ECON 710 - Advanced Macroeconomics

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Introduction to Macroeconomics Data

This document provides an overview of the key concepts and topics covered in the Advanced Macroeconomics course. The course aims to equip students with the theoretical knowledge and analytical tools necessary to understand modern macroeconomic analysis.

Course Objectives

The macroeconomics course has three main objectives:

1. To identify the relevant theoretical knowledge to understand the foundations of modern macroeconomic analysis.
2. To learn how to use this theoretical knowledge to conduct advanced macroeconomic research independently.
3. To review certain topics and modern issues in macroeconomics using these tools.

Contents

1 Why Study Economic Growth?

Economic growth is a crucial determinant of material well-being for billions of people. In advanced economies, growth since the Industrial Revolution has allowed almost everyone to live a lifestyle that was once reserved for a privileged few. Growth in sectors like medicine and pharmaceuticals has enabled most people to live longer and healthier lives compared to the 19th century. Conversely, the lack of growth in the world's poorest countries results in appalling living conditions compared to richer nations. Understanding the determinants of economic growth helps us comprehend why humanity has become much wealthier and why this wealth is so unevenly distributed.

1.1 Economic Growth Correlates, Well-being, and Poverty

Material well-being is closely linked to economic growth. As economies expand, they generate higher levels of income and wealth, which in turn improve living standards. Economic growth leads to increased employment opportunities, higher wages, and better access to essential services such as healthcare, education, and housing. This growth also enables governments to collect more tax revenue, which can be invested in public infrastructure and social programs that further enhance quality of life.

Additionally, technological advancements and innovations driven by economic growth can lead to more efficient production processes and the creation of new products and services that improve daily living. Overall, a growing economy provides the resources and opportunities necessary for individuals and communities to achieve greater material well-being and a higher standard of living.

For instance, the association between income per capita and consumption per capita, in Figure 1, in year 2000 shows a positive correlation. Similarly, GDP growth and the average growth of investments to GDP ratio from 1960 to 2000, in Figure 2, indicate that higher investment rates are associated with higher economic growth. Education also plays a significant role in economic growth, as evidenced by the positive relationship between GDP growth and average years of schooling from 1960 to 2000 (Figure 3).

1.2 Life Expectancy and Economic Growth

Economic growth is also associated with improvements in life expectancy. Higher income per capita often leads to better healthcare, nutrition, and living conditions, which contribute to longer life expectancy.

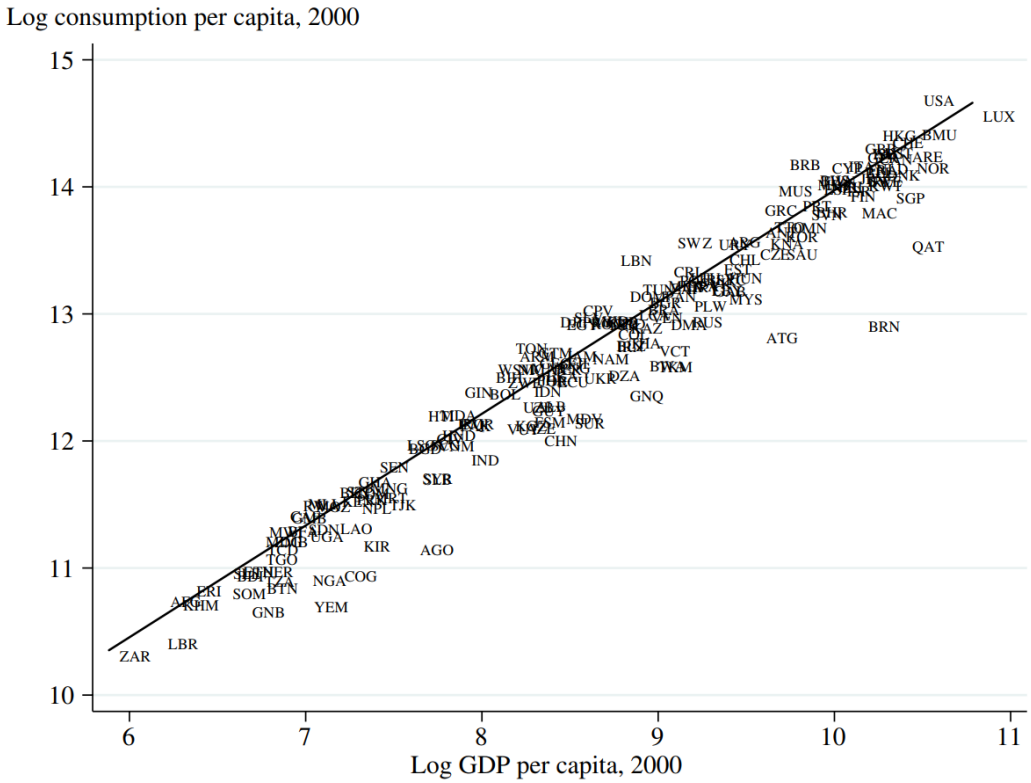


Figure 1: The association between income per capita and consumption per capita in 2000

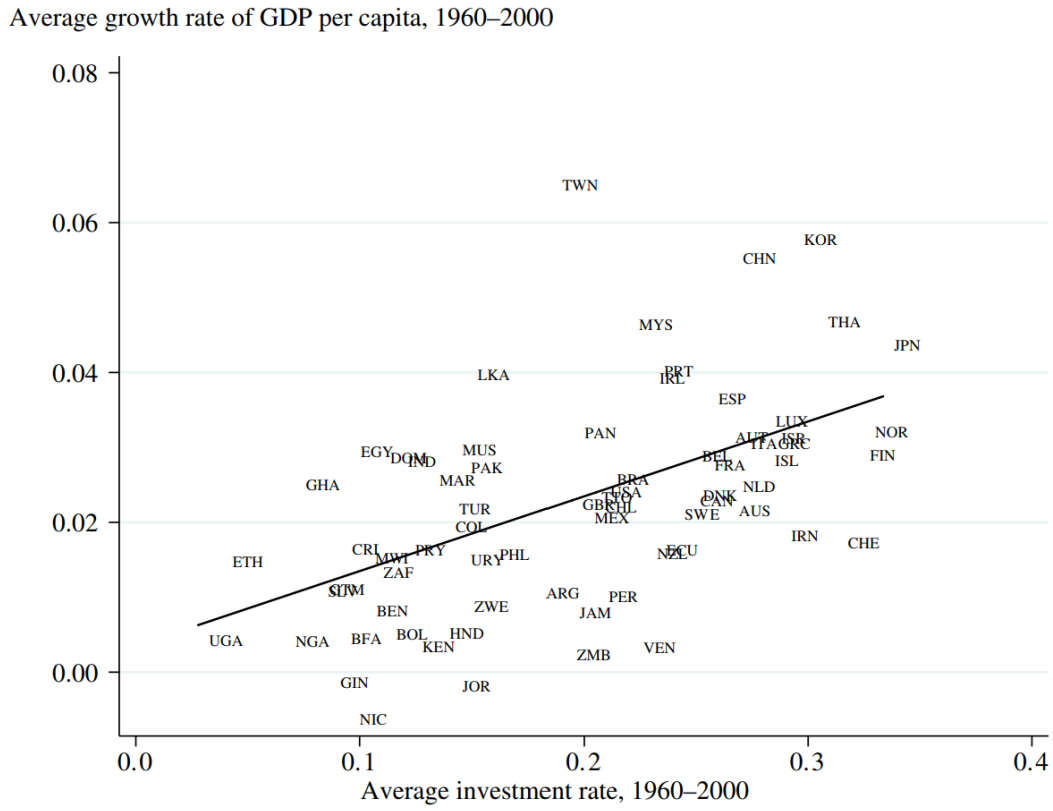


Figure 2: GDP growth and average growth of investments to GDP ratio, 1960–2000

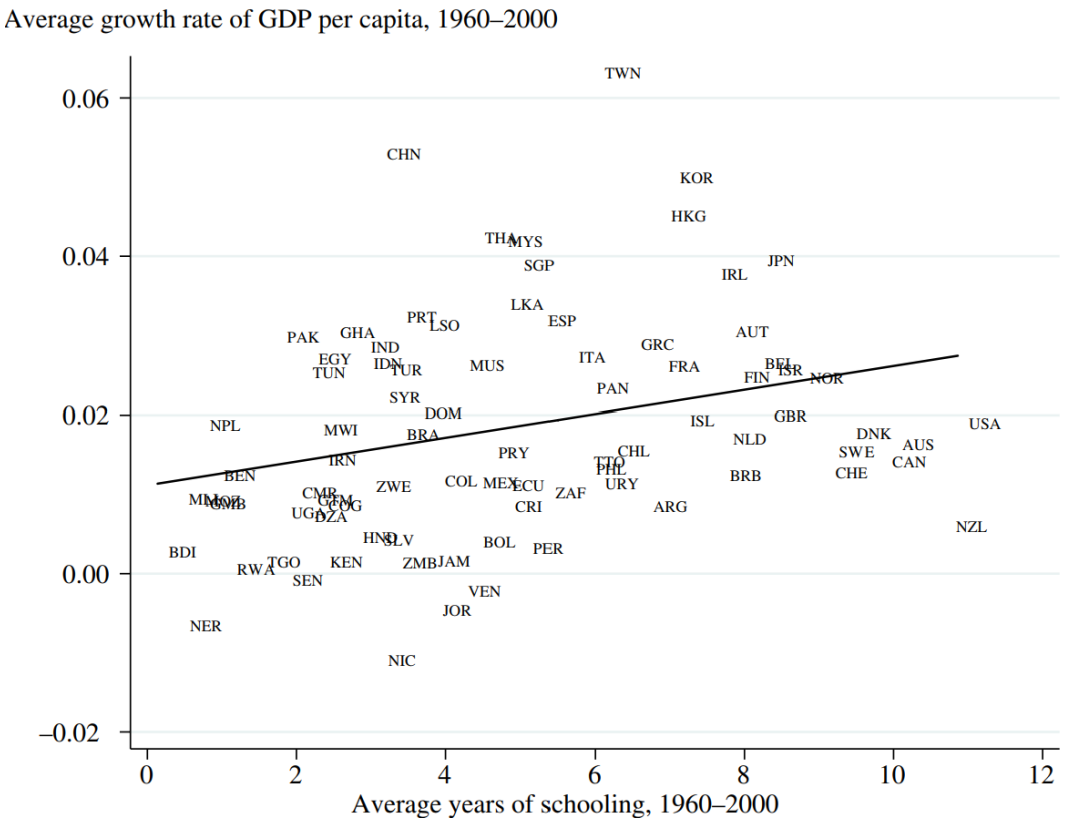


Figure 3: GDP growth and average years of schooling, 1960-2000

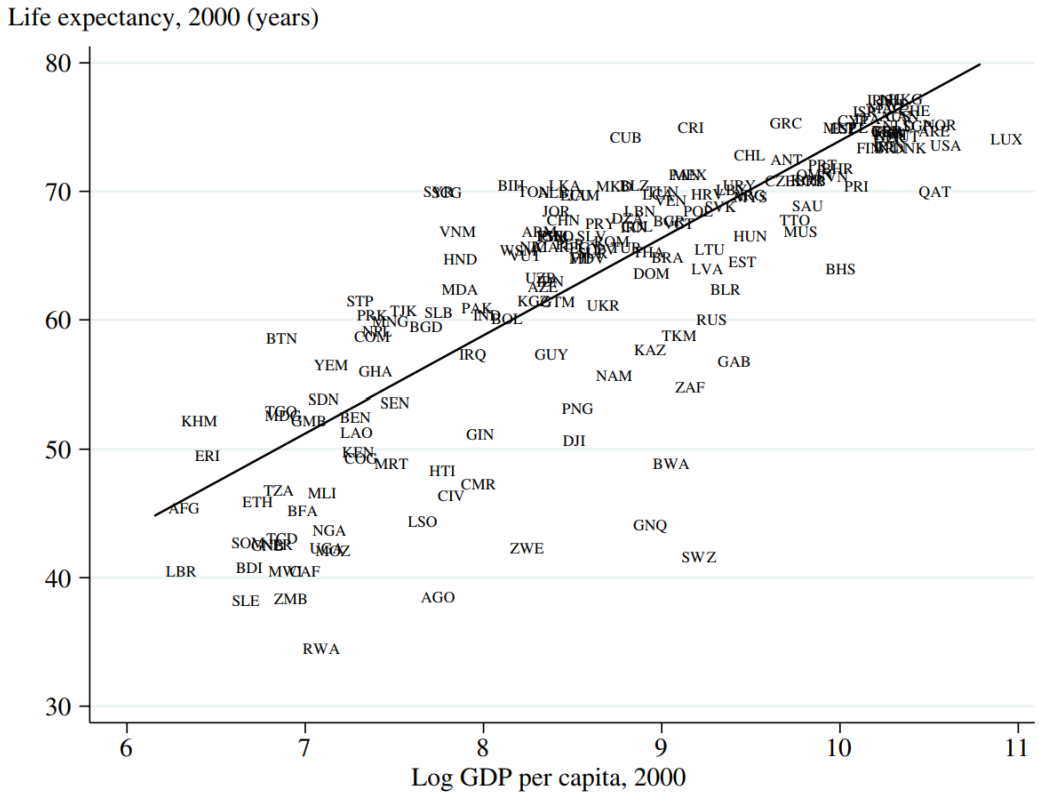


Figure 4: The association between income per capita and life expectancy at birth in 2000

1.3 World Income Distribution

The distribution of income across the world has changed significantly over time. The following figures illustrate the world income distribution in 1970 and 2000, highlighting the shifts in global wealth.

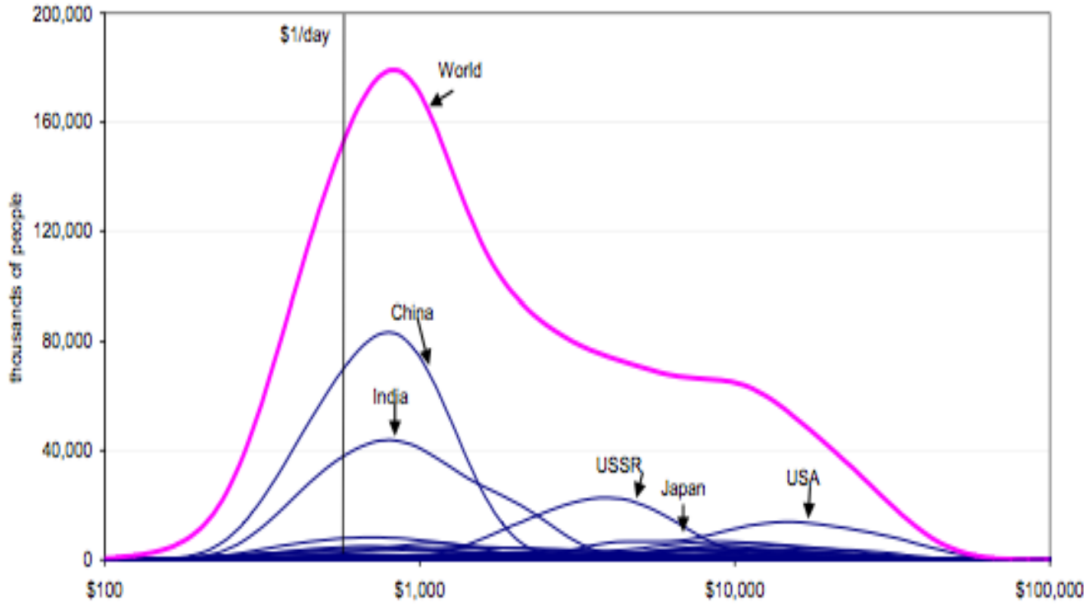


Figure 5: World income distribution in 1970

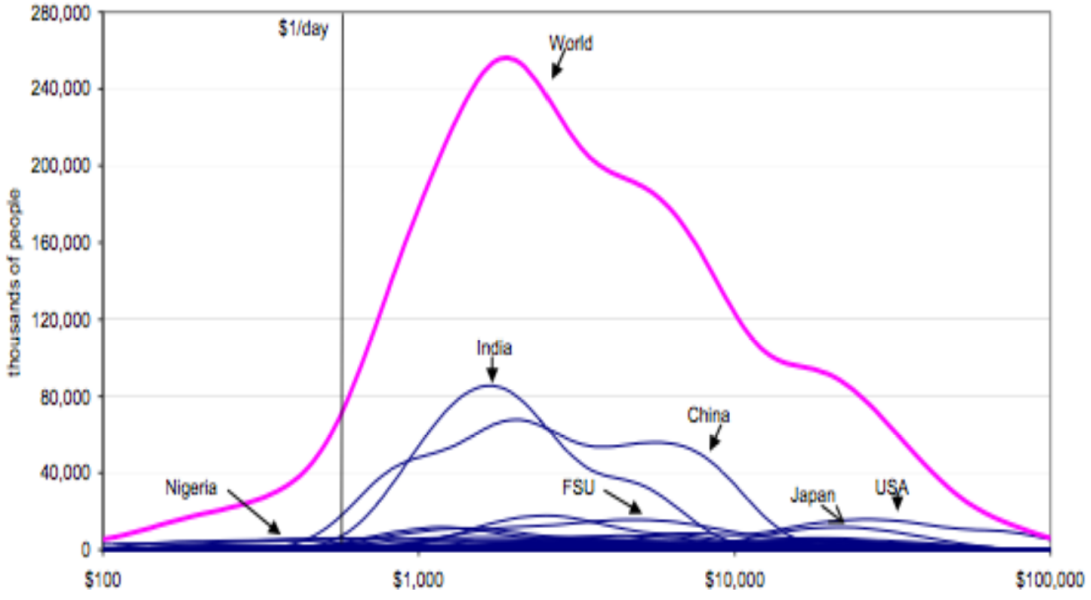


Figure 6: World income distribution in 2000

1.4 Poverty Reduction and Income Distribution

Different countries have experienced varying trends in poverty reduction and income distribution. For example, China has seen a significant reduction in poverty over time, while Nigeria has experienced an increase in poverty. India has also made notable progress in reducing poverty.

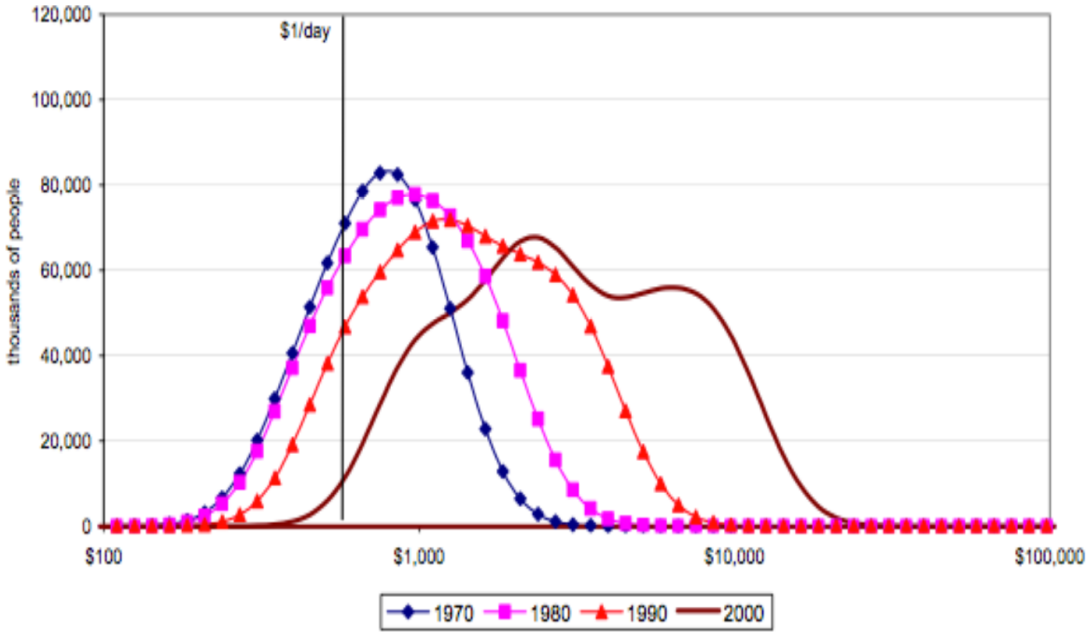


Figure 7: Distribution of income in China over time

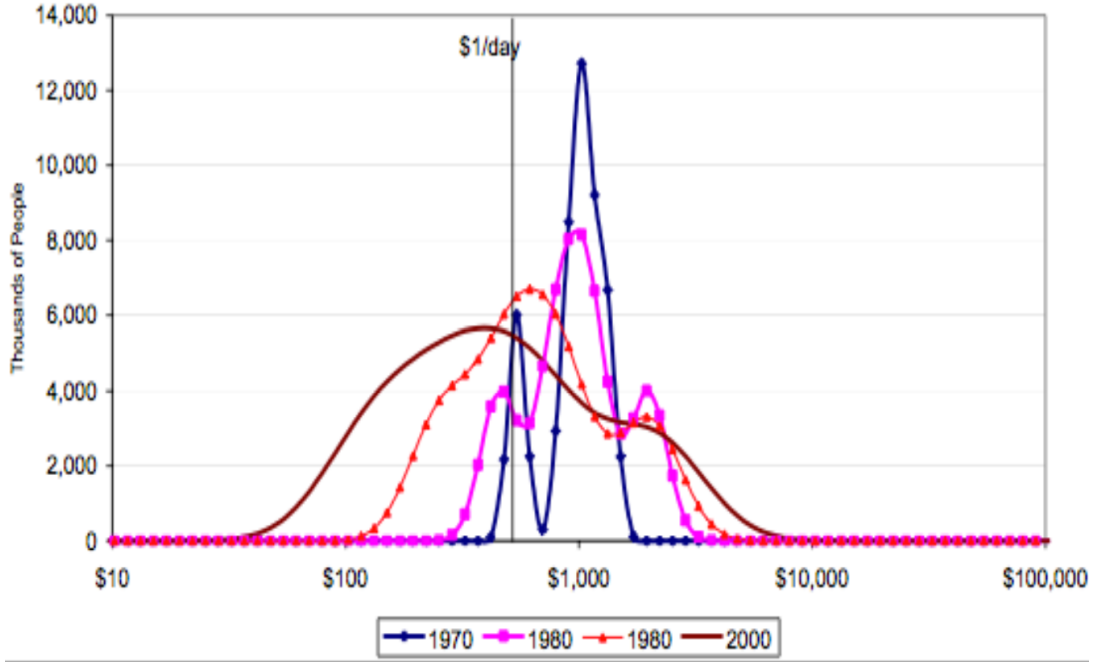


Figure 8: Distribution of income in Nigeria over time

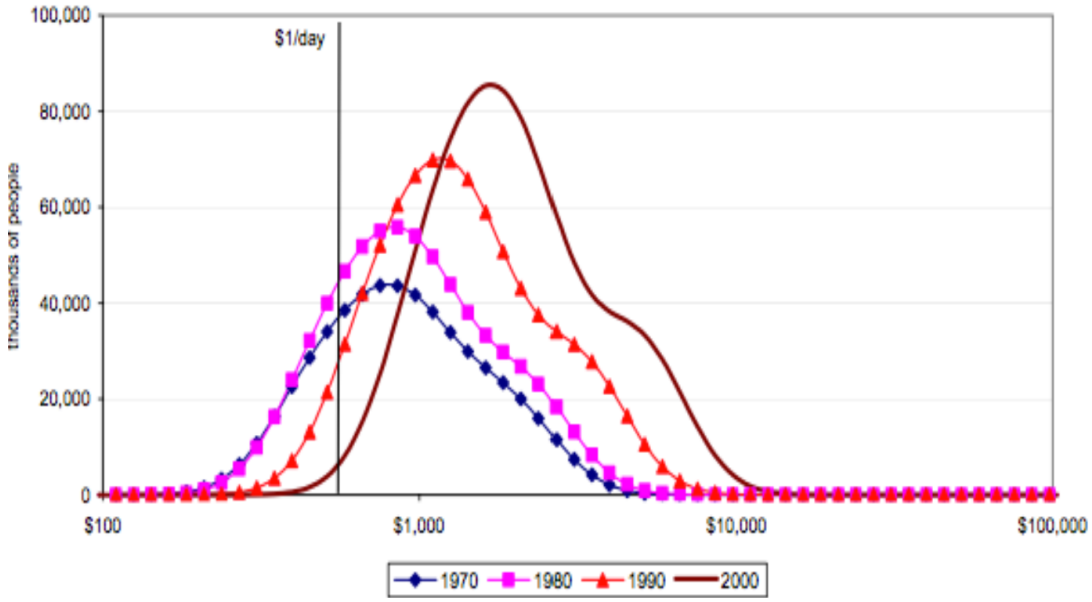


Figure 9: Distribution of income in India over time

2 The Question of Convergence

The concept of convergence in economics refers to the idea that poorer economies will eventually catch up to richer economies in terms of income per capita. This section explores the evolution of the global distribution of income per capita and the distribution of growth rates across countries.

The global distribution of income per capita has evolved over time, with some countries experiencing rapid growth while others lag behind (see Figure 10). Additionally, the distribution of growth rates across countries shows significant variation, with some countries achieving high growth rates while others experience stagnation or decline (see Figure 11).

2.1 Absence of Absolute Convergence

Figure 12 illustrates the relationship between growth and initial income, showing that poorer countries have not always caught up with richer ones. The scatter plot depicts the initial income levels on the x-axis and subsequent growth rates on the y-axis for a sample of countries. The lack of a clear negative relationship between initial income and growth rates indicates that absolute convergence is not occurring between 1960 and 2000. Instead, the data suggests that many low-income countries are not growing faster than their high-income counterparts, and some are even falling further behind.

2.2 Conditional Convergence

Conditional convergence is a concept in economic growth theory that suggests economies will converge in terms of per capita income, but only if they share similar characteristics such as

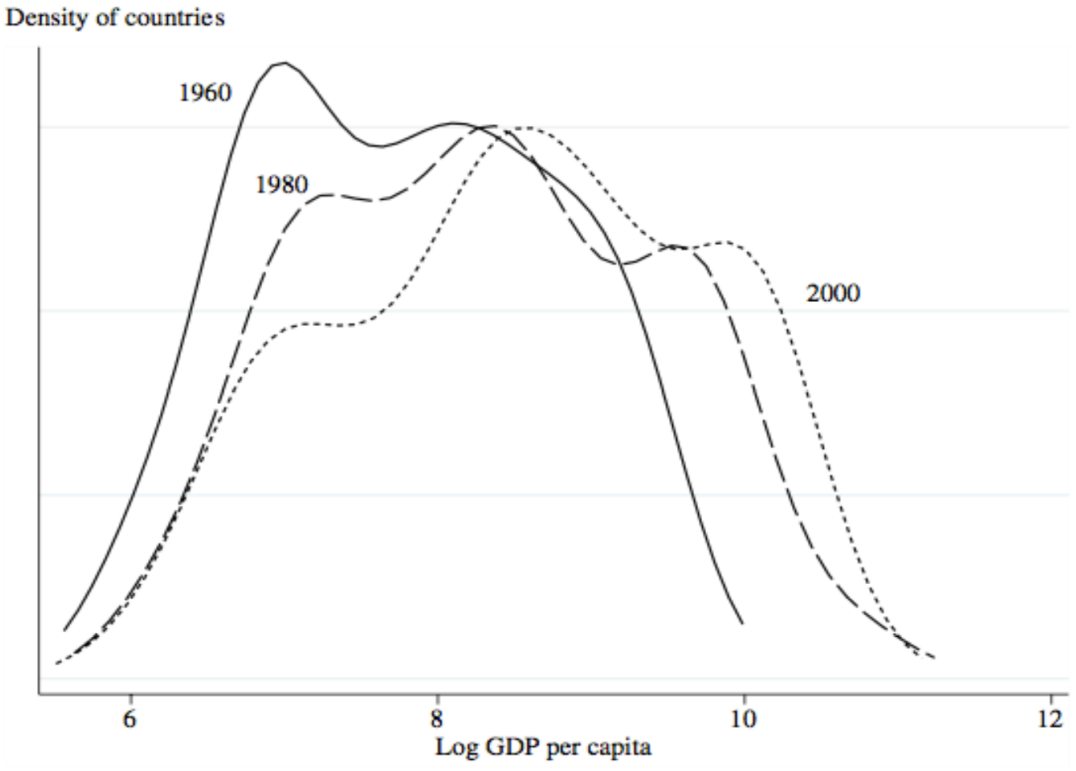


Figure 10: Growth versus initial income

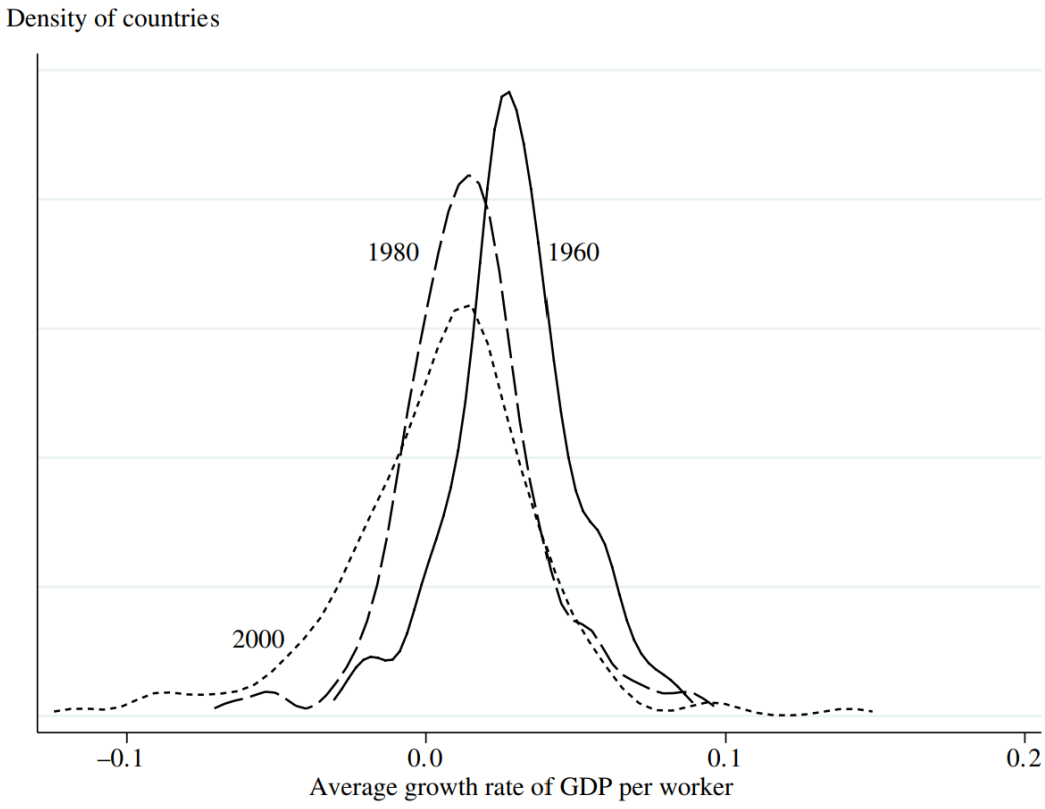


Figure 11: Distribution of countries according to the growth rate of GDP per worker

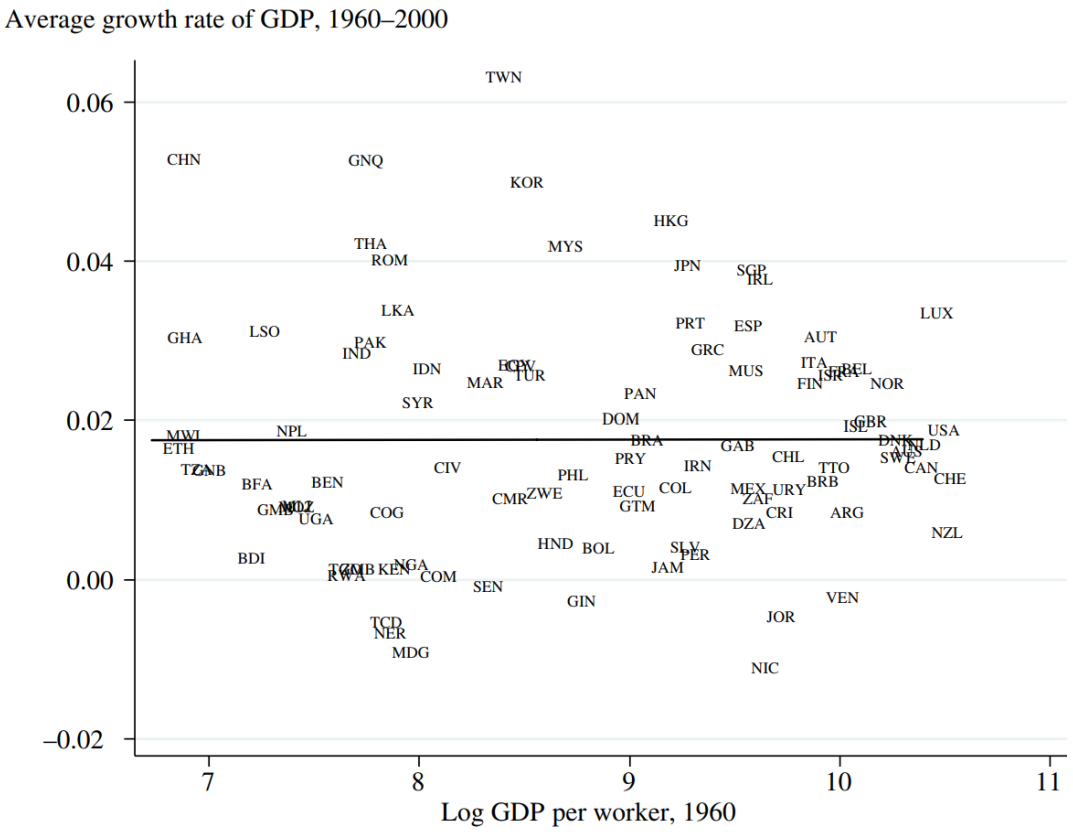


Figure 12: Growth versus initial income

savings rates, population growth rates, and access to technology. Unlike absolute convergence, which predicts that poorer economies will catch up to richer ones regardless of their specific conditions, conditional convergence takes into account the structural and policy differences between countries. This means that countries with similar economic structures and policies will tend to grow at similar rates and eventually converge in terms of income per capita.

Figure 13 illustrates the concept of conditional convergence among OECD countries. The graph shows the relationship between the initial level of income per capita and subsequent growth rates for these countries. The trend line indicates that countries with lower initial income levels tend to grow faster than those with higher initial income levels, provided they have similar economic characteristics. This pattern supports the idea of conditional convergence, as it demonstrates that countries with comparable economic environments are converging towards similar income levels over time.

2.3 Converging to Convergence

In their 2022 study, "Converging to Convergence," Michael Kremer and his co-authors revisit the concept of economic convergence, providing new insights into the trends observed over recent decades[1]. The study highlights a significant shift towards unconditional convergence

[1] https://www.nber.org/papers/w29484

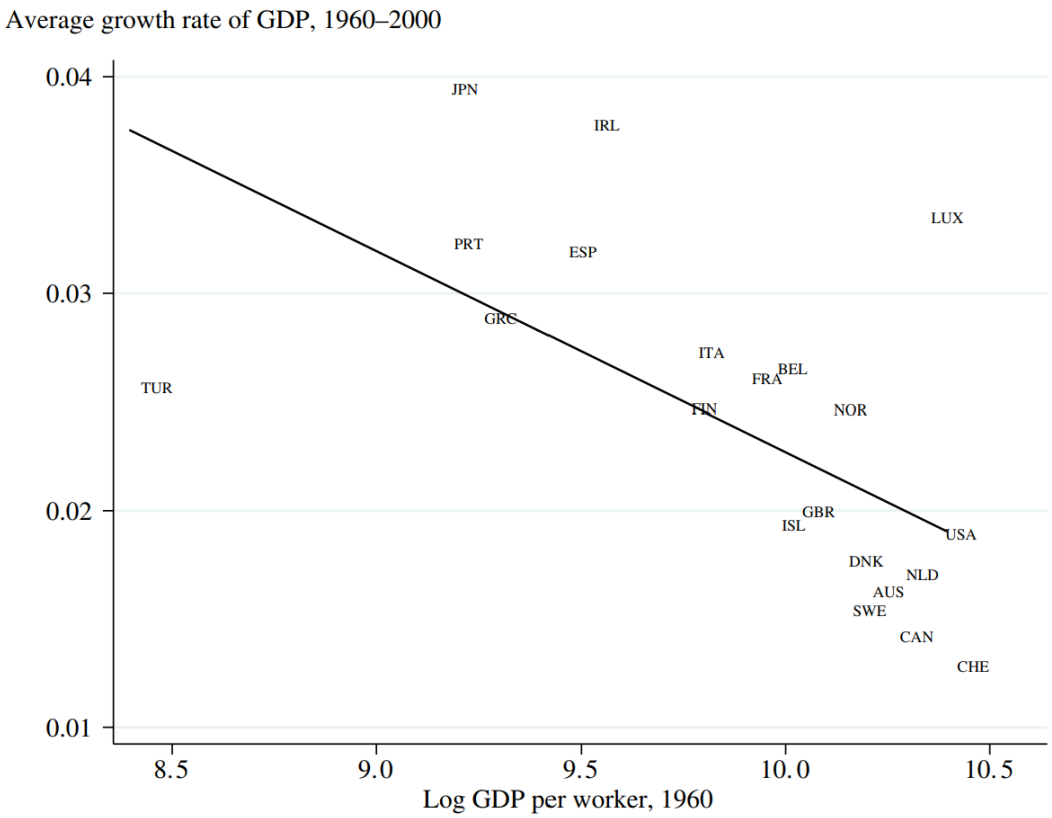


Figure 13: Convergence between OECD countries

since the 1990s, with a notable acceleration in the 2000s. This trend is characterized by poorer countries experiencing faster growth rates compared to richer countries, leading to a reduction in income disparities. Kremer et al. (2022) attribute this shift to several factors, including improvements in human capital, better economic policies, and enhanced institutional quality across many developing nations.

The study also notes that the growth-correlate slopes for fundamental economic variables, such as investment rates and population growth, have remained stable, while those for other correlates have flattened, contributing to the observed convergence. This research underscores the importance of structural and policy improvements in driving economic growth and supports the idea that with the right conditions, poorer countries can indeed catch up with developed countries.

3 Basic Statistical Calculations

3.1 Growth Rates

The growth rate of a variable X over a period from $t = 0$ to $t = T$ is given by:

$$G_{0,T} = \frac{X_T - X_0}{X_0}$$

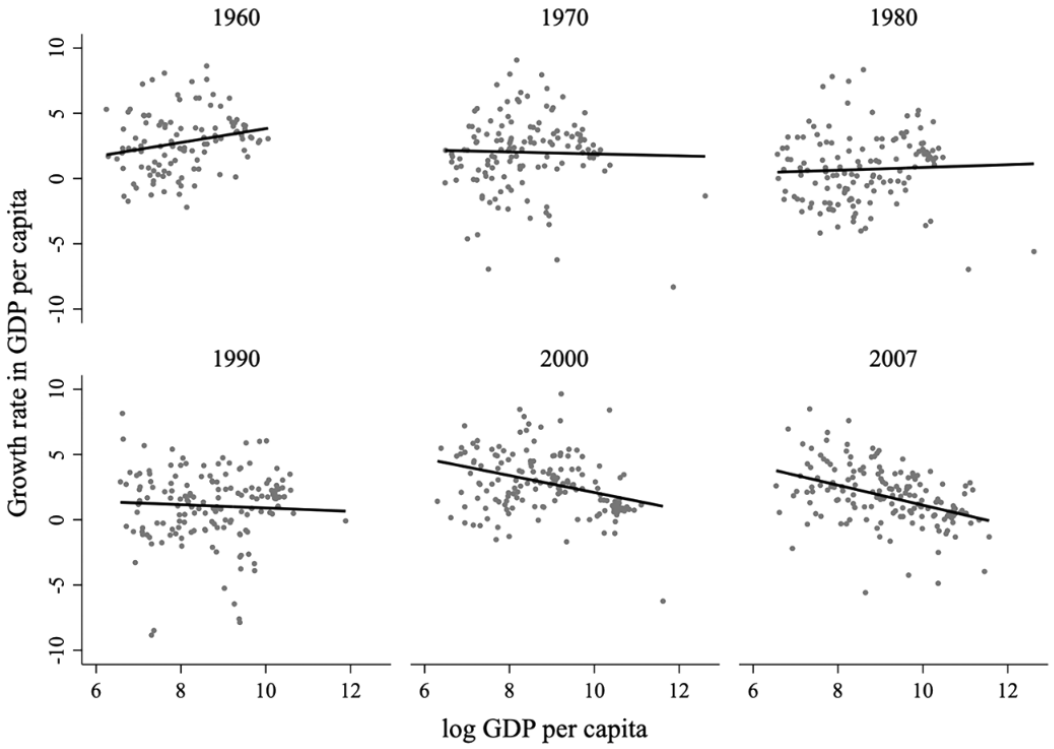


Figure 14: Income convergence by decade

where X_T and X_0 are the values of X at times T and 0, respectively.

Annual Average Growth Rate:
Assuming a constant annual growth rate g, it is defined as:

$$g = \left(\frac{X_T}{X_0}\right)^{1/T} - 1$$

where T is the number of years.

Growth of the Product of Two Variables:
If $Z = X \cdot Y$, then the growth rate of Z is given by:

$$1 + G_Z = (1 + G_X) \cdot (1 + G_Y) \tag{1}$$

or

$$G_Z \approx G_X + G_Y$$

where G_X and G_Y are the growth rates of X and Y, respectively.

Proof. For small values of G_X and G_Y, taking the log of the equation and using $\ln(1+\varepsilon) \approx \varepsilon$ for small ε, one gets:

$$G_Z \approx G_X + G_Y$$

□

3.2 National Accounts and GDP Calculation

- **Value-Added Approach:** GDP is the sum of the value-added generated by firms within the economy.
- **Income Approach:** GDP is the total income distributed in the economy over a specific period.
- **Expenditure Approach:** GDP is the total value of final goods and services consumed in the economy.

In a closed economy:

$$Y = C + I + G,$$

where Y is GDP, C is consumption, I is investment, and G is government expenditure. National Savings:

$$S = Y - C - G.$$

► **Example of GDP Calculation from Statistics Canada:** Let us consider an economy composed of three businesses: an agricultural business (the farmer) that grows wheat, an industrial business that produces flour (the miller), and a business that produces bread sold to households (the baker).

- **Farmer**: The farmer imports seeds worth \$15 and pays wages to employees amounting to \$115. He sells part of his production to the miller for \$100 and exports the remaining part for \$50.
- **Miller**: The miller buys wheat from the farmer for \$100 and sells part of his flour to households for \$35 and another part to the baker for \$130. The miller pays wages to employees amounting to \$45.
- **Baker**: The baker buys flour from the miller for \$130 and produces bread, which he sells entirely to households for \$200. He pays wages to his employees amounting to \$60.
- **Total GDP:** \$270.

4 Short Term vs Long Term

The distinction between long-term and short-term macroeconomics is, fundamentally, a distinction between the phenomena being studied.

The purpose of long-term macroeconomic analysis is to:

- Understand the trends in major variables such as GDP, consumption, investment, and unemployment.
- Explain long-term income levels, economic growth, and structural unemployment.

On the other hand, the purpose of short-term macroeconomic analysis is to:

- Understand annual or quarterly fluctuations around the trends of these macroeconomic variables.
- Explain business cycles.

4.1 Long-Term Trends and Filtering

We aim to express a macroeconomic time series y_t as follows:

$$y_t = y_t^x + y_t^c$$

where y_t^x represents the long-term component and y_t^c the cyclical component.

A filter is applied to y_t to separate these two components.

- A filter is an operator that extracts movements from the series occurring at specific frequency ranges.
- In macroeconomics, frequencies typically range between 6 and 32 quarters.

4.1.1 Method 1: First Difference

The cyclical component of y_t can be measured by calculating its first difference.

$$y_t^c = \Delta y_t = y_t - y_{t-1}, \quad \text{and} \quad y_t^x = y_{t-1}$$

If y_t grows at a constant rate g_y, then

$$y_t = (1+g_y)y_{t-1} \Longleftrightarrow y_t - y_{t-1} = g_y \cdot y_{t-1}$$

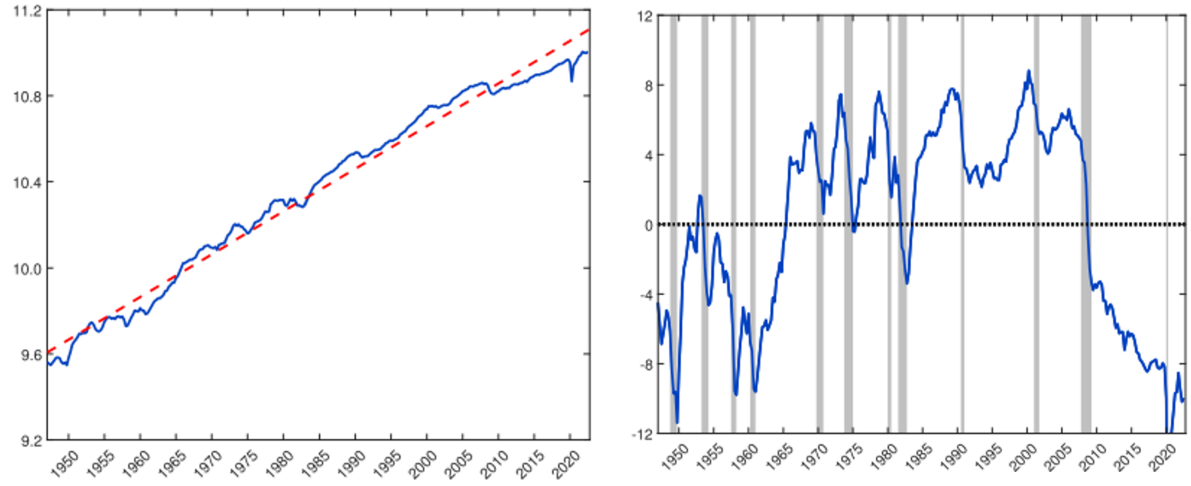
Using the earlier expressions for the trend and cycle, we derive:

$$y_t^c = g_y \cdot y_t^x, \quad \text{which implies} \quad g_y = \frac{\mathbb{E}(y_t^c)}{\mathbb{E}(y_t^x)}$$

4.1.2 Method 2: Deterministic Trend

This involves specifying the order of the polynomial and estimating the coefficients using OLS:

$$y_t = a_0 + \sum_{j=1}^{J} a_j t^j + y_t^c, \quad \mathbb{C}\text{orr}(y_t^x, y_t^c) = 0$$



(a) Long-term Trend

(b) Cyclical Component

Figure 15: Decomposition of Canada real GDP per capita

4.1.3 Method 3: Hodrick-Prescott (HP) Filter

This is one of the most commonly used methods in macroeconomics. The trend of the series is obtained by solving the following problem:

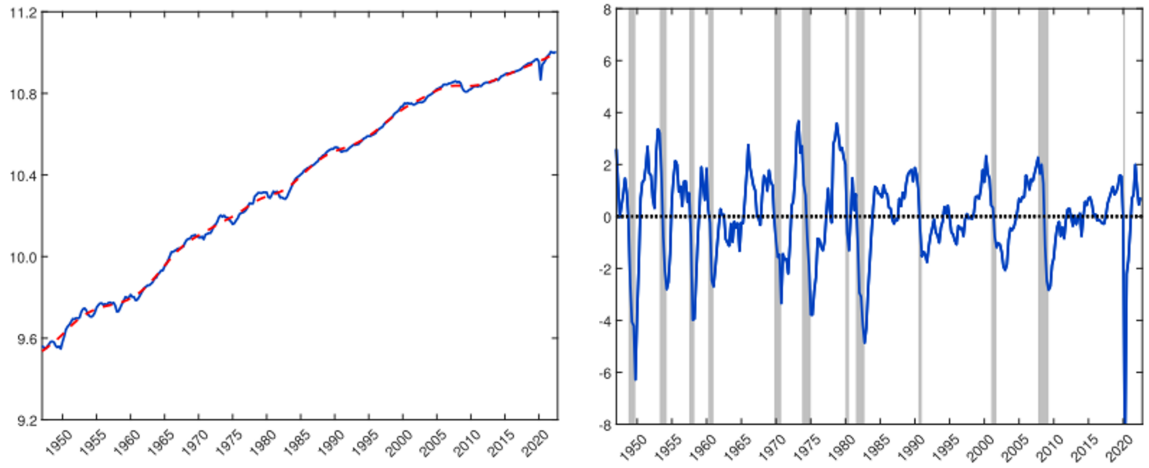
$$\min_{y_t^x} \left\{ \sum_{t=1}^{T} (y_t - y_t^x)^2 + \lambda \sum_{t=2}^{T-1} \left[(y_{t+1}^x - y_t^x) - (y_t^x - y_{t-1}^x) \right]^2 \right\}$$

- λ is a smoothing parameter.
- Common choices are $\lambda = 100$ for annual data, $\lambda = 1600$ for quarterly data, and $\lambda = 14400$ for monthly data.
- Occasionally, different λ values are used for specific data types (e.g., quarterly unemployment rates).

4.2 Stylized Facts

4.2.1 Stylized Facts of Growth

The stylized facts of growth highlighted by Kaldor (1957) include:



(a) Long-term Trend (b) Cyclical Component

Figure 16: Trend and Cyclical Component: HP Filter

- The shares of capital and labor income are constant in the long term. These are approximately 0.33 and 0.67, respectively.
- The growth rate of capital per capita is constant in the long term.
- The growth rate of output per worker is constant in the long term.
- The capital/output ratio is constant in the long term.
- The rate of return on investment is constant in the long term.
- There are notable variations (between 2% and 5%) in the growth rates of labor productivity and total output across countries.

4.2.2 Short-term Analysis: The Business Cycle

Generally, three indicators are used to study the business cycle:

- Volatility (absolute and relative): the standard deviation of the variable in level terms, or relative to the standard deviation of GDP.
- Co-movements: cross-correlations (or lags), i.e., $\mathbb{C}\text{orr}(y_t^c, z_{t-j}^c)$ with $j = -5, -4, \ldots, 0, \ldots, +4, +5$.
- Persistence, measured by autocorrelation coefficients, i.e., $\mathbb{C}\text{orr}(z_t^c, z_{t-j}^c)$ with $j = 1, 2, \ldots$.

For more stylized facts on the business cycle, see King and Rebelo (1999) and Stock and Watson (1999).

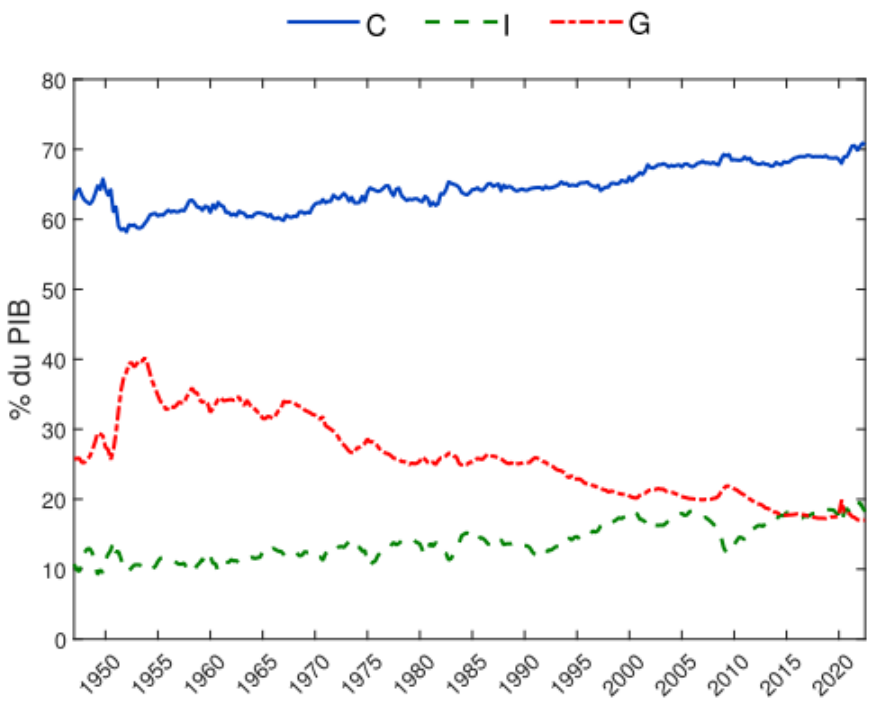


Figure 17: Components of Gross Domestic Product in Relative Shares

4.2.3 Stylized Facts About Volatility

Consumption

- Consumption of non-durable goods and services is less volatile than output.
- Durable goods consumption is much more volatile than output.
- Since durable goods account for only a small portion of household consumption, total consumption is less volatile than output.
- Public consumption expenditures are less volatile than output.

Investment

- Investment is much more volatile than output. All categories of investment are more volatile than output.
- Residential investment is the most volatile component.

Hours Worked, Productivity, and Wages

- Volatility in total hours worked is comparable to output volatility.
- Volatility in total hours worked is mainly due to employment volatility (extensive margin), not hours per worker (intensive margin).
- Labor productivity is about half as variable as output.
- Real wages are also less variable than output.

4.2.4 Stylized Facts About Co-Movements

- Most macroeconomic variables (C_t, I_t, M_t, X_t, etc.) exhibit pro-cyclical behavior, i.e., positive contemporary correlation with the cyclical component of output.
- Public consumption expenditures are acyclical (or counter-cyclical for some public spending components).
- The correlation between output and hours worked is strongly positive.
- Real wages went from counter-cyclical between the wars to pro-cyclical after World War II.

4.2.5 Stylized Facts About Persistence

- Most macroeconomic variables are highly persistent, i.e., the first-order autocorrelation of the cyclical component is strongly positive. This fact holds regardless of the method used to calculate the cyclical component.
- Growth rates of most macroeconomic variables are highly persistent.
- Macroeconomic variables (Y_t, C_t, I_t, H_t) appear less persistent when measured by the autocorrelation of differenced series. The aggregate price index is an exception to this rule.

4.2.6 Description of the Business Cycle

Table 2
Descriptive statistics for cyclical components of series, 1953–1996

Series	Std dev.	Cross correlations with output (corr(x_t, y_{t+k}))												
		−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6
Gross Domestic Product	1.66	−0.29	−0.18	0.03	0.33	0.66	0.91	1.00	0.91	0.66	0.33	0.03	−0.18	−0.29
Sectoral employment														
1. Contract and construction employment	3.75	0.02	0.20	0.39	0.58	0.73	0.80	0.77	0.65	0.44	0.19	−0.04	−0.23	−0.35
2. Manufacturing employment	2.61	−0.06	0.14	0.40	0.67	0.87	0.94	0.84	0.59	0.26	−0.06	−0.30	−0.43	−0.45
3. Finance, insurance and real estate employment	1.01	0.25	0.35	0.43	0.49	0.50	0.46	0.38	0.28	0.15	0.02	−0.10	−0.20	−0.28
4. Mining employment	3.79	0.13	0.19	0.25	0.28	0.25	0.16	−0.00	−0.20	−0.40	−0.53	−0.58	−0.55	−0.45
5. Government employment	0.82	0.51	0.53	0.49	0.43	0.35	0.29	0.23	0.15	0.04	−0.08	−0.21	−0.31	−0.37
6. Service employment	0.83	0.20	0.33	0.49	0.63	0.71	0.69	0.55	0.34	0.08	−0.15	−0.33	−0.44	−0.50
7. Wholesale and retail trade employment	1.20	−0.01	0.21	0.45	0.68	0.83	0.87	0.79	0.60	0.35	0.10	−0.10	−0.24	−0.32
8. Transportation and public utility employment	1.54	0.23	0.42	0.61	0.77	0.83	0.76	0.56	0.26	−0.06	−0.33	−0.49	−0.53	−0.50

Figure 18: Description of the Business Cycle according to Stock and Watson (1999)

Series	Std dev.	Cross correlations with output (corr(x_t, y_{t+k}))												
		−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6
Gross Domestic Product	1.66	−0.29	−0.18	0.03	0.33	0.66	0.91	1.00	0.91	0.66	0.33	0.03	−0.18	−0.29
NIPA components														
9. Consumption (total)	1.26	−0.39	−0.28	−0.07	0.21	0.51	0.76	0.90	0.89	0.75	0.53	0.29	0.09	−0.06
10. Consumption (nondurables)	1.11	−0.36	−0.24	−0.02	0.25	0.52	0.74	0.83	0.80	0.65	0.43	0.21	0.02	−0.12
11. Consumption (services)	0.64	−0.13	−0.00	0.14	0.31	0.49	0.66	0.78	0.80	0.70	0.51	0.27	0.05	−0.12
12. Consumption (nondurables + services)	0.78	−0.28	−0.15	0.05	0.29	0.55	0.75	0.87	0.85	0.71	0.49	0.25	0.03	−0.13
13. Consumption (durables)	4.66	−0.46	−0.38	−0.19	0.09	0.42	0.70	0.85	0.86	0.73	0.53	0.32	0.15	0.03
14. Investment (total fixed)	4.97	−0.34	−0.19	0.04	0.32	0.61	0.82	0.89	0.83	0.65	0.41	0.18	−0.00	−0.13
15. Investment (equipment)	5.25	−0.06	0.16	0.41	0.65	0.84	0.92	0.88	0.73	0.49	0.23	−0.01	−0.20	−0.31
16. Investment (nonresidential structures)	4.67	0.20	0.40	0.58	0.70	0.74	0.67	0.52	0.30	0.07	−0.14	−0.30	−0.40	−0.44
17. Investment (residential structures)	10.04	−0.49	−0.48	−0.37	−0.18	0.09	0.38	0.62	0.77	0.78	0.69	0.53	0.36	0.20
18. Change in bus. inventories (rel. to trend GDP)	0.38	−0.58	−0.50	−0.32	−0.04	0.28	0.57	0.73	0.72	0.56	0.32	0.08	−0.08	−0.15
19. Exports	4.76	0.33	0.42	0.47	0.50	0.48	0.40	0.27	0.09	−0.11	−0.29	−0.43	−0.50	−0.51
20. Imports	4.42	−0.45	−0.28	−0.03	0.27	0.54	0.72	0.78	0.70	0.53	0.34	0.17	0.05	−0.02
21. Trade balance (relative to trend GDP)	0.38	0.54	0.45	0.30	0.10	−0.11	−0.29	−0.42	−0.48	−0.49	−0.48	−0.45	−0.41	−0.35
22. Government purchases	2.49	0.30	0.25	0.22	0.21	0.21	0.19	0.15	0.03	−0.10	−0.20	−0.23	−0.19	−0.09
23. Government purchases (defense)	4.66	0.21	0.18	0.15	0.14	0.12	0.09	0.05	−0.06	−0.18	−0.26	−0.27	−0.20	−0.08
24. Government purchases (non-defense)	1.35	0.21	0.12	0.07	0.08	0.13	0.19	0.22	0.23	0.21	0.18	0.13	0.08	0.01

Figure 19: Description of the Business Cycle according to Stock and Watson (1999)

Series	Std dev.	Cross correlations with output (corr(x_t, y_{t+k}))												
		−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6
Aggregate employment, productivity and utilization														
25. Employment (total employees)	1.39	0.07	0.26	0.49	0.72	0.89	0.92	0.81	0.57	0.24	−0.07	−0.31	−0.44	−0.49
26. Employment (total hours)	1.61	−0.06	0.13	0.37	0.63	0.85	0.94	0.88	0.67	0.36	0.03	−0.23	−0.39	−0.45
27. Employment (average weekly hours)	0.37	−0.51	−0.44	−0.24	0.05	0.38	0.66	0.82	0.80	0.64	0.40	0.16	−0.03	−0.15
28. Unemployment rate	0.76	0.13	−0.03	−0.27	−0.55	−0.80	−0.93	−0.89	−0.69	−0.39	−0.07	0.19	0.33	0.37
29. Vacancies (Help Wanted index)	14.52	−0.25	−0.09	0.15	0.43	0.71	0.89	0.93	0.80	0.54	0.23	−0.06	−0.26	−0.38
30. New Unemployment claims	13.19	0.47	0.43	0.27	−0.00	−0.35	−0.67	−0.86	−0.87	−0.71	−0.43	−0.14	0.08	0.21
31. Capacity utilization	3.07	−0.37	−0.23	0.01	0.31	0.63	0.86	0.93	0.83	0.59	0.29	0.02	−0.16	−0.25
32. Total factor productivity	2.29	−0.54	−0.46	−0.29	−0.03	0.27	0.56	0.77	0.86	0.82	0.68	0.50	0.31	0.16
33. Average labor productivity	1.05	−0.49	−0.60	−0.58	−0.41	−0.11	0.24	0.53	0.70	0.72	0.62	0.47	0.32	0.21

Figure 20: Description of the Business Cycle according to Stock and Watson (1999)

Series	Std dev.	Cross correlations with output (corr(x_t, y_{t+k}))												
		−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6
Prices and wages														
34. Consumer price index (level)	1.35	0.34	0.24	0.12	−0.04	−0.21	−0.38	−0.51	−0.62	−0.68	−0.67	−0.59	−0.48	−0.34
35. Producer price index (level)	2.26	0.36	0.33	0.27	0.18	0.05	−0.09	−0.24	−0.37	−0.47	−0.54	−0.56	−0.55	−0.50
36. Oil prices	11.12	0.22	0.16	0.09	0.01	−0.08	−0.17	−0.26	−0.35	−0.41	−0.44	−0.42	−0.36	−0.28
37. GDP price deflator (level)	0.91	0.23	0.12	−0.02	−0.18	−0.33	−0.46	−0.54	−0.60	−0.61	−0.59	−0.52	−0.42	−0.30
38. Commodity price index (level)	7.43	0.18	0.28	0.36	0.41	0.41	0.38	0.30	0.18	0.04	−0.11	−0.26	−0.36	−0.43
39. Consumer price index (inflation rate)	1.44	0.34	0.47	0.58	0.64	0.62	0.52	0.35	0.14	−0.08	−0.27	−0.40	−0.48	−0.51
40. Producer price index (inflation rate)	2.64	0.10	0.21	0.33	0.43	0.49	0.49	0.43	0.34	0.21	0.07	−0.05	−0.17	−0.27
41. GDP price deflator (inflation rate)	0.96	0.45	0.55	0.61	0.58	0.48	0.32	0.15	−0.01	−0.14	−0.25	−0.34	−0.41	−0.47
42. Commodity price index (inflation rate)	10.55	−0.28	−0.23	−0.15	−0.03	0.09	0.22	0.33	0.41	0.44	0.39	0.28	0.14	−0.01
43. Nominal wage rate (level)	0.94	0.22	0.13	0.02	−0.09	−0.21	−0.34	−0.45	−0.56	−0.62	−0.62	−0.54	−0.42	−0.27
44. Real wage rate (level)	0.64	−0.16	−0.13	−0.07	0.00	0.08	0.14	0.16	0.14	0.10	0.07	0.05	0.05	0.07
45. Nominal wage rate (rate of change)	1.14	0.31	0.35	0.38	0.41	0.42	0.38	0.29	0.14	−0.05	−0.24	−0.39	−0.47	−0.49
46. Real wage rate (rate of change)	1.10	−0.05	−0.13	−0.18	−0.18	−0.13	−0.05	0.04	0.08	0.08	0.04	−0.00	−0.04	−0.05

Figure 21: Description of the Business Cycle according to Stock and Watson (1999)

Series	Std dev.	Cross correlations with output (corr(x_t, y_{t+k}))												
		−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6
Interest rates and stock prices														
47. Federal funds rate	1.47	0.26	0.38	0.50	0.60	0.63	0.56	0.38	0.13	−0.16	−0.41	−0.60	−0.69	−0.71
48. Treasury Bill rate (3 month)	1.09	0.20	0.29	0.40	0.50	0.57	0.54	0.41	0.18	−0.10	−0.38	−0.58	−0.69	−0.71
49. Treasury Bond rate (10 year)	0.71	0.03	0.03	0.07	0.13	0.17	0.16	0.08	−0.07	−0.24	−0.39	−0.49	−0.52	−0.48
50. Real Treasury Bill rate (3 month)	0.71	−0.02	−0.04	−0.05	−0.07	−0.12	−0.19	−0.28	−0.35	−0.38	−0.36	−0.29	−0.20	−0.11
51. Yield curve spread (long–short)	0.76	−0.29	−0.40	−0.52	−0.61	−0.66	−0.64	−0.52	−0.32	−0.07	0.17	0.38	0.52	0.59
52. Commercial paper/Treasury Bill spread	0.32	0.44	0.58	0.66	0.65	0.54	0.33	0.06	−0.20	−0.41	−0.53	−0.54	−0.49	−0.40
53. Stock prices	8.28	−0.23	−0.32	−0.35	−0.28	−0.12	0.10	0.34	0.51	0.57	0.49	0.32	0.11	−0.08
Money														
54. Money stock (M2, nominal level)	1.48	−0.39	−0.35	−0.27	−0.15	0.03	0.22	0.39	0.53	0.59	0.58	0.51	0.40	0.27
55. Monetary base (nominal level)	1.12	−0.06	−0.05	−0.03	0.01	0.07	0.13	0.18	0.19	0.18	0.16	0.13	0.10	0.07
56. Money stock (M2, real level)	2.00	−0.39	−0.30	−0.17	0.00	0.20	0.40	0.57	0.69	0.73	0.71	0.62	0.49	0.33
57. Monetary base (real level)	1.53	−0.18	−0.11	−0.01	0.12	0.25	0.36	0.45	0.49	0.50	0.46	0.40	0.32	0.23
58. Money stock (M2, nominal rate of change)	2.07	−0.08	−0.22	−0.36	−0.48	−0.54	−0.50	−0.38	−0.19	0.01	0.19	0.31	0.37	0.38
59. Monetary base (nominal rate of change)	1.38	−0.01	−0.07	−0.14	−0.18	−0.19	−0.16	−0.08	−0.01	0.05	0.10	0.14	0.17	0.18
60. Consumer credit	3.29	0.30	0.50	0.67	0.75	0.74	0.63	0.46	0.25	0.06	−0.08	−0.15	−0.18	−0.18

Figure 22: Description of the Business Cycle according to Stock and Watson (1999)

Series	Std dev.	Cross correlations with output (corr(x_t, y_{t+k}))												
		−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6
Miscellaneous leading indicators														
61. Consumer expectations	9.15	−0.61	−0.64	−0.59	−0.46	−0.25	0.00	0.25	0.44	0.54	0.53	0.44	0.32	0.20
62. Building permits	16.19	−0.51	−0.54	−0.51	−0.41	−0.21	0.07	0.36	0.60	0.74	0.75	0.67	0.52	0.36
63. Vendor performance	10.87	−0.40	−0.40	−0.32	−0.14	0.09	0.34	0.53	0.61	0.58	0.43	0.23	0.04	−0.11
64. Mfrs' unfilled orders, durable goods industry	6.73	0.48	0.60	0.69	0.72	0.70	0.61	0.47	0.28	0.06	−0.15	−0.32	−0.45	−0.50
65. Mfrs' new orders, non-defense capital goods	8.11	−0.09	0.09	0.30	0.53	0.72	0.83	0.83	0.71	0.51	0.26	0.02	−0.16	−0.27
International output														
66. Industrial production – Canada	3.43	−0.19	−0.03	0.19	0.45	0.68	0.84	0.87	0.77	0.56	0.29	0.04	−0.17	−0.30
67. Industrial production – France	2.58	0.03	0.20	0.35	0.44	0.46	0.39	0.26	0.12	−0.01	−0.11	−0.18	−0.21	−0.22
68. Industrial production – Japan	4.46	0.09	0.23	0.37	0.49	0.53	0.49	0.35	0.15	−0.06	−0.23	−0.33	−0.36	−0.33
69. Industrial production – UK	2.60	−0.04	0.11	0.27	0.42	0.51	0.53	0.47	0.39	0.28	0.18	0.10	0.03	−0.02
70. Industrial production – Germany	3.19	0.01	0.08	0.18	0.29	0.38	0.40	0.35	0.24	0.09	−0.07	−0.19	−0.27	−0.31

Figure 23: Description of the Business Cycle according to Stock and Watson (1999)