# Population and Economic Growth

"The most decisive mark of the prosperity of any country is the increase in the number of its inhabitants". [Adam Smith].

# The growth question

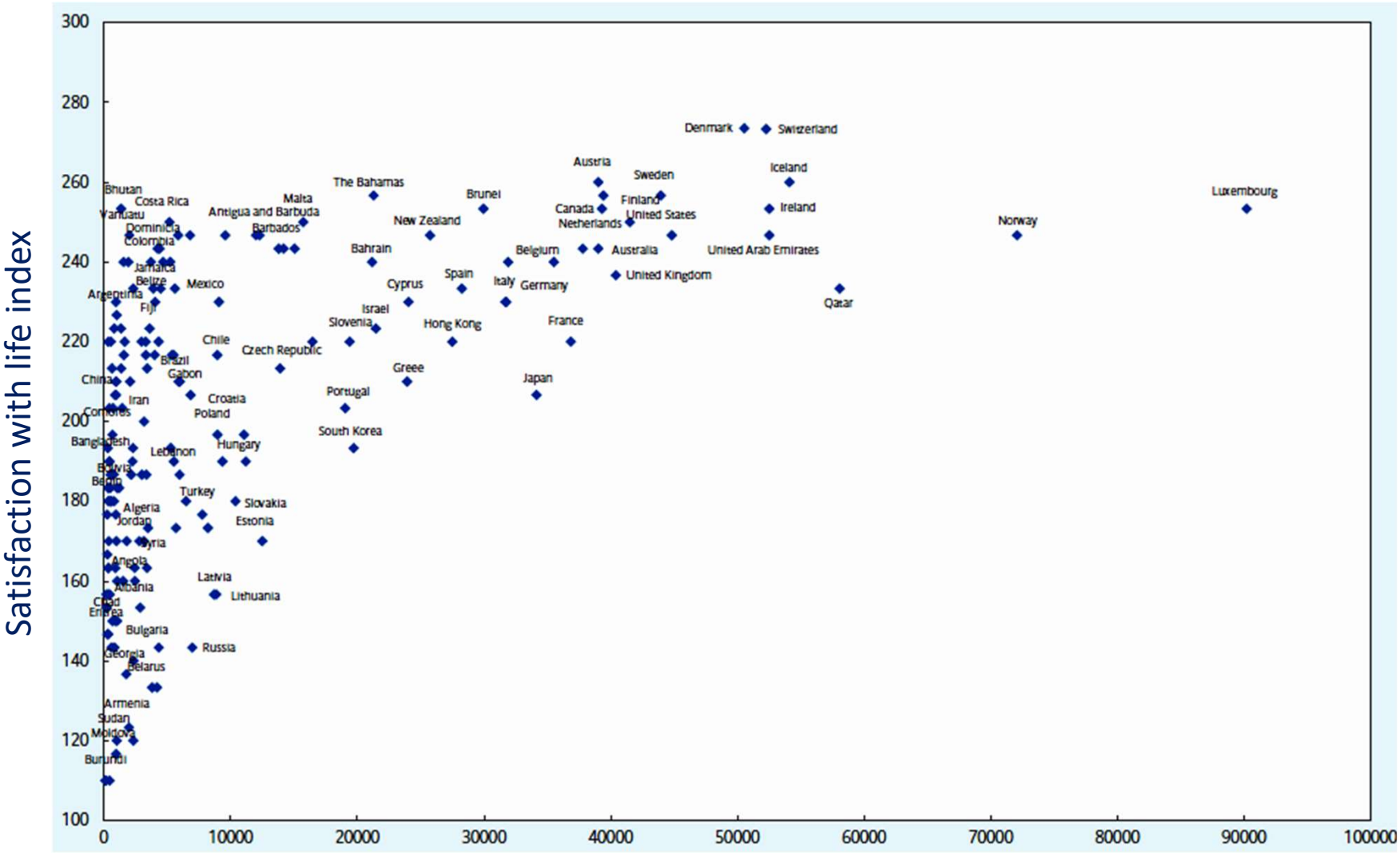
# Issues on Macroeconomics

Long – run growth

- Why are some countries richer than other?
- Why are some countries growing faster than other?
- Are per capita incomes converging?
- Is there something government policies can do about?

# GDP per Capita and Life Satisfaction in 2006

## Figure 1.1: GDP p.c. and Life Satisfaction

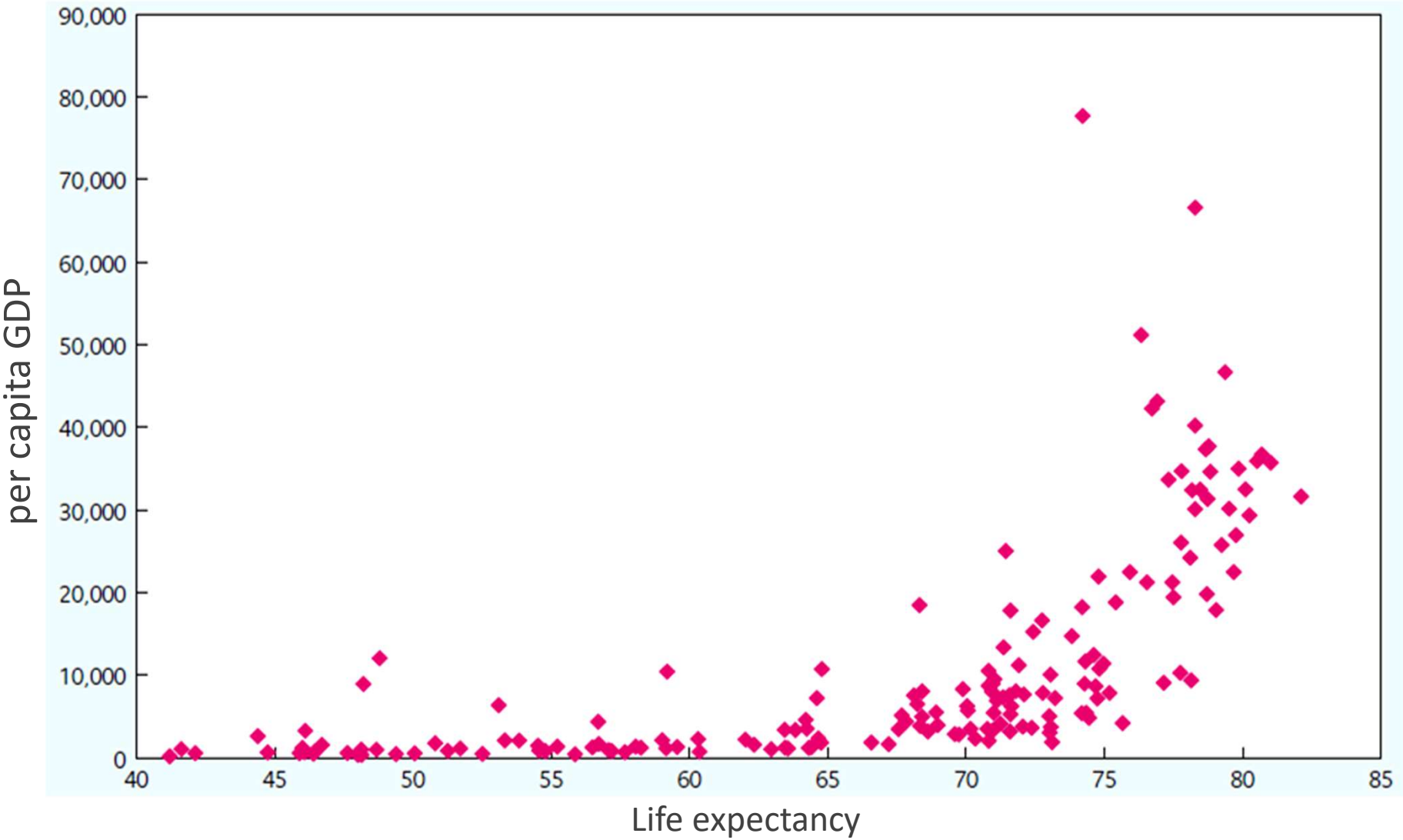







Sources: World Economic Outlook, IMF; Wikipedia

# Figure 4.3: Life Expectancy and Income

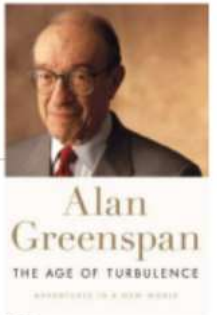






Source: Heston, Summers and Aten (2006)

# Growth and happiness




«Regrettably, economic growth cannot produce lasting contentment or happiness. Were that the case, the tenfold increase in world real per capita GDP over the past two centuries would have fostered a euphoric rise in human contentment. The evidence suggests that rising incomes do raise happiness, but only up to a point and only for a time. Beyond the point at which basic needs are met, happiness is a relative state that, over the long run, is largely detached from economic growth» Alan Greenspan (2007) *op. cit.* p. 269.

**Income is not everything**

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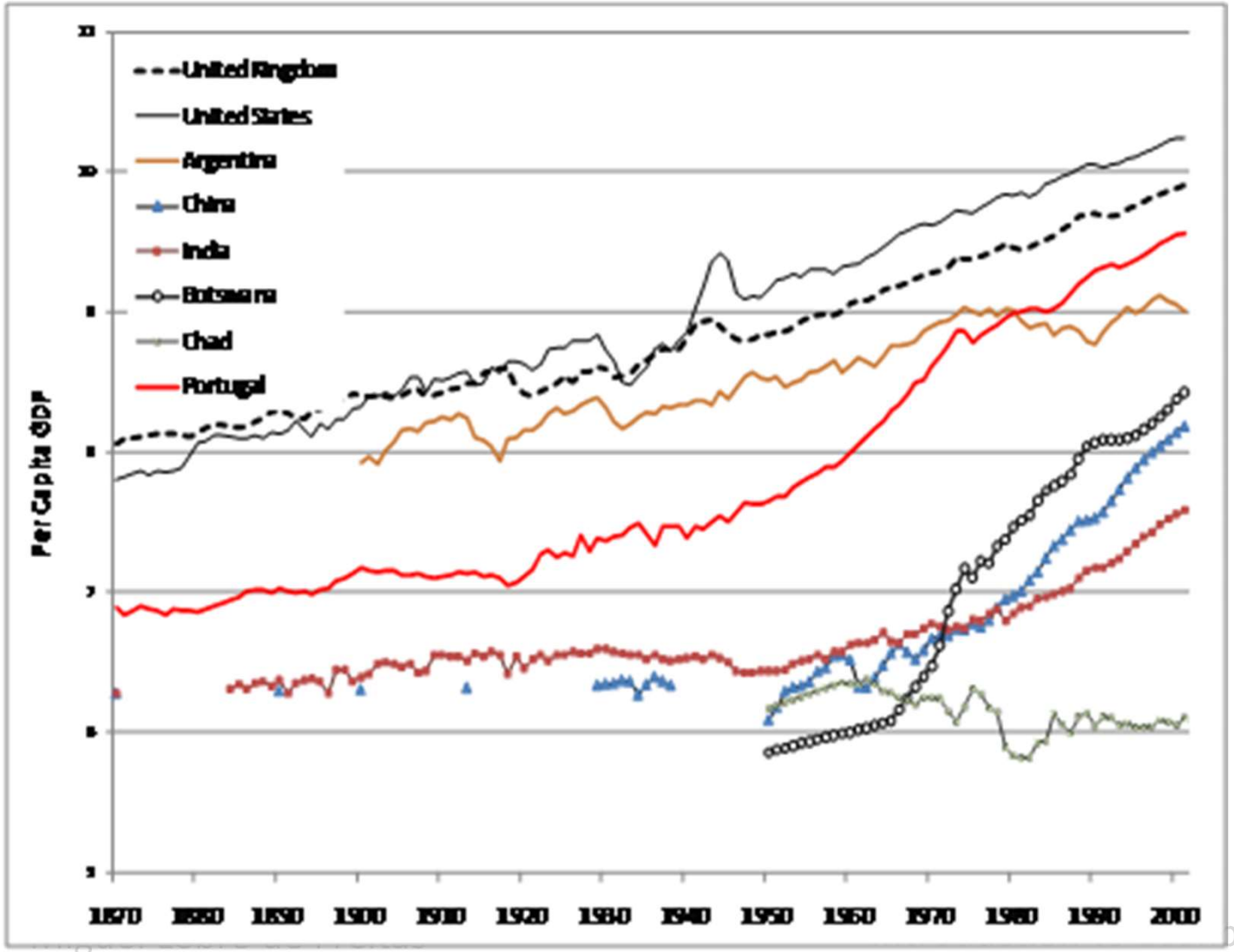
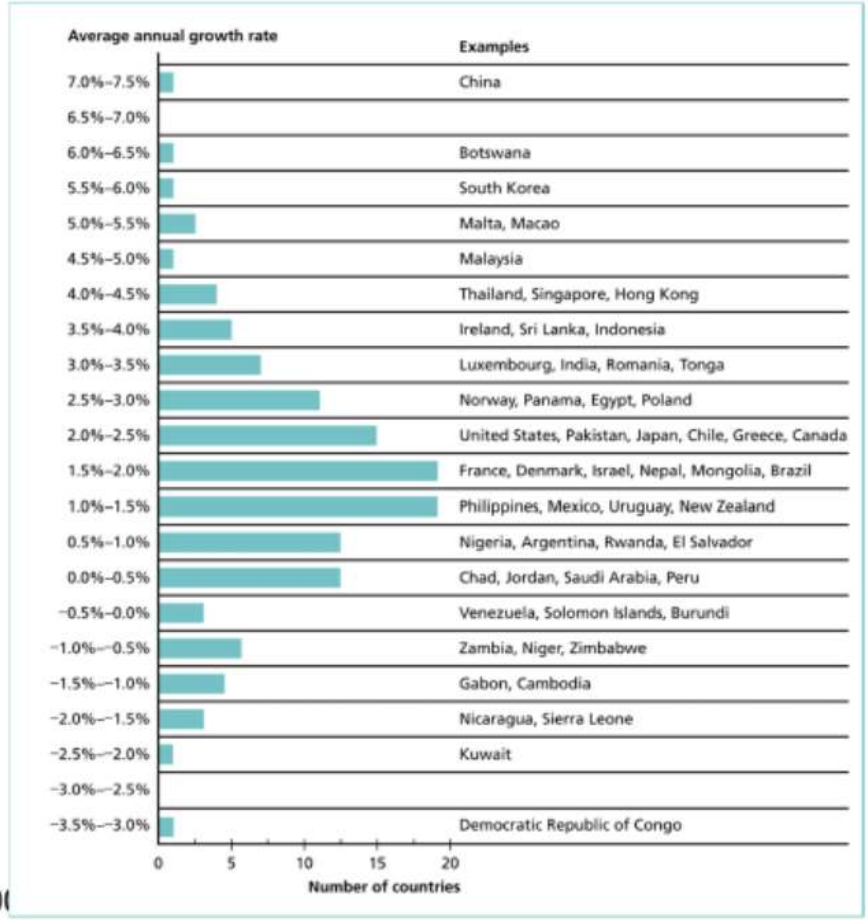
# Miracles and disasters




omic Growth

# **Figure 1.6** The Distribution of Growth Rates, 1970–2005






Sources: Heston, Summers, and Aten (2006), World Bank (2007a).

# The income Mobility of Countries (1962-1984)

Quah (1993)

| | Quarter or less | Quarter to Half | Half to Average | Average to Twice | Twice or more |
|---|---|---|---|---|---|
| Quarter or less | 88 | 8 | 4 | 0 | 0 |
| Quarter to Half | 48 | 43 | 10 | 0 | 0 |
| Half to Average | 0 | 28 | 56 | 14 | 3 |
| Average to Twice | 0 | 0 | 32 | 42 | 26 |
| Twice or more | 0 | 3 | 3 | 6 | 88 |

- The relative distribution of world income has been quite stable
- Lots of movements in the distributions however
- No ultimate traps do development
- Sticky ends mobile middels

# Chapter outline

- Malthus: population expansion decreases living standards (LDR)
- However, technological progress can override diminishing returns
  - Race between technology and diminishing returns
  - Population has a positive impact in technology
  - The quality of population matters
- Demographic transition
  - Why attitudes have changed?
  - Why it happened where it happened?

# Introduction

- Malthus contended that a fixed amount of natural resources could not feed a constantly increasing population.
- Societies throughout history had experienced different types of checks on excessive population growth
- This includes epidemics, famines, and wars, that masked the fundamental problem of populations overstretching their resource limitations (“Positive checks”).
- In plus, human beings differs from other animals in that they may deliberately reduce fertility in face of a resource shortage (“p*reventive* checks”, like abortion, birth control and postponement of marriage)

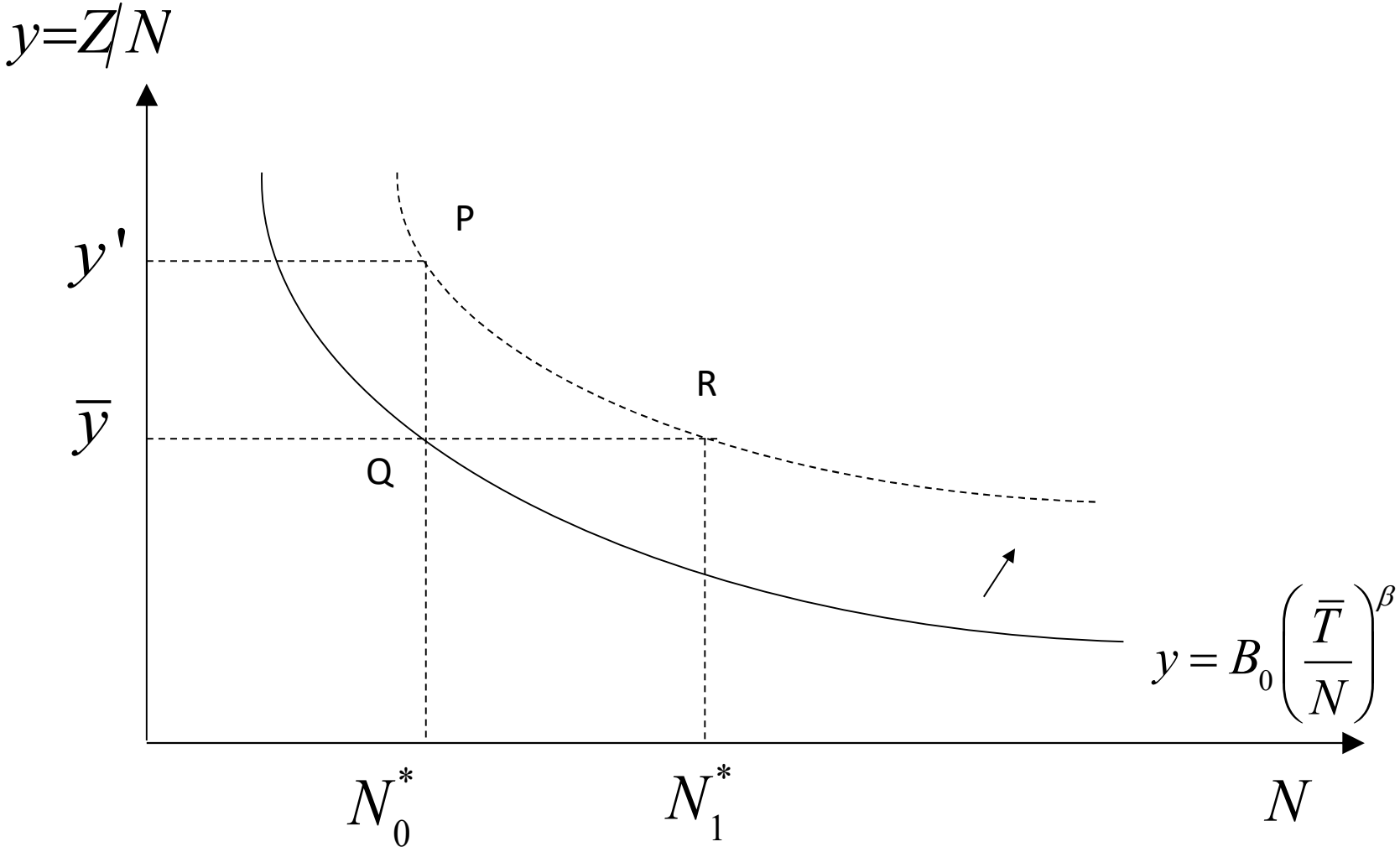
# Model' assumptions

- Available land is constant
- Absence of technical progress
- Diminishing returns on labor
- Population dynamics:

  - When income is above subsistence level, the "powerful instinct to increase the species" dominates

  - When income falls short the subsistence level, "preventive" and "positive" checks force population to decline

# Equilibrium in the Malthus model



# Productivity and population

- The model predicts that differences in technology should give rise to differences in population density but not in differences in living standards.
- Race between technological progress and population: what if technology expanded faster than population?

$$\hat{y} = \frac{\dot{B}}{B} - \beta n > 0$$

Rate of technological progress must be faster than adjusted population growth

# *Endogenous technical change*

- What if technological progress depended on the size of population?

  If each person has a given probability of inventing something, then, all else equal, a larger and more *diverse* population should, in principle, be capable of generating more inventions per unit of time.

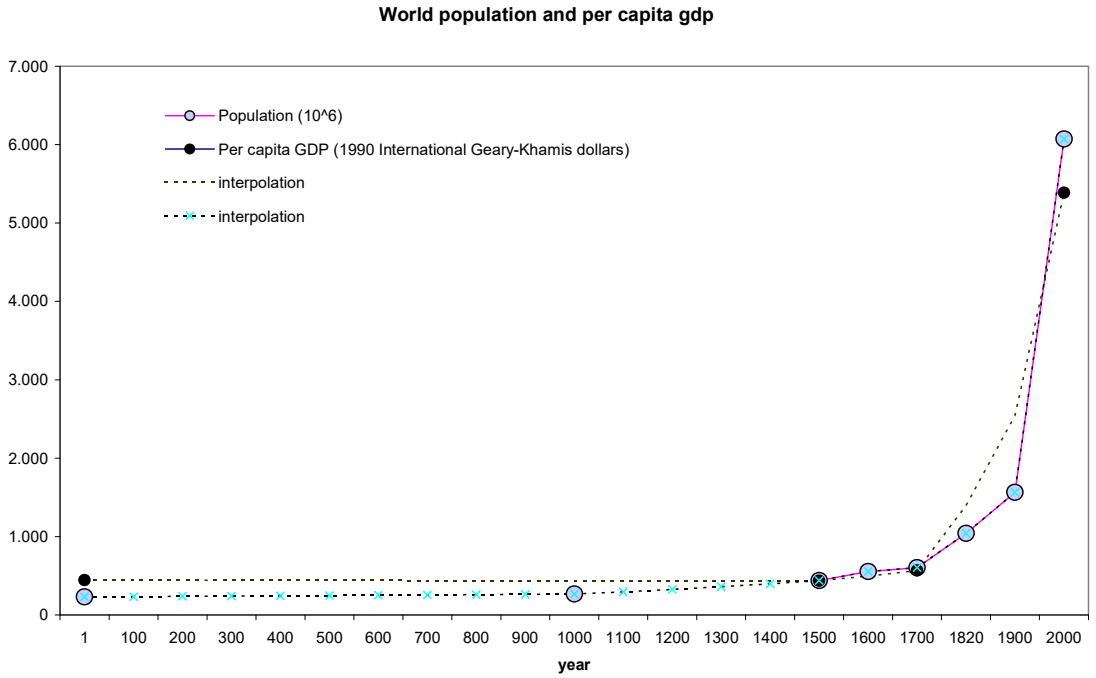
  For instance, if:

- P*opulation and technology will reinforce each other*
- *Initially larger regions should grow faster*.

# Population and technology

- The size of population and per capita income increased very little until the 17$^{th}$ century.
- In the last two hundred years, however, **both** accelerated abruptly (technological progress outpaced population growth)

At at certain moment in time *population lost the race* with technological change.



# *Technology and population*

- Race between technology and diminishing returns

$$\hat{y} = \frac{\dot{B}}{B} - \beta n > 0$$

- What if technological progress depended on the size of population?

$$\frac{\dot{B}}{B} = bN$$

- P*opulation and technology will reinforce each other*
- *Initially larger regions should grow faster*.

$$n = \frac{b}{\beta} N$$

# An historical experiment

Empirical problem:

- Cross-border knowledge spillovers mitigate technological differences, blessing the laggard regions with the opportunity to catch up.

How can we abstract from this effect?

- Kremer (1993) focused on a historical experiment.
- Before the end of the last ice age (about 10.000 B.C.) ocean levels were so low that humans could easily migrate across continents, including through the Bering Strait, which connects Asia to the Americas.
- With the melting of the polar ice caps, around 10,000 B.C, land bridges were flooded. In consequence, the Old World (Europe, Asia, Africa), the Americas, Australia, Tasmania and the Flinders Island became isolated from each other.

# An historical experiment

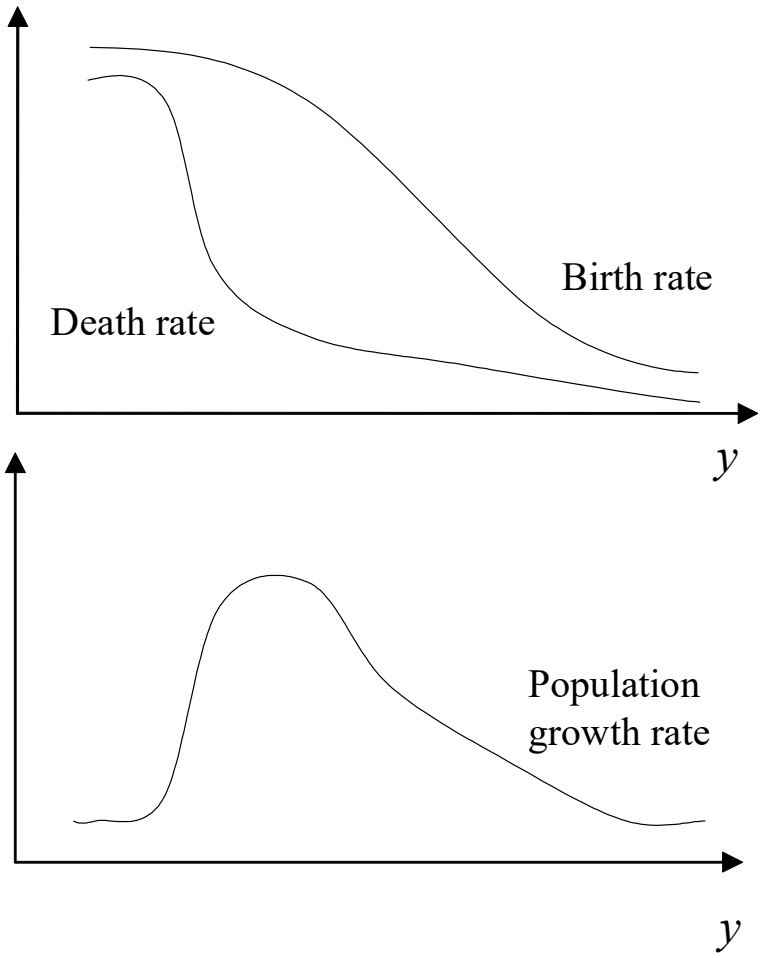
15th century

- - Population densities
  - Eurasia-Africa (4.85/km2)
  - Americas (0,36/Km2)
  - Australia (0.026/Km2)
  - Tasmania (0,018/Km2 to 0.074/Km2)
  - Flinder Island (0,0/Km2).
- Technology:
  - The Old World had the highest level of technological sophistication
  - The Aztec and the Mayan civilizations had already discovered agriculture.
  - Australia developed some artefacts like the boomerang, but not agriculture
  - Tasmania registered technological *regression*: its inhabitants lost the ability to make bone tools.
  - The Flinders Island, with 680 square kilometres of land and only 500 inhabitants initially, lost all its inhabitants by around 4,700 BC.

# Demographic transition

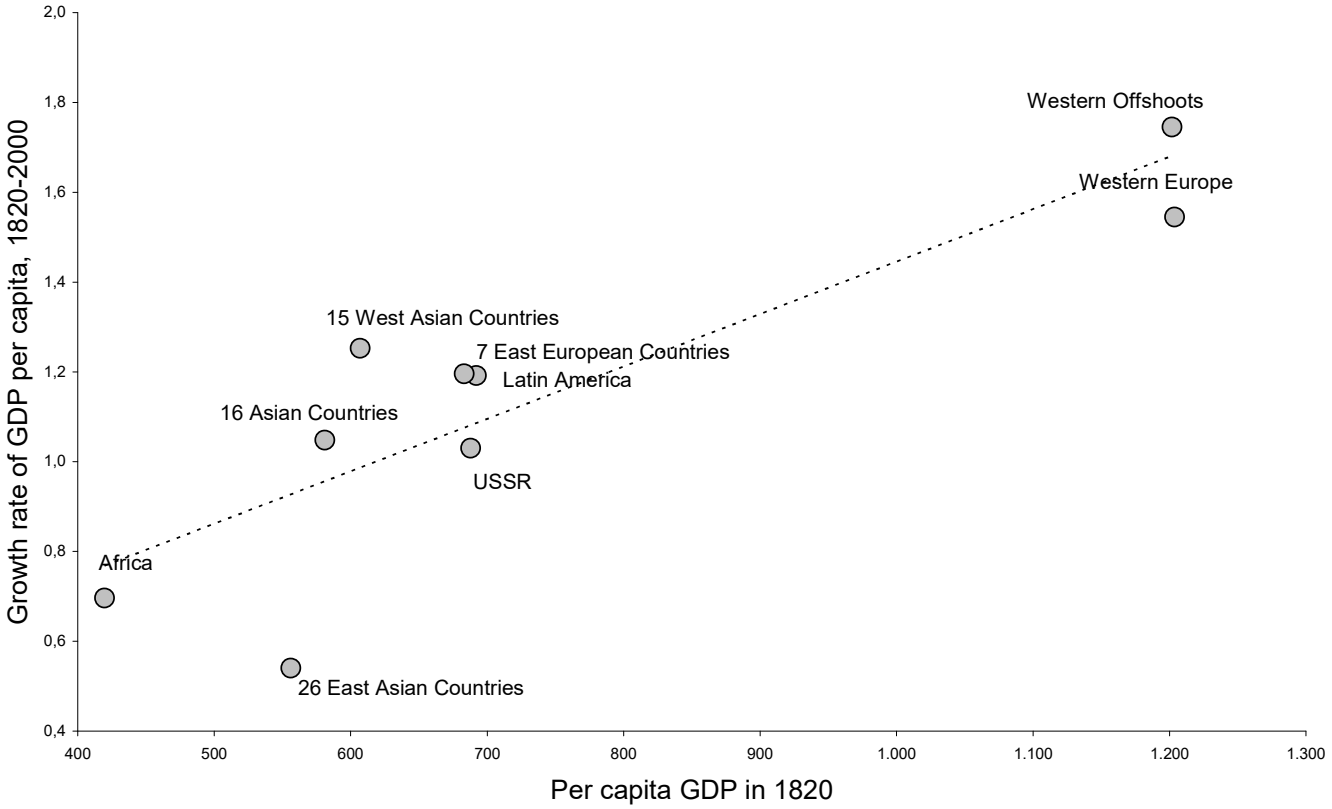
**Three stages:**

- High birth rates and high death rates.
- Steady decline of death rates, while birth rates remain high.
- The continuing decline in death rates is accompanied by an even faster decline in birth rates, so population expansion decelerates.



| | 1 | 1000 | 1500 | 1600 | 1700 | 1820 | 1900 | 1960 | 2000 |
|---|---|---|---|---|---|---|---|---|---|
| **29 Western European Countries** | | | | | | | | | |
| (1) GDP | | | | | | | | | |
| Billions of 1990 International Geary-Khamis dollars | 11 | 10 | 44 | 66 | 81 | 160 | 676 | 2,251 | 7,430 |
| Growth Rate (% per annun) | | *-0.01* | *0.29* | *0.40* | *0.21* | *0.57* | *1.82* | *2.02* | *3.03* |
| (2) Population | | | | | | | | | |
| Millions | 25 | 25 | 57 | 74 | 81 | 133 | 234 | 326 | 391 |
| Growth Rate (% per annun) | | *0.00* | *0.16* | *0.25* | *0.10* | *0.41* | *0.71* | *0.56* | *0.45* |
| (3) Per Capita GDP | | | | | | | | | |
| 1990 International Geary-Khamis dollars | 450 | 400 | 771 | 890 | 998 | 1,204 | 2,893 | 6,896 | 19,002 |
| Growth Rate (% per annun) | | *-0.01* | *0.13* | *0.14* | *0.11* | *0.16* | *1.10* | *1.46* | *2.57* |
| Memo: | | | | | | | | | |
| (4) Total Factor Productivity (% per annun) | | *-0.01* | *0.19* | *0.23* | *0.15* | *0.29* | *1.35* | *1.65* | *2.73* |
| (5) Population growth divided by GDP growth | | | 0.55 | 0.64 | 0.46 | 0.72 | 0.39 | 0.28 | 0.15 |
| **Asia** | | | | | | | | | |
| (1) GDP | | | | | | | | | |
| Billions of 1990 International Geary-Khamis dollars | 78 | 82 | 161 | 217 | 230 | 413 | 557 | 1,736 | 13,762 |
| Growth Rate (% per annun) | | *0.00* | *0.14* | *0.30* | *0.06* | *0.49* | *0.37* | *1.91* | *5.31* |
| (2) Population | | | | | | | | | |
| Millions | 174 | 183 | 284 | 379 | 402 | 710 | 873 | 1,687 | 3,605 |
| Growth Rate (% per annun) | | *0.00* | *0.09* | *0.29* | *0.06* | *0.48* | *0.26* | *1.10* | *1.92* |
| (3) Per Capita GDP | | | | | | | | | |
| 1990 International Geary-Khamis dollars | 449 | 449 | 568 | 572 | 571 | 581 | 638 | 1,029 | 3,817 |
| Growth Rate (% per annun) | | *0.00* | *0.05* | *0.01* | *0.00* | *0.01* | *0.12* | *0.80* | *3.33* |
| Memo: | | | | | | | | | |
| (4) Total Factor Productivity (% per annun) | | *0.00* | *0.08* | *0.10* | *0.02* | *0.17* | *0.20* | *1.18* | *4.03* |
| (5) Population growth divided by GDP growth | | | 0.65 | 0.98 | 1.03 | 0.97 | 0.69 | 0.58 | 0.36 |

# The great divergence



# The Great Divergence

- Some theories relate the Great Divergence with the different timings that different countries performed their demographic transitions
- Industrialization played a key role in these transitions
  - Industrialization generates an increased demand for skilled labour, raising the returns to education and leading parents to alter their choices over their children education.
  - In response, societies press their governments to introduce universal schooling
  - As educational reforms induce more children to engage in formal educational, fertility rates decline.
- Nations with comparative advantages in manufactures developed first

# Summary

- The Law of Diminishing Returns (LDR) plays an important role in the theory of economic growth.
- The Malthus model puts it in a simple manner: in this model, a growing labour force leads to a more intensive use of land and thereby to a decline in labour productivity and wages. At the moment wages fall below a given subsistence level, both population and output stop growing.
- The Malthus prediction that technological gains should translate into higher population densities rather than to higher leaving standards describes pretty well the history of human kind for a long period in the pre-industrial era.
- Along the centuries, however, technology started winning the race against population: population expanded with per capita income, but not the enough to avoid the increase in per capita income. This pattern is labeled the post-Malthusian regime.
- In the Modern Growth regime, the relationship between income and population growth is reversed.

# Summary

- The change in human attitudes toward fertility along the process of economic development is labeled “Demographic Transition”.
- To understand this phenomenon one needs to look at the microeconomics of fertility.
- In the Malthusian regime, fertility rates tend to be high, because children play an “asset role” and because of risk aversion. In the Modern growth regime, formal institutions dominate children in their asset role.
- In modern economies, the cost of rearing children and preparing them to enter in the labor force is higher than in traditional societies. Thus, parents’ choices move from “quantity” to “quality”.
- Technological change played a key role in the demographic transition.
- The fall in birth rates entails some inertia, either because of social norms and because of the “population momentum”.

# Summary

- The rising cross-country income disparities along the last two centers is known as “The Great Divergence”.
- Some authors argued that the great divergence was the result of an interaction between globalization, industrialization and attitudes towards fertility.
- England achieved an agriculture revolution when it was basically a closed economy. In such a context, the Engel’ Law implied an expansion of employment in manufactures, triggering investments in education and faster technological progress.
- In the XIX century, at the time most countries opened to international trade, England and other western countries had already comparative advantages in manufactures.
- Countries with comparative advantages in agriculture remained basically in the Malthusian regime, with technological improvements matched by population expansions.
- In countries with comparative advantages in manufactures, societies felt the pressure to switch from child quantity to child quality, investing more in education and achieving faster technological change, in a virtuous cycle.
- This story points to a distinction between static efficiency and dynamic efficiency.