Development Economics

Slides 3

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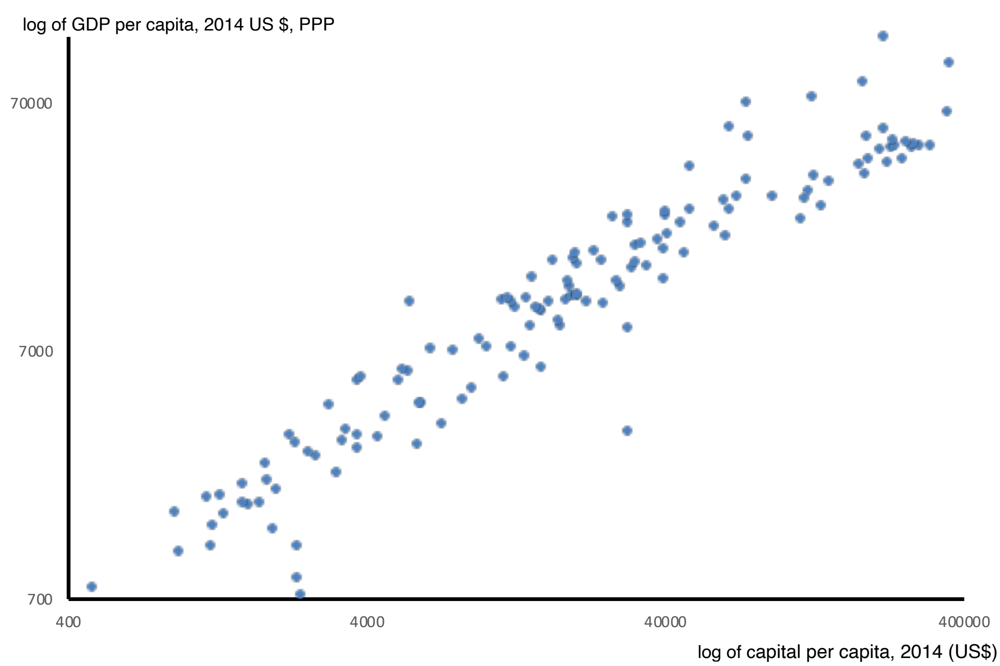
Capital

- **Physical capital**: a fundamental correlate of per-capita income.



Log per capita GDP and log per capita capital value, 2014

Capital

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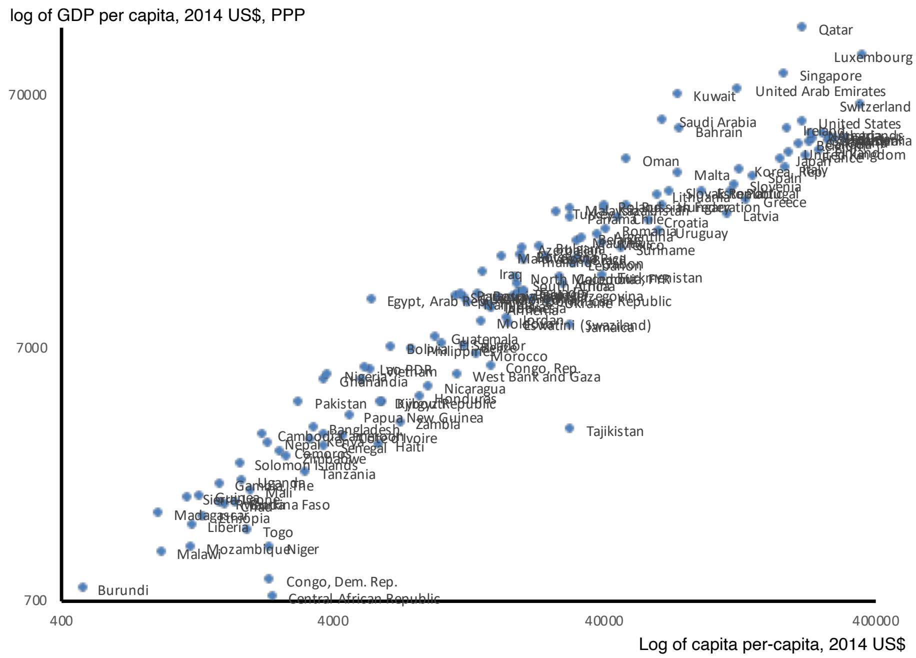


log per capita GDP and log per capita capital value, 2014

Capital

- If this correlation is so strong, isn't **capital accumulation** the answer?
  - Savings ability and motives
  - How savings translate into output
- That takes us to the **theory of economic growth**.

The Production Function

- **Production function:**

$$Y = F(K, L)$$

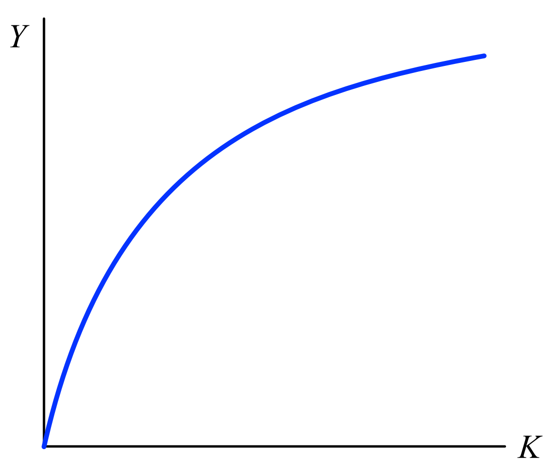
K and L: a long list of inputs, but think of them as two numbers for now.

- **Returns to scale:**

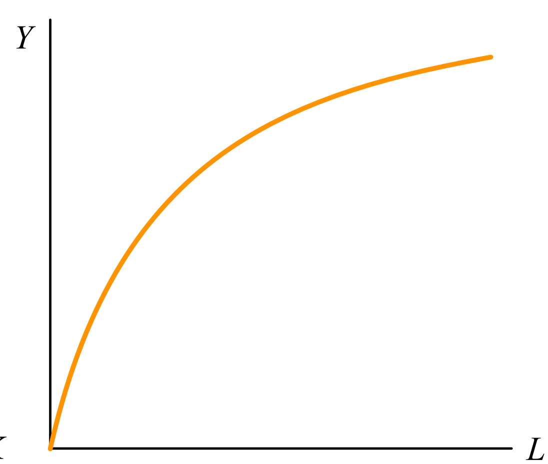
  - Constant returns to scale: $F(\lambda K, \lambda L) = \lambda F(K, L)$ for all $\lambda > 0$.
  - Increasing returns to scale: $F(\lambda K, \lambda L) > \lambda F(K, L)$ for all $\lambda > 1$.
  - Decreasing returns to scale: $F(\lambda K, \lambda L) < \lambda F(K, L)$ for all $\lambda > 1$.

The Production Function

- **Diminishing returns to individual inputs:**



Drawn for some fixed value of L



Drawn for some fixed value of K

- Typical example is **Cobb-Douglas production function**

$$Y = AK^aL^b$$

  - Explain $0 < a < 1$, $0 < b < 1$.

- **Returns to scale with Cobb-Douglas**
  - $a + b = 1$ (**constant returns to scale**, our leading case)
  - $a + b < 1$ (decreasing returns to scale)
  - $a + b > 1$ (increasing returns to scale)

The Production Function in Per-Capita Form

- Start with Cobb-Douglas case $Y = AK^aL^b$. Divide through by L to get

$$\frac{Y}{L} = A\frac{K^a}{L^{1-b}} = A\left(\frac{K}{L}\right)^a \quad \Rightarrow \quad y = Ak^a,$$

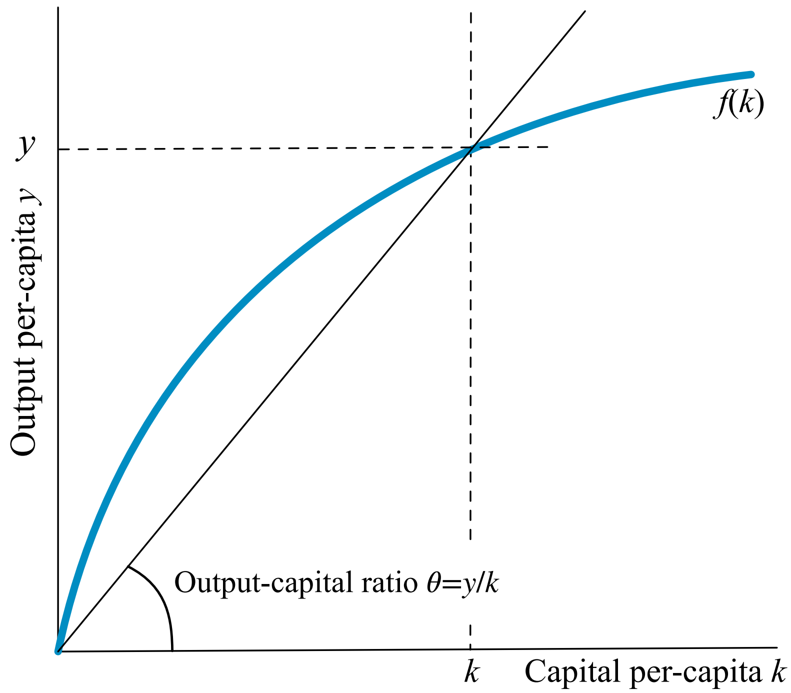
where $y = Y/L$ and $k = K/L$ — provided that $a + b = 1$.

- General case: $Y = F(K, L)$. CRS: $F(\lambda K, \lambda L) = \lambda F(K, L)$.
  - Setting $\lambda = 1/L$ in this equation, we get

$$F\left(\frac{K}{L}, 1\right) = \frac{1}{L}F(K, L) = \frac{Y}{L}, \text{ or } y = f(k),$$

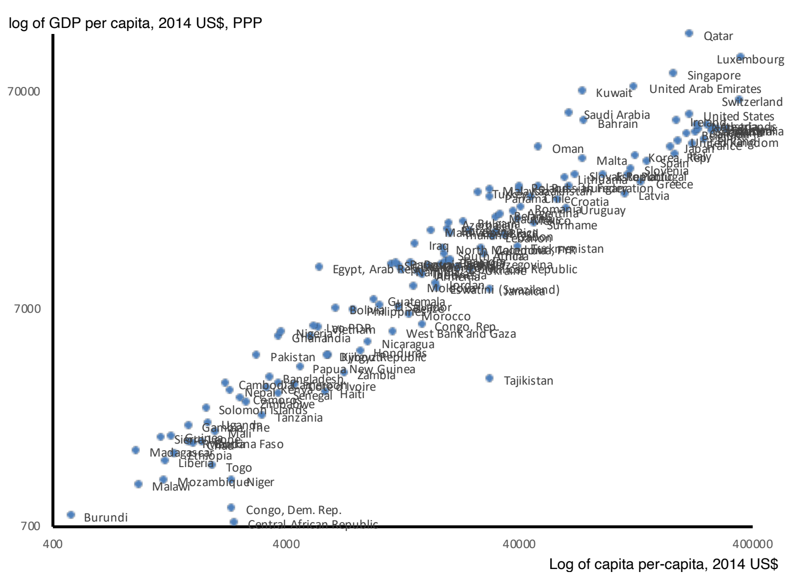
where $y = Y/L$, $k = K/L$ and $f(k) = F(k, 1)$.

The Production Function in Per-Capita Form



The Production Function in Per-Capita Form

- **Recall: $y = f(k)$ and in the Cobb-Douglas case, $y = Ak^a$.**
- Observation: Take logs in the Cobb-Douglas case, get $\ln y = \ln A + a \ln k$:
  - Linear: earlier scatter plot pretty impressively in line:



Caveats to Keep in Mind

- **Lots of residual variations around linearity in that scatter plot:**
- **Productivity variations:**

$$Y = AK^aL^b$$

- "A" surely varies across countries.

  limited flow of technology across countries.

  high fixed costs: infrastructure, roundaboutness in production.

  allocative inefficiency: imperfect capital markets, political patronage.

Caveats to Keep in Mind

- **Lots of residual variations around linearity in that scatter plot:**
- **Limited human capital:** $Y = F(K,$ labor of different qualities$)$
- Cobb-Douglas case again:

$$Y = AK^a(eL)^b$$

- where e is years of schooling per person
- link to "lower A" via efficiency units.
- Alternatively: $Y = AK^aU^bH^c$
- where U is unskilled labor and H is "human capital".
- imperfect substitution across labor types.

Caveats to Keep in Mind

- And last but not least:
- **Physical capital is endogenous**
  - Where does this huge range of physical capital come from?
  - Need to demonstrate why the pace of accumulation is slow.
  - Combine production function with “behavioral model”.
  - Leads to a theory of economic growth.