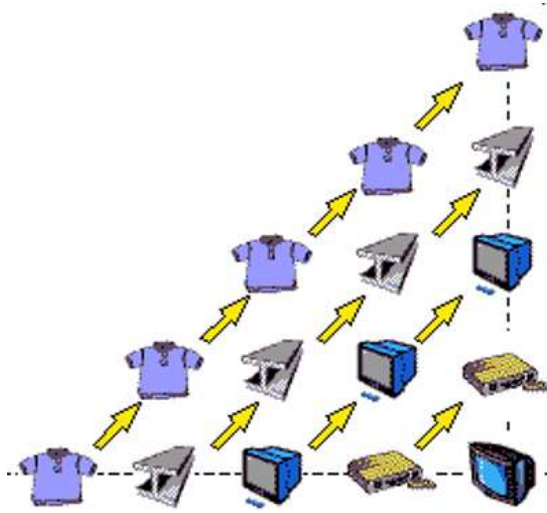


# From growth models/empirics to growth strategy



**Darryl McLeod**

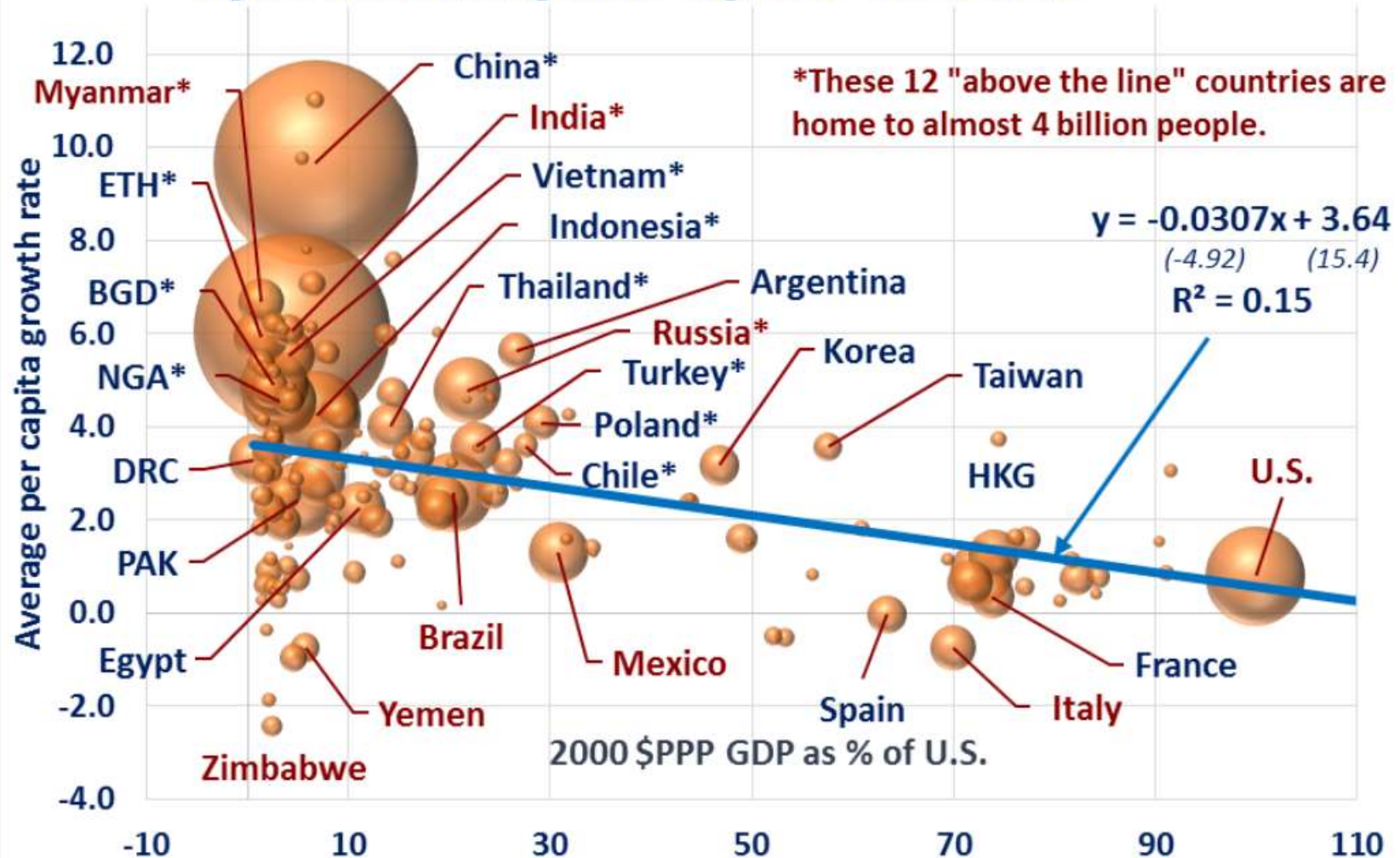
**Economic Growth & Development**

**Econ 6470 Spring 2017**

# **Beta convergence happens when poor countries grow faster than rich ctys**

- Solow-Swan model predicts beta convergence.... even in closed economies with no trade or capital flows, why? Augmented Solow model adds H...
- Absolute convergence tests failed until about 2000 then LDC growth sped up and OECD slowed see next slide...
- Globalization (labor, trade & capital flows) should speed convergence but had serious side effects
- Convergence slowed by poverty traps.... But we have medicine for this (effective aid, FDI)

**Figure C-2 Convergence, "big-time" 2000-2013**

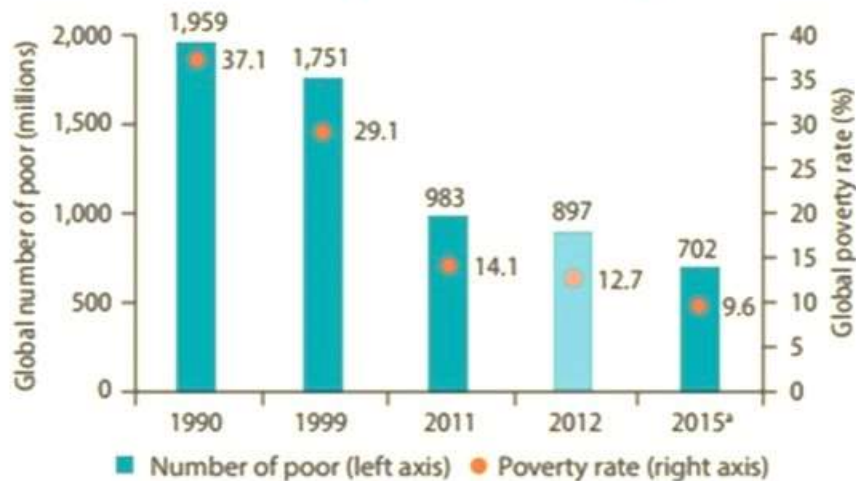


Source: IMF WEO database October 2012 the size of each bubble is proportional to the population of that country.

# Does growth help the poor, (shared prosperity, MDGs, SDGs) (see GMR, 2016)

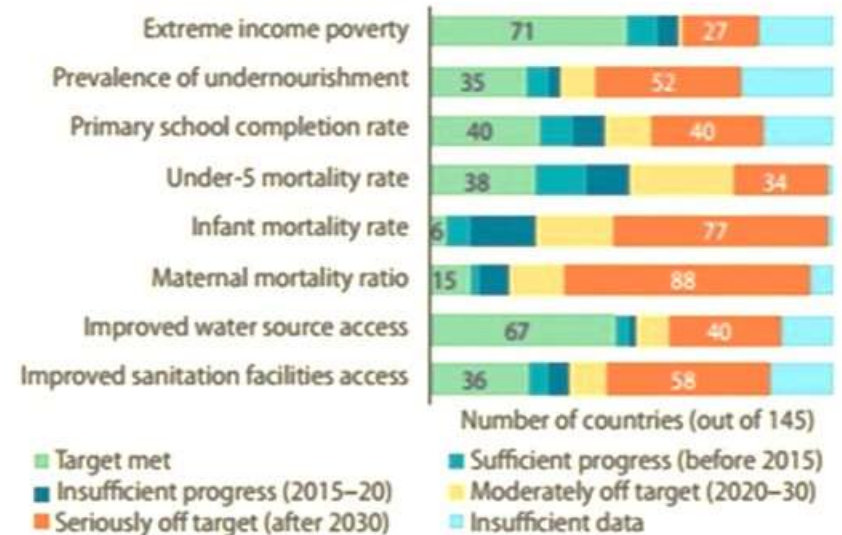
## MONITORING GLOBAL DEVELOPMENT PROGRESS: A SNAPSHOT

Projections show that the global poverty rate may have fallen to single digits in 2015. Yet, the number of poor remains high.

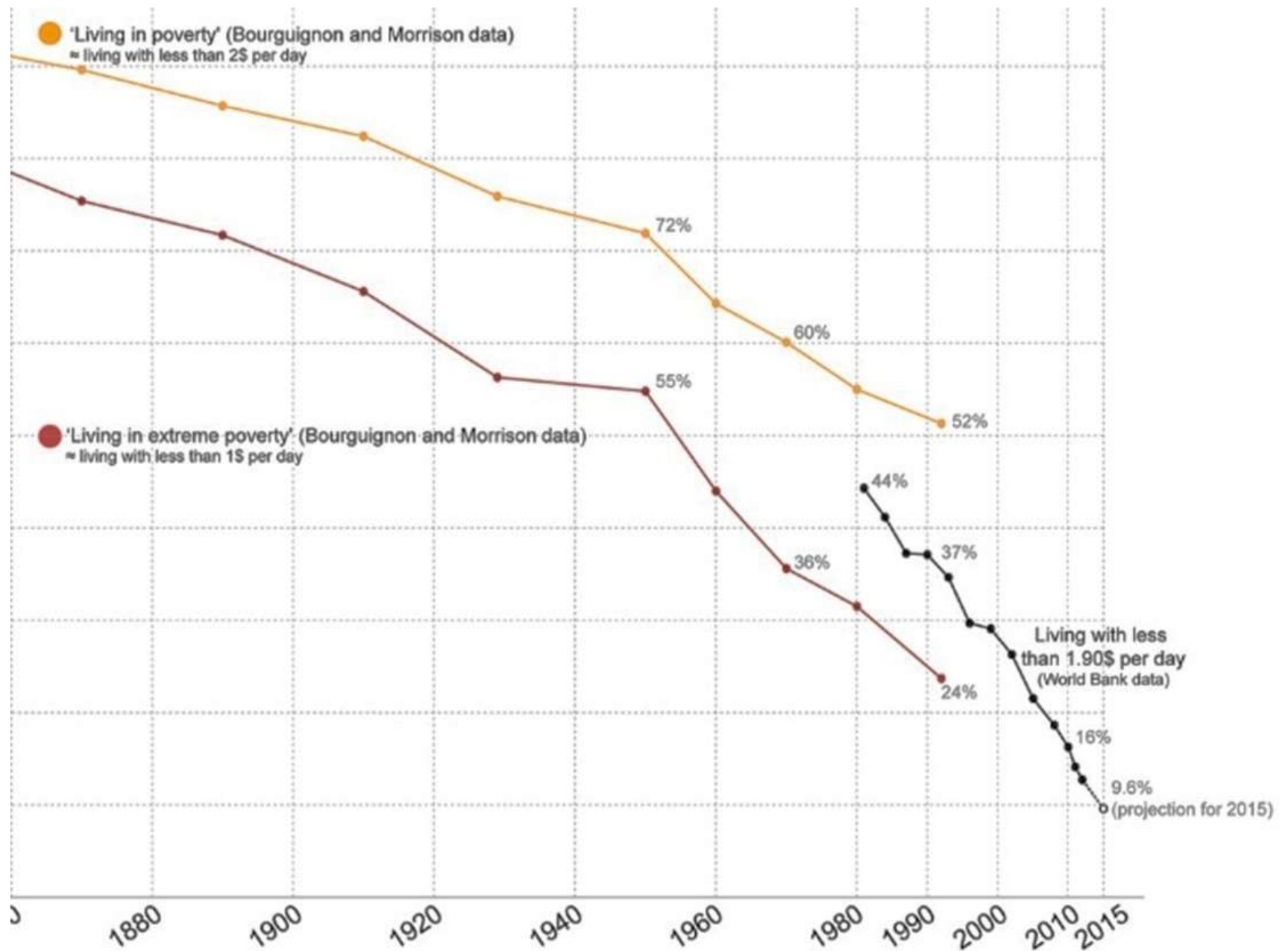


Note: Based on the \$1.90 poverty line and 2011 PPP.  
a. Forecast.

While income poverty fell rapidly during the MDG-era, a large unfinished agenda remains for the SDGs with respect to non-income goals.







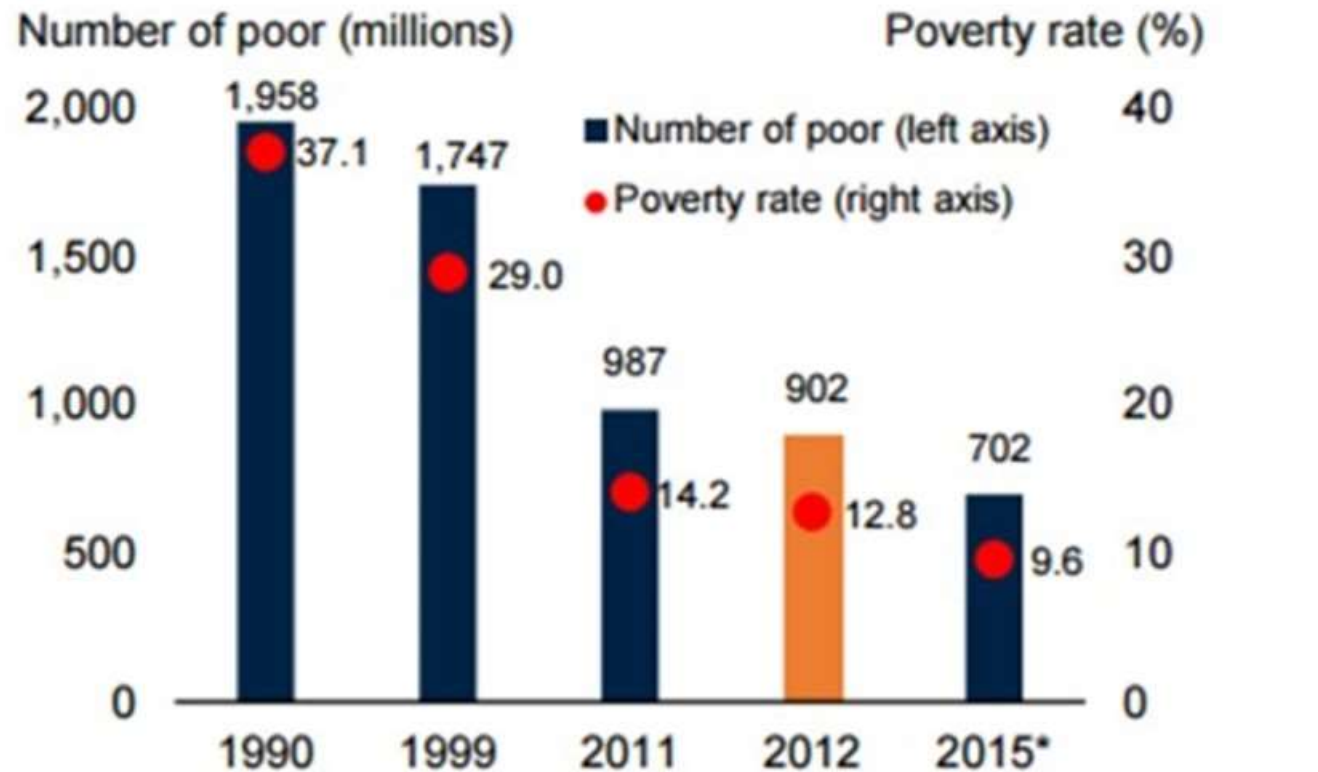
Morrison (2002) - Inequality among World Citizens, In The American Economic Review; 1981-2015 World Bank (PovcalNet)

at [OurWorldinData.org](http://OurWorldinData.org). There you find the raw data and more visualisations on this topic.

Licensed under CC-BY-SA by the author Max Roser.

## World Bank [Policy Research Note No.3: Ending Extreme Poverty and Sharing Prosperity: Progress and Policies](#)

**Projections show that the global poverty rate may have fallen to single digits in 2015. Yet, the number of poor remains high.**



Note: Based on the \$1.90 poverty line and 2011 PPP. \* is forecast

# Share of the World Population living in Absolute Poverty, 1820-2015

All data are adjusted for inflation over time and for price differences between countries (PPP adjustment).

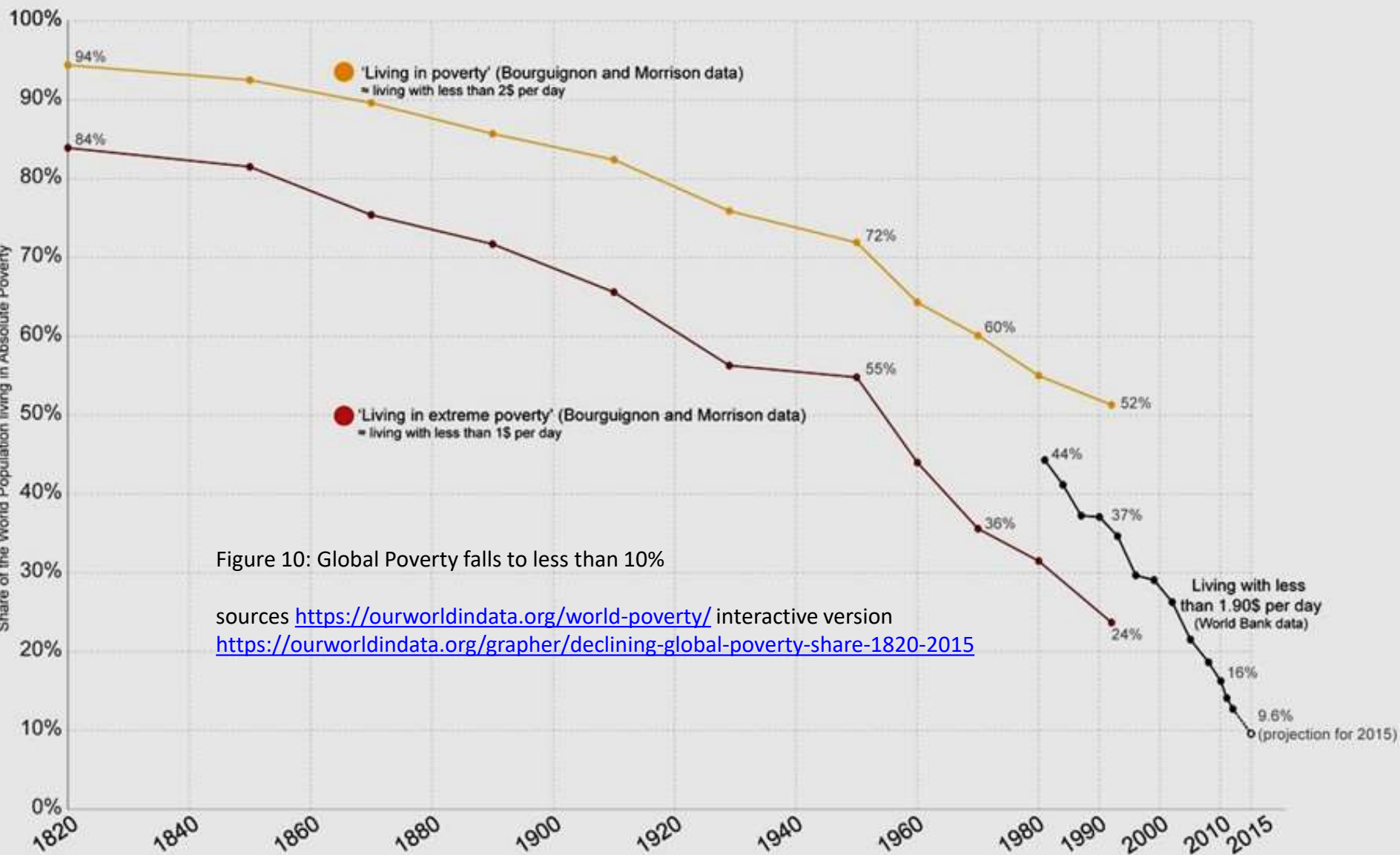


Figure 10: Global Poverty falls to less than 10%

sources <https://ourworldindata.org/world-poverty/> interactive version  
<https://ourworldindata.org/grapher/declining-global-poverty-share-1820-2015>

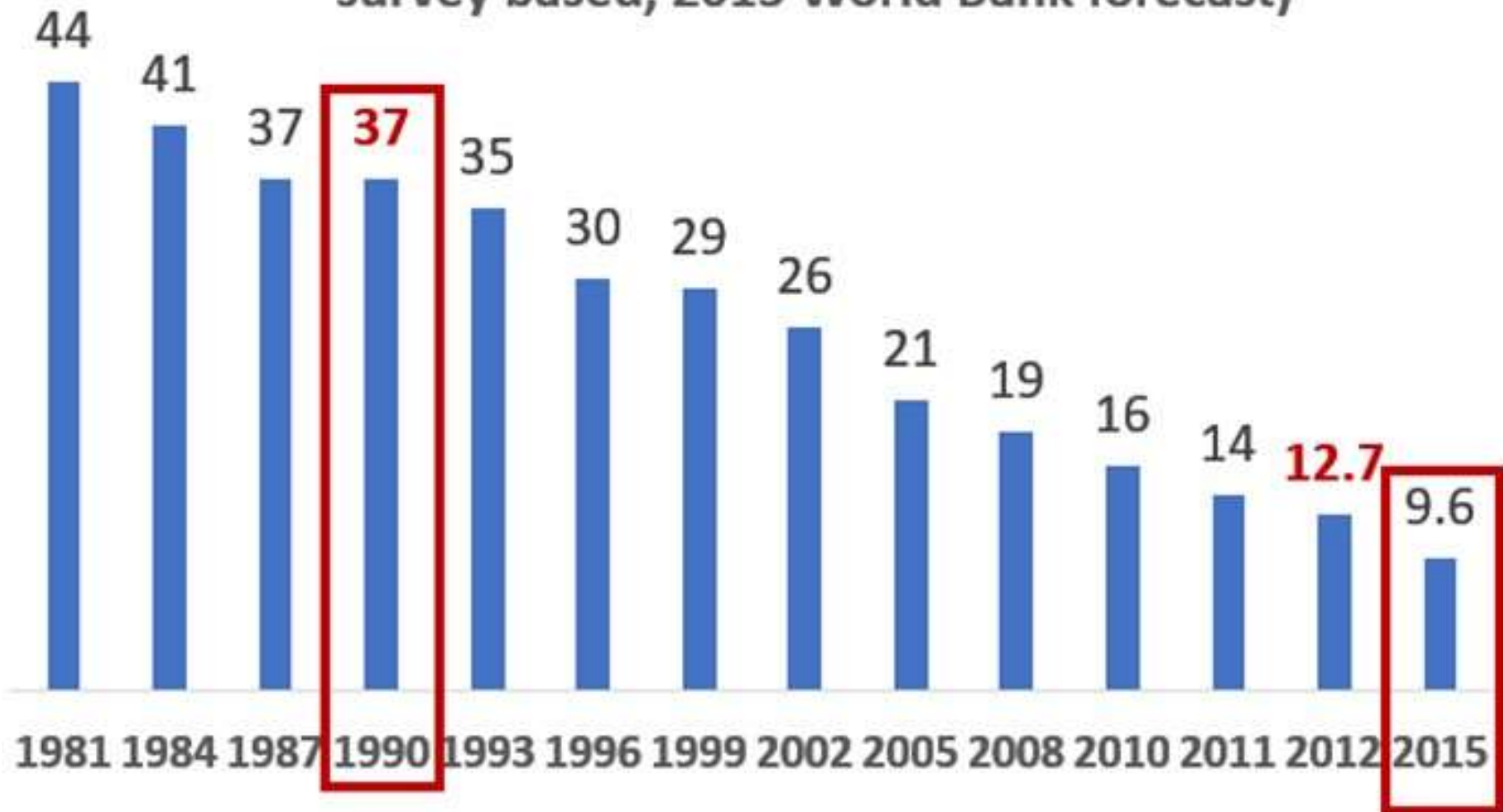
Data sources: 1820-1992 Bourguignon and Morrison (2002) - Inequality among World Citizens, In The American Economic Review; 1981-2015 World Bank (PovcalNet)

The interactive data visualisation is available at [OurWorldinData.org](https://ourworldindata.org). There you find the raw data and more visualisations on this topic.

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World Bank [Policy Research Note No.3: Ending Extreme Poverty and Sharing Prosperity: Progress and Policies](#)

Figure 1.2 \$1.90 per day Poverty rate (2012 estimate survey based, 2015 World Bank forecast)

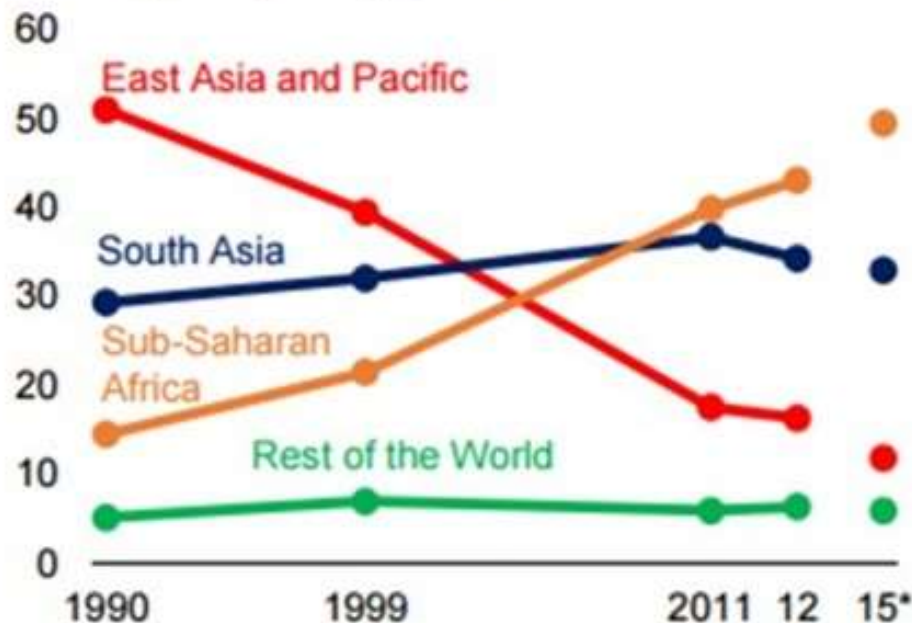




## World Bank [Policy Research Note No.3: Ending Extreme Poverty and Sharing Prosperity: Progress and Policies](#)

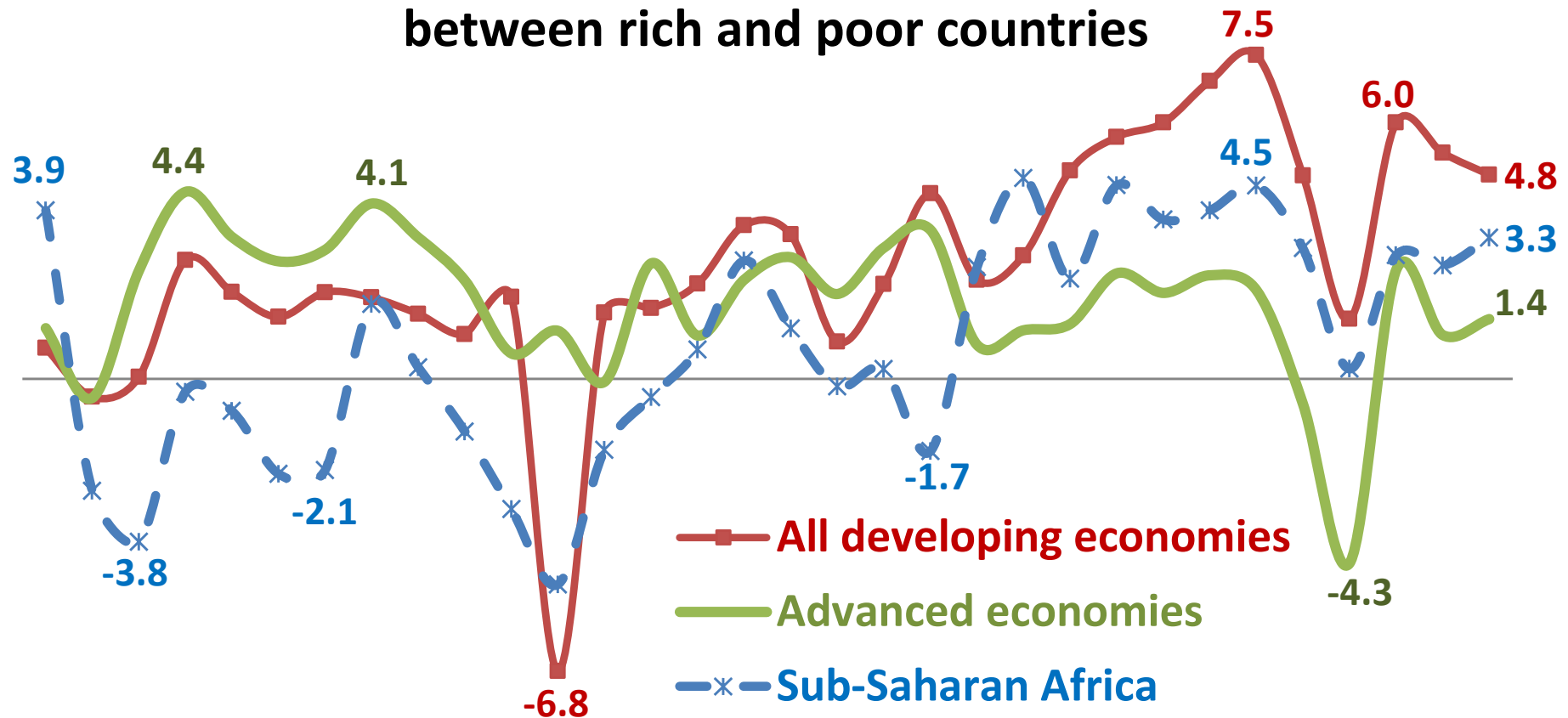
**With extreme poverty concentrating in Sub-Saharan Africa, more focus is needed on the poorest among the poor**

Share in global poverty, percent



Note: Based on the \$1.90 poverty line and 2011 PPP. \* is forecast.

**Figure 3: A decade of faster growth shrinks gap between rich and poor countries**



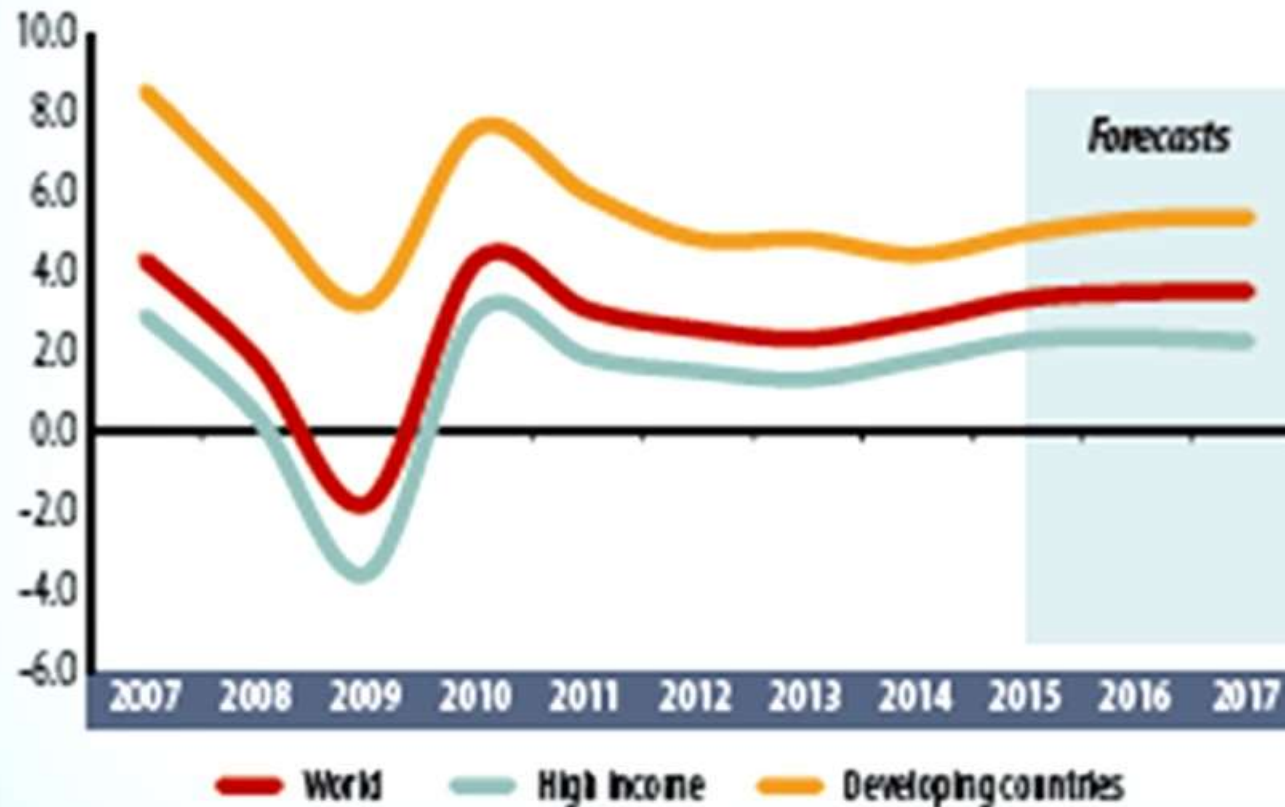
1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011

Source: Per capita GDP growth from IMF, WEO, September 2011 (2011 forecast)

# In 2015 WB predicts converge led by SSA

FIGURE 1: Global GDP growth

Real GDP growth, percent



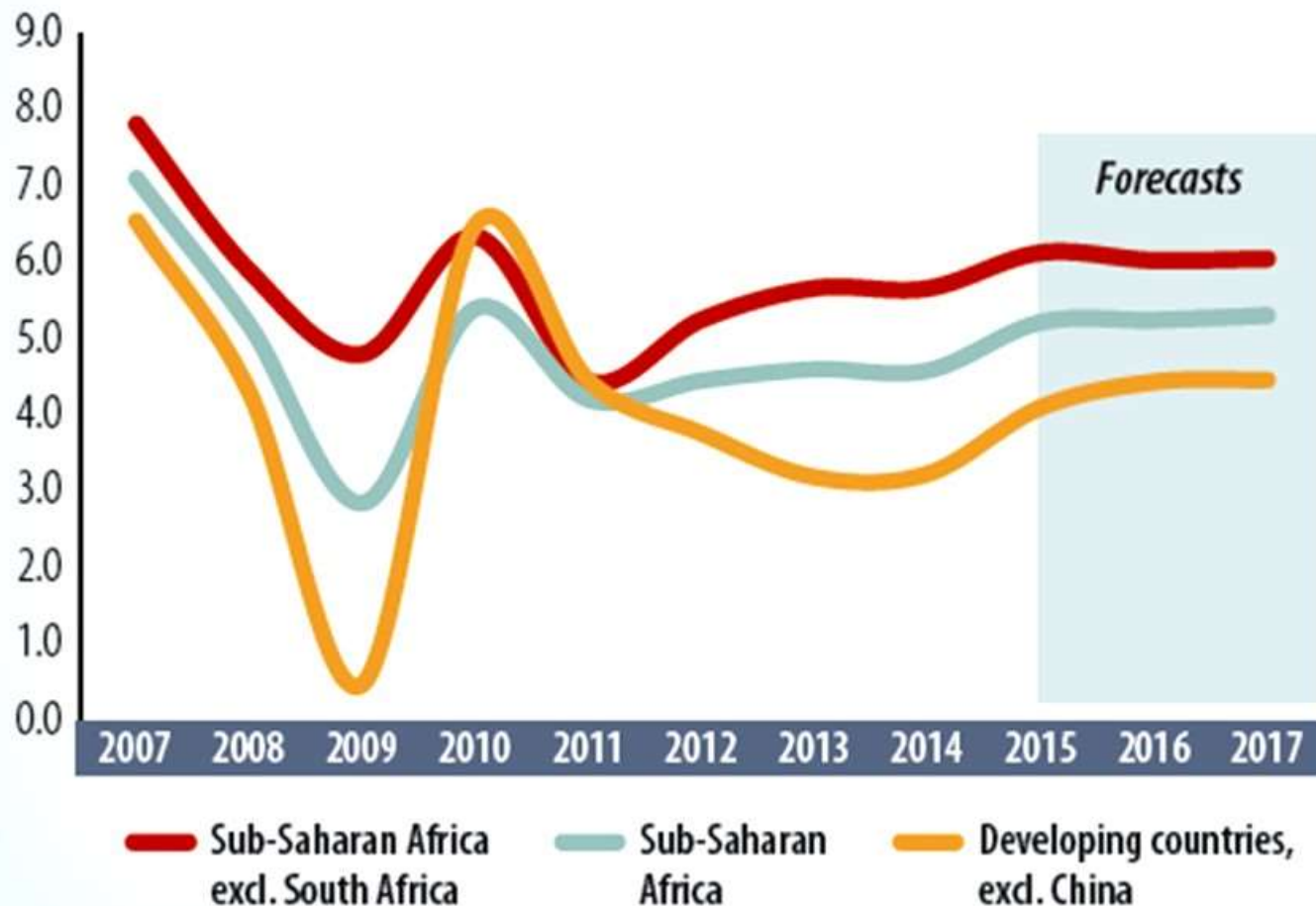
A modest pickup in global growth is expected in the second half of 2014, lifting growth to 2.6 percent for the year

Source: World Bank.

# WB predicts beta converge led by SSA

FIGURE 2: GDP growth in Sub-Saharan Africa

Real GDP growth, percent

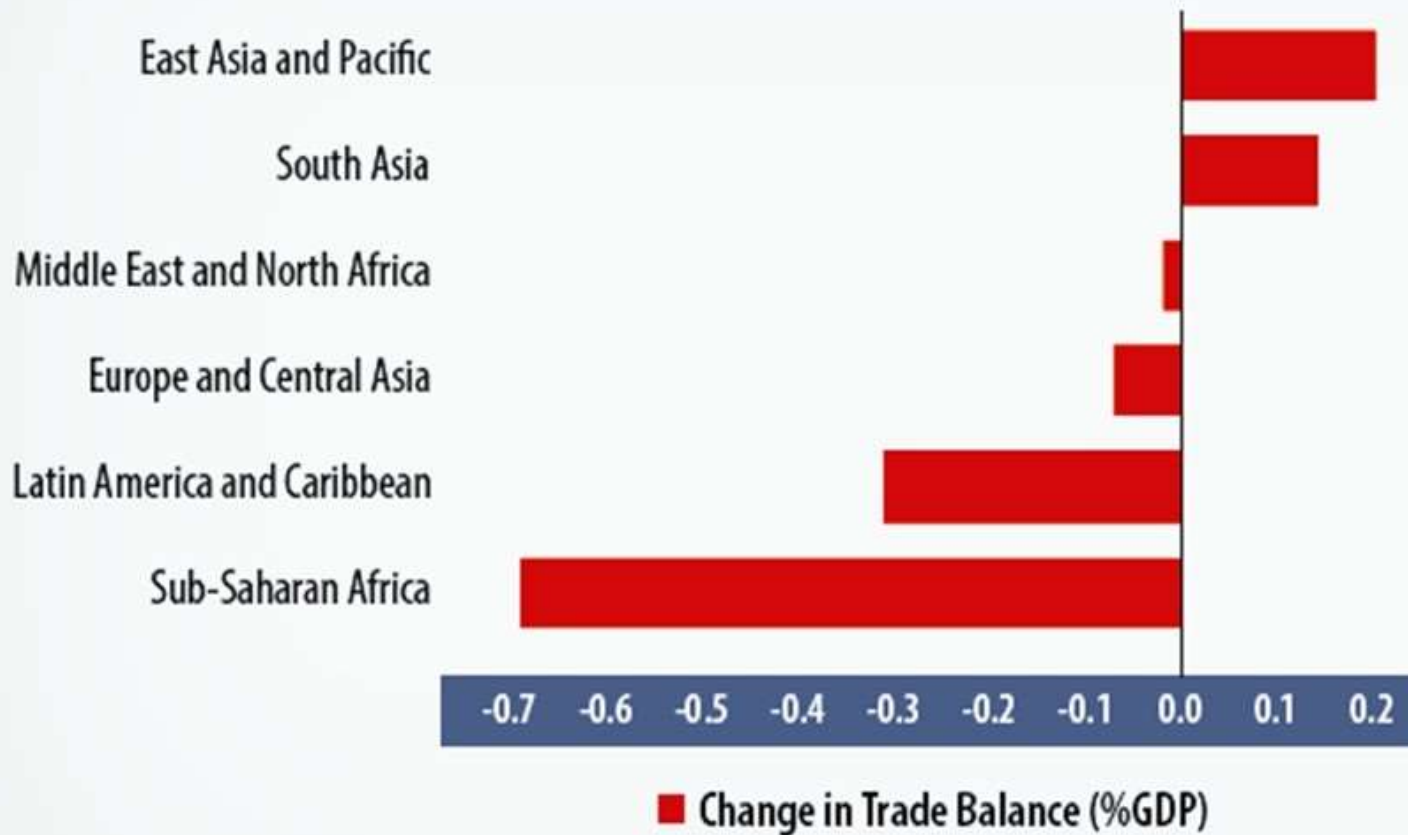


GDP growth in the region is projected to be 4.6 percent in 2014, strengthening to an average annual pace of 5.2 percent during 2015-16



# Commodity Prices may slow growth in SSA

FIGURE 10: Simulation results of a commodity price decline by region



A sharper-than-expected decline in commodity prices would affect Sub-Saharan Africa the most

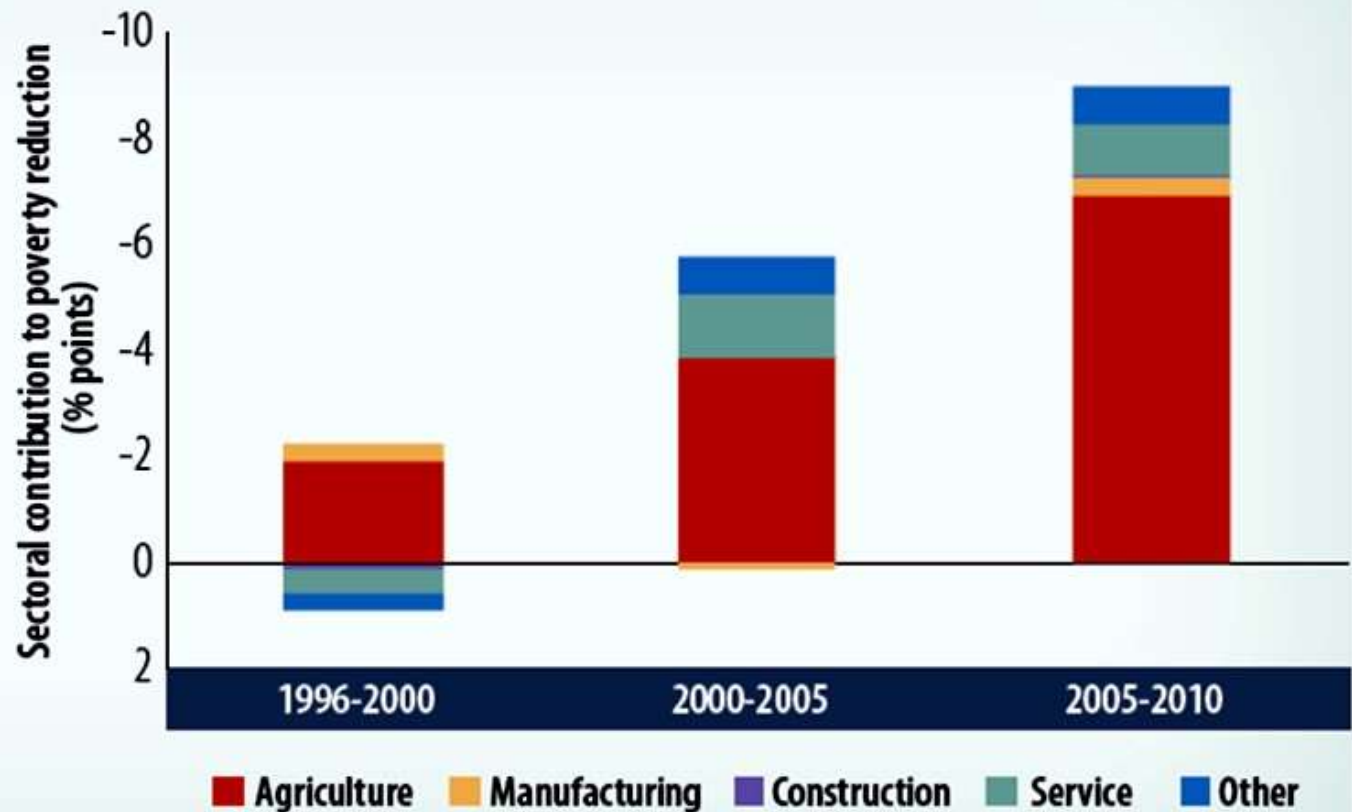
Source: World Bank staff estimates.

Note: Results are for a 15 percent decline in non-energy commodity prices.

# Ethiopia is a wonderful “agricultural growth case study... with flying geese too

Recent agricultural growth in Ethiopia has reduced poverty 1:1

FIGURE 29: Sectoral contribution to poverty reduction in Ethiopia



Source: Hill and Tsehaye 2014.

no

**U.S. growth has been remarkably constant for the last 16 years at just under 2%, using the rule of 70, this income per person doubles every 35 years.**

**Since 1950, other nations have begun to catch up....**

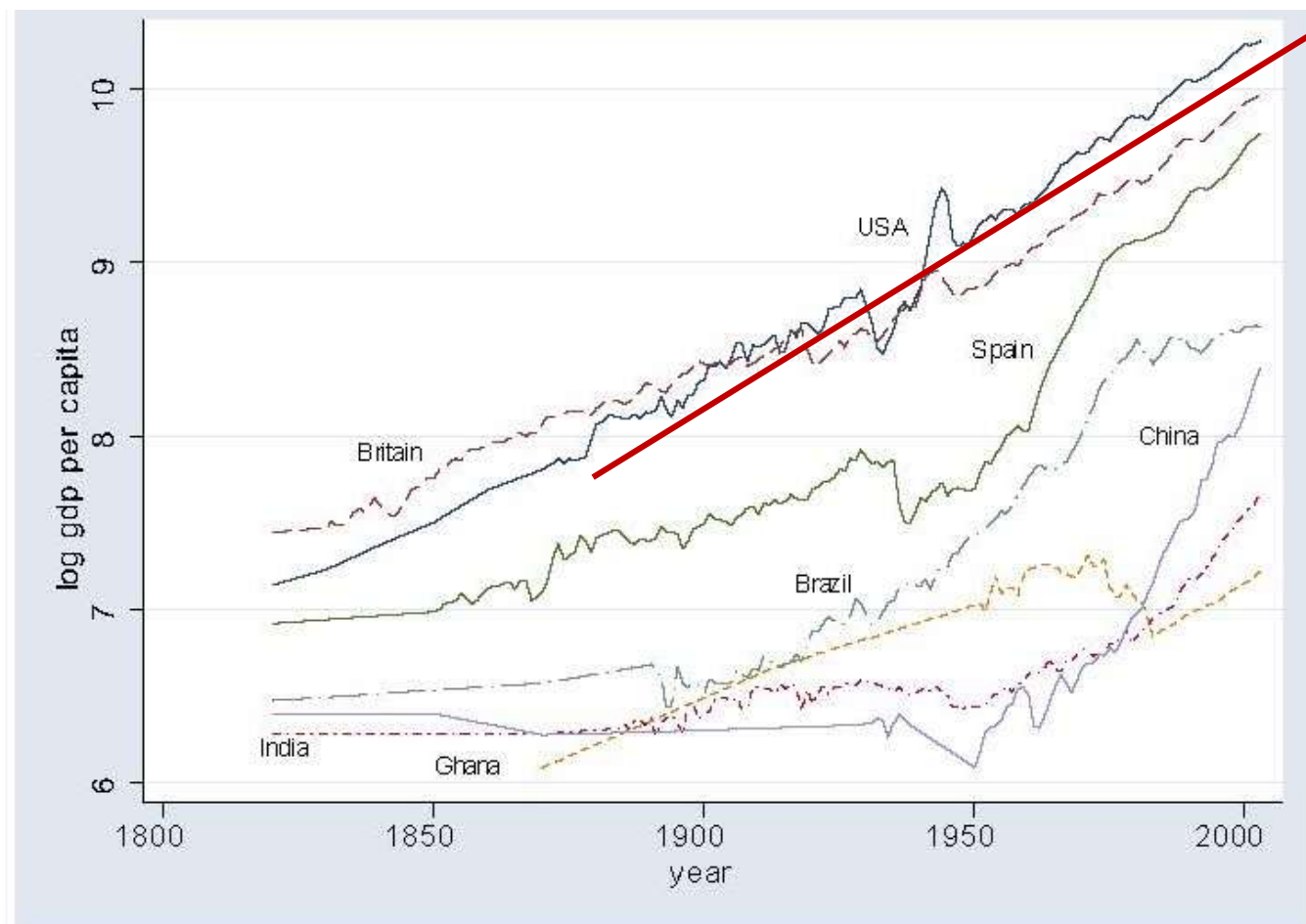


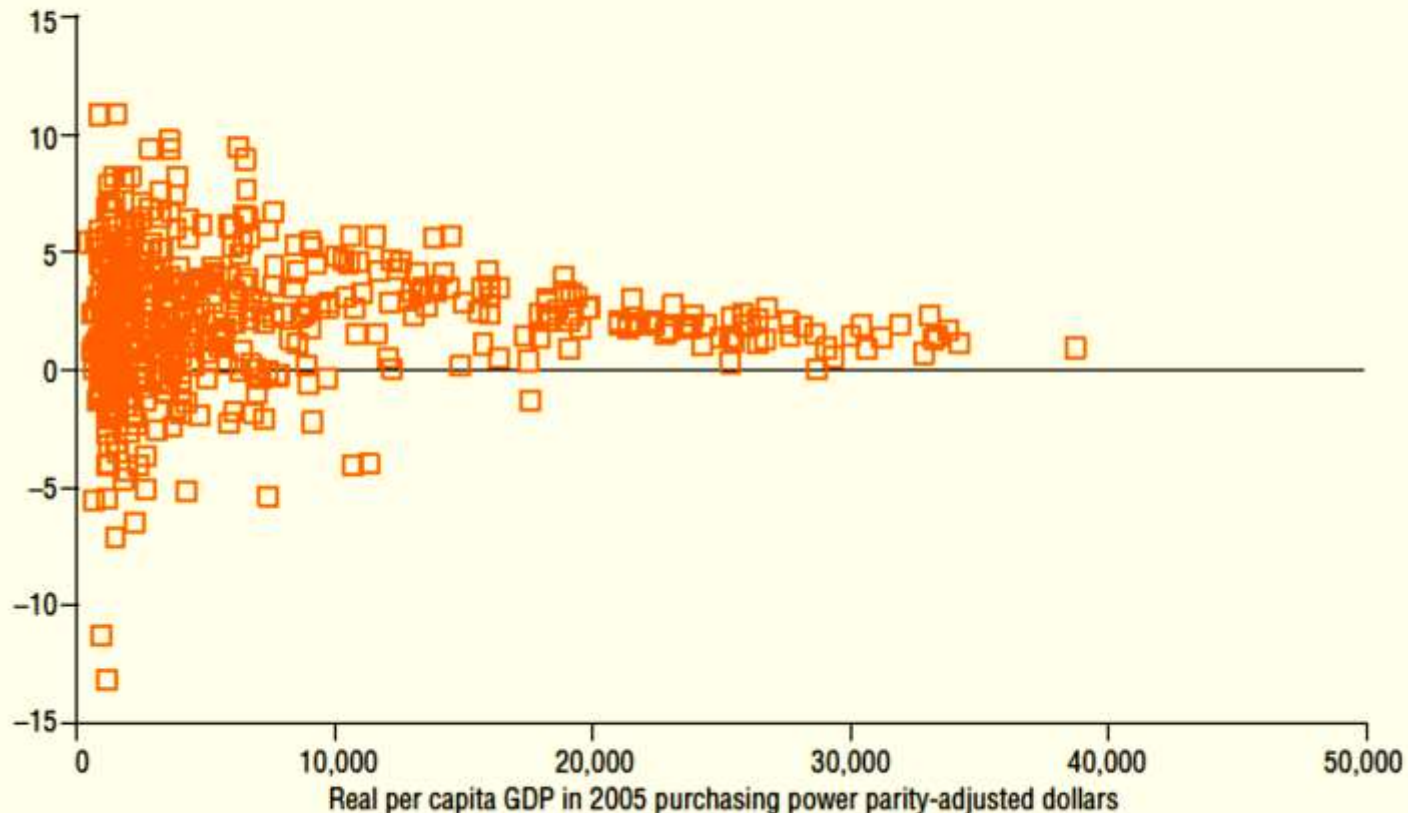
Figure: Evolution of income per capita in various countries.

# Wynne (2011) “Will China become as rich as the U.S.?”

## Per Capita GDP Growth Slows as Countries Develop

(Ten-year average growth rate versus level of real per capita GDP, 1950–2009)

Growth rate, real per capita GDP (percent)



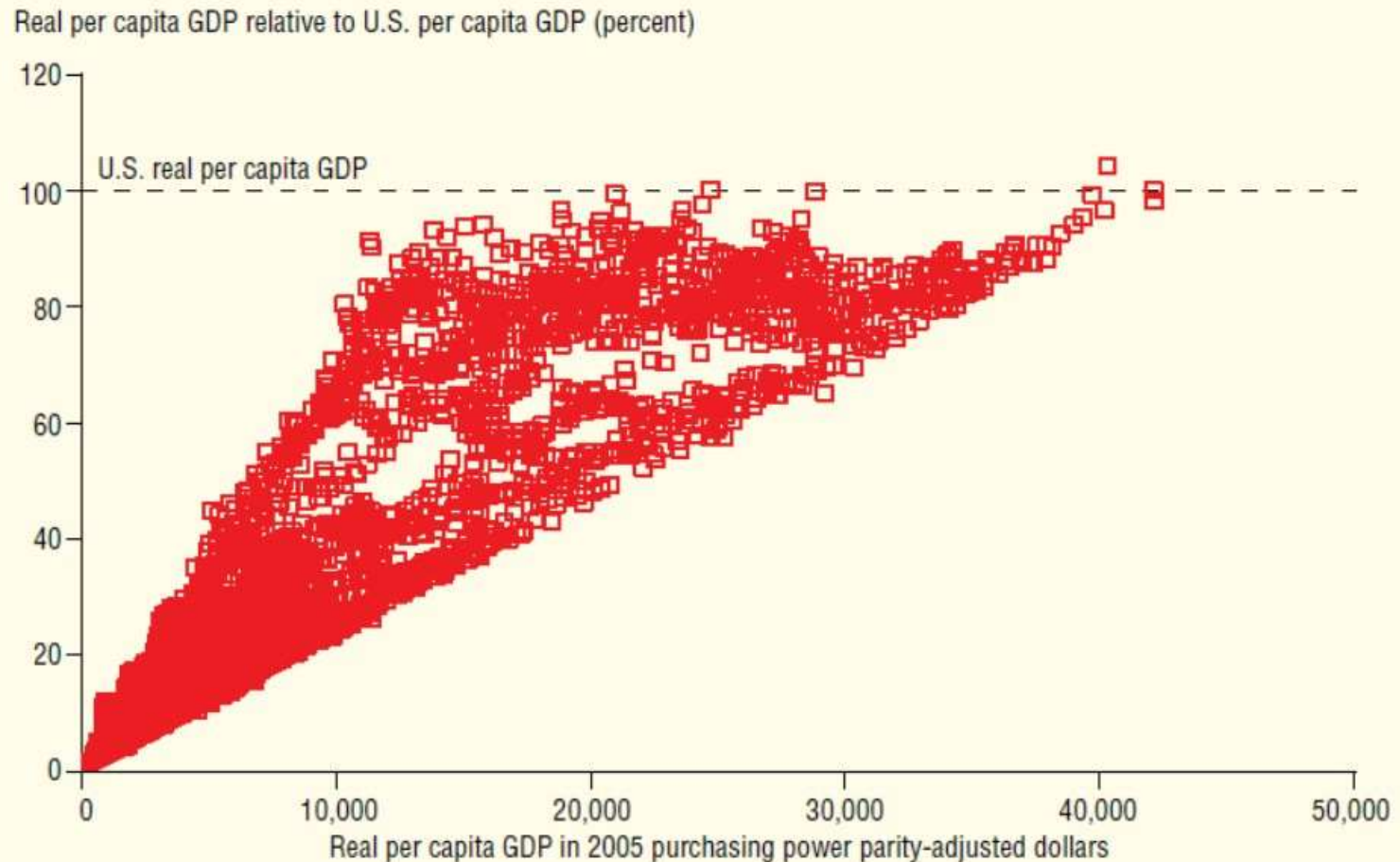
NOTE: Each square represents a single country over a decade.

SOURCES: Penn World Tables, version 7.0; author's calculations.



## Wynne (2011) “Will China become as rich as the U.S.?”

### Countries Approach but Don't Surpass U.S. Per Capita GDP (Data for the period 1950–2009)

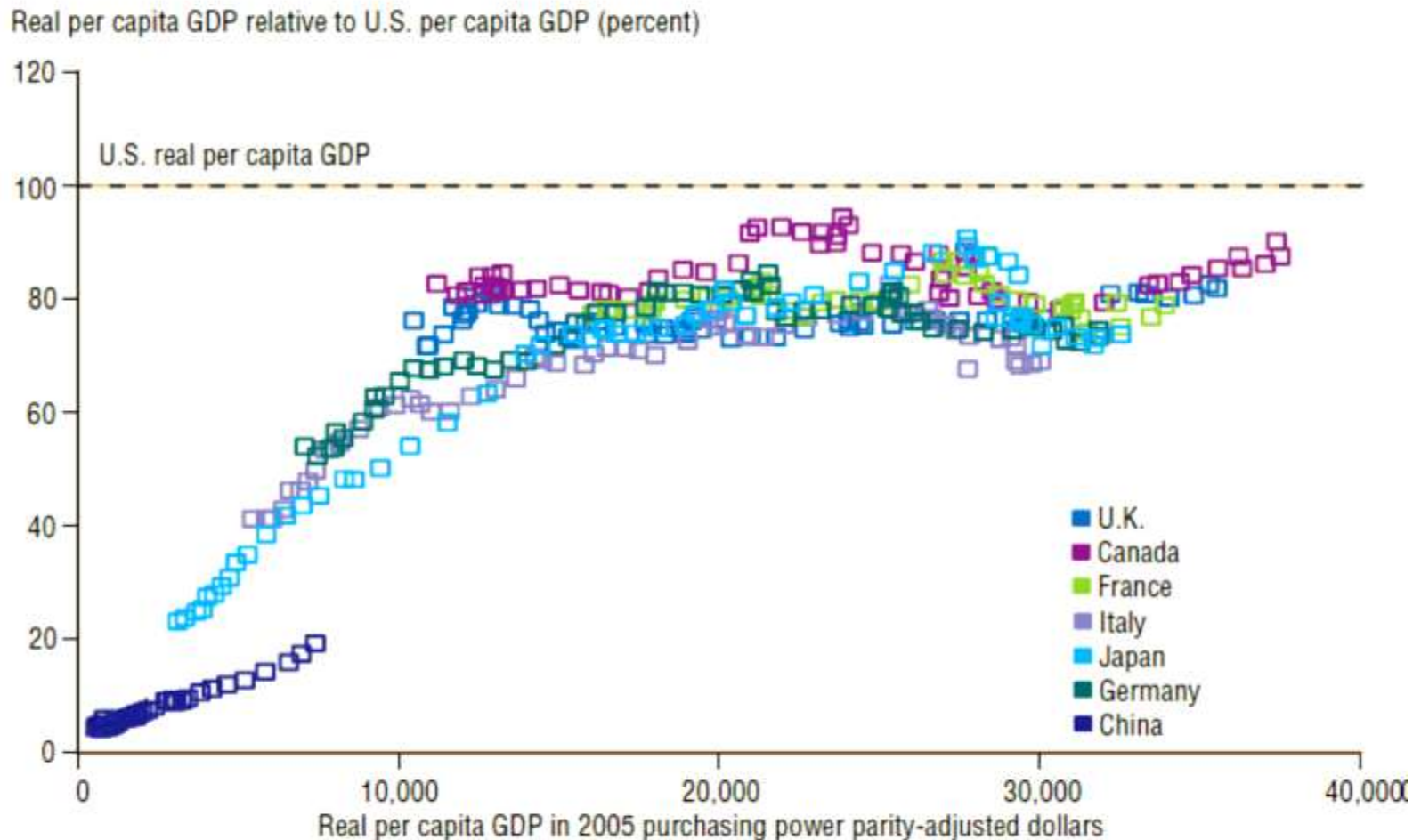


NOTE: Each square represents a single country over a one-year period.

SOURCES: Penn World Tables, version 7.0; author's calculations.

## Wynne (2011) “Will China become as rich as the U.S.?”

### G-7 Members and China: Catching Up with the U.S.? (Data for the period 1950–2009)



NOTE: Each square represents the country over a one-year period.

SOURCES: Penn World Tables, version 7.0; author's calculations.

# Barriers to growth, levers for growth

- Poor institutions, property rights, credit markets etc. (corruption, misuse of aid)
- Resource curse.. Nigeria, Venezuelas
- Capital and trade flows: handmaidens
- Debt crises... many debt crises
- In Africa especially: poverty traps, low savings, low public investment, poor health rapid population growth...

# Theories of growth

- Poor institutions, property rights, credit markets etc. (corruption, misuse of aid)
- Geography: Resource curse.. Nigeria, Venezuela, ethnic conflict (South Sudan).
- Integration: Capital and trade flows: handmaidens? EPZs and weak RER levers for growth, exploit global markets to boost growth temporarily...
- Poverty traps: Africa in particular, conflict, low savings, low public investment, poor health rapid population growth... Aid and Debt: HIPC initiative, Glenn eagle surge in foreign Aid.

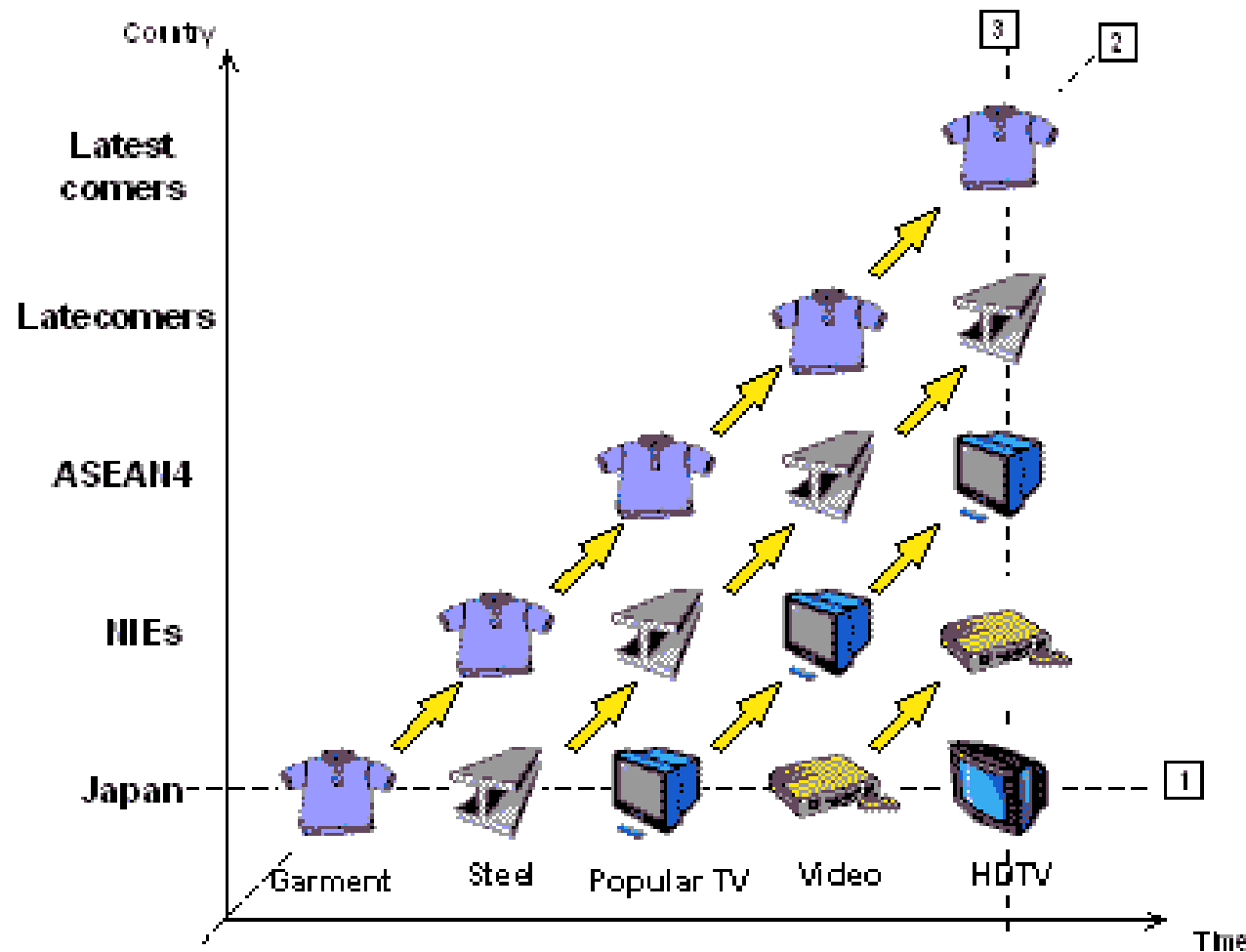


# Justin Lin: slaying the dragons, becoming a dragon

- Absolute convergence 2007-2008
- Reversal of fortune (China and India)
- Capital and trade flows: working in reverse
- Debt crises... odious debt
- In Africa especially: poverty traps, low savings, low public investment, poor health rapid population growth...

# Justin Lin's on the Akamatsu model: garments first, then....

## Structural Transformation in East Asia



# Geese still flying (Akamatsu)

Table 1  
Geese still flying in Asia: country rankings in selected industries, 1992 and 2008

	Live animals		Pharmaceuticals		Footwear		Iron & steel	
<u>Country</u>	1992	2008	1992	2008	1992	2008	1992	2008
China	1	1	2	3	1	1	3	1
India	5	4	3	1	4	2	4	4
Japan	3	3	1	2	5	5	1	2
Korea Rep.	2	5	4	4	2	4	2	3
Thailand	4	2	5	5	3	3	5	5

	Plastics		Electrical machinery, parts		Television receivers		Toys	
<u>Country</u>	1992	2008	1992	2008	1992	2008	1992	2008
China	3	1	3	1	3	1	1	1
India	5	5	5	5	5	5	5	5
Japan	1	2	1	2	1	2	2	2
Korea Rep.	2	3	2	3	2	3	3	4
Thailand	4	4	4	4	4	4	4	3

Note: Rankings established from data at the two-digit level for exports in the WITS database.

Source: World Bank, WITS database.

# Geese still flying (Akamatsu)

Table 2

Flying geese and the international division of production: Asian economies with a revealed comparative advantage in footwear, 1962–2000

RCA in Footwear								
1962	1965	1970	1975	1980	1985	1990	1995	2000
Japan	Japan							
China	China	China	China	China	China	China	China	China
	Taiwan, China	Taiwan, Ch.	Taiwan, Ch.	Taiwan, Ch.	Taiwan, Ch.	Taiwan, Ch.		
	S. Korea	S. Korea	S. Korea	S. Korea	S. Korea	S. Korea		
		Pakistan						
				Philippines	Philippines	Philippines		
					Thailand	Thailand	Thailand	Thailand
						Indonesia	Indonesia	Indonesia
						India	India	India
							Vietnam	Vietnam
							Sri Lanka	Sri Lanka
								Myanmar
								Bangladesh
								Fiji
								Cambodia

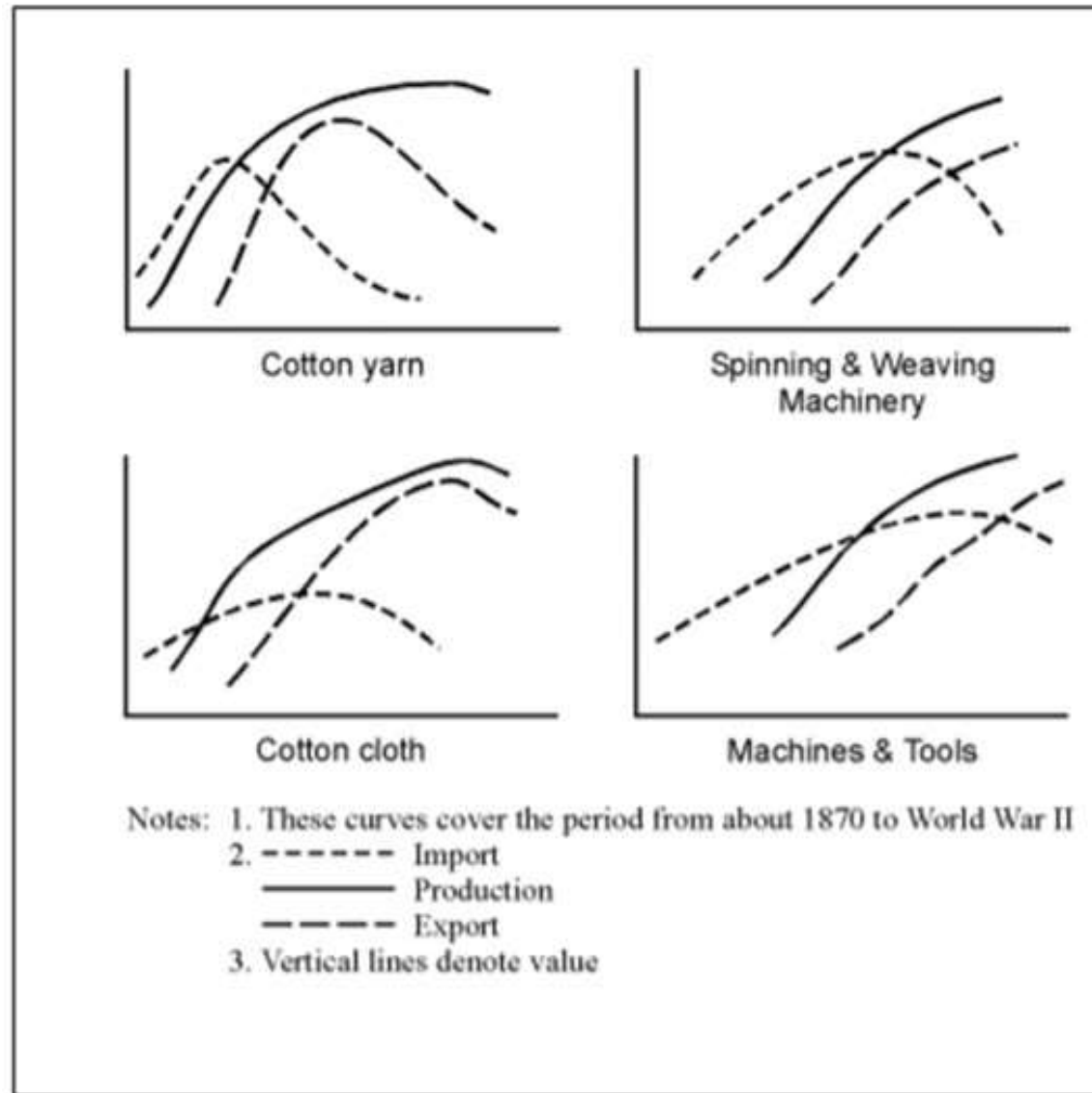
Other L-MICs  
/LICs

LICs  
enter

Note: Revealed comparative advantage is calculated as the share of footwear in the economy's exports divided by the share of footwear in global exports. The comparative advantage of a particular economy is 'revealed' when this ratio is greater than 1. All economies in the table except China are ranked by income level.

Source: UN COMTRADE data.

# Geese flying: the case of Japan (Akamatsu)



**Fig. 1: Intraindustry Aspect of the Flying Geese Model**

Source: Akamatsu 1961: 12.

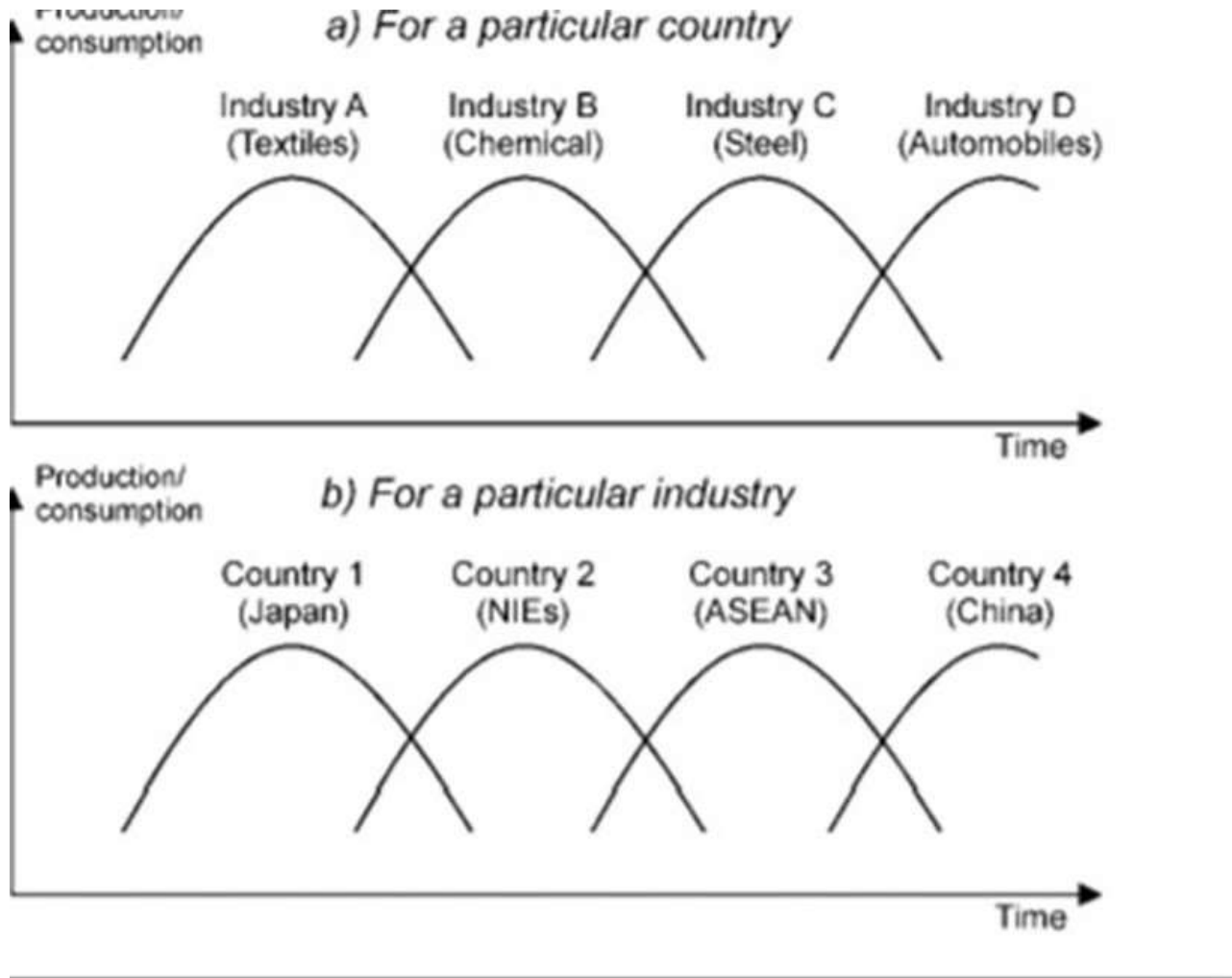


Geese  
flying: the  
case of Japan  
([Akamatsu  
model](#) ) see  
page 203

Schröppel, Christian, and  
Mariko Nakajima (2002)

"The changing  
interpretation of the flying  
geese model of economic  
development."

Japanstudien: Jahrbuch des  
Deutschen Instituts Für  
Japanstudien. IUDICIUM  
Verlag (2002): 203-234.



**Interindustry and International Aspect of the Flying Geese Model**

Based on Kwan 1994: 82 and Yamazawa 1990b: 9. Kwan uses "Indicator comparative advantage" instead of "Production/consumption."

# Alternatives models of development: Akamatsu & Kojima see page 222

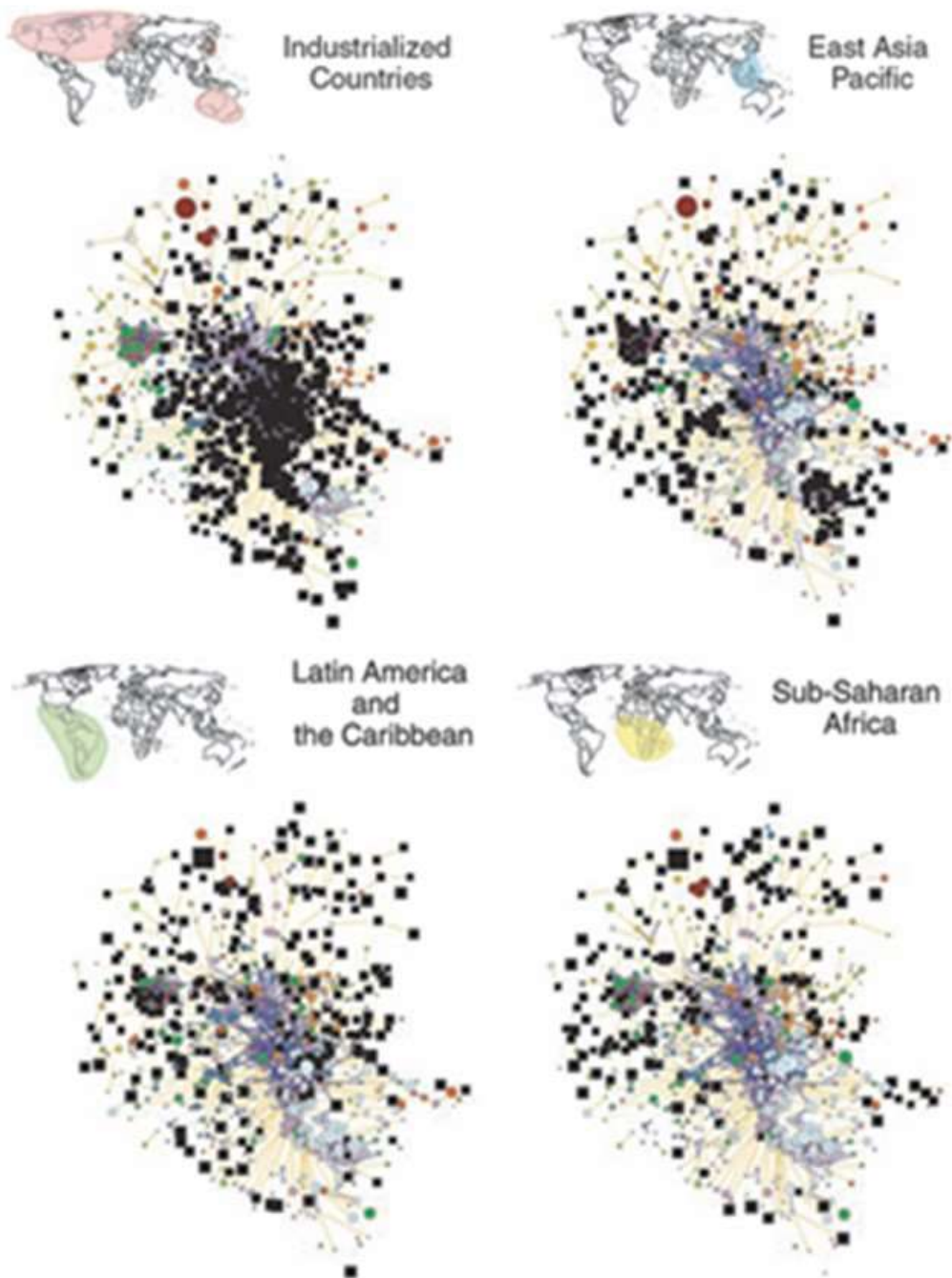
Schröppel, Christian, and Mariko Nakajima (2002) "The changing interpretation of the flying geese model of economic development." Japanstudien: Jahrbuch des Deutschen Instituts Fur Japanstudien. IUDICIUM Verlag (2002): 203-234.

	Flying Geese Approach		Product Cycle Theory Vernon	Neoclassical Theory
	Akamatsu	Kojima		
<b>Main concept</b>	Linkages	Factors (economy-specific)	Resources (firm-specific)	Factors (capital and labor)
<b>Driving force of development</b>	Demand	Supply	Supply	Supply
<b>Country development</b>	Dynamic	Dynamic	Static	Static
<b>Product development</b>	Static	Static	Dynamic	Static
<b>International trade</b>	Moderate protectionism	Free trade	Moderate protectionism	Free trade
<b>Industrial policy</b>	Comprehensive	Limited	Limited	None
<b>Dialectical view</b>	Yes	No	No	No

*Table 1: Major Differences Between Theories of Economic Development*

# Summary: China has done it (two reversals) who will be the next?

- [Justin Lin says](#) golden [Geese are flying from China](#), wages are rising, productivity is increasing, where will they go next? [85 million new jobs?](#)? Who are the Dragons (not just Mario Draghi, head of the ECB)
- From tigers to lions: boom spreads to Africa
- [Does what you export matter?](#) ( if yes industrial policy (EPZs) or just a weak RER (check: or all of the above?)
- An African/Latin growth miracle? Latin America & Africa are growing faster, will it last? Can they replicate China's EPZ strategy? Or a new model?



Latin America is bit spread out but its forest of industries is a little denser than Africa's

**Fig. 2.** Localization of the productive structure for different regions of the world. The products for which the region has an  $RCA > 1$  are denoted by black squares.

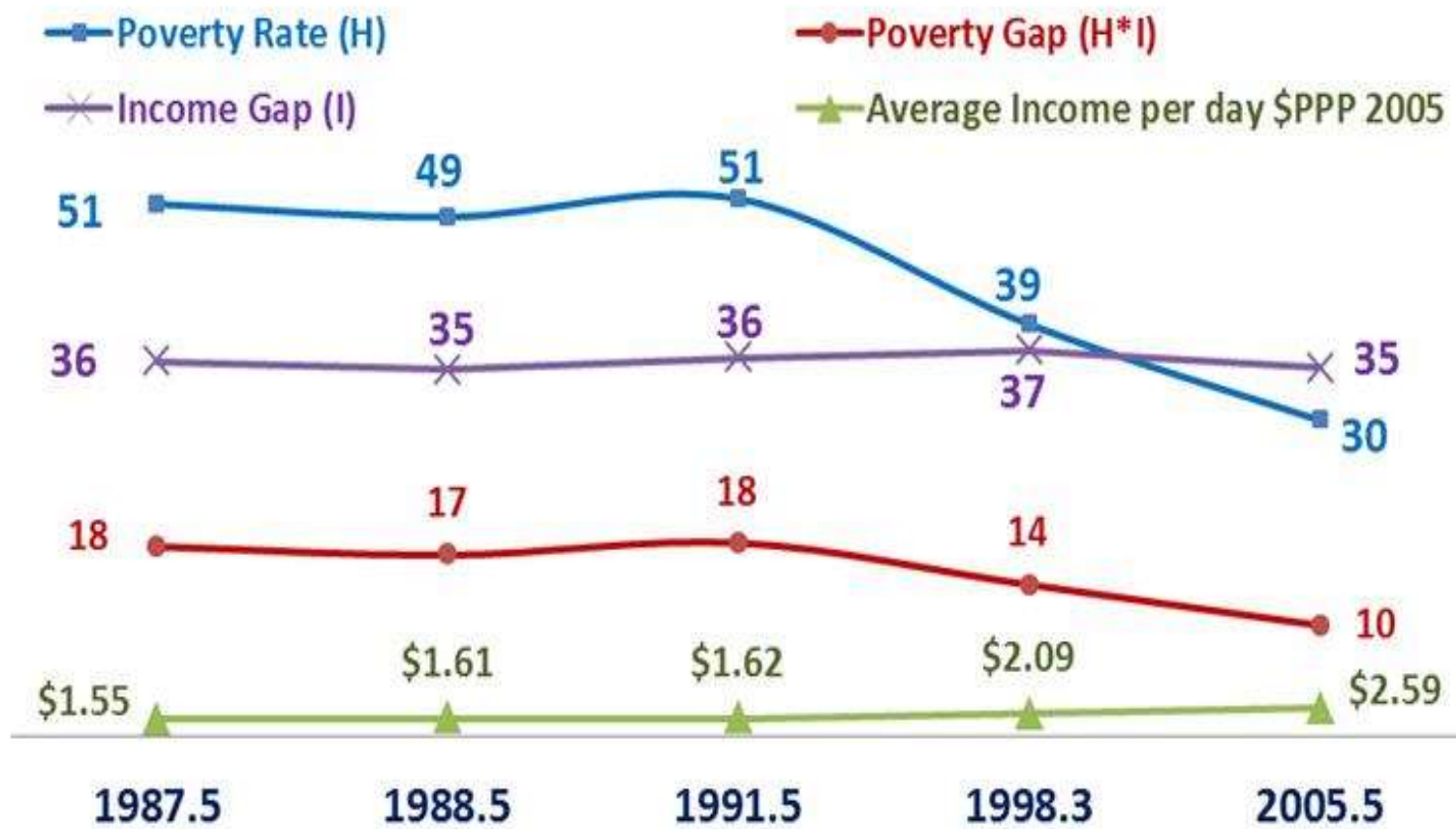
# **Africa vs Latin America the later mainly middle income, SSA mainly low income**

- Low incomes and wages in Africa, but Latin America has better institutions, education, etc.
- LatAm's poorer countries HND, SLV, NIC, GTM, Bolivia can opt export led growth, but will they?
- What about [the DR](#) and [Haiti](#)? Some remain hopeful of trade can be expand (are [Haiti's OTEXA agreements](#)... working?)
- Which LatAm countries are doing best with the leading goose, garment trade? see [otexa data](#)...



# Ghana is on track to achieve MDG 1: a goal few thought was in reach for Africa

Figure AF-7 Ghana \$1.25/day Poverty

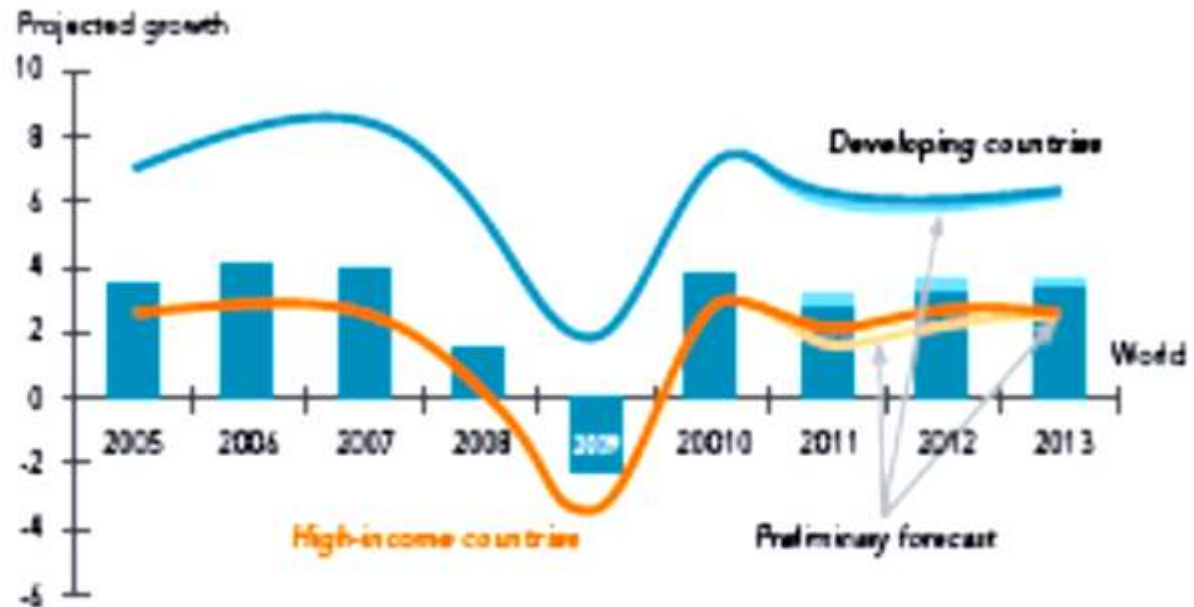


Source: World Bank, Povcalnet March 2012  
(<http://iresearch.worldbank.org/PovcalNet/index.htm?1>)

# Compare Sachs et al. (2004) to Africa's Pulse September 2011 (world bank)

FIGURE 1

Weak growth  
in high income  
countries



Source: Global Economic Prospects (June 2011), World Bank

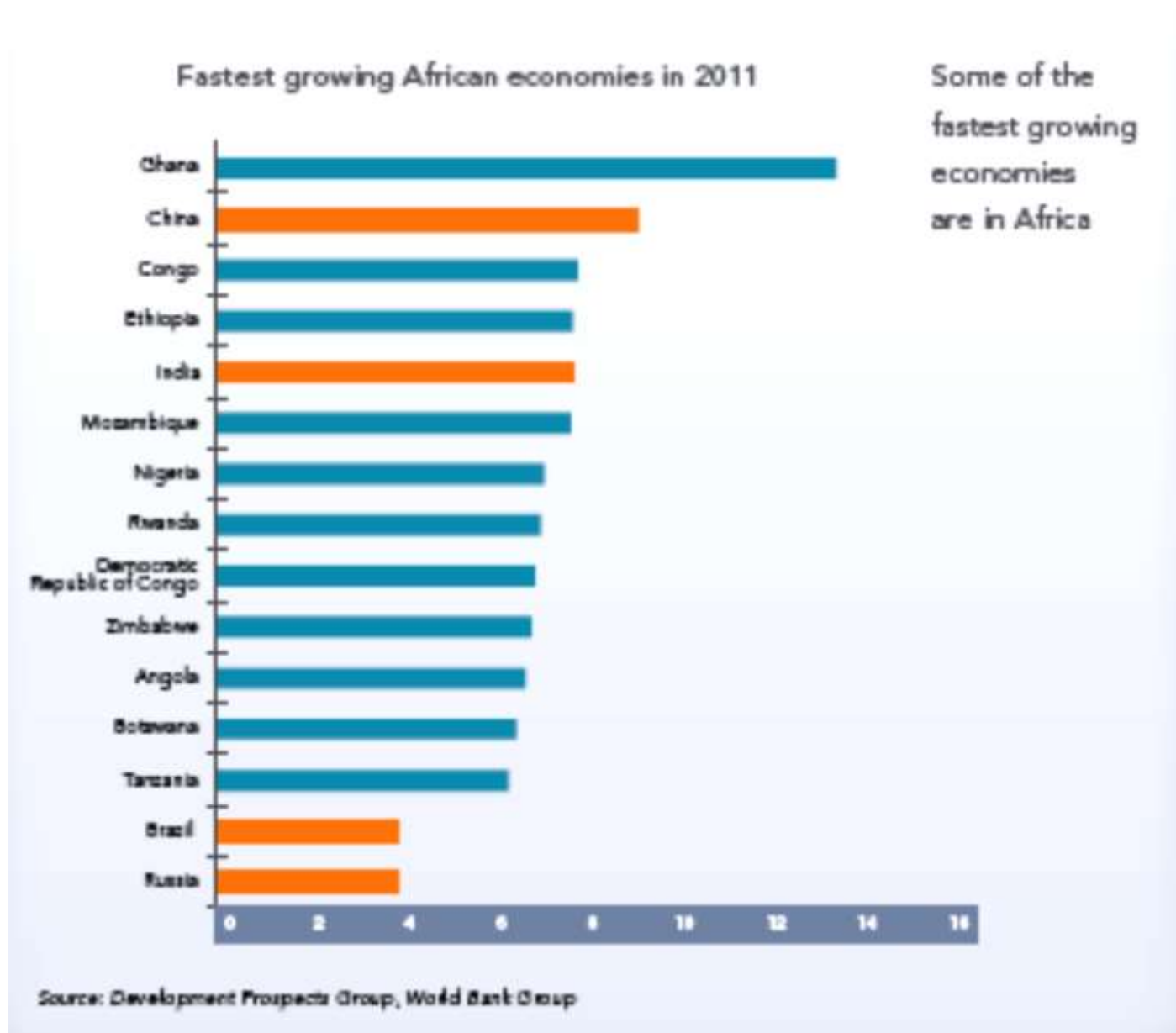
# Compare Sachs et al. (2004) to Africa's Pulse September 2011 (world bank)



FIGURE 2, 3

Growth in Sub-Saharan Africa remains robust

# Compare Sachs et al. (2004) to Africa's Pulse September 2011



# Food prices rise, but not everywhere

FIGURE 12

Prices of key staples in Africa

African countries show heterogeneity in food price movements



Source: Price Watch, FEWS NET, August 2011



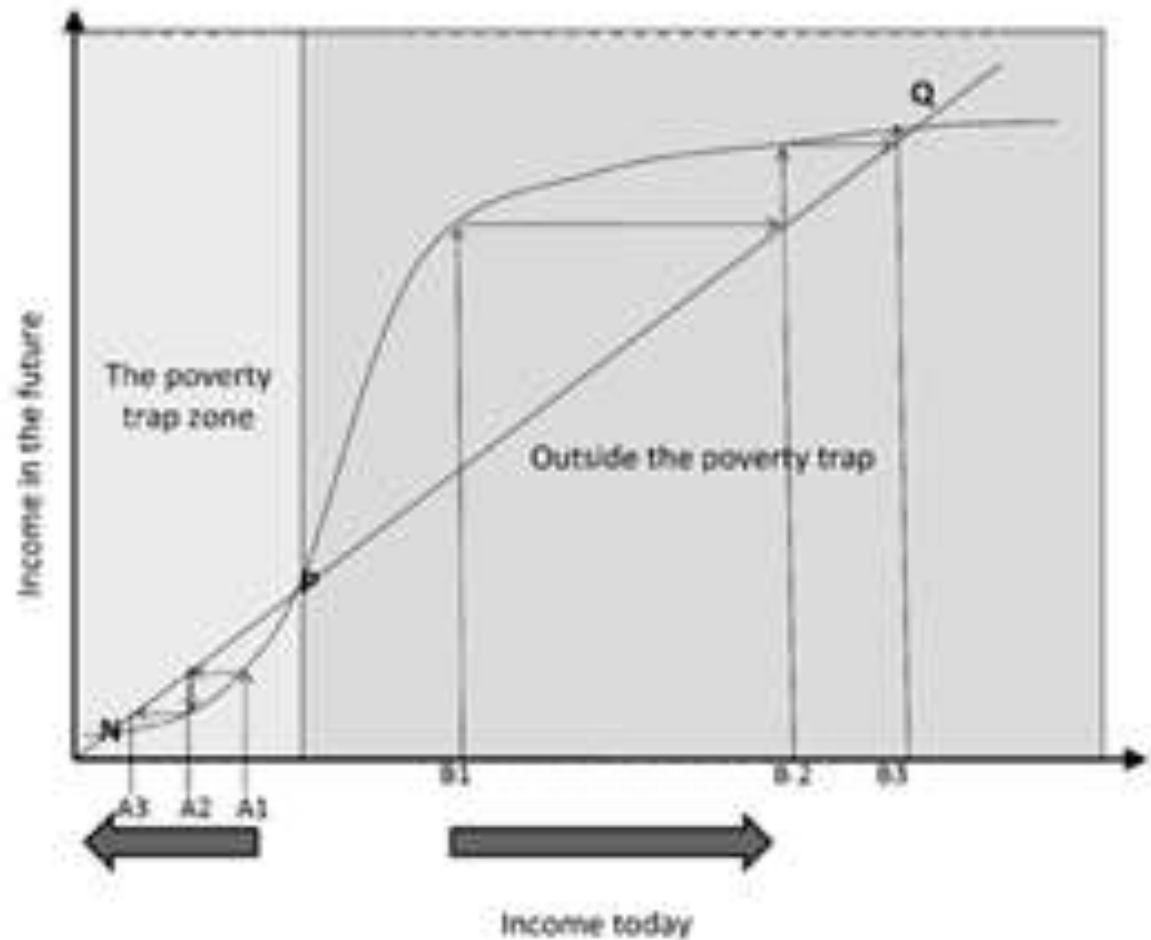
# Today

- Conditional vs. Absolute convergence
- Three growth models
- Poverty traps
- Trade vs. industrial policy
- Rapid growth despite resources boom

New issues:

Migration, microfinance and climate change

# Generic poverty trap from Banerjee and Duflo (2011) Poor Economics Chapter 1



S-Shape Curve and the Poverty Trap

# Development imperatives

1. Climate change: adaptation vs. mitigation, migration vs. development
2. Food and commodity price increases (landless poor) slowing growth in yields per hectare.
3. High fertility rates: world population now 7 billion...
4. Migration and remittances... works (Kerala) but driven by 1-3 could be politically destabilizing.

# Development outcomes

- Arab Spring: convergence in education and health (life span) governance
- Food and commodity price increases (landless poor)
- High fertility rates: world population now 7 billion...
- Migration and remittances... Kerala
- China and India: commodity prices

# Consensus on growth strategies: post East Asian miracle (institutions?)

## **Early Washington Consensus**

- Trade liberalization
- Open capital account??
- Macroeconomic stability
- Privatization

## **Sachs-Warner Index:**

- Tariffs < 10%, quotas < 40%
- BMP < 20%
- Non-socialist government
- No export monopoly

## **Post EA miracle consensus**

- Weak RER
- Macro stability
- Exports and FDI
- EPZ + socialism works too

## **Africa w/poverty traps:**

- **Levers for growth**
- **Macro stability, weak RER**
- **Aid OK, resource rents?**
- **Aid can break poverty trap**
- **Debt relief?**



# What about institutions?

## **Institutions fundamental but,**

- Country specific (Rodrik)  
hard to change
- May be endogenous  
(Resource curse- Collier)
- Correlated with Geography  
(Sachs- malaria, landlocked)
- Some work-arounds:  
(Collier– ISA, military, EPZs)
- Asset redistribution shocks

## **Not essential as there are other levers for growth** (Johnson et al. below)

- Trade- EPZs
- Competition, open capital  
markets
- FDI- new technologies
- Education
- Political coalitions (Marshall  
plan)
- Black and white cats both  
hunt mice... (China, HRS, etc.)

# Rodrik and Subara

Chart 2

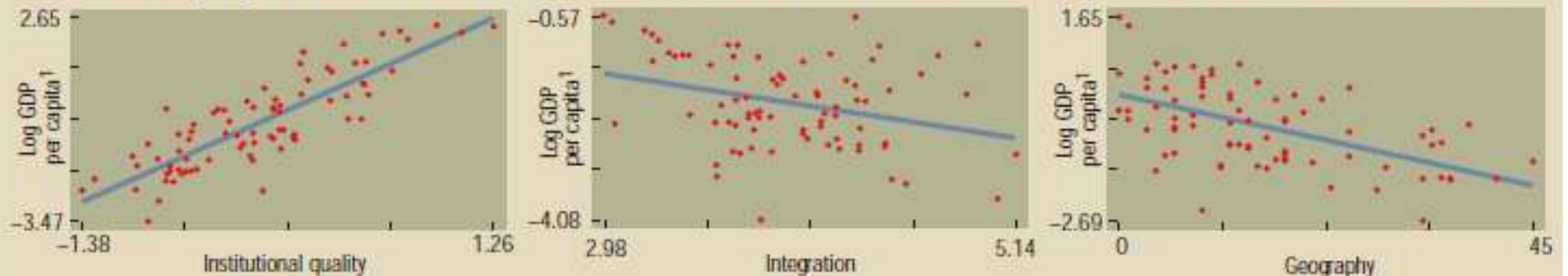
## Institutional quality scores high

Institutional quality can boost income significantly, while global integration and geography, on their own, do not.

**As institutional quality rises, so does income ...**

**but increases in integration may not help**

**... nor does a more benign geographic location.**



Source: Authors

Note: The graphs capture the causal impact of each of the determinants on income, after controlling for the impact of the others. The indicators of integration and geography used are the ratio of trade to GDP and distance from the equator, respectively. For further details, see Rodrik, Subramanian, and Trebbi (2002).

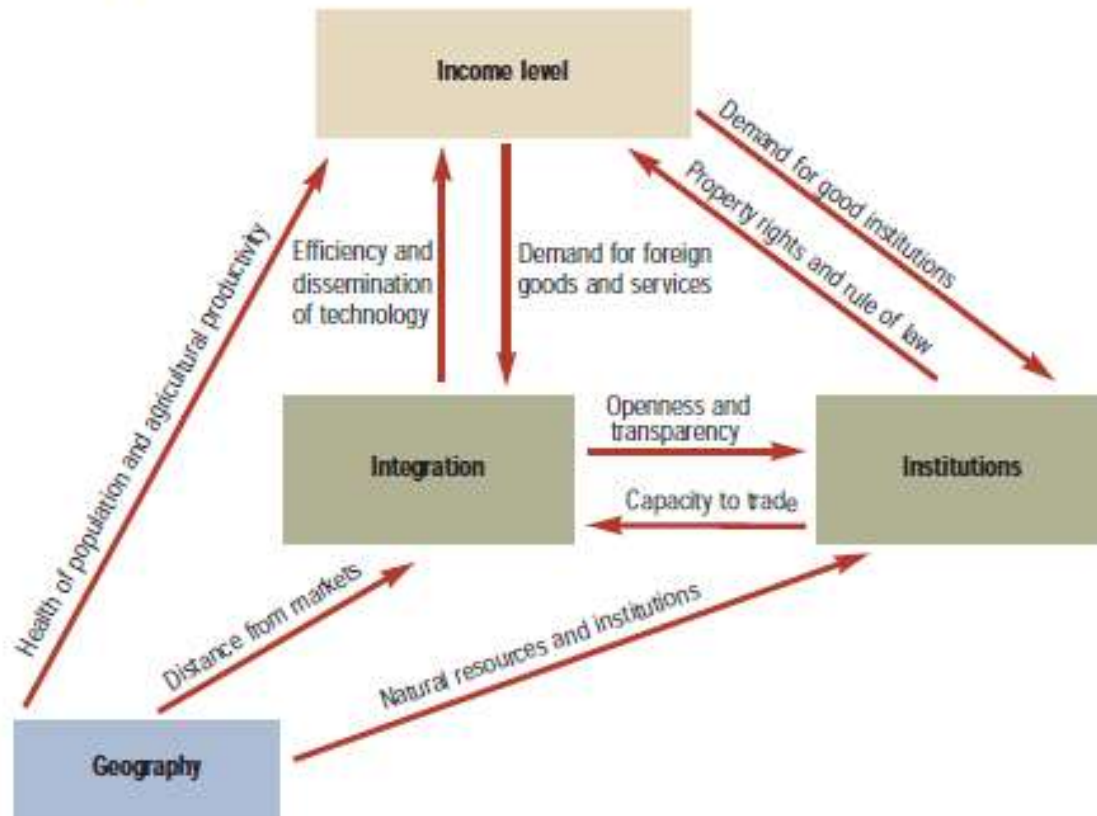
<sup>1</sup>Expressed in terms of purchasing power parity, 1995.

# Rodrik and Subramanian (2003) F&D

Chart 1

## The "deep determinants" of income

Development and its determinants are related in multiple and complex ways, making the task of determining and quantifying causality difficult.



# Levers for growth in Africa

## Showing promise

Some African countries show strong potential when compared with developing countries that have previously managed sustained growth.<sup>1</sup>

	Measures of Broad Institutions		Economic Outcomes			Potential Policy Levers						
	Economic Institutions	Political Institutions	Growth	Export performance		Key characteristics of recent sustained growth cases, with weak initial institutions						
	Investment risk <sup>2</sup>	Constraint on the executive <sup>3</sup>		Exports to GDP <sup>5</sup>	Manufacturing exports to GDP <sup>5</sup>	Trade openness <sup>6</sup>	Currency over-valuation <sup>7</sup>	Inflation <sup>8</sup>	Primary education <sup>9</sup>	Secondary education <sup>9</sup>	Aid to GDP <sup>5</sup>	Costs of entry <sup>10</sup>
Burkina Faso	9.0	3.0	1.6	5.3	1.2	0.50	1.5	2.03	43.6	n.a.	11.9	3.3
Ethiopia	7.0	3.0	4.0	7.9	0.9	0.83	-19.0	17.78	63.9	19.0	16.6	4.3
Ghana	6.8	4.0	1.9	27.5	4.8	1.00	-17.0	26.7	81.4	37.7	9.4	1.0
Mali	7.5	5.0	1.7	26.0	0.16	1.00	8.6	-1.4	57.0	n.a.	11.8	2.3
Mozambique	8.5	4.0	5.7	9.9	0.68	1.00	-3.7	13.4	98.9	13.3	32.0	0.7
Senegal	8.0	6.0	1.3	21.2	6.3	0.00	13.2	0.0	75.3	18.7	7.7	1.2
Tanzania	7.5	3.0	1.3	9.3	1.4	1.00	130.2	3.5	69.9	n.a.	12.2	2.3
Uganda	9.0	3.0	4.1	7.6	0.6	1.00	25.6	7.8	136.4	n.a.	11.1	1.1
Average	7.9	3.9	2.7	14.3	2.0	0.79	17.4	8.7	78.3	22.2	14.1	2.0
Sub-Saharan Africa	7.5	3.7	1.4	26.0	5.6	0.48	12.6	12.9	90.9	38.8	11.1	1.4
Sustained growth countries (SGCs)	6.4	2.1	6.5	22.4	5.7	0.65	-13.5	9.1	96.0	34.3	5.1	0.2
Developing world	8.3	4.4	1.6	28.9	13.2	0.44	-6.1	8.3	99.0	60.4	7.0	0.7

Source: Compiled by authors.

<sup>1</sup>Data are for the most recent period available, except for the SGCs. For the SGCs, see note to each column.

<sup>2</sup>The risk rating, from the International Country Risk Guide Economic Rating, is the sum of three components (contract viability, payment delays, and profit repatriation) and varies from 0 (high risk) to 12 (low risk). For SGCs, data refer to the mid-1980s.

<sup>3</sup>The measure, which is an assessment of the operational independence of the chief executive of the country, varies from 0 (no constraint) to 7 (maximum constraint) and is from the Polity IV database. For SGCs, data refer to the start of the growth episode (T).

<sup>4</sup>For SGCs, values are averages over the period T to T+7 (World Bank's World Development Indicators).

<sup>5</sup>For SGCs, values are averages over the period T to T+5 (World Bank's World Development Indicators).

<sup>6</sup>The measure combines five criteria—tariffs, nontariff barriers, black market premium, state monopoly over exports, and socialist economic system—for determining openness. It is based on Sachs and Warner (1995) as updated by Romain Wacziarg and Karen Horn Welch. It varies from 0 (closed regime) to 1 (open regime). For SGCs, values are averages over the period T to T+5.

<sup>7</sup>The measure is the percentage overvaluation of the real exchange rate in 2000. Overvaluation is measured as the deviation of a country's actual exchange rate from a benchmark rate related to a country's per capita income measured in purchasing power parity terms. For SGCs, values are averages over the 10-year period from T-5 to T+5.

<sup>8</sup>For SGCs, data refer to the most recent period (IMF's *International Financial Statistics*).

<sup>9</sup>Measured as the gross enrollment ratio (World Bank's World Development Indicators). For SGCs, data refer to the year T.

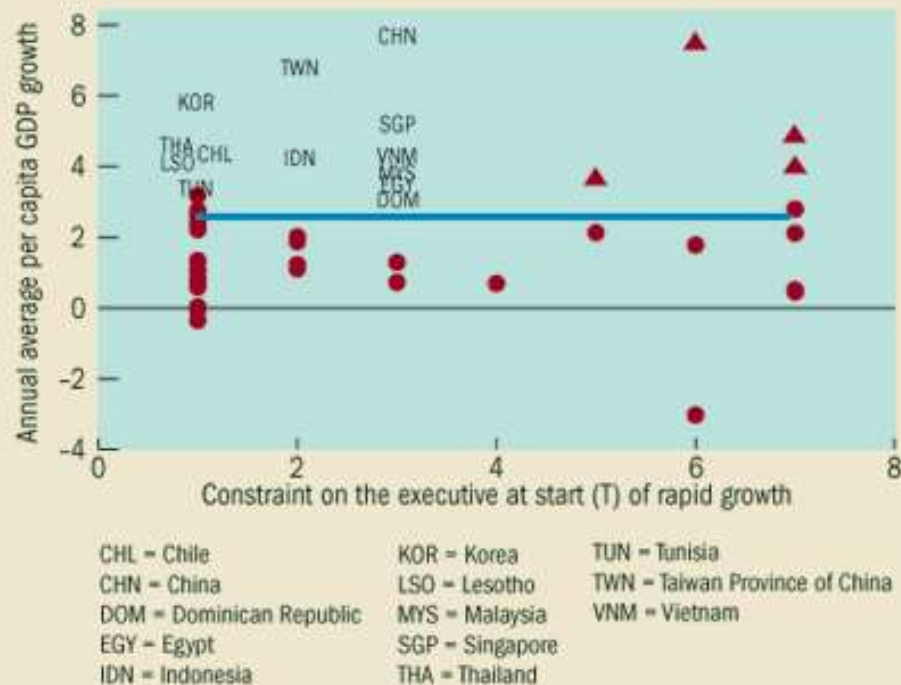
<sup>10</sup>From World Bank Doing Business Database, and measured as the costs in U.S. dollars per capita of starting a business. For SGCs, data are for the most recent period.



Chart 1

## No holding them back

Many of the countries that experienced sustained growth started with weak institutions.



Sources: World Bank, World Development Indicators database, and Polity IV.

Note: The following notation applies to all the charts: countries with weak initial institutions are represented by country codes in the case of sustained growers and by circles in the case of unsustained growers, and countries with strong initial institutions by triangles (see text for definitions). T refers to the start of the growth acceleration as identified in Hausmann, Pritchett, and Rodrik, (2004), or to 1970 for countries without accelerations. The growth rate is the average from T to the most recent period for which data are available.

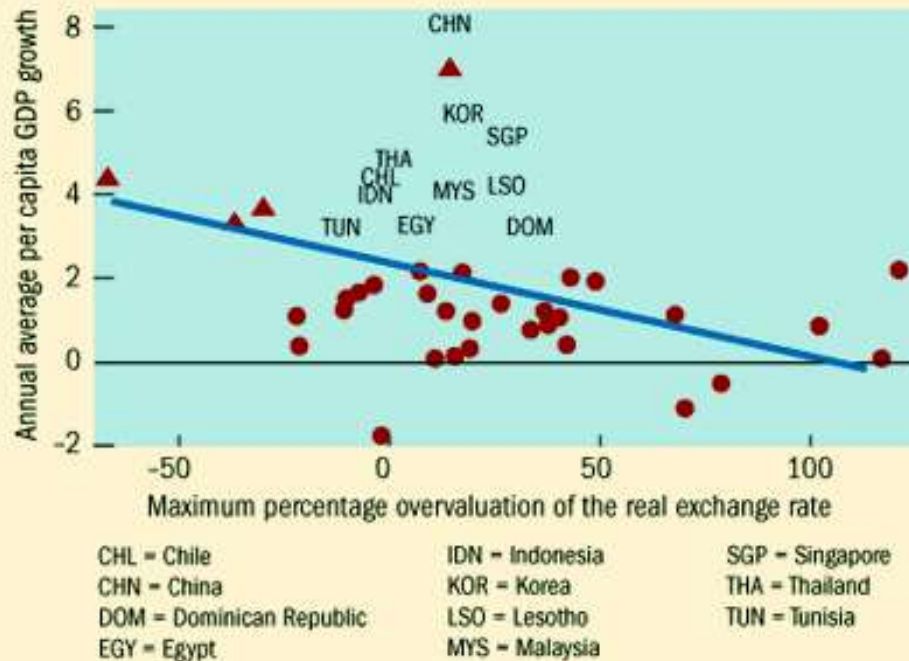


# Competitive RER

Chart 2

## Getting the currency right

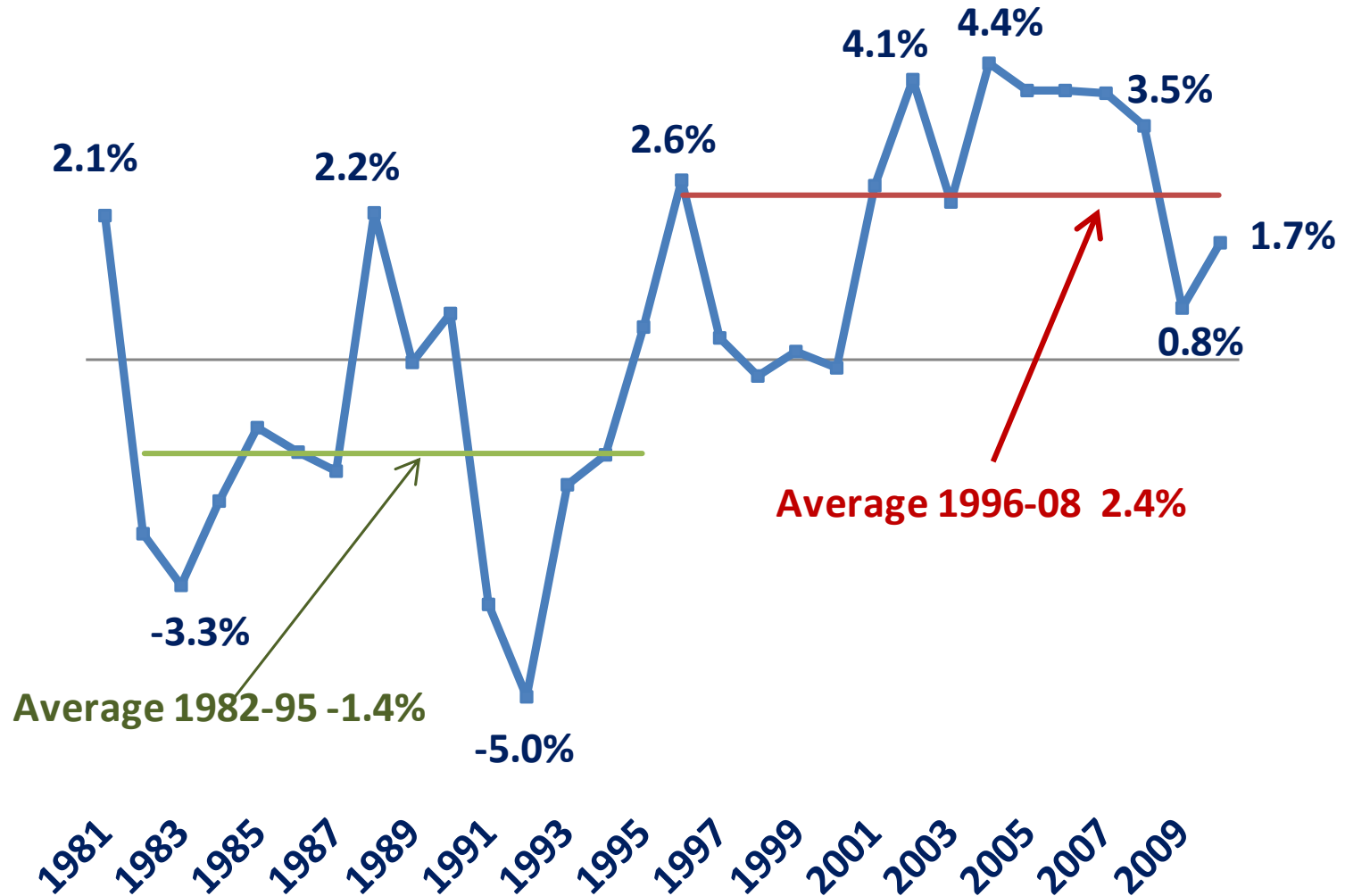
The sustained growers avoided prolonged bouts of currency overvaluation.



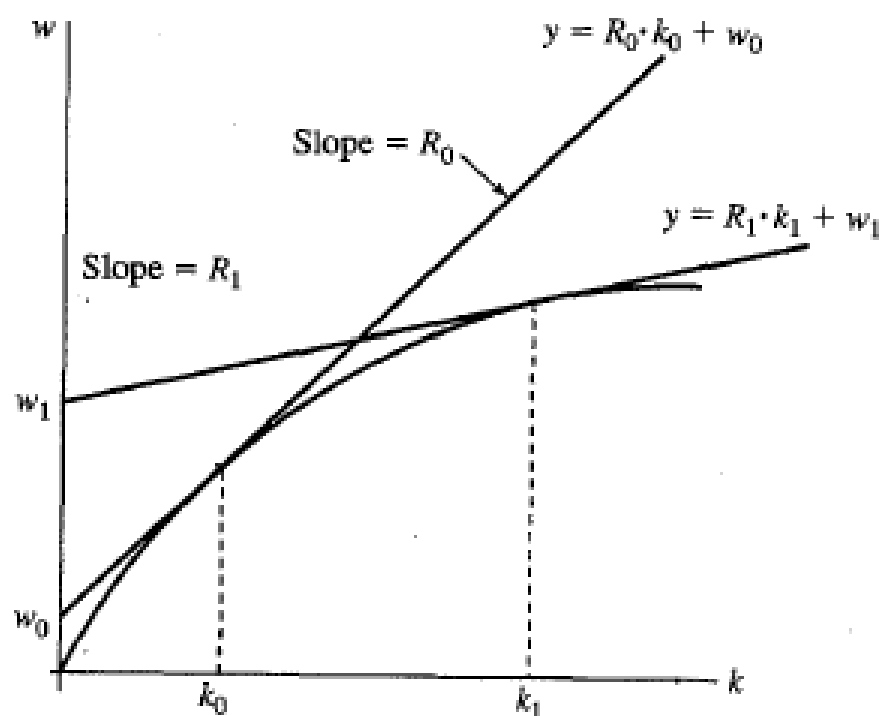
Sources: World Bank, World Development Indicators database, and IMF staff estimates.

Note: Overvaluation is measured as the residual from a regression of the real exchange rate against per capita income, measured in terms of purchasing power parity.

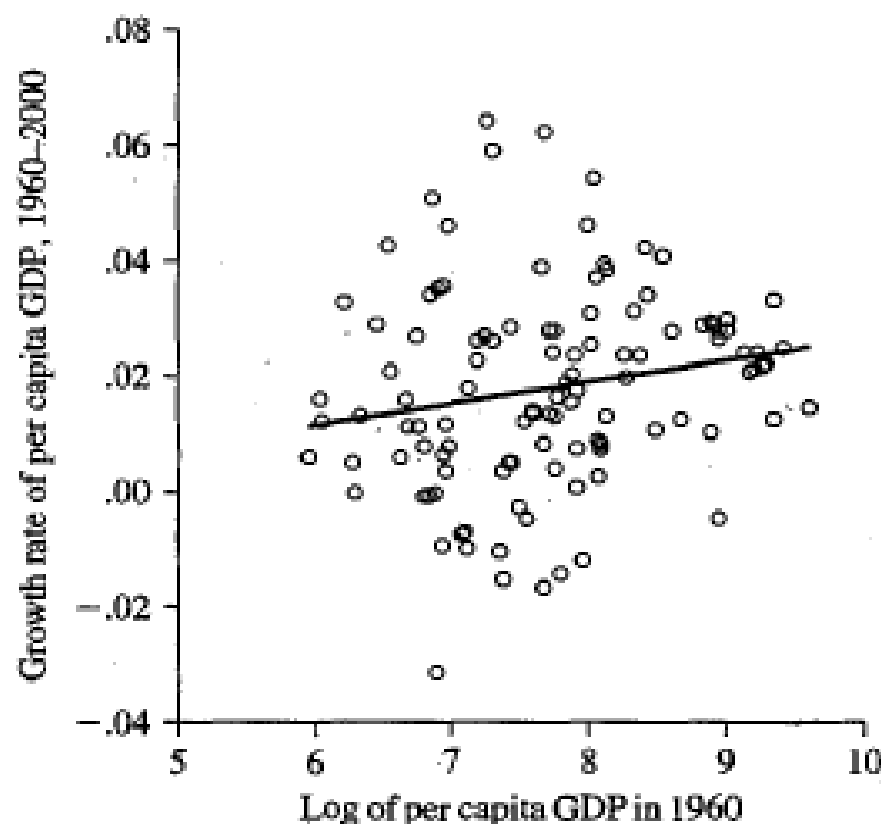
**Figure 1 SSA Per capita GDP Growth rate**



*Source: IMF WEO April 2010 Database (population weight average GDP per capita) not including Liberia, Eritrea,*

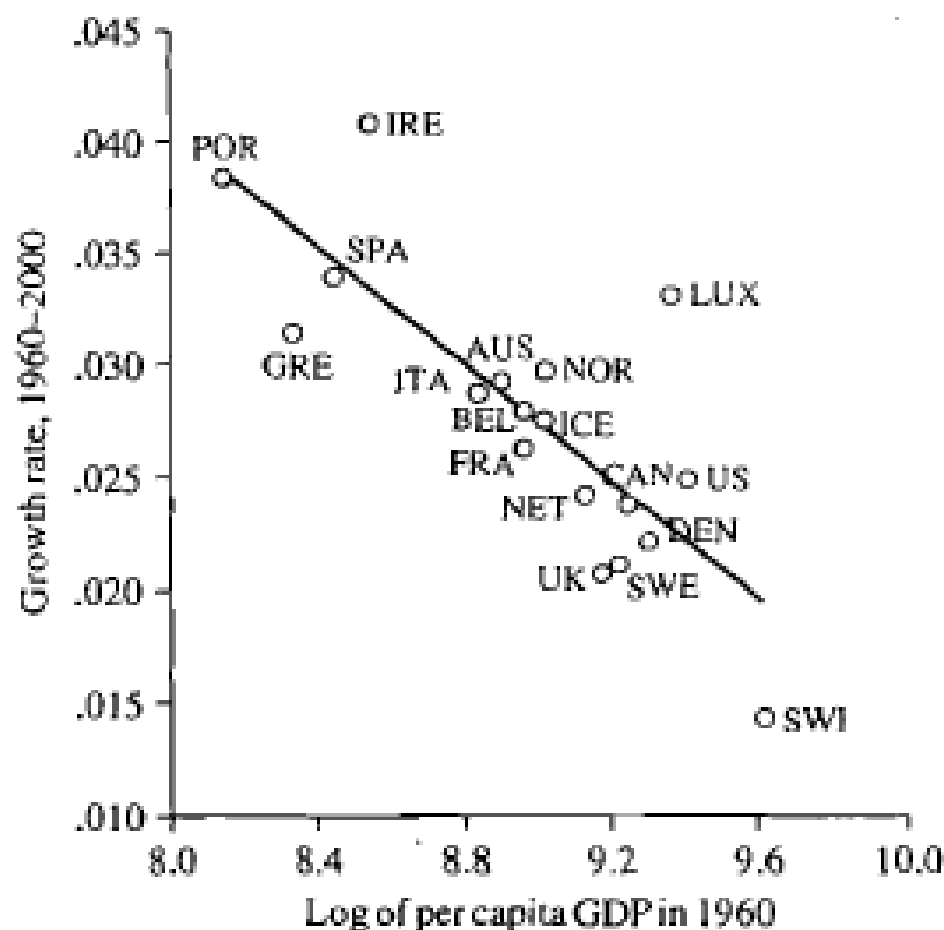
**Figure 1.5**

**Input prices during the transition.** At  $k_0$ , the straight line that is tangent to the production function has a slope that equals the rental price  $R_0$  and an intercept that equals the wage rate  $w_0$ . As  $k$  rises toward  $k_1$ , the rental price falls toward  $R_1$ , and the wage rate rises toward  $w_1$ .



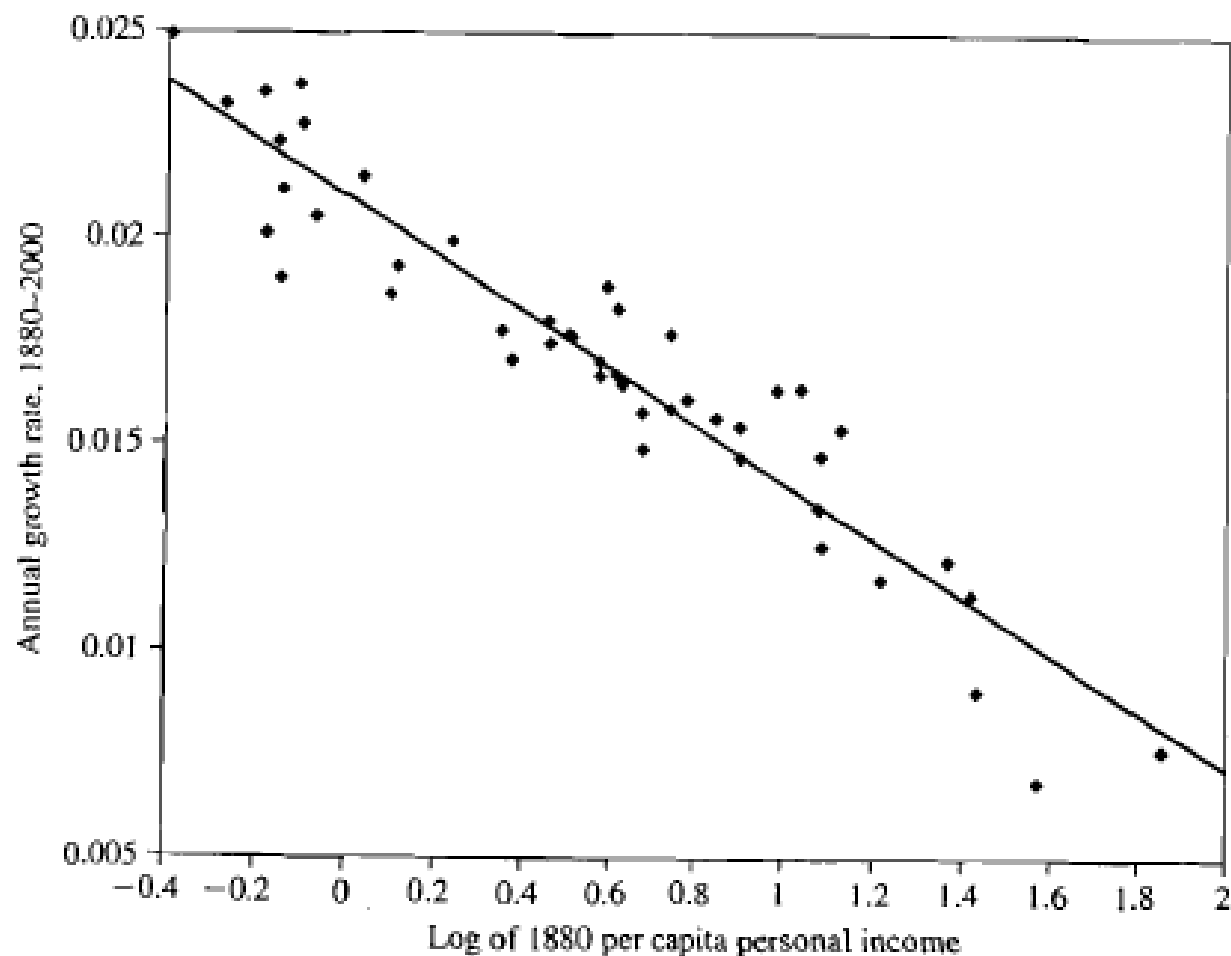
**Figure 1.7**

**Convergence of GDP across countries: Growth rate versus initial level of real per capita GDP for 114 countries.** For a sample of 114 countries, the average growth rate of GDP per capita from 1960 to 2000 (shown on the vertical axis) has little relation with the 1960 level of real per capita GDP (shown on the horizontal axis). The relation is actually slightly positive. Hence, absolute convergence does not apply for a broad cross section of countries.



**Figure 1.8**

**Convergence of GDP across OECD countries: Growth rate versus initial level of real per capita GDP for 18 OECD countries.** If the sample is limited to 18 original OECD countries (from 1961), the average growth rate of real per capita GDP from 1960 to 2000 is negatively related to the 1960 level of real per capita GDP. Hence, absolute convergence applies for these OECD countries.



**Figure 1.9**

**Convergence of personal income across U.S. states: 1880 personal income and income growth from 1880 to 2000.** The relation between the growth rate of per capita personal income from 1880 to 2000 (shown on the vertical axis) is negatively related to the level of per capita income in 1880 (shown on the horizontal axis). Thus absolute convergence holds for the states of the United States.



# Hybrid models: See page 66-67 Barro & Sala-i-Martin old Sobelo model...

If  $f(k) \rightarrow \infty$  as  $k \rightarrow \infty$ , then an application of l'Hôpital's rule shows that the limits as  $k$  approaches infinity of the average product,  $f(k)/k$ , and the marginal product,  $f'(k)$ , are the same. (We assume here that  $\lim_{k \rightarrow \infty} [f'(k)]$  exists.) Hence, the key condition for endogenous, steady-state growth is that  $f'(k)$  be bounded sufficiently far above 0:

$$\lim_{k \rightarrow \infty} [f(k)/k] = \lim_{k \rightarrow \infty} [f'(k)] > (n + \delta)/s > 0$$

This inequality violates one of the standard Inada conditions in the neoclassical model,  $\lim_{k \rightarrow \infty} [f'(k)] = 0$ . Economically, the violation of this condition means that the tendency for diminishing returns to capital tends to disappear. In other words, the production function can exhibit diminishing or increasing returns to  $k$  when  $k$  is low, but the marginal product of capital must be bounded from below as  $k$  becomes large. A simple example, in which the production function converges asymptotically to the  $AK$  form, is

$$Y = F(K, L) = AK + BK^\alpha L^{1-\alpha} \quad (1.62)$$

32. See Kurz (1968) for a related discussion.

# Hybrid models: See page 66-67 Barro & Sala-i-Martin old Sobelo model...

We can write the function in per capita terms as

$$y = f(k) = Ak + Bk^\alpha$$

The average product of capital is given by

$$f(k)/k = A + Bk^{-(1-\alpha)}$$

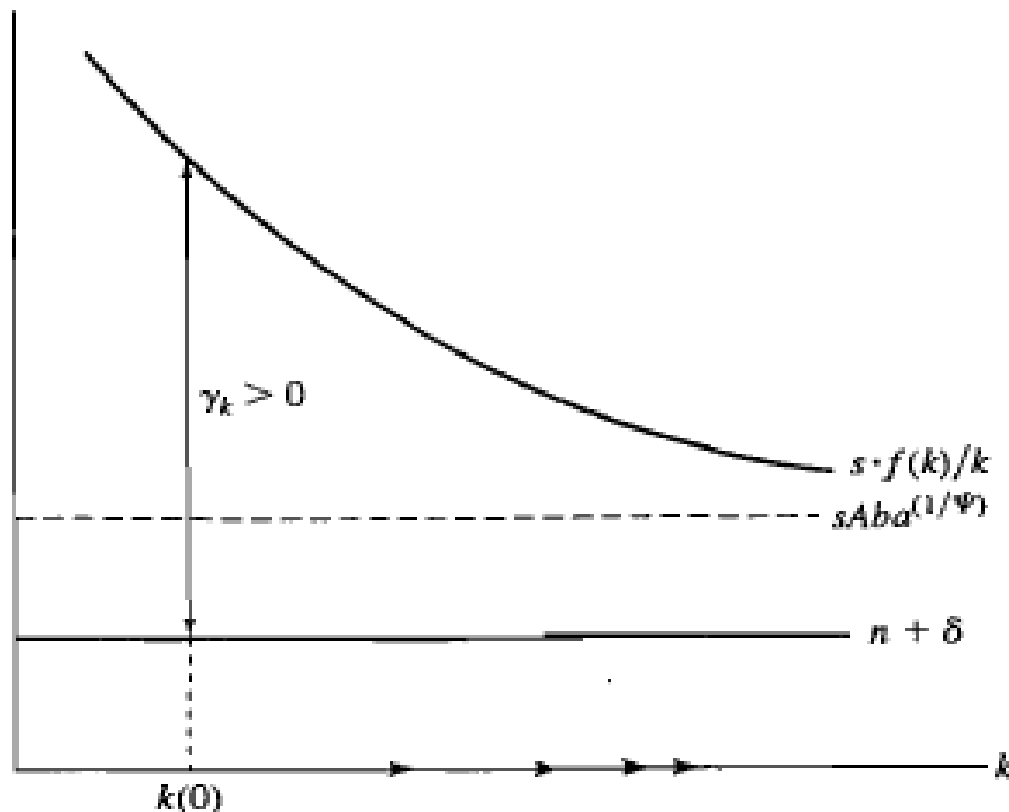
which is decreasing in  $k$  but approaches  $A$  as  $k$  tends to infinity.

The dynamics of this model can be analyzed with the usual expression from equation (1.13):

$$\dot{k}/k = s \cdot [A + Bk^{-(1-\alpha)}] - (n + \delta) \quad (1.63)$$

Figure 1.13 shows that the saving curve is downward sloping, and the line  $n + \delta$  is horizontal. The difference from figure 1.4 is that, as  $k$  goes to infinity, the saving curve in figure 1.13 approaches the positive quantity  $sA$ , rather than 0. If  $sA > n + \delta$ , as assumed in the figure, the steady-state growth rate,  $(\dot{k}/k)^*$ , is positive.

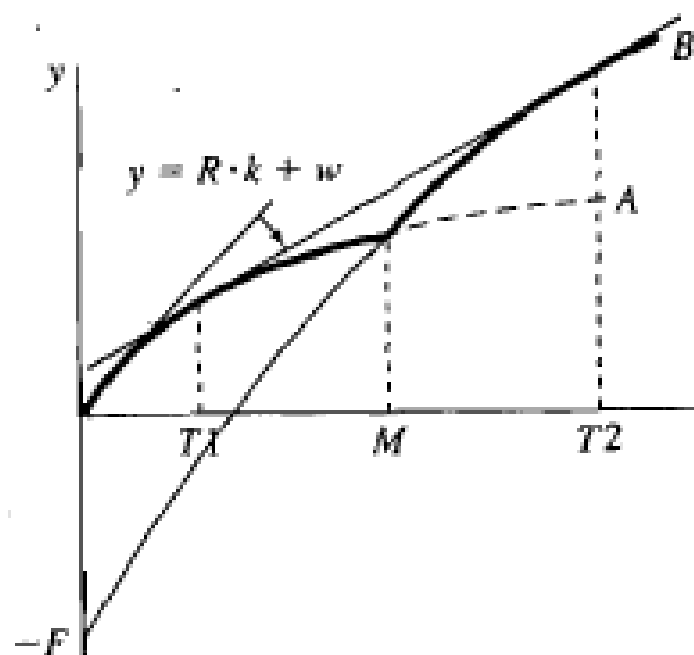
# Hybrid models: [See page 66-67](#) Barro & Sala-i-Martin old Solow model...



**Figure 1.14**

The CES model with  $0 < \psi < 1$  and  $sAb \cdot a^{1/\psi} > n + \delta$ . If the CES technology exhibits a high elasticity of substitution ( $0 < \psi < 1$ ), endogenous growth arises if the parameters satisfy the inequality  $sAb \cdot a^{1/\psi} > n + \delta$ . Along the transition, the growth rate of  $k$  diminishes.

# Demand side poverty traps....



**Figure 1.18**

**Traditional and modern production functions.** The traditional production function has relatively low productivity. The modern production function exhibits higher productivity but is assumed to require a fixed cost to operate.

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# Falling severe \$1.25 a day poverty now to \$2.00/day makes see [\*See Chandy & Gertz \(Brookings, Jan 2011\)\*](#)

TABLE 1: REGIONAL AND GLOBAL POVERTY, 2005, 2010, 2015

	Number of poor (millions)			Poverty rate (% population)		
	2005	2010	2015	2005	2010	2015
East Asia	304.5	140.4	53.4	16.8%	7.4%	2.7%
Europe and Central Asia	16.0	8.4	4.3	3.4%	1.8%	0.9%
Latin America and Caribbean	45.0	35.0	27.3	8.4%	6.2%	4.5%
Middle East and North Africa	9.4	6.7	5.4	3.8%	2.5%	1.9%
South Asia	583.4	317.9	145.2	40.2%	20.3%	8.7%
Sub-Saharan Africa	379.5	369.9	349.9	54.5%	46.9%	39.3%
World	1,337.8	878.2	585.5	25.7%	15.8%	9.9%

Source: Authors' calculations