

Chapter 6

**Economic Growth:
Malthus and Solow**

Class notes for ECO 3203 – intermediate Macroeconomics
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- **Malthus:**
Limited fixed factors of production.
Solution is population control.
WRONG
- **Solow:**
Solution is to Increase Total Factor of Productivity (TFP) – Improvement in knowledge and in technical ability.

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Solow Based growth Models

- **Exogenous growth models**
Growth caused by forces not explained by the model itself.
- **Endogenous growth models**
Examine the economic factors that cause growth.

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Agenda

- Empirical
 1. Economic growth facts
 2. Growth accounting: approach to attribute the growth in GDP to growth in factor inputs and in total factor productivity – learn from the data.
- Theoretical

Modeling economic growth: exogenous or endogenous growth models

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ECONOMIC GROWTH FACTS

1. Pre-1800: Constant per capita Income across Time and Space
2. Post-1800: Sustained Growth in the Rich Countries
3. High Investment \leftrightarrow High Standard of Living
4. High Population Growth \leftrightarrow Low Standard of Living
5. Divergence of per capita Incomes: 1800–1950
6. No conditional Convergence amongst all Countries
7. Conditional Convergence amongst the Rich Countries
8. No Conditional Convergence amongst the Poorest Countries

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Figure 6.1 **Natural Log of Real per Capita Income in the United States, 1869–2002**

FACT 2: in the U.S.

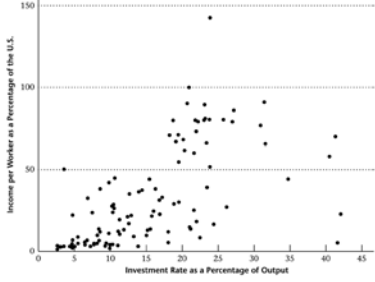
The slope is the growth rate which is around 2% a year (134 years)



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Figure 6.2 Output per Worker vs. Investment Rate

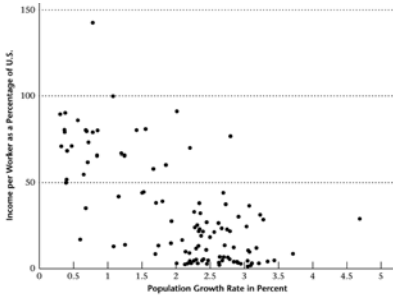
FACT 3: Across countries, there is a positive correlation (1995)



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Figure 6.3 Output per Worker vs. the Population Growth Rate

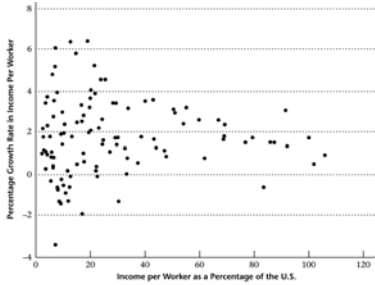
FACT 4: Across countries, there is a negative correlation (1960-1995)



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Figure 6.4 No Convergence Among All Countries

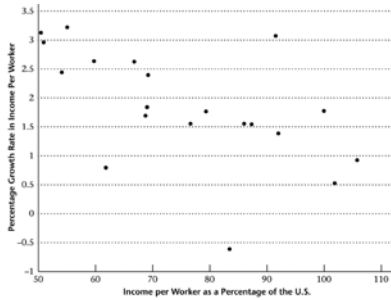
FACT 6: No correlation across countries



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Figure 6.5 Convergence Among the Richest Countries

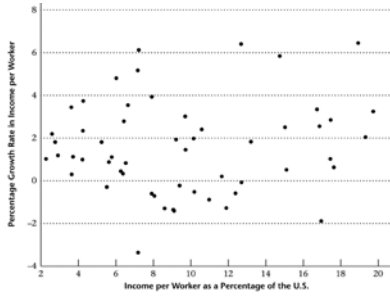
FACT 7: Negative correlation across rich countries (50% of the USA)



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Figure 6.6 No Convergence Among the Poorest Countries

FACT 8: No correlation across poor countries (20% or less of the USA)



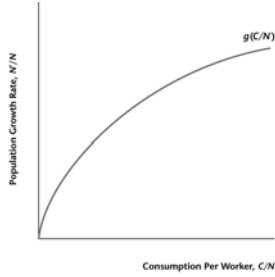
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Malthusian Model of Economic Growth (Thomas Malthus 1798)

1. Production Determined by Labor and Fixed Land Supply
2. Population Growth and per capita Consumption
3. Steady-state Consumption and Population
 1. Effects of Technological Change
 2. Effects of Population Control
4. Malthus: Theory and Evidence

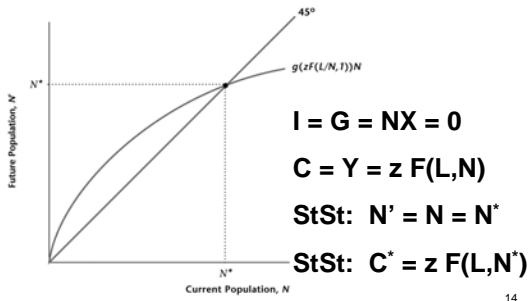
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Figure 6.7 Population Growth Depends on Consumption per Worker in the Malthusian Model



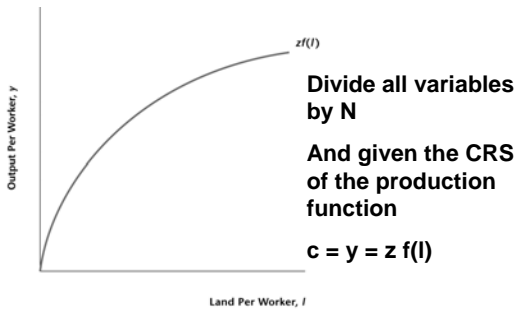
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Figure 6.8 Determination of the Population in the Steady State



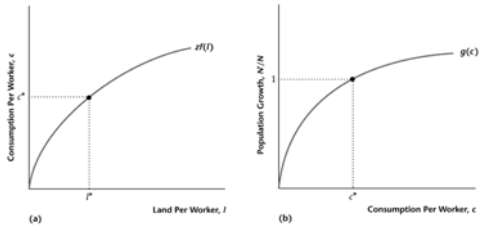
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Figure 6.9 The Per-Worker Production Function



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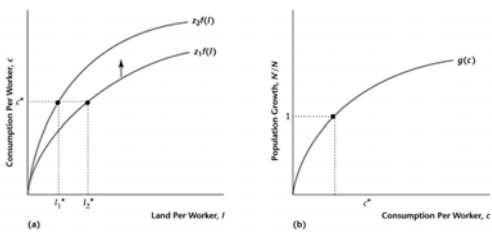
Figure 6.10 Determination of the Steady State in the Malthusian Model



At StSt $N' = N \Rightarrow 1 = g(c^*) \Rightarrow c^* \Rightarrow l^*$

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Figure 6.11 The Effect of an Increase in z in the Malthusian Model

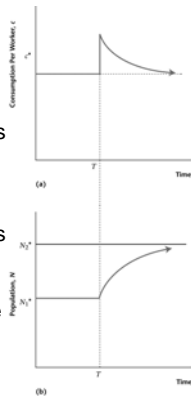


An improvement in Agriculture techniques – no long run improvement in living standards – same stst c

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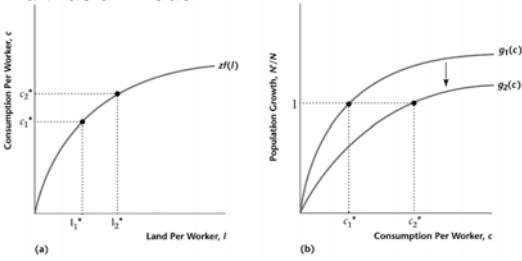
Figure 6.12 Adjustment to the Steady State in the Malthusian Model When z Increases

Z increases \rightarrow output increases
 $\rightarrow c$ increases \rightarrow population growth increases $\rightarrow c$ decreases \rightarrow no long run improvement in living standards
 \rightarrow better technology generates better nutrition and more population that consume all the extra food produced



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Figure 6.13 Population Control in the Malthusian Model



Population control shifts $g()$ down \rightarrow higher c
 Wrong assumptions (mainly: no capital accumulation)

SOLOW GROWTH MODEL
