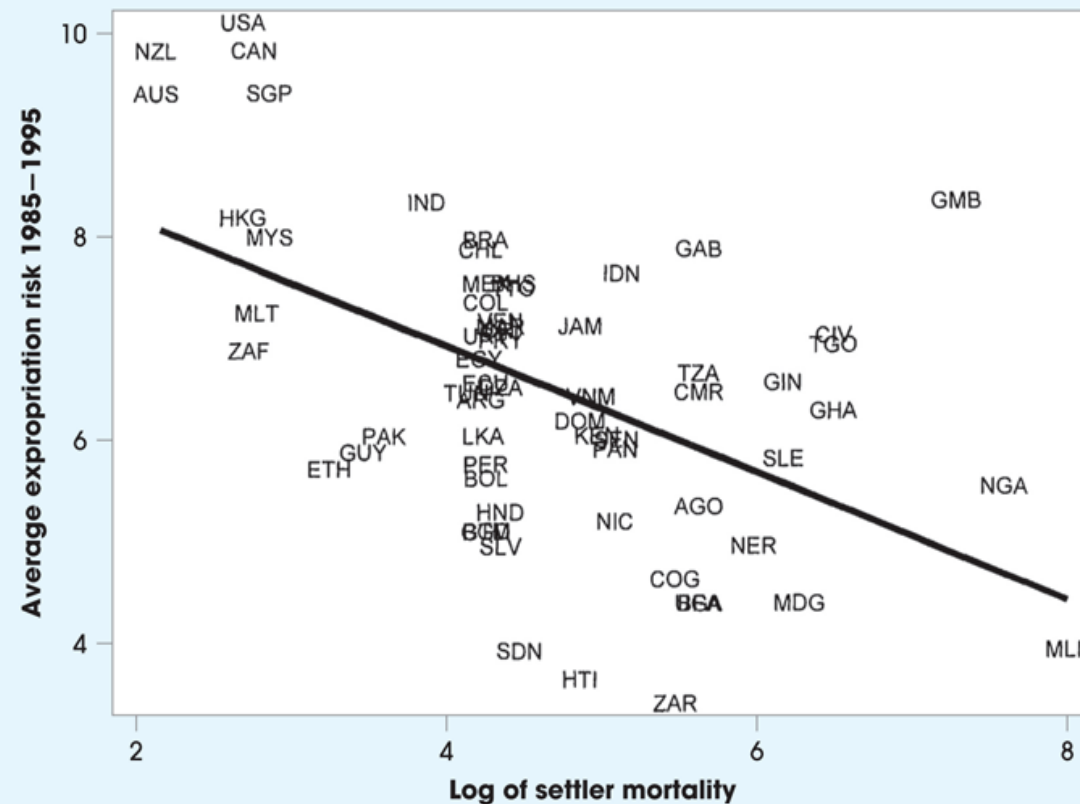


Countries in which economic agents are better protected against the risk of expropriation, an indicator of the quality of institutions, have a higher level of economic development as measured by log GDP per capita.

Source: Daron Acemoglu, Simon Johnson, and James A. Robinson, "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review* 91, no. 5 (2001): 1380. Printed with permission of American Economics Association.

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH

Figure 4.7.
A Negative
Correlation
between
Settler
Mortality
and
Protection
Against
Expropriati
on.



The early mortality of European colonial settlers several hundred years ago is negatively correlated with the quality of institutions at the end of the 20th century.

Source: Acemoglu, Johnson, Robinson, "The Colonial Origins of Comparative Development: An Empirical Investigation," 2001: 1384. Printed with permission of American Economics Association.

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH

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- Most of the current research in development economies tries to understand the role of institutions and their effects.

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH

- But....
- Some criticisms about the empirical approach
 - 64 observations
 - Not geography, but...
- Even if one believes the empirical approach establishing causality, one still needs to determine what makes institutions.
- “*Protection against expropriation*” is an institution?
- *What are Institutions?*
- *How does one grow institutions?*
- *Which ones?*

How does one grow an economy? How does one grow institutions?



INTRODUCTION

Institutions are the *constraints* (rules) placed by law and *social norms* on human behavior.

- These constraints help *reduce transaction costs*, the costs associated with buying or selling merchandise, borrowing money, or investing in a business.
- *Millions of transactions* means that reducing costs can greatly improve aggregate economic performance.
- How do *efficient institutions* affect transaction costs?
- How do transaction costs affect *economic development*?
- What are the *different types* of institutions?
- How do institutions help resolve problems? (e.g., moral hazard, the hold-up problem, coordination, etc.)
- Why do *inefficient institutions persist*?

WHAT ARE INSTITUTIONS?

Institutions underlie *well-functioning markets*:

- Without *quality institutions* transaction costs will be higher and thus less economic development is likely to take place.
- The more *complex products and markets*, the greater the importance of institutions. Since complexity increases with development, institutions become *more important over time*.

There are two types of institutions:

- *Formal institutions*: codified in writing and more precise than unwritten rules.
 - *Political institutions* set rules for major political figures, bodies, parties, etc.
 - *Legal institutions* allocated among religious law, common law and civil law.
- *Informal institutions*: are not legally codified, based on *social norms*, conventions, social values, and culture.
 - *Enforced informally (e.g., peer pressure, moral obligations)*
 - *Religion also plays a role in shaping social norms and values.*

WHAT ARE INSTITUTIONS?

Interactions Between Institutions

- Formal institutions (laws) *evolve with* informal institutions (culture and social norms - e.g., capital punishment).
- Difficult to establish formal laws which *conflict* with social norms (e.g., border versus ethnic division in Africa)
- Formal institutions can *strengthen* informal institutions and vice versa. They can be *complementary*.

What Do Institutions Do?

There are *five important problems* that institutions can solve:

- Informational problems
- Hold-up problems
- Commitment problems
- Cooperation problems
- Coordination problems

WHAT DO INSTITUTIONS DO?

Institutional Solutions to Informational Problems

- *Disclosure rules* are obligations to disclose relevant information about a transaction (common for houses, etc.).
- *Regulation of access or entry* rules to govern entry into a profession (e.g. diplomas, certificates, licenses).
- *Warranties* and *return policies* guarantee quality of a product.
- *Signaling* provides credible information (brand names, franchising).
- Chain stores are *informational intermediaries* which gather information about the products they sell.
- *Rating agencies* also serve as informational intermediaries (Cars.com, eBay feedback). Watch *incentives* (Moody's, S&P)
- These solutions usually work well *only if there are effective formal institutions* (legal system) to enforce contracts.
- Informal institutions help solve informational problems: *repeated interaction, reputation, relational contracting*, etc.

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH: Again:

- Even if one believes the empirical approach establishing causality, one still needs to determine what makes institutions.
- *What are Institutions?*
- *How does one grow institutions?*
- *Which ones?*

EMPIRICAL ANALYSIS OF ECONOMIC GROWTH: Long Run View

What drives the main differences in economic growth between rich and poor countries?

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- In 1988 Canada's productivity was about 94% of the U.S. level. The *capital-output ratio* (K/Y) and *TFP* (A) level were about the same between the countries. Most of the difference is explained by lower *human capital ratio* (H/L) in Canada.
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- *Geography (Sachs) or Institutions (North)*
- The growing consensus is that *countries with stronger institutions develop faster, but there are still issues about causation*

Next

- What happens to the economy as growth takes place?
 - Structural transformation: some sectors may expand faster than others
1. We will discuss structural change and rural to urban migration.
 2. We will examine different growth strategies including sector promotion, import substitution, and export promotion