

# **Income Differences Across Countries**

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*Society for Economic Dynamics*

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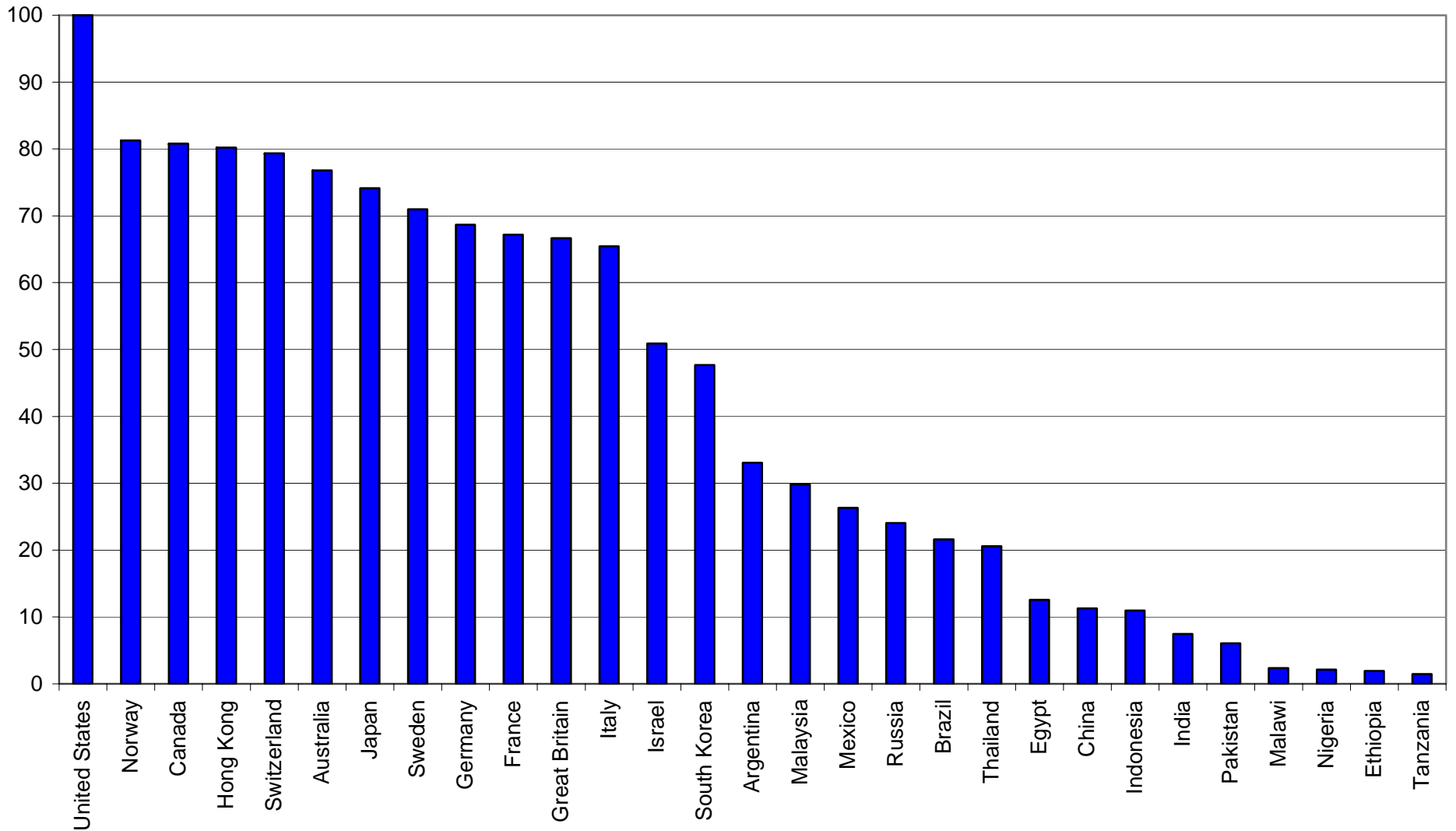
# 2000 PPP Income per capita

**90<sup>th</sup>/10<sup>th</sup>                      25.6**

**75<sup>th</sup>/25<sup>th</sup>                        8.8**

**S.D. of logs                    1.16**

# Relative Income Per Capita 2000



Source: Penn World Table

# Production function

$$Y = K^{\alpha} (AhL)^{1-\alpha}$$

$Y =$  PPP GDP       $pop =$  population

$L =$  hours worked       $K =$  PPP physical capital

$h =$  human capital per worker       $A =$  a residual

# A useful decomposition

$$\frac{Y}{pop} = \frac{L}{pop} \left[ \frac{K}{Y} \right]^{\frac{\alpha}{1-\alpha}} Ah$$

# Point 1: Quality and Variety

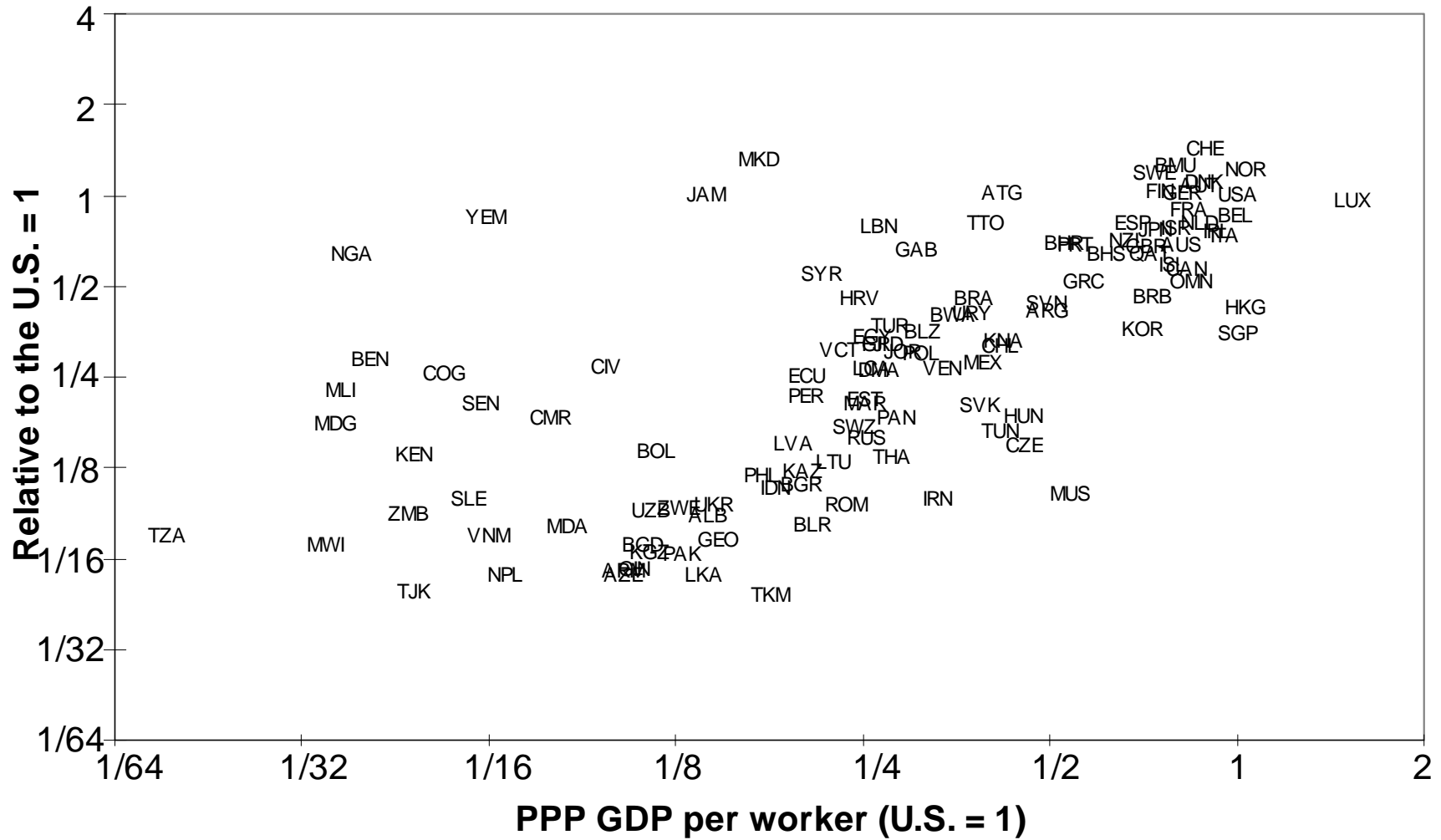
## Quality:

**Perhaps 30% higher in rich vs. poor.**

**ICP: services are “comparison resistant”.**

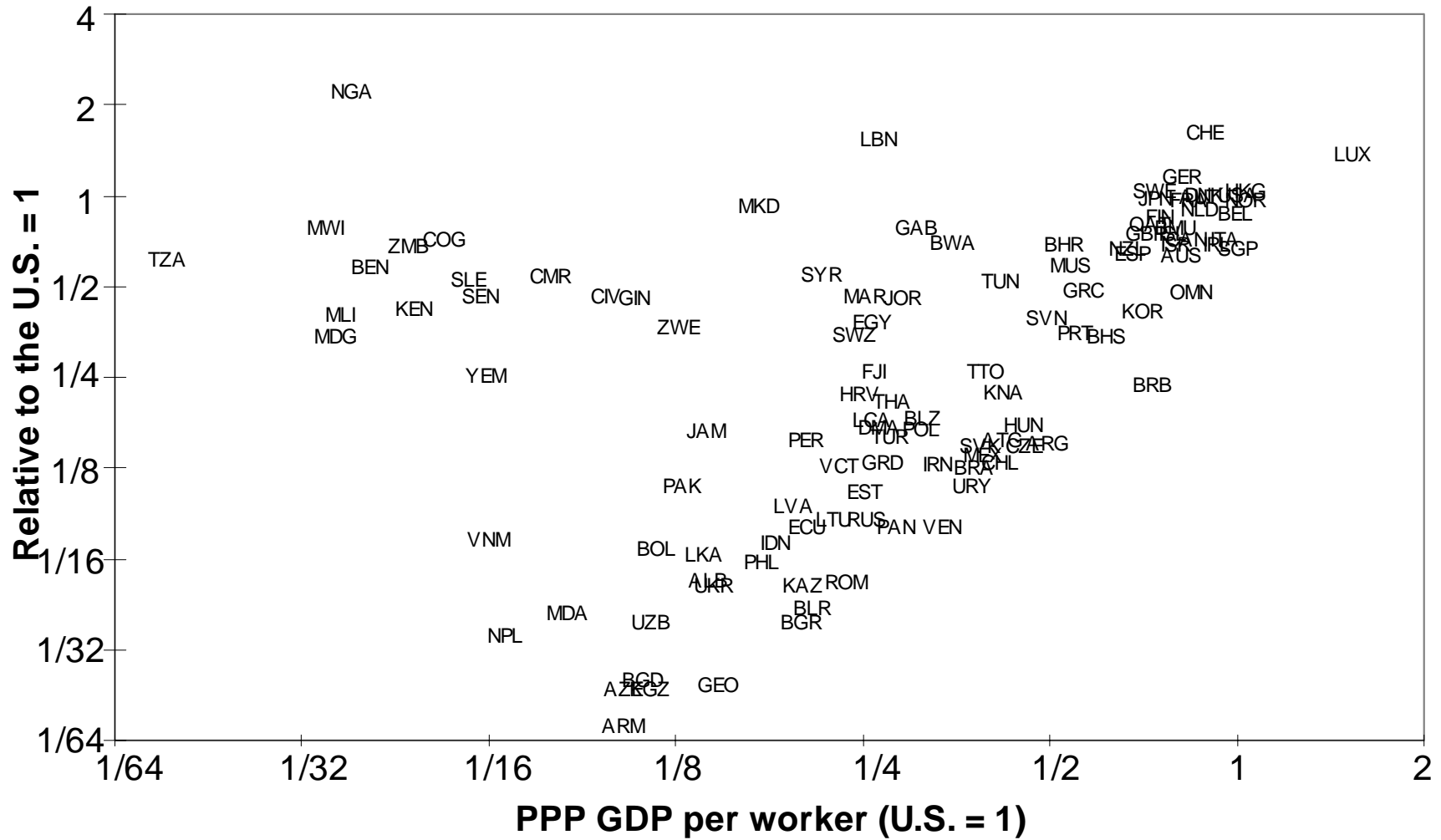
**⇒ half is missed in PPP calculations.**

# Price of Medical Care



Source: Penn World Table (114 countries in 1996)

# Price of Education



Source: Penn World Table (114 countries in 1996)



# Point 1: Quality and Variety

## Variety:

Perhaps 15% higher in rich vs. poor.

Suppose 2/3 (consumer portion) missed.

Taken together, factor of 30 rather than 24!

## **Point 2: L/pop**

**Prescott, Rogerson:**

**Explains income gap b/w U.S., Western Europe**

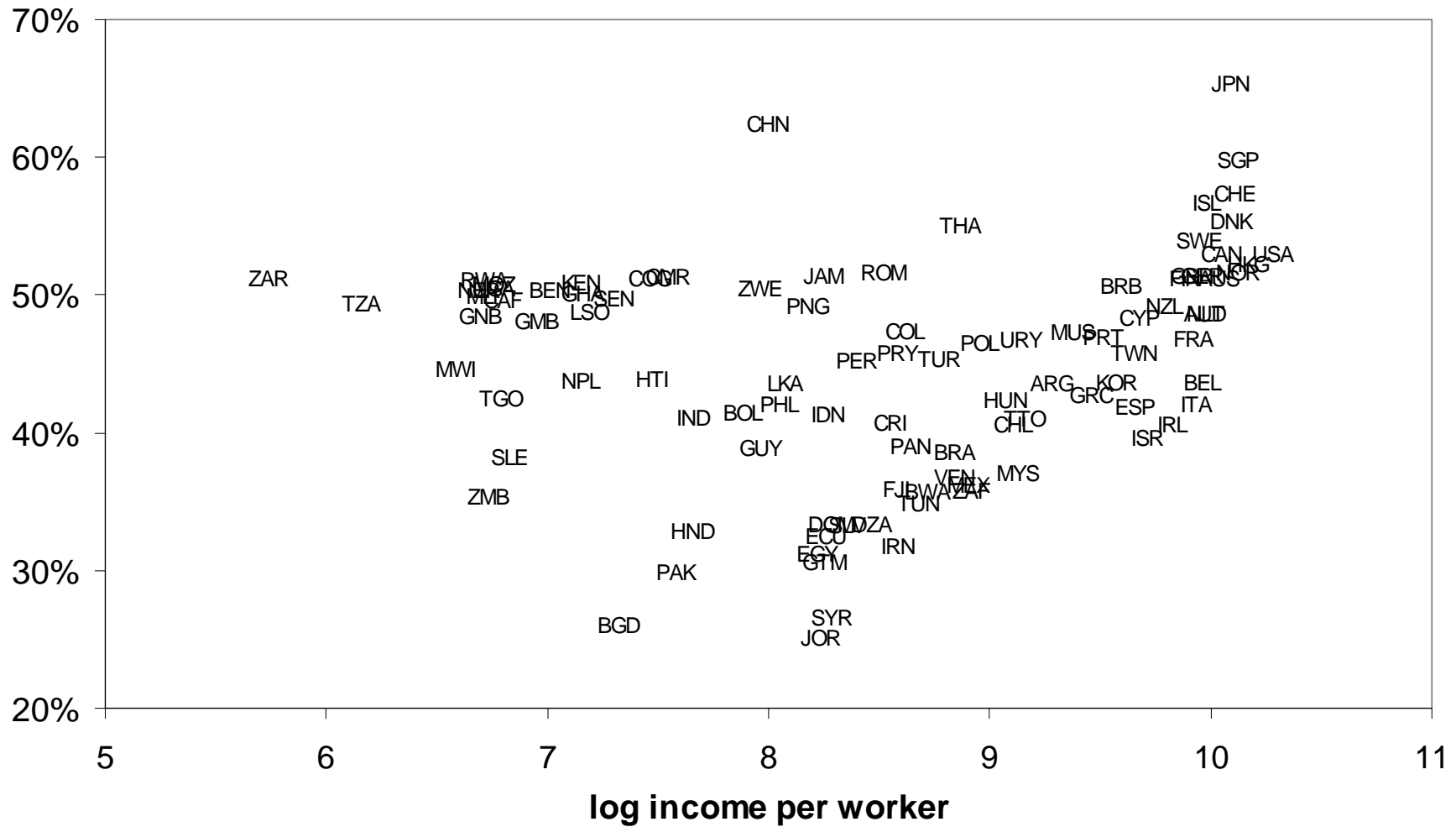
**Alwyn Young:**

**Explains 20% of growth in Asian Tigers, China**

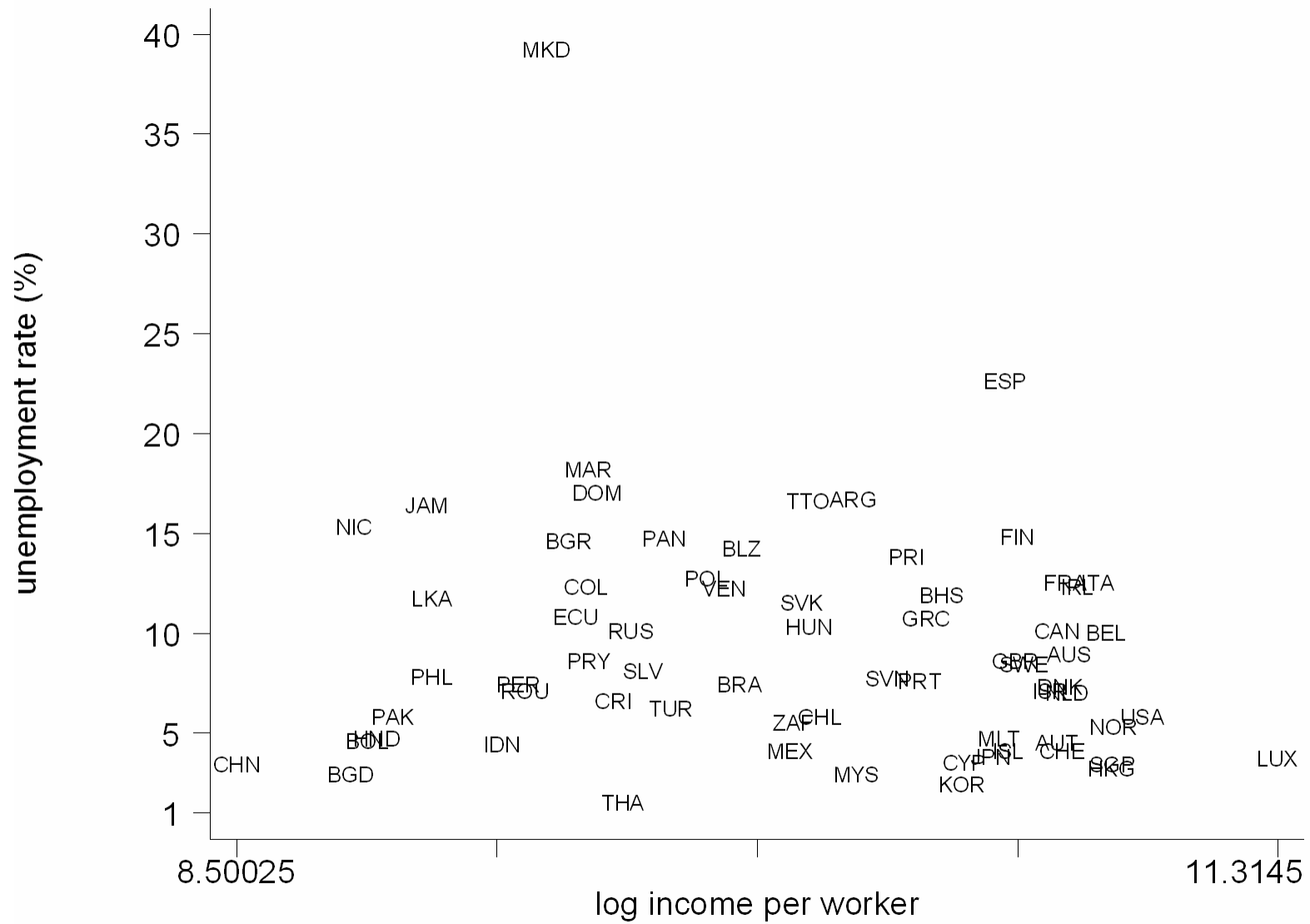
**Parente, Rogerson & Wright:**

**Poor do more home work, less market work**

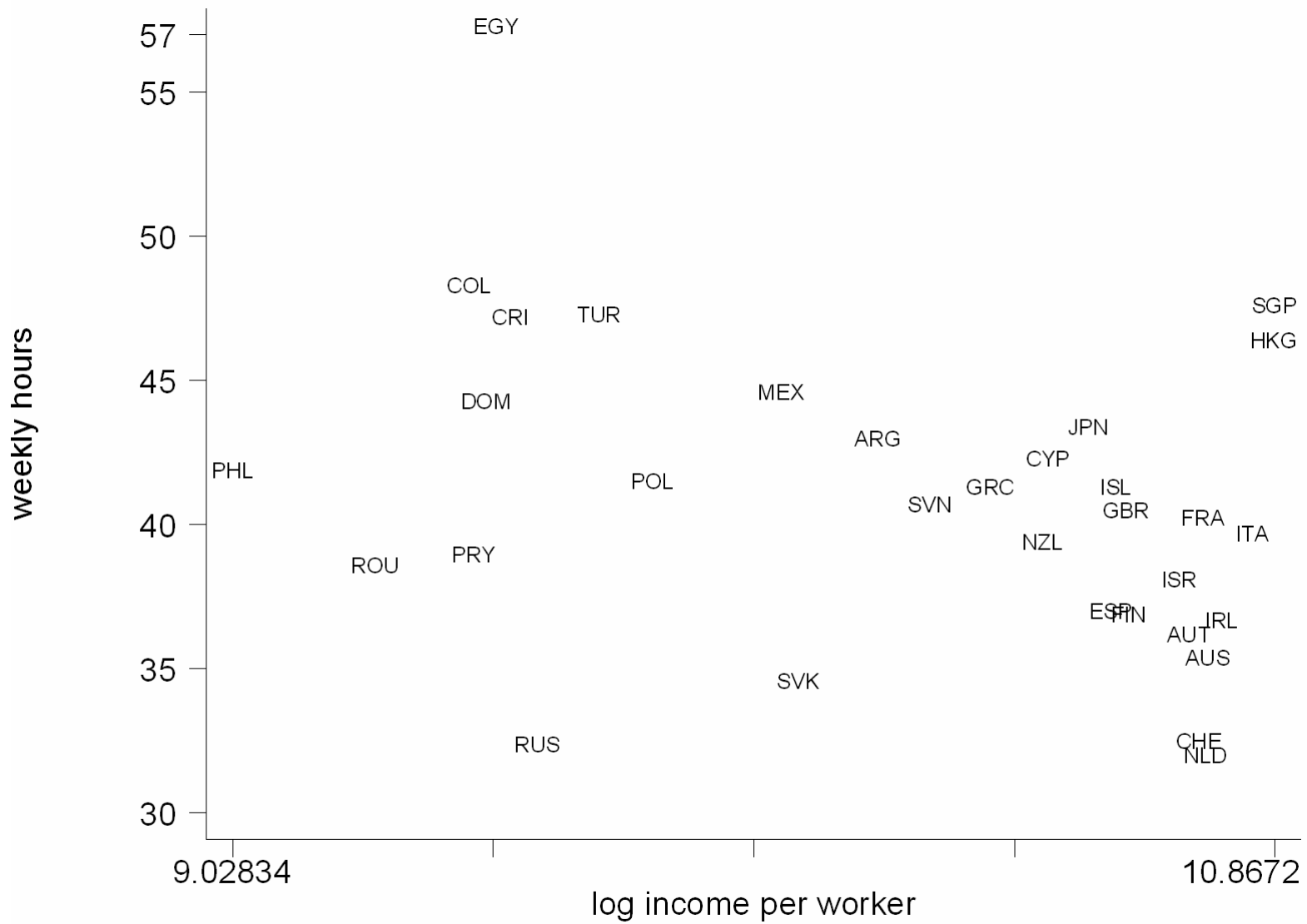
## Labor Force / Population



Source: ILO via Penn World Table (97 countries in 1996)



Source: WDI via Caselli (2005)



Source: ILO via Caselli (2005), 41 countries in 1996

# Development Accounting

$$\underbrace{\frac{Y}{pop}}_{24} = \underbrace{\frac{L}{pop}}_1 \left[ \frac{K}{Y} \right]^{1-\alpha} h A$$

# **L/pop: Open Questions**

**ILO data suspect?**

**10% of Asian growth, vs. Young's 20%**

**Hours worked per agricultural worker?**

**Alternatively, count home production.**

## **Point 3: K/Y**

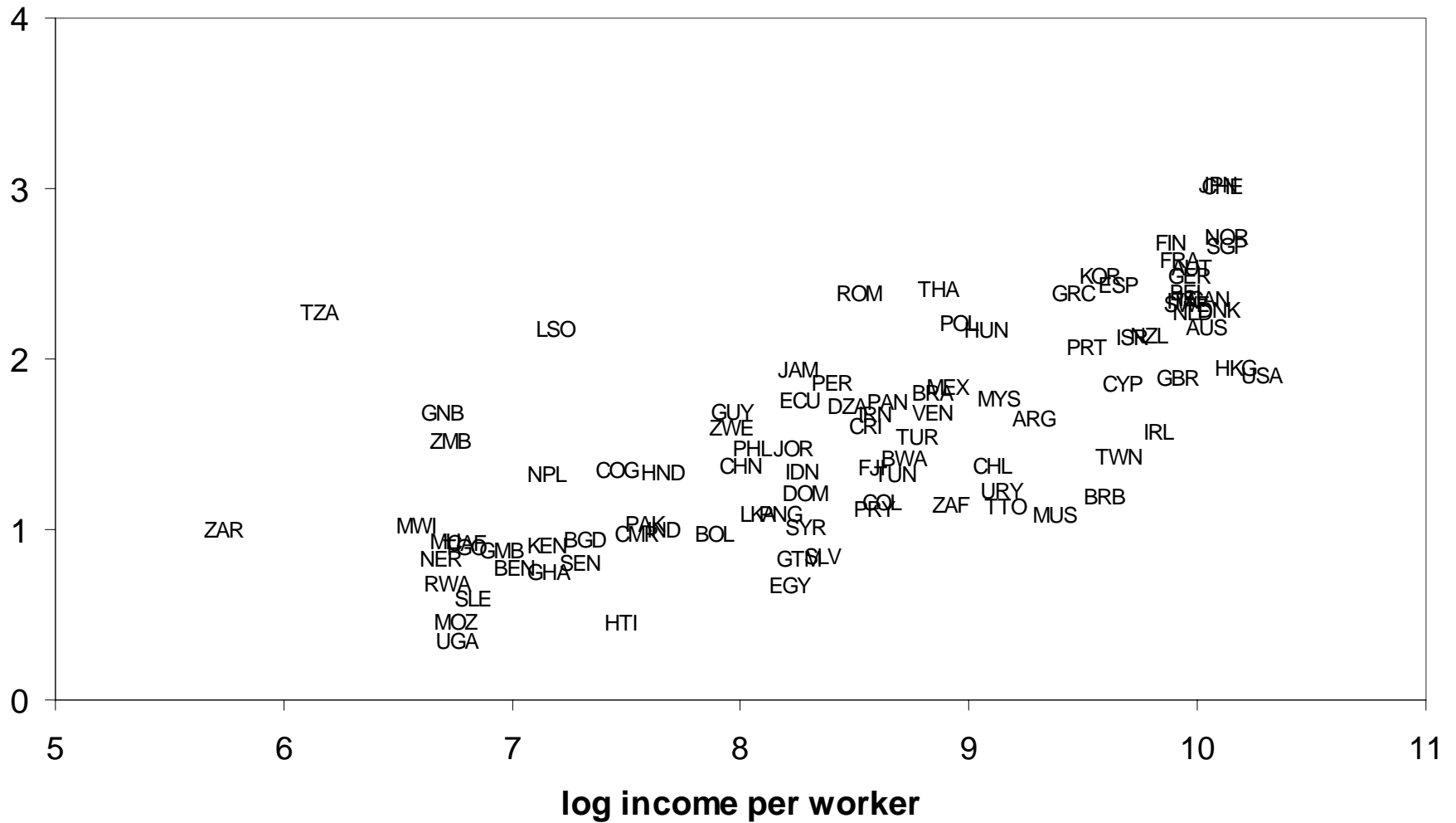
**Richer countries have higher PPP I/Y (corr 0.6).**

**Estimate K/Y using perpetual inventory and an initial stock guess.**

**$\Rightarrow$  richer countries have higher K/Y (corr 0.7).**



K/Y



# Development Accounting

$$\underbrace{\frac{Y}{pop}}_{24} = \underbrace{\frac{L}{pop}}_1 \underbrace{\left[ \frac{K}{Y} \right]^{1-\alpha}}_2 h A$$

# Forces driving K/Y variation

# Forces driving $K/Y$ variation

**Saving rates?**



# Forces driving K/Y variation

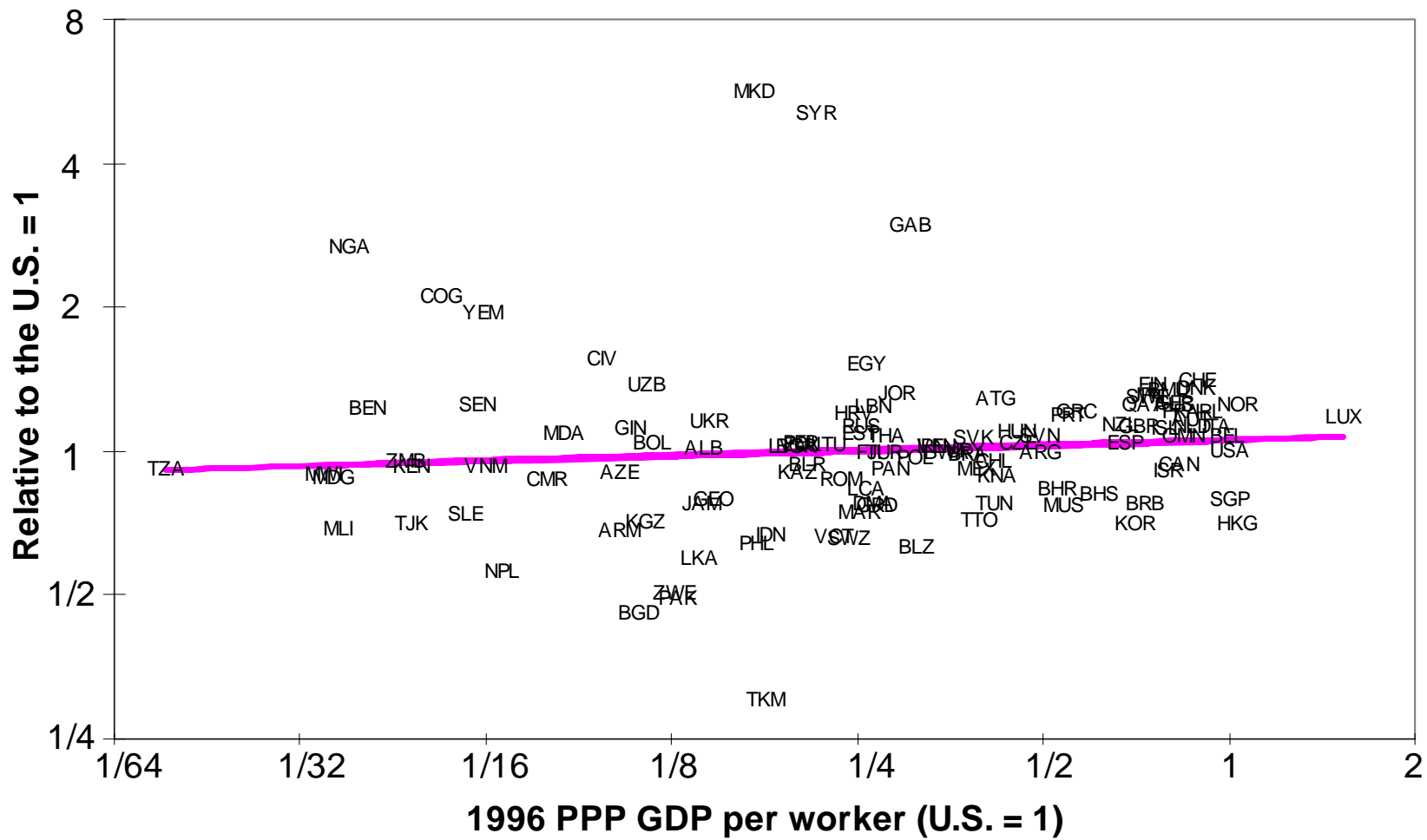
**Saving rates? NO**

# Forces driving $K/Y$ variation

Saving rates? **NO**

Investment prices?

# 1996 Price of Equipment





# Forces driving $K/Y$ variation

**Saving rates? NO**

**Investment prices? NO**

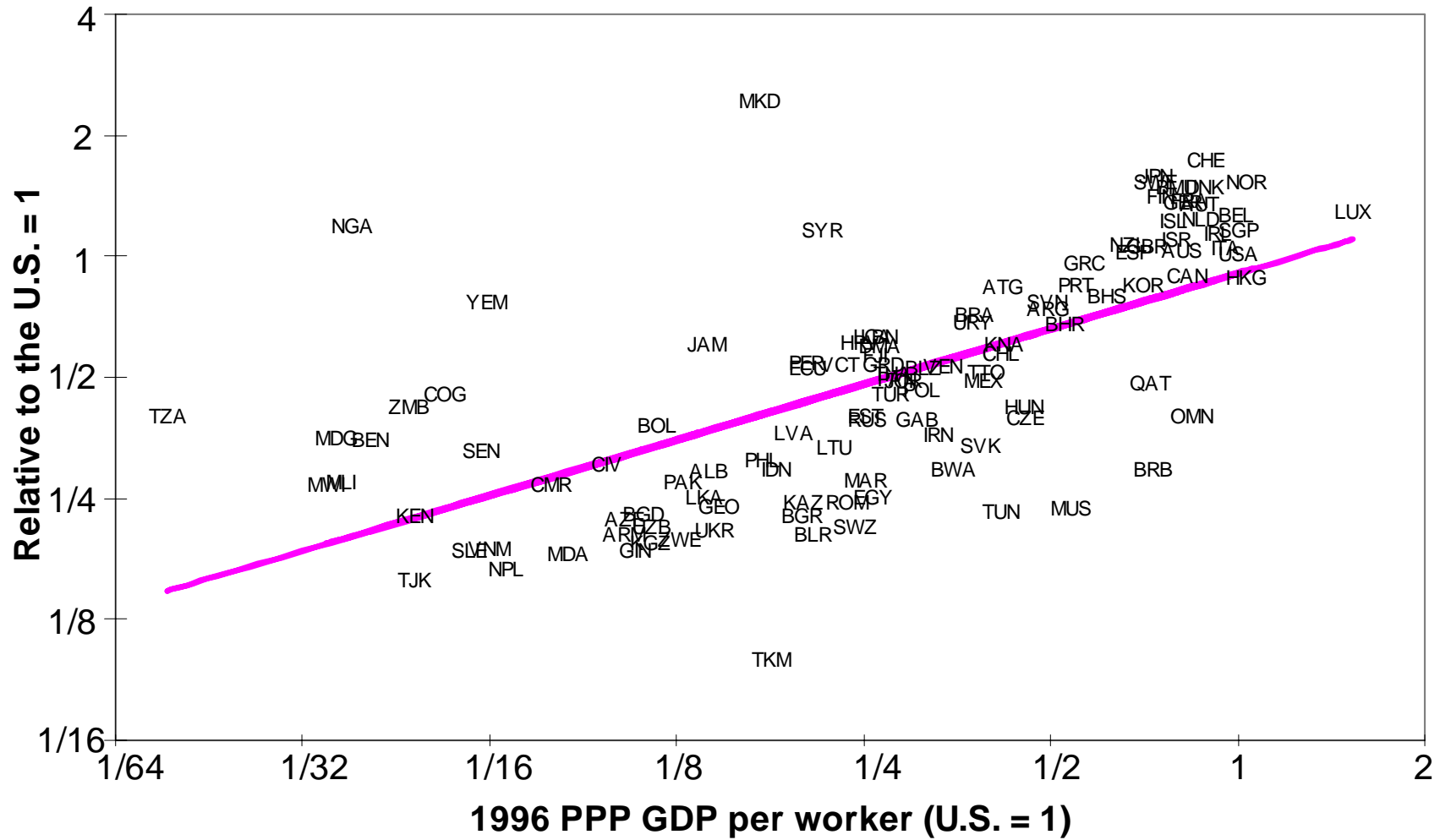
# Forces driving $K/Y$ variation

Saving rates? **NO**

Investment prices? **NO**

Consumption prices?

# 1996 Price of Consumption



Source: Penn World Table

# Forces driving K/Y variation

**Saving rates? NO**

**Investment prices? NO**

**Consumption prices? YES**

# **K/Y: Open Questions**

**Why are richer countries better at making K?**

**Just a reflection of h differences?**

**Eaton & Kortum:**

**Quality differences mask import barriers?**

## Point 4: MPK

**Lucas: why doesn't capital flow from rich to poor?**

**Lately it has:  $S/Y$  is more correlated with  $Y/L$  (0.5)  
than is  $I/Y$  (0.05 at domestic prices).**

**Why doesn't capital flow to equalize MPK's?**

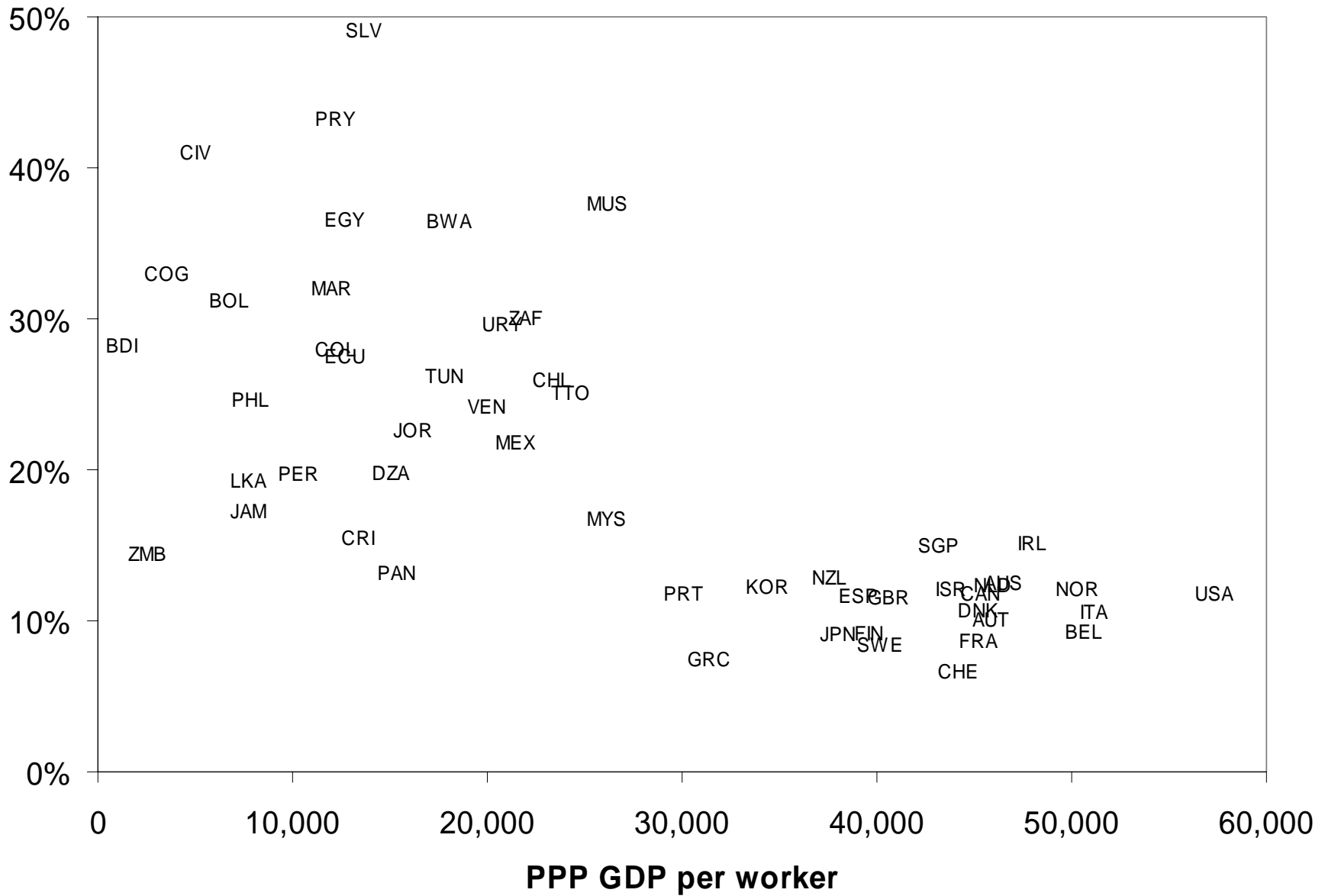
**Caselli & Feyrer: It does!**

# Caselli & Feyrer MPK's

$$\text{Naive MPK} \equiv \frac{\alpha Y}{K}$$

$$\text{Corrected MPK} \equiv \frac{\alpha P_Y Y - \text{land rents}}{P_K K}$$

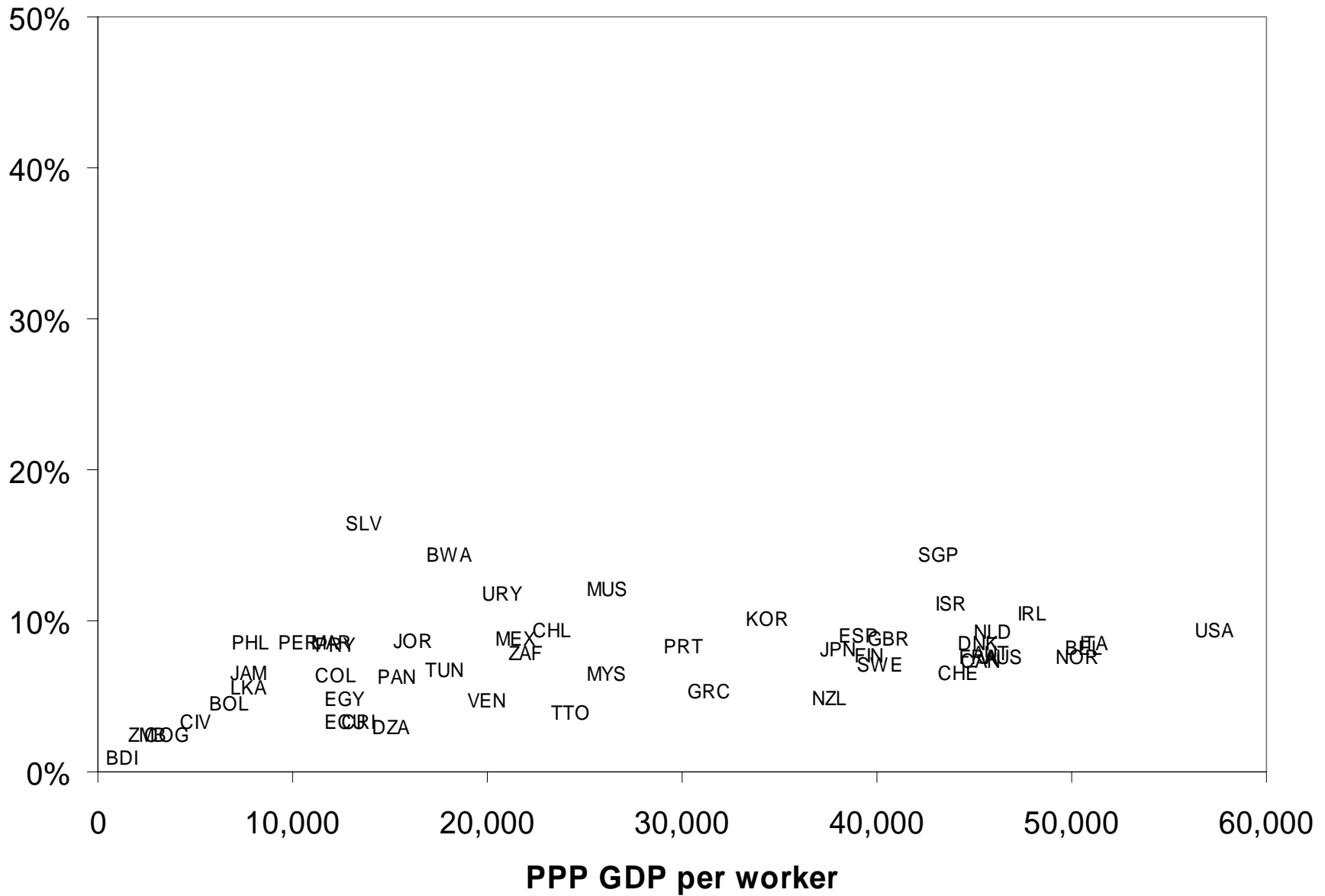
# Naive MPK



Source: Caselli & Feyrer (2006), 52 countries in 1996



# MPK Corrected for Prices, Land Rents



Source: Caselli & Feyrer (2006), 52 countries in 1996

# **MPK: Open Questions**

**Why does K's share rise with development?**

**Caselli & Coleman, Hansen & Prescott**

**No single MPK?**

**Banerjee & Duflo.**

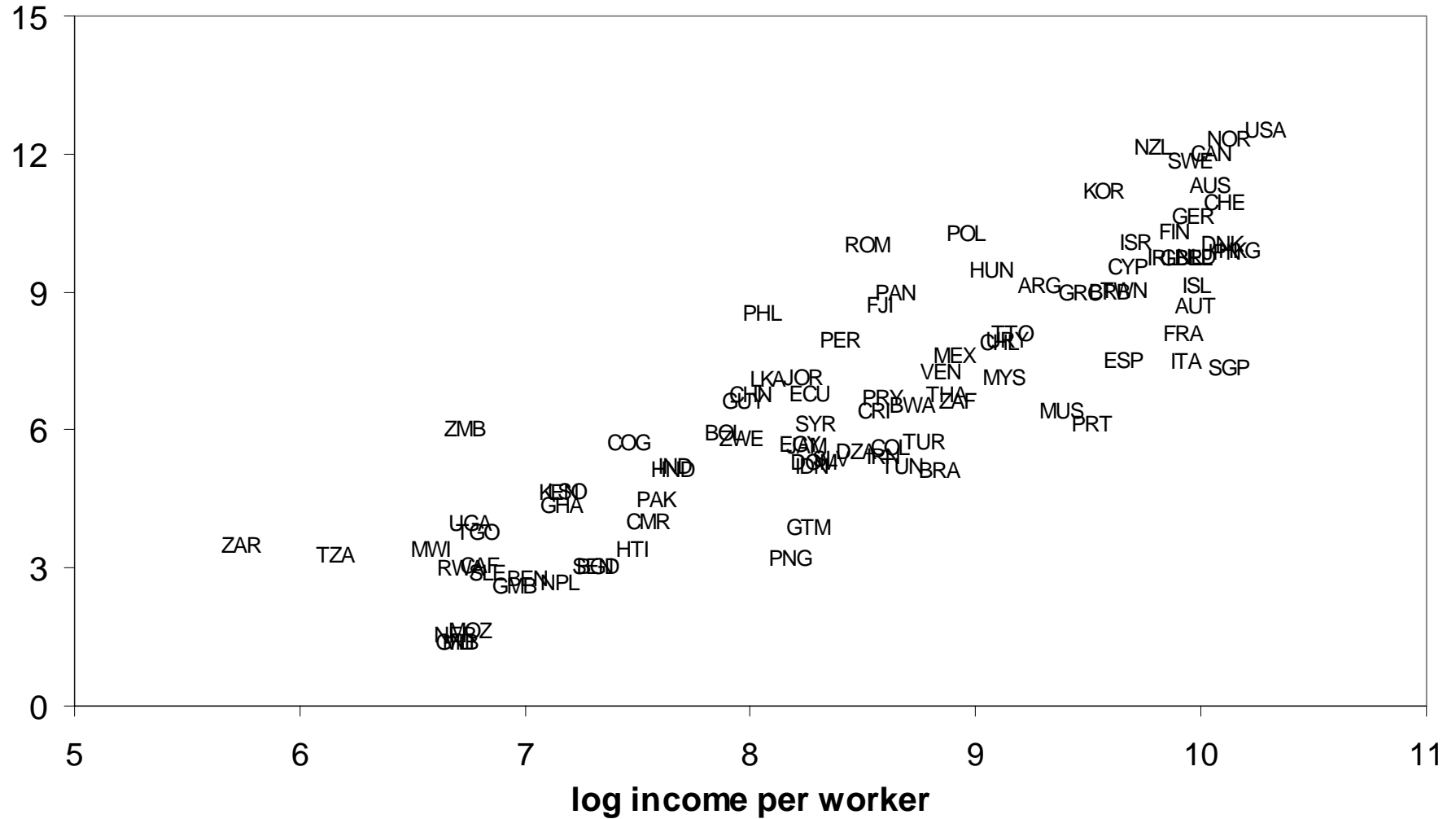
## **Point 5: Schooling and $h$**

**Higher attainment in rich countries (corr 0.9).**

**Can estimate  $h$  using Mincerian formulation  
(log of  $h$  is linear in schooling).**

**1 more year of schooling  $\approx$  10% higher  $h$**

## Years of Schooling



Source: Penn World Table and Barro-Lee (97 countries in 1996)

# Development Accounting

$$\underbrace{\frac{Y}{pop}}_{24} = \underbrace{\frac{L}{pop}}_1 \underbrace{\left[ \frac{K}{Y} \right]^{1-\alpha}}_2 \underbrace{h}_2 A$$

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$$\underbrace{\frac{Y}{pop}}_{24} = \underbrace{\frac{L}{pop}}_1 \underbrace{\left[ \frac{K}{Y} \right]^{1-\alpha}}_2 \underbrace{h}_2 \underbrace{A}_6$$

# Point 6: MPH

**Single Mincerian return in all countries?**

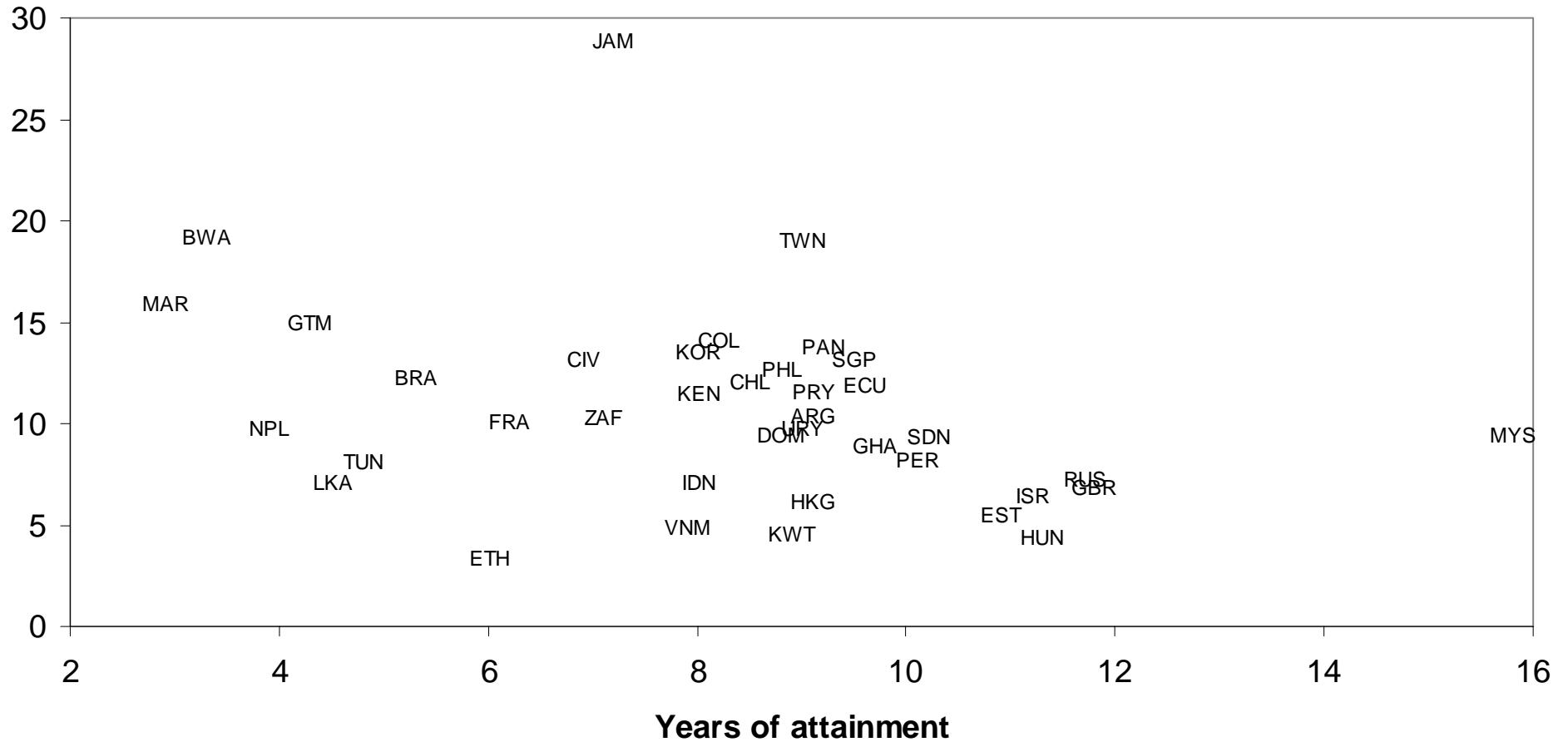
**Psacharopoulos & collaborators:**

**higher Mincerian return in poor countries**

**Banerjee & Duflo:**

**when well-measured, similar across countries**

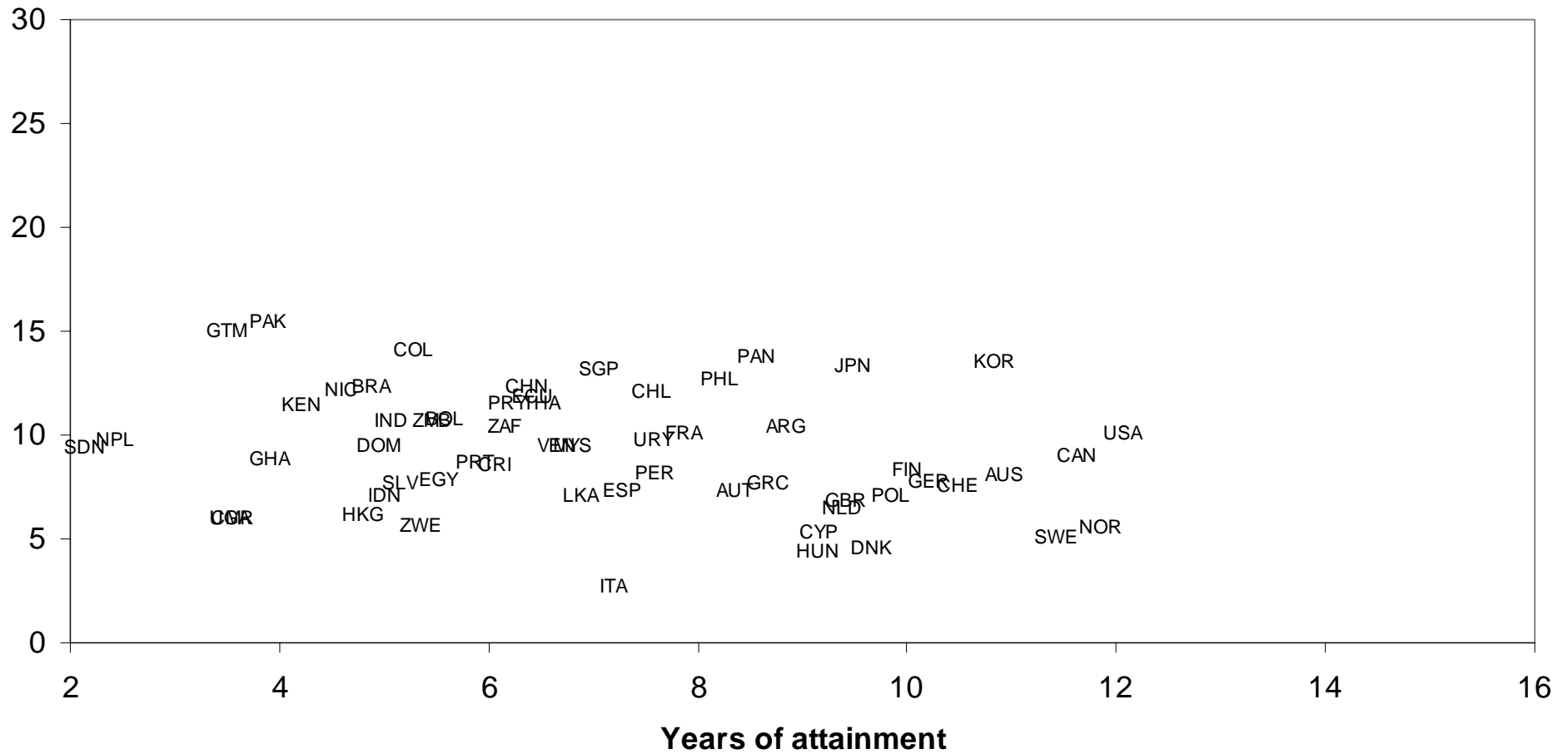
## Mincerian returns vs. schooling



Source: Banerjee and Duflo (2005); 38 countries, various years



## Mincerian returns vs. schooling (better data)



Source: Banerjee and Duflo (2005); 59 countries, various years

# Limits to the Mincerian Approach

Manuelli & Seshadri / Erosa, Koreshkova, Restuccia:

$\ln h_i = f(s_i, y_i, a_i)$ ,  $y = \text{inputs}$ ,  $a = \text{ability}$

$$\frac{d \ln h_i}{ds_i} = \frac{\partial f}{\partial s_i} + \frac{\partial f}{\partial y_i} \frac{\partial y_i}{\partial s_i} + \frac{\partial f}{\partial a_i} \frac{\partial a_i}{\partial s_i}$$

But x-country = x-individual?

# x-country vs. x-individual

Country TFP differences

$$\Rightarrow \text{x-country } \frac{\partial y_i}{\partial s_i} \gg \text{x-individual } \frac{\partial y_i}{\partial s_i}$$

Even more so with public schools?

$$\text{Yet perhaps x-country } \frac{\partial a_i}{\partial s_i} \ll \text{x-individual } \frac{\partial a_i}{\partial s_i}.$$

# **h: Open Questions**

**Production function for h?**

**Accumulation at home, on the job?**

**Externalities?**

**Sources of h variation across countries?**

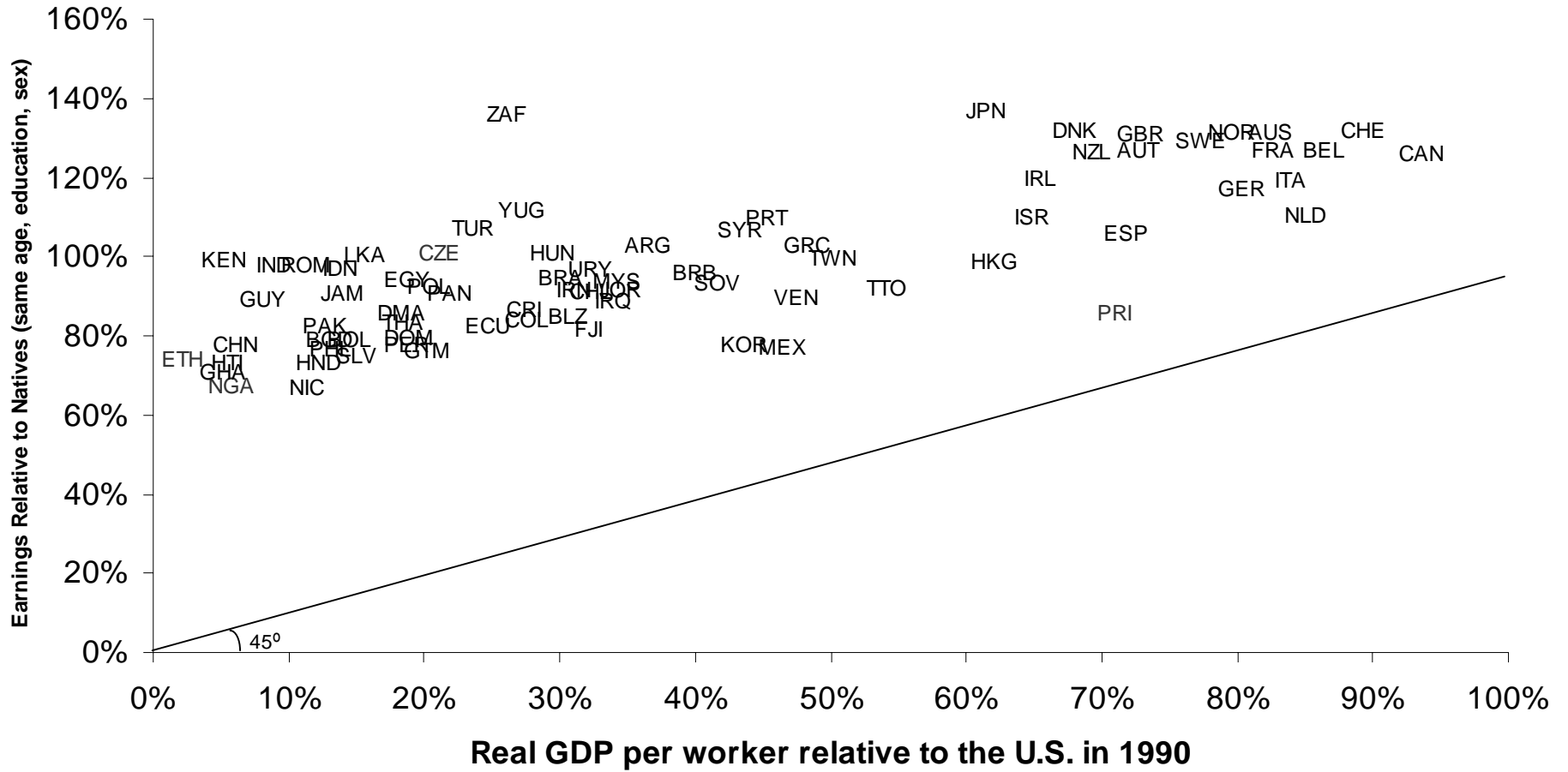
# **Point 7: Immigrants and h**

**Immigrants provide useful info on h.**

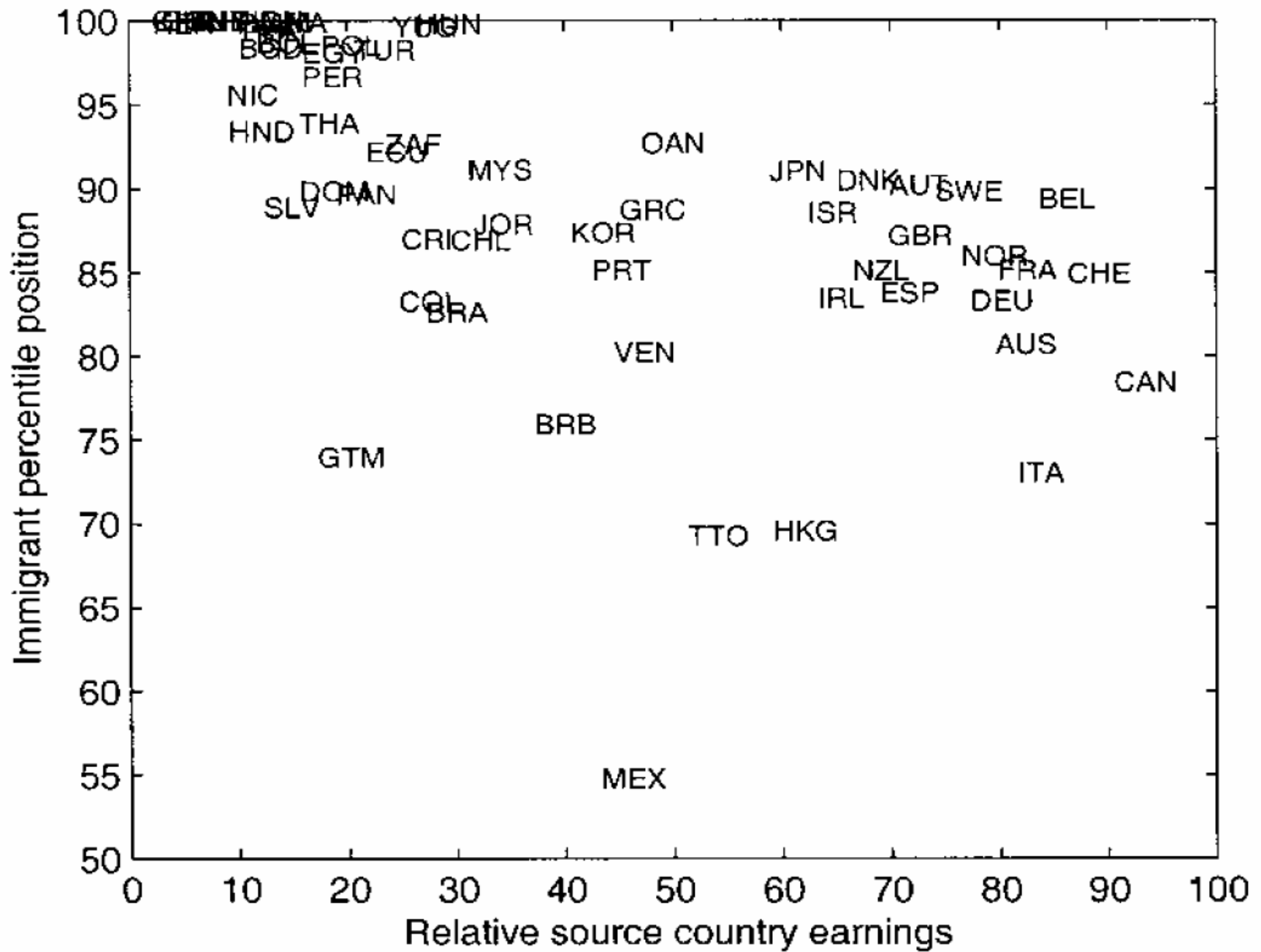
**Different source countries, one market.**

**Hendricks: U.S. Census data for 1990**

## Immigrants vs. Natives in the U.S.



Source: Hendricks (2002); 74 countries in 1990



Source: Hendricks (2002)

# Development Accounting

$$\underbrace{\frac{Y}{pop}}_{24} = \underbrace{\frac{L}{pop}}_1 \underbrace{\left[ \frac{K}{Y} \right]^{1-\alpha}}_2 \underbrace{h}_{2-4} A$$



# Development Accounting

$$\underbrace{\frac{Y}{pop}}_{24} = \underbrace{\frac{L}{pop}}_1 \underbrace{\left[ \frac{K}{Y} \right]^{1-\alpha}}_2 \underbrace{h}_{2-4} \underbrace{A}_{3-6}$$

# **Point 8: Technology and A**

**Same technology in all countries?**

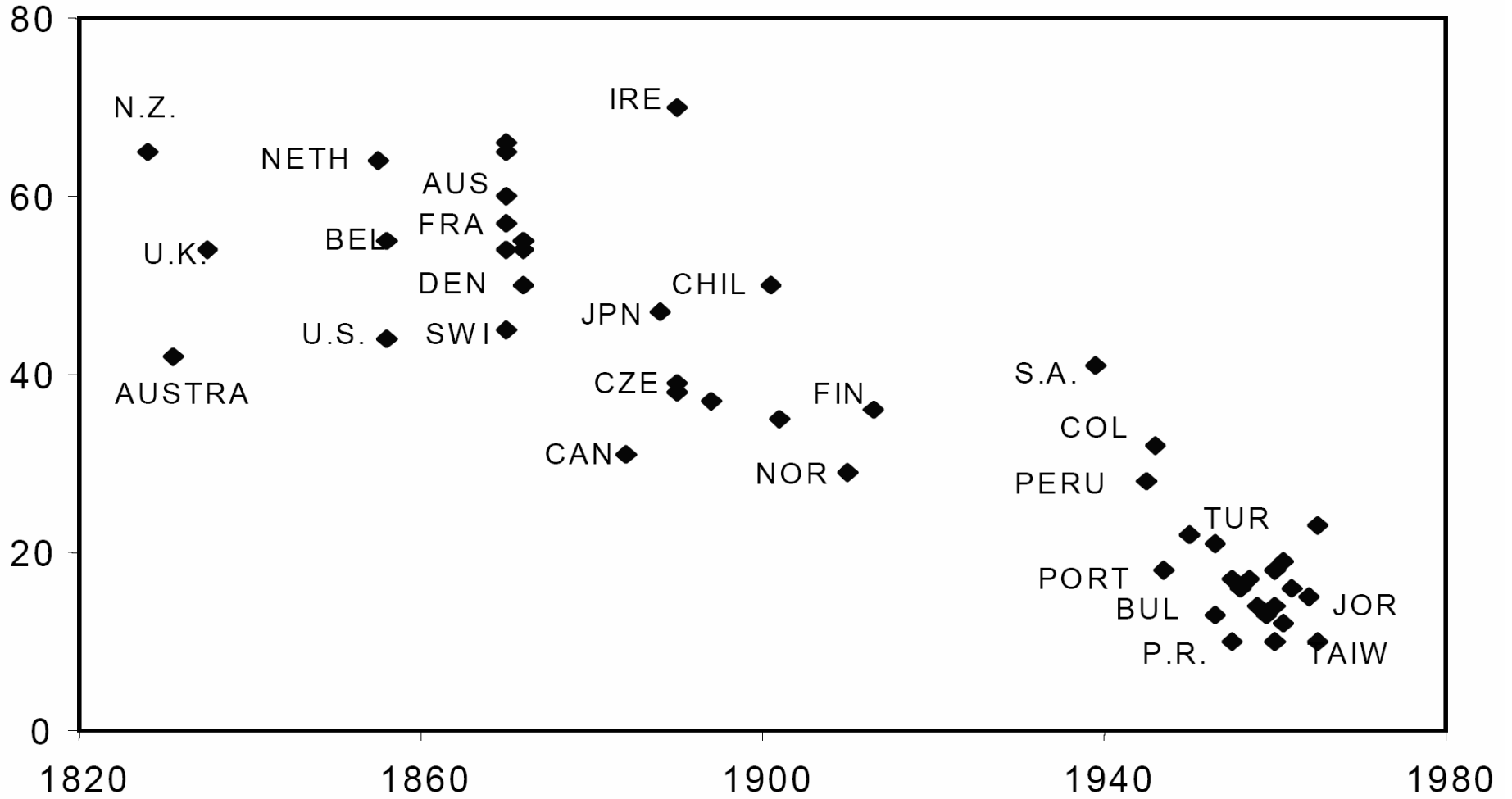
**TFP gaps exist even within countries.**

**Firms may have to invest in adoption.**

**Why can't FDI eliminate any differences?**

**See Chad Jones' recent paper.**

# Years for Income per Capita to Grow from 2,000 to 4,000 (1990 \$U.S.)



# Technology and A: Open Questions

**Data on barriers and investments?**

**Channels for international diffusion?**

**Right model? Parente & Prescott**

**Howitt**

**Klenow & Rodriguez-Clare**

# Points 9 & 10: Misallocation and A

Perhaps less efficient allocation of K and L within poor countries.

Maybe no higher average MPK, but more dispersion of MPK's within poor countries.

Parente & Prescott

Schmitz

Restuccia & Rogerson

# Point 9: Agriculture and A

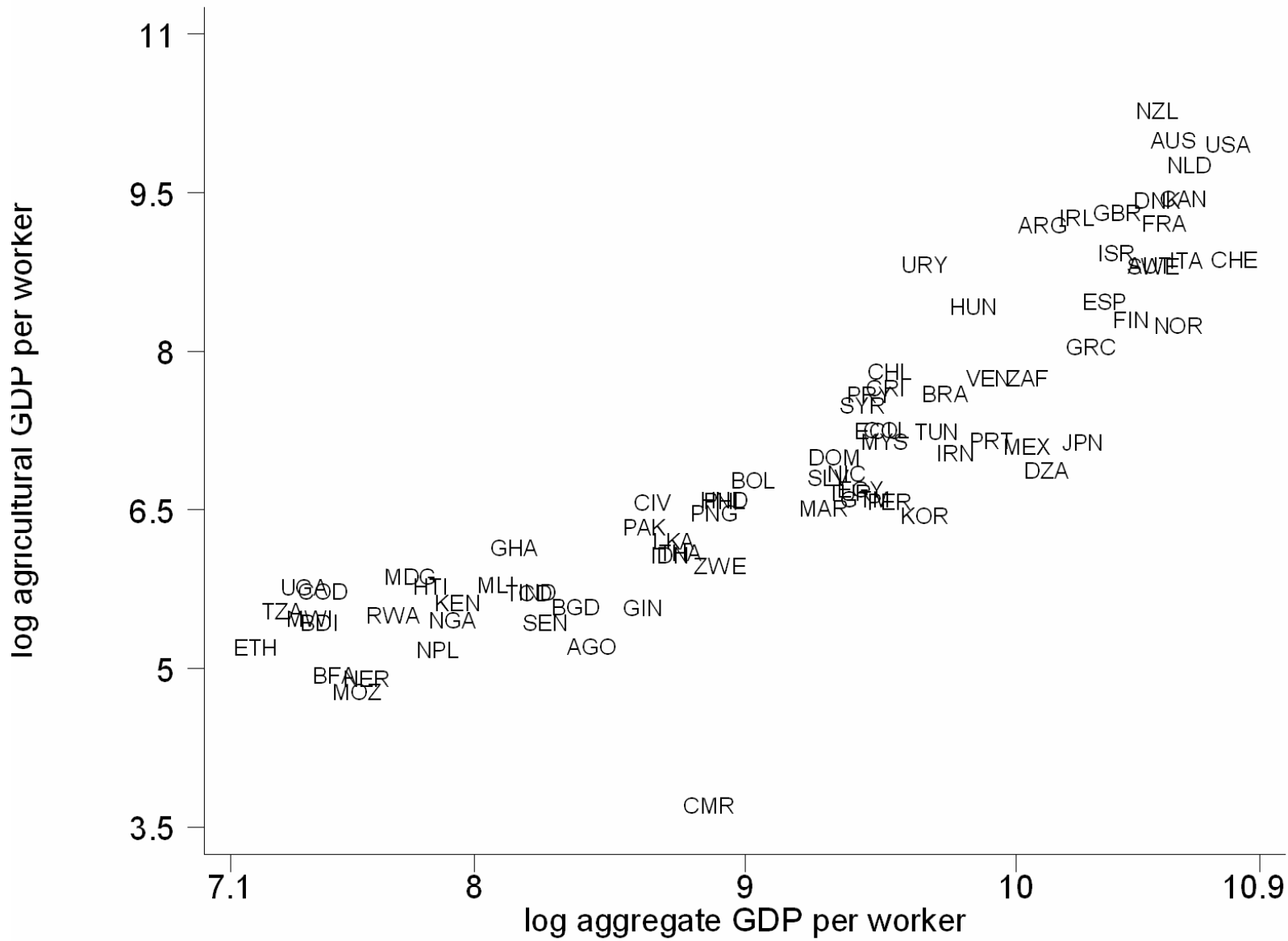
**Within agriculture, K and land less efficiently allocated in poor countries?**

**Between agriculture and rest of economy, L less efficiently allocated in poor countries?**

**Restuccia, Yang, & Zhu**

**Gollin, Parente & Rogerson**

**Caselli Handbook**



Source: Caselli (2005)





# Productivity in Agriculture

	<u>Ag.</u>	<u>Non-ag.</u>
<b>S.D. of log Y/L</b>	<b>1.47</b>	<b>0.57</b>
<b>90<sup>th</sup>/10<sup>th</sup></b>	<b>45</b>	<b>4.2</b>

Source: Caselli (2005), 80 countries in 1985

# Counterfactual Calculation

	<u>S.D.</u>	<u>90th/10th</u>
<b>Actual log Y/L</b>	<b>1.1</b>	<b>22</b>
<b>With U.S. emp. shares</b>	<b>0.6</b>	<b>4</b>

# **Ag. vs. Non-ag.: Open Questions**

**Model of transition with Y/L gaps?**

**Lucas, Hansen & Prescott**

**Gaps reflect h differences?**

**Caselli & Coleman, Jeong & Kim**

**Gaps reflect home production?**

**Parente, Rogerson & Wright**

# **Point 10: Manufacturing and A**

**Big TFP gaps across plants within industries.**

**TFP gaps may imply MPK and MPL gaps.**

**If so, large potential gains from reallocation.**

# TFP Dispersion within 4-digit industries

	<u>90<sup>th</sup>/10<sup>th</sup></u>	<u>75<sup>th</sup>/25<sup>th</sup></u>
U.S.	1.9	1.3
China	5.6	2.5
India	5.7	2.4

Source: Syverson (2004) for the U.S.,  
Hsieh and Klenow (2006) for China and India.

# Potential A Gains from Reallocation

**Melitz model (monopolistic competition between firms with different productivity).**

**Reallocate K and L to equalize MPK and MPL across plants.**

**Result: China and India could **double** A.**

# **Mfg. Misallocation: Open Questions**

**Right model to gauge gaps and gains?**

**Gaps tied to observable distortions?**

**More measurement error in poor countries?**

# Recap of Development Accounting

$$\underbrace{\frac{Y}{pop}}_{24} = \underbrace{\frac{L}{pop}}_1 \underbrace{\left[ \frac{K}{Y} \right]^{1-\alpha}}_2 \underbrace{h}_{2-4} \underbrace{A}_{3-6}$$



# Plenty of Open Questions

**Quality and Variety**

**Magnitude and sources of h differences**

**Externalities**

**Extent and sources of misallocation**