

DEVELOPMENT ACCOUNTING

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DEVELOPMENT ACCOUNTING: BASICS

- How much of cross-country income differences are “due to”:
 - Factor inputs (capital, education)
 - Efficiency
- First step in understanding cross-country income differences
Doesn't attempt to explain why inputs differ
- Levels analog to growth accounting
(sometimes called levels accounting)
- Goes back to Denison (1967), Christensen, Cummings, and Jorgenson (1981).
Modern literature starts with King and Levine (1994) and particularly
Klenow and Rodriguez-Claire (1997) and Hall and Jones (1999)

CAUSES OF INCOME DIFFERENCES

Research on income differences can arguably be classified into one or more arrows in the following chain of causality:

Geography, Climate, Luck \Rightarrow Human Capital, Physical Capital, TFP \Rightarrow Income



Institutions, Culture \Rightarrow Human Capital, Physical Capital, TFP \Rightarrow Income



Policies, Rule of Law, Corruption \Rightarrow Human Capital, Physical Capital, TFP \Rightarrow Income

- Development accounting is about right-most arrows

Source: Hsieh and Klenow (2010)

- Following Hall and Jones (1999):

$$Y_i = K_i^\alpha (A_i H_i)^{1-\alpha}$$

where

$$H_i = e^{\phi(E_i)} L_i$$

- H_i denotes human capital (quality-adjusted labor)
- L_i denotes “raw” labor
- E_i denotes education (years of schooling)

MEASUREMENT: OUTPUT

- Main data source: Penn World Tables
(Modern incarnation of Summers and Heston (1991) dataset)
- Output: GDP per worker at PPP
- Penn World Tables:
 - Basic idea: Correct GDP for difference in prices across space
(analogous to adjusting for inflation over time)
 - Done using International Comparisons Program (ICP) price data
 - Has undergone substantial methodological changes over time
(Major change between V7 and V8)
 - Many older results in literature not robust to these changes
 - See Feenstra, Inklaar, Timmer (2015) for description of “modern” version

MEASUREMENT: CAPITAL

- Early versions: Capital constructed from investment:

$$K_{it} = I_{it} + (1 - \delta)K_{i,t-1}$$

With an initial capital stock of:

$$K_{i,0} = \frac{I_{i,0}}{g + \delta}$$

where

- g is the average growth rate of investment before 1970
- $\delta = 0.06$
- More recent versions of PWT include capital series
(which is constructed “more carefully” using perpetual inventory method)

MEASUREMENT: HUMAN CAPITAL

$$H_i = e^{\phi(E_i)}$$

- Use average years of schooling as a proxy for E_i
- Data on average years of schooling from Barro and Lee (2013)
- With competitive factor markets, workers are paid their marginal product
- Use wages to inform $\phi(E_i)$ (Mincerian wage regressions)
- Assume $\phi(E_i)$ is piecewise linear with slopes:
 - 0.134 for $s \leq 4$
 - 0.101 for $4 < s \leq 8$
 - 0.068 for $8 < s$

where s is average years of schooling

- Based on Psacharopoulos's (1994) survey of returns-to-schooling estimates

MEASUREMENT: α AND ROBUSTNESS

- Typical to assume $\alpha = 1/3$ for all countries
- Gollin (2002) suggests this is reasonable
(but Feenstra, Inklaar, Timmer (2015) disagree)
- Caselli (2005) shows results are quite sensitive to this choice
- In contrast, Caselli argues that results are not very sensitive to:
 - Depreciation rate
 - Initial capital stock
 - Reasonable variation in returns to schooling
 - Mismeasurement of years of schooling
 - Variation in hours worked per person

FLAVORS OF DEVELOPMENT ACCOUNTING

- Hall and Jones (1999) / Jones (2016):

$$\log \left(\frac{Y_i}{L_i} \right) = \frac{\alpha}{1 - \alpha} \log \left(\frac{K_i}{Y_i} \right) + \log \left(\frac{H_i}{L_i} \right) + \log A_i$$

- Caselli (2005):

$$\log \left(\frac{Y_i}{L_i} \right) = \alpha \log \left(\frac{K_i}{L_i} \right) + (1 - \alpha) \log \left(\frac{H_i}{L_i} \right) + \log A_i$$

$$\log \left(\frac{Y_i}{L_i} \right) = \log \left(\frac{Y_i}{L_i} \right)_{KH} + \log A_i$$

$$\log y_i = \log y_{i,KH} + \log A_i$$

(Notice in Hall-Jones flavor it is K/Y that shows up rather than K/L . See Growth Accounting lecture for details. Caselli starts with $Y_i = A_i K_i^\alpha H_i^{1-\alpha}$.)

TABLE I
PRODUCTIVITY CALCULATIONS: RATIOS TO U. S. VALUES

Country	Y/L	Contribution from		
		$(K/Y)^{\alpha/(1-\alpha)}$	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
Japan	0.587	1.119	0.797	0.658
Mexico	0.433	0.868	0.538	0.926
Argentina	0.418	0.953	0.676	0.648
U.S.S.R.	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	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
Correlation with Y/L (logs)	1.000	0.624	0.798	0.889
Correlation with A (logs)	0.889	0.248	0.522	1.000

Source: Hall and Jones (1999). Comparison year: 1988

- Comparing richest 5 and poorest 5:
 - Difference in output per worker: factor of 31.7
 - Difference in capital intensity: factor of 1.8
 - Difference in human capital per worker: factor of 2.2
 - Difference in productivity: factor of 8.3
- Productivity explains the bulk of cross-country income differences

Table 6 Basic development accounting, 2010

	GDP per worker, y	Capital/GDP (K/Y)$^{\alpha/(1-\alpha)}$	Human capital, h	TFP	Share due to TFP
United States	1.000	1.000	1.000	1.000	—
Hong Kong	0.854	1.086	0.833	0.944	48.9%
Singapore	0.845	1.105	0.764	1.001	45.8%
France	0.790	1.184	0.840	0.795	55.6%
Germany	0.740	1.078	0.918	0.748	57.0%
United Kingdom	0.733	1.015	0.780	0.925	46.1%
Japan	0.683	1.218	0.903	0.620	63.9%
South Korea	0.598	1.146	0.925	0.564	65.3%
Argentina	0.376	1.109	0.779	0.435	66.5%
Mexico	0.338	0.931	0.760	0.477	59.7%
Botswana	0.236	1.034	0.786	0.291	73.7%
South Africa	0.225	0.877	0.731	0.351	64.6%
Brazil	0.183	1.084	0.676	0.250	74.5%
Thailand	0.154	1.125	0.667	0.206	78.5%
China	0.136	1.137	0.713	0.168	82.9%
Indonesia	0.096	1.014	0.575	0.165	77.9%
India	0.096	0.827	0.533	0.217	67.0%
Kenya	0.037	0.819	0.618	0.073	87.3%
Malawi	0.021	1.107	0.507	0.038	93.6%
Average	0.212	0.979	0.705	0.307	63.8%
1/Average	4.720	1.021	1.418	3.260	69.2%

Source: Jones (2016)

DEVELOPMENT ACCOUNTING: MEXICO vs. U.S.

- Output per worker in Mexico is 33.8% of U.S.
- Capital-output ratio of Mexico is 87% of U.S.
 - $0.87^{\alpha/(1-\alpha)} = 0.87^{1/2} = 0.931$
- Schooling: 8.8 year in Mexico vs. 13.2 years in U.S.
 - Difference: 4.6 years
 - $0.068 \times 4.6 = 0.32$
 - $0.76 = 1/1.32$
- TFP is $0.338 / (0.931 \times 0.760) = 0.477$ of U.S. level

DEVELOPMENT ACCOUNTING: MEXICO vs. U.S.

- Inputs explain a factor of

$$\frac{1}{0.931} \times \frac{1}{0.760} = 1.4$$

- TFP explains the rest

$$\frac{1}{0.338} \times \frac{1}{1.4} = 2.1$$

- Fraction explained by TFP:

$$\frac{2.1}{1.4 + 2.1} = 0.597$$

(Not sure this makes sense. Think of factors explaining 1.0.)

Alternative Decomposition:

- Total difference $1/0.338 = 2.96$. In logs: 1.08
- Log difference explained by capital: $\log(1/0.931) = 0.07$
- Log difference explained by schooling: $\log(1/0.760) = 0.27$
- Log difference explained by TFP: $\log(1/0.477) = 0.74$
- Fraction explained by TFP: $0.74/1.08 = 0.68$

HALL AND JONES (1999) vs. JONES (2016)

- In Hall and Jones (1999) K/Y explains factor of 2
- In Jones (2016) K/Y explains essentially nothing
- Not totally clear why the difference
- One possibility: Jones (2016) uses PWT capital series which is constructed “more carefully” than Hall-Jones capital series
 - Capital price series lower in poor countries than investment price series (used by Hall and Jones) because structures are more important in capital than in investment (because they depreciate slower) and structures are cheap in poor countries (see Feenstra, Inklaar, Timmer (2015, p. 3178)
 - Lower capital prices in poor countries implies more capital [I think]

CASELLI'S DECOMPOSITION

- Question: What would cross-country income distribution look like if all countries had the same TFP?
- Consider:

$$\text{var}[\log y_i] = \text{var}[\log y_{i,KH}] + \text{var}[\log A_i] + 2\text{cov}[\log y_{i,KH}, \log A_i]$$

- If A_i the same in all countries:

$$\text{var}[\log A_i] + 2\text{cov}[\log y_{i,KH}, \log A_i] = 0$$

- Motivates using

$$\text{success}_1 = \frac{\text{var}[\log y_{i,KH}]}{\text{var}[\log y_i]}$$

to measure role of factors

Table 1
Baseline success of the factor-only model

$\text{var}[\log(y)]$	1.297	y^{90}/y^{10}	21
$\text{var}[\log(y_{KH})]$	0.500	y_{KH}^{90}/y_{KH}^{10}	7
success_1	0.39	success_2	0.34

Source: Caselli (2005)

Table 2
Success in sub-samples

Sub-sample	Obs.	var[log(y)]	var[log(y _{KH})]	<i>success</i> ₁
Above the median	47	0.172	0.107	0.620
Below the median	47	0.624	0.254	0.407
OECD	24	0.083	0.050	0.606
Non-OECD	70	1.047	0.373	0.356
Africa	27	0.937	0.286	0.305
Americas	25	0.383	0.179	0.468
Asia and Oceania	25	0.673	0.292	0.434
Europe	17	0.136	0.032	0.233
All	94	1.297	0.500	0.385

Source: Caselli (2005)

DEVELOPMENT ACCOUNTING: BASIC FINDINGS

- Capital-Output ratio explains between 0 and 20%
 - Depends on version of analysis
- Schooling explains a substantial amount
 - Perhaps about 1/3 across rich vs. poor countries
- TFP explains at least half

INTERPRETATION OF BASIC FINDINGS

- Possibly help point to type of “friction” that plagues poor countries
- If K/Y is low: problems associated with capital accumulation?
 - Taxes on capital (implicit or explicit)
 - Financial repression
 - Restrictions of international capital flows
- If education is low: problem in education sector?
 - Insufficient supply of education (by government?)
 - Low demand for education (culture/beliefs/high prices?)

FOUR STRANDS OF SUBSEQUENT LITERATURE

1. **Is MPK larger for poor countries?**

(Lucas 90, Caselli-Feyrer 07, Hsieh-Klenow 07)

2. Quality of schooling

(Hendricks 02, Schoellman 12, Hendricks-Schoellman 18, 21, Lagakos et al. 18)

3. **Agricultural productivity gap**

(Caselli 05, Restuccia-Yang-Zhu 08, Gollin-Lagakos-Waugh 14)

4. Misallocation

(Restuccia-Rogerson 08, Hsieh-Klenow 09, Moll 12, Midrigan-Xu 14)

WHY DOESN'T CAPITAL FLOW TO POOR COUNTRIES?

Lucas (1990):

- Two countries with same Cobb-Douglas production function:

$$y = Ak^{\alpha}$$

where y is output per person and k is capital per person

- Marginal product of capital is:

$$r = \alpha Ak^{\alpha-1}$$

- Using production function to plug in for k

$$r = \alpha A^{1/\alpha} y^{(\alpha-1)/\alpha}$$

WHY DOESN'T CAPITAL FLOW TO POOR COUNTRIES?

- Taking a ratio of this equation for India vs. US:

$$\frac{r^{\text{India}}}{r^{\text{US}}} = \left(\frac{y^{\text{India}}}{y^{\text{US}}} \right)^{(\alpha-1)/\alpha}$$

- Suppose

$$\alpha = 0.4 \quad \text{and} \quad \frac{y^{\text{India}}}{y^{\text{US}}} = \frac{1}{15}$$

- Then we have that

$$\frac{r^{\text{India}}}{r^{\text{US}}} = 15^{1.5} = 58$$

- Marginal product of capital in India is 58 times higher than in the U.S.

WHY DOESN'T CAPITAL FLOW TO POOR COUNTRIES?

- If the MPK is 58 times higher in India than U.S., why doesn't more capital flow to poor countries?
- Maybe because MPK is not 58 times higher in India
(and since Lucas' paper was published, India has grown a lot)
- Calculation assumes India and U.S. have same productivity
- Development accounting suggests this is not the case

MARGINAL PRODUCT OF CAPITAL

- Let's combine

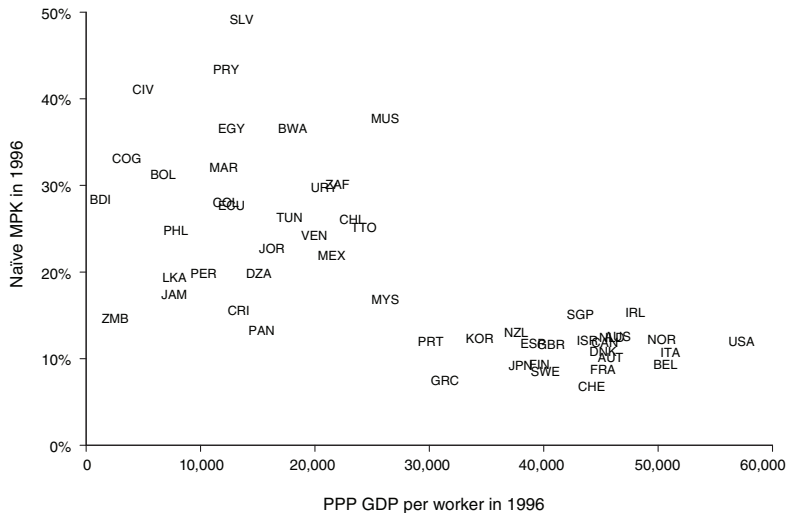
$$r = \alpha A k^{\alpha-1} \quad \text{and} \quad y = A k^{\alpha}$$

to eliminate A :

$$r = \alpha \left(\frac{k}{y} \right)^{-1}$$

- Hall-Jones 99 results have India's k/y at 50% of U.S. level
- Implies MPK is twice as high in India
(Jones 16 results don't imply this. But let's ignore that for now.)
- Significant focus of literature in 1990s (see, e.g., Mankiw 95)

NAIVE MARGINAL PRODUCT OF CAPITAL



Source: Hsieh and Klenow (2010) using data from Caselli and Feyrer (2007)

Make two adjustments to naive MPK calculation:

1. Adjust for non-reproducible capital (land and natural resources)
2. Adjust for high price of capital relative to consumption in poor countries

- Naive marginal product of capital:

$$MPK = \alpha \frac{Y}{K}$$

where α is capital share of income

- Usual way to measure capital share of income:
 - One minus labor share of income
- But that includes income to non-reproducible capital
(land and natural resources)
- While K is only reproducible capital
(constructed from perpetual inventory method)

- So naive:

$$\text{MPK} = \alpha \frac{Y}{K}$$

yields an estimate of MPK that is too high

- This bias is bigger for poor countries since non-reproducible capital is a larger share of capital in poor countries
- Makes MPK look higher for poor countries

LAND AND NATURAL RESOURCES

TABLE I
PROPORTION OF DIFFERENT TYPES OF WEALTH IN TOTAL WEALTH IN 2000

Variable	Mean	St dev	Median	Weighted mean*	Corr w/ log(GDP)**
Subsoil resources	10.5	16.4	1.5	7.0	-0.13
Timber	1.7	2.6	0.8	0.9	-0.34
Other forest	2.2	5.4	1.1	0.3	-0.49
Cropland	11.4	15.2	5.1	3.2	-0.73
Pasture	4.5	5.4	2.7	1.9	-0.00
Protected areas	1.9	2.5	0.3	1.4	0.01
Urban land	13.1	4.6	13.5	16.5	0.70
Reproducible capital	54.8	19.2	56.3	68.6	0.70

* Weighted by the total value of the capital stock.

** GDP is per worker.

Source: Authors calculations using data from World Bank [2006].

Source: Caselli and Feyrer (2007)

PRICE OF CAPITAL RELATIVE TO OUTPUT

- In “one-good” model, price of capital is the same as the price output
- In reality, this is not necessarily the case
- Recognizing this, return to capital is

$$\frac{P_y(t)MPK(t) + P_k(t+1)(1 - \delta)}{P_k(t)}$$

- Ignoring capital gains, frictionless international capital markets imply

$$\frac{P_y MPK}{P_k} = R^* - (1 - \delta)$$

- This is what should be equal across countries

PRICE OF CAPITAL RELATIVE TO OUTPUT

- Earlier estimate:

$$MPK = \alpha \frac{Y}{K}$$

- Adjusted estimate:

$$\frac{P_y MPK}{P_k} = \alpha \frac{P_y Y}{P_k K}$$

PRICE OF OUTPUT RELATIVE TO CAPITAL

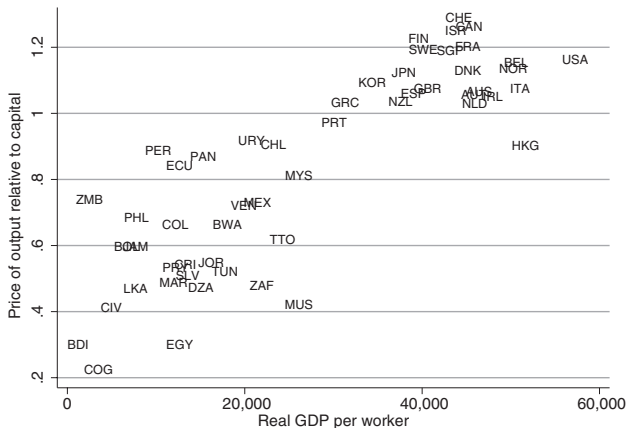


FIGURE II
Relative Prices

Source: Penn World Tables 6.1.

Source: Caselli and Feyrer (2007)

EQUIPMENT PRICES ACROSS COUNTRIES

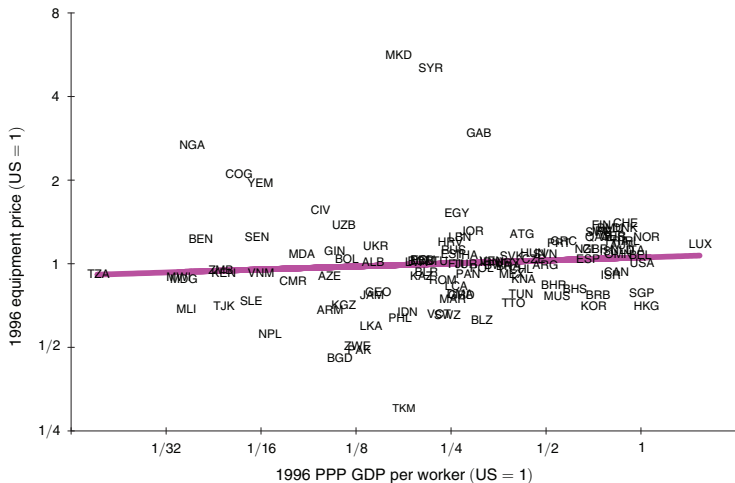


FIGURE 5. EQUIPMENT PRICES VERSUS INCOME LEVELS

Source: Hsieh and Klenow (2010)

CONSUMPTION PRICES ACROSS COUNTRIES

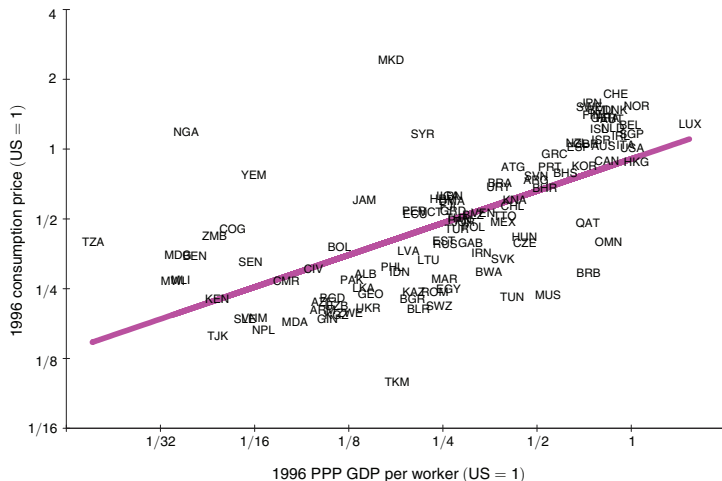
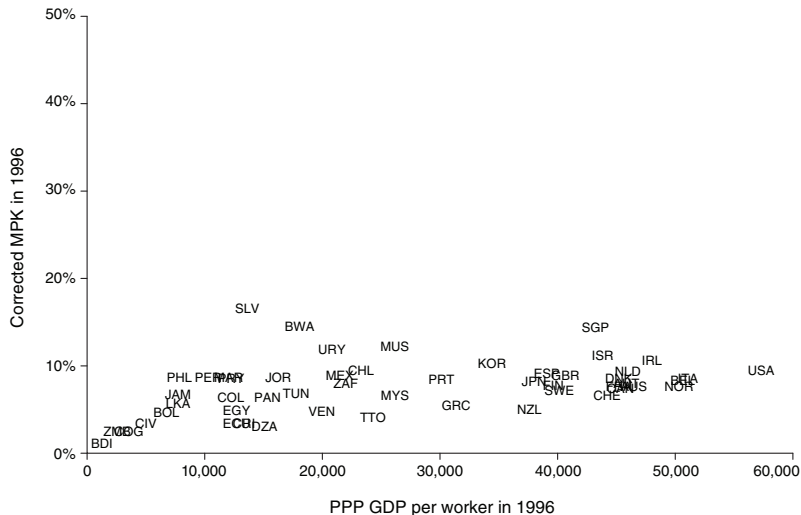


FIGURE 6. CONSUMPTION PRICES VERSUS INCOME LEVELS

Source: Hsieh and Klenow (2010)

ADJUSTED MARGINAL PRODUCT OF CAPITAL



Source: Hsieh and Klenow (2010) using data from Caselli and Feyrer (2007)

Conclusion:

- “There is no *prima facie* support for the view that international credit frictions play a major role in preventing capital flows from rich to poor countries”
- Low K/L in poor countries due to:
 - low endowments of complementary factors to capital
 - low efficiency (TFP)

Capital may be misallocated **within** country. Misallocation literature following Hsieh and Klenow (2009)

- A classic view is that development is about reallocation out of agriculture into “modern” sectors
(Rosenstein-Rodin 43, Nurkse 53, Lewis 55, Rostow 60)
- Most people work in agriculture in poor countries
- Productivity is low in agriculture, especially in poor countries
(Lewis 55, Kuznets 71)

IMPORTANCE OF AGRICULTURE

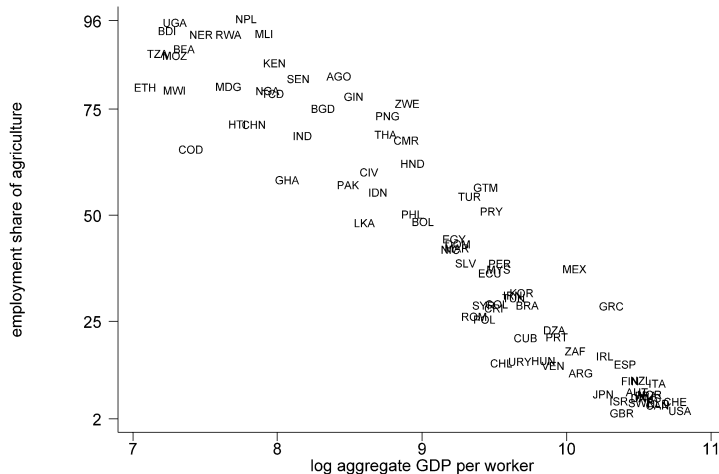


Figure 15. The importance of agriculture.

Source: Caselli (2005)

1. Unproductive urban sector is the problem
 - Urban sector can't absorb labor
 - Unproductive or can't grow fast enough
 - People in country-side are "army of surplus labor"
 - This is the conventional wisdom
2. Unproductive agricultural sector is the problem
 - Labor needed to produce food
 - Agricultural sector can't shed labor
 - Timmer (1988), Gollin, Parente, Rogerson (2002, 2007)

Not clear which of these stories is more important

A TWO SECTOR MODEL

- Perfect labor mobility across sectors
- Competitive labor markets
- Production functions:

$$Y_a = A_a L_a^\theta K_a^{1-\theta}$$

$$Y_n = A_n L_n^\theta K_n^{1-\theta}$$

- Price of non-ag good is numeraire
- Price of ag good is p_a

(See Gollin, Lagakos, and Waugh (2014) for more details)

A TWO SECTOR MODEL

- Labor mobility implies common wage w
- Labor demand in each sector:

$$p_a \theta \frac{Y_a}{L_a} = w \qquad \theta \frac{Y_n}{L_n} = w$$

- Combining these implies

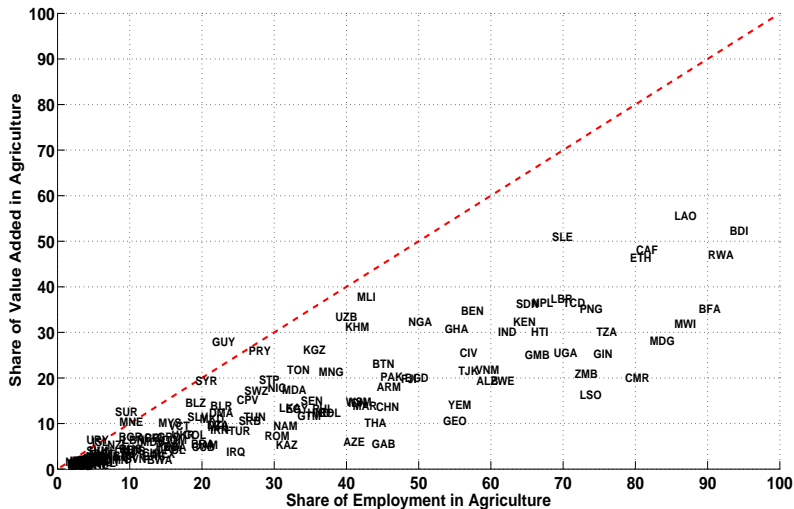
$$\frac{p_a Y_a / L_a}{Y_n / L_n} = \frac{VA_a / L_a}{VA_n / L_n} = 1$$

- Value added per worker should be the same in both sectors

$$\frac{VA_a}{L_a} = \frac{VA_n}{L_n}$$

- True whether growth bottleneck is low A_a or low A_n

AGRICULTURAL PRODUCTIVITY GAP



Source: David Lagakos

AGRICULTURAL PRODUCTIVITY GAP

- Employment share in agriculture is larger than value added share
- Particularly so in poor countries
- Agricultural productivity gap:

$$APG = \frac{VA_n/L_n}{VA_a/L_a}$$

- Frictionless model implies $APG = 1$

RAW AGRICULTURAL PRODUCTIVITY GAP

TABLE I
RAW AGRICULTURAL PRODUCTIVITY GAPS

	All countries	Quartile of income distribution			
		Q1	Q2	Q3	Q4
10th percentile	1.3	1.0	1.3	1.0	1.2
Median	2.6	1.7	2.7	2.8	4.3
Mean	3.5	2.0	3.2	3.4	5.6
90th percentile	6.8	4.0	6.6	7.1	12.5
Number of countries	151	38	38	38	37

Note: Income quartiles are determined using 2005 PPP GDP per capita. Q1 is the richest quartile and Q4 is the poorest quartile. The raw agricultural productivity gaps are defined as the ratio of value added per worker in the nonagricultural sector to value added per worker in the agricultural sector, without any adjustments to the underlying value added or employment data.

Source: Gollin, Lagakos, Waugh (2014)

AGRICULTURAL PRODUCTIVITY GAP

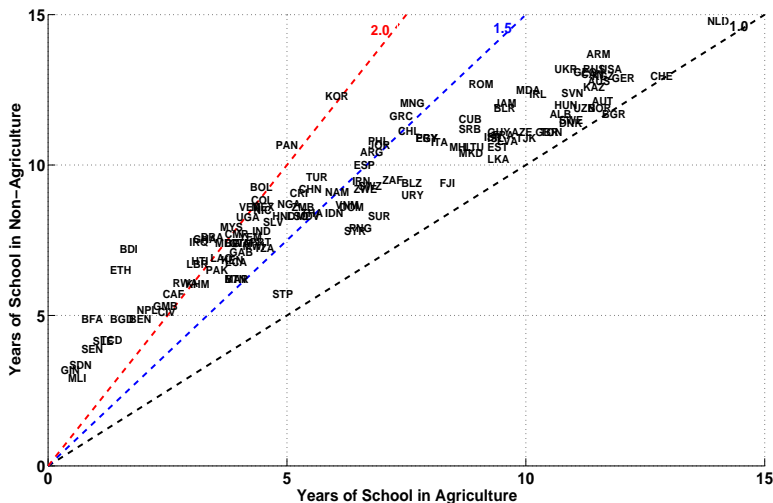
- Frictionless model implies $APG = 1$
- In practice, $APG = 3.5$ and even larger in poor countries
- Suggests large misallocation of labor across sectors

IS IT REAL OR MISMEASUREMENT?

- Agricultural workers may work fewer hours (lean season)
- Rural people may be misclassified as agricultural workers
- Agricultural output may be undermeasured due to home production
- Agricultural workers may have less human capital

- Gather database of population censuses and household surveys to better measure agricultural productivity gap
- Sector level data on:
 - Average hours worked
 - Average years of schooling
- Findings:
 - Non-ag workers work modestly more hours than ag workers
 - Average schooling higher in non-ag
- Can explain about 1/3 of agricultural productivity gap

SECTORAL HUMAN CAPITAL DIFFERENCE



Source: Gollin, Lagakos, Waugh (2014)

ADJUSTED AGRICULTURAL PRODUCTIVITY GAP

TABLE III
AGRICULTURAL PRODUCTIVITY GAPS AND ALL ADJUSTMENTS

Measure	Raw APG	All adjustments	All adjustments by quartile			
			Q1	Q2	Q3	Q4
10th Percentile	1.3	1.0	0.8	1.2	0.7	1.3
Median	3.1	1.9	1.4	2.0	2.1	2.3
Mean	3.5	2.2	1.7	2.1	1.9	3.0
90th percentile	6.4	4.3	3.3	2.8	4.3	5.6
Number of countries	72	72	18	16	18	20

Note: Income quartiles are determined using 2005 PPP GDP per capita. Q1 is the richest quartile and Q4 is the poorest quartile. The raw APG is defined as the ratio of value added per worker in the non-agricultural sector to value added per worker in the agricultural sector, without any adjustments to the underlying value added or employment data. The adjusted APG is defined as the the ratio of value added per worker in the nonagricultural sector to value added per worker in the agricultural sector after adjusting for average hours worked per worker and average human capital per worker.

Source: Gollin, Lagakos, Waugh (2014)

- Construct alternative measures of value added by sector using household surveys for 10 developing countries
- Measures output whether sold or consumed at home
- Result: Sectoral differences similar to NIPA data
- Mismeasurement of value added not likely to explain APG

ADJUSTED AGRICULTURAL PRODUCTIVITY GAP

TABLE IV
MICRO AND MACRO DATA AND AGRICULTURAL PRODUCTIVITY GAPS

	Agriculture share of				
	Employment		Value added		APG
	Micro	Macro	Micro	Macro	Micro
Armenia (1996)	34.2	36.8	32.8	0.9	1.1
Bulgaria (2003)	14.1	11.7	18.4	1.2	0.7
Cote d'Ivoire (1988)	74.3	32.0	42.1	4.7	4.0
Ghana (1998)	53.9	36.0	33.3	2.2	2.3
Guatemala (2000)	40.2	15.1	18.7	3.8	2.9
Kyrgyz Republic (1998)	56.9	39.5	39.3	2.0	2.0
Pakistan (2001)	46.9	25.8	22.6	2.5	3.0
Panama (2003)	27.0	7.8	11.8	4.4	2.7
South Africa (1993)	11.0	5.0	7.0	2.3	1.7
Tajikistan (2009)	41.0	24.7	30.1	2.1	1.6
Average	40.0	23.4	25.6	2.6	2.2

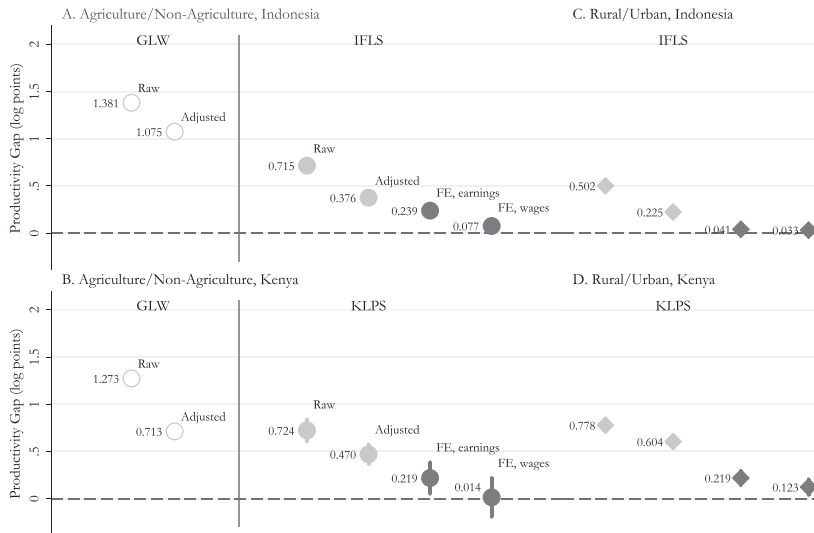
Note: “Micro” means calculated using LSMS household survey data. “Macro” means calculated using national accounts data. APGs are calculated using the shares of value added from micro and macro data, and the shares of employment from micro data.

Source: Gollin, Lagakos, Waugh (2014)

- Poor countries employ most of their workers in a sector in which they are particularly unproductive
- Why this apparent deviation from comparative advantage?

- Poor countries employ most of their workers in a sector in which they are particularly unproductive
- Why this apparent deviation from comparative advantage?
- Young (2013) and Hamory-Kleemans-Li-Miguel (2021) argue difference is due to selective migration of high skill workers
- Munshi and Rosenzweig (2016) argue for trade-off between higher earnings in the city and access to caste-based insurance in the village in India

IS APG DRIVEN BY SELECTION?



Source: Hamory, Kleemanns, Li, and Miguel (2021)

QUASI-EXPERIMENTAL EVIDENCE ON MOBILITY

- Bryan, Chowdhury, Mobarak (2014): Randomly giving workers in rural Bangladesh a bus ticket (\$8.50) led to large increase in consumption
- Sarvimäki, Uusitalo, Jäntti (2022): Forced migration in Finland after WWII led to large increases in income for people that started off in agriculture
- Chetty, Hendren, Katz (2016): Giving families in high poverty areas vouchers to move to lower-poverty areas raises long-term outcomes of young children
- Nakamura, Sigurdsson, Steinsson (2021): People induced to move from high income village due to volcanic eruption saw large increase in income

COMPARATIVE ADVANTAGE

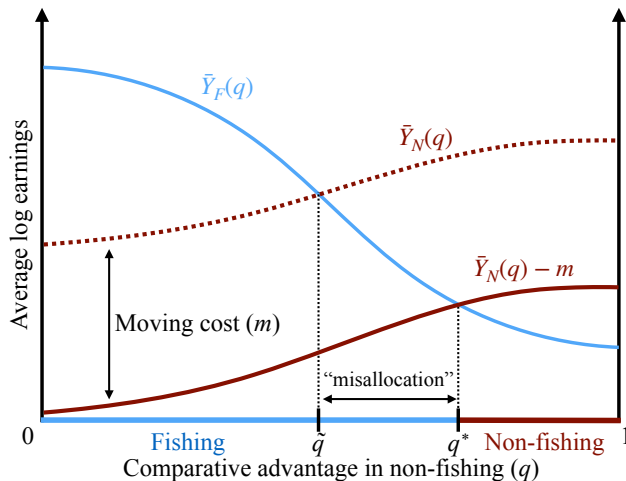


Figure 8: Sorting by Comparative Advantage

Source: Nakamura, Sigurdsson, Steinsson (2021)

ABSOLUTE VS. COMPARATIVE ADVANTAGE

- Absolute advantage: Someone is better at everything
- Fixed effects regressions control for absolute advantage
 - Abowd, Kramarz, Margolis (1999)
- Comparative advantage:
 - Some people are good at fishing
 - Others are good at rabbit hunting
- “Roy model” means model with comparative advantage (Roy, 1951)
(as does Ricardian model)