

Pandas and Statsmodels

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- Recall human capital-augmented Cobb-Douglas production function:

$$Y = AK^\alpha (hL)^{1-\alpha}, \quad (1)$$

where:

- Y : production of final goods and services
- K : stock of physical capital
- L : labor force
- h : human capital *per worker*
- A *total factor productivity* or TFP

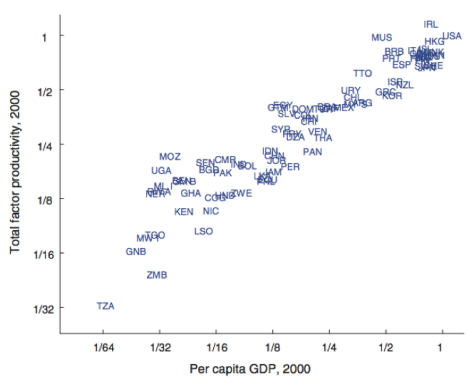
- In the production function, every variable *except* A is *measured*:
 - Y measured by (real) GDP
 - K : inferred from investment and depreciation data
 - L : measured as number of workers or number of worker hours
 - h : typically measured as average years of education
- Of course macroeconomic measurement is subject to *measurement error*.

- The production function *implies* a value for A :

$$A = \frac{Y}{K^{\alpha}(hL)^{1-\alpha}} \quad (2)$$

- A captures all other determinants of production that are not reflected in K , L , or h . For example:
 - Quality of economic and political institutions
 - Degree of technology adoption
 - Public health

Figure 1: **TFP and GDP per capita across countries.** All values relative to the US. Source: Jones and Romer (2010)



- *Even after accounting for their lower levels of human capital per worker and physical capital per worker, workers in lower-income countries are less productive*
- Workers in lower-income countries use what human and physical capital they *do* have less efficiently than workers in higher-income countries.
- Since TFP isn't directly observable, we still don't know exactly why.

Jones, Charles I. and Paul M. Romer, “The New Kaldor Facts: Ideas, Institutions, Population, and Human Capital,” *American Economic Journal: Macroeconomics*, 2010, 2 (1), 224–45.