Chapter 1

Economic Growth

Introduction

Thomas F. Cooley and Edward C. Prescott
ECONOMIC GROWTH AND BUSINESS CYCLES

1. The first model of business cycles...
ECONOMIC GROWTH AND BUSINESS CYCLES

The Environment

The growth model

In Chapters 7-9, we described the results of simulating the stochastic growth model in the data. The results of our choices and weak inferences about the role of stochastic disturbances and shocks in determining the behavior of the economy is a central theme throughout the book. We will devote the entire section 6 to this question. The discussion is based on a model of business cycle fluctuations. The model is based on a system of equations and the variables are demand and supply. We assume that the model is consistent with the data and that it reflects the underlying economy. The model is based on a system of equations and the variables are demand and supply. We assume that the model is consistent with the data and that it reflects the underlying economy. The model is based on a system of equations and the variables are demand and supply. We assume that the model is consistent with the data and that it reflects the underlying economy.
ECONOMIC GROWTH AND BUSINESS CYCLES

The Prime's Problem

We assume the aggregate resource constraint as

\[ (H, Y') \cdot \lambda = \gamma (Y - I) + \gamma ( \nu + Y' ) \]

where \(
\gamma (Y - I) \) and \( \gamma ( \nu + Y' ) \) are the coefficients that capture the aggregate resource constraint.

If we impose that this economy is娥ated by a perfectly competitive social planner, the solution to the planner's problem is:

\[ K = \frac{1}{\gamma} \cdot \frac{(H, Y')}{(H, Y')} \]

Our interest in the planner's problem is motivated by the need for this model homogenization of output; moreover, the production function is:

\[ (K, Y) \cdot \lambda = \gamma (Y - I) + \gamma ( \nu + Y' ) \]

where \( \gamma (Y - I) \) and \( \gamma ( \nu + Y' ) \) are the coefficients that capture the aggregate resource constraint.

The condition on the planner's problem is:

\[ \gamma (Y - I) = \gamma ( \nu + Y' ) \]

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Economic Growth and Business Cycles

The necessary and sufficient conditions for growth are

1. (X) + (X) = X
2. Y + Y = Y
3. (Y) + (Y) ≤ (X)
4. max \((a,b)\) \((X) + (a,b)\) = \(X\)

Supporting the solution to the planner's problem as a recursive

The first-order condition for the planner's problem is

\[ \delta [Y(g - 1 + a)] d \sum_{d=0}^{\infty} \delta = [Y + \delta d \sum_{d=0}^{\infty} \delta \max \begin{cases} \delta \sum_{d=0}^{\infty} \delta & \text{if } a \geq 0 \\ 0 & \text{if } a < 0 \end{cases} \]

max \([X + \delta d \sum_{d=0}^{\infty} \delta \max \begin{cases} \delta \sum_{d=0}^{\infty} \delta & \text{if } a \geq 0 \\ 0 & \text{if } a < 0 \end{cases} \]

of economic welfare.

\[ \{H, (X), Y\} \cdot d = I \]

(6)

and

(7)

For all i, if we assume constant terms in capital, the planner's problem is characterized.

(8)

be real wage rate, \(\nu\) and the real capital price of capital, \(\nu\) in terms of capital

From the necessary and sufficient conditions for maximization of the

as solving a series of static, one-period profit maximization problems:

(9)
ECONOMIC GROWTH AND BUSINESS CYCLES

The previous section describes a model of economy growth that is explicitly designed to replicate the economy growth described in these situations.

Implications in Production. These are features we would like a model economy to exhibit in order to be consistent with the principles of economic growth outlined in this section. One model is the economic growth model. This model is consistent with these principles, but it does not incorporate some features that are present in the dynamic, real-world economy. The economic growth model is designed to reproduce some features of the model economy, but it does not incorporate some features that are present in the dynamic, real-world economy.

In our model economy, the economy grows at a constant rate. However, this rate may change over time as a result of changes in productivity or changes in the capital stock. In the real-world economy, the rate of growth is not constant and it may change as a result of changes in productivity or changes in the capital stock. The economic growth model is designed to reproduce some features of the model economy, but it does not incorporate some features that are present in the dynamic, real-world economy.

Changes in Output. The output of the economy grows at a constant rate. However, this rate may change over time as a result of changes in productivity or changes in the capital stock. In the real-world economy, the rate of growth is not constant and it may change as a result of changes in productivity or changes in the capital stock. The economic growth model is designed to reproduce some features of the model economy, but it does not incorporate some features that are present in the dynamic, real-world economy.

Changes in Employment. The employment of the economy grows at a constant rate. However, this rate may change over time as a result of changes in productivity or changes in the capital stock. In the real-world economy, the rate of growth is not constant and it may change as a result of changes in productivity or changes in the capital stock. The economic growth model is designed to reproduce some features of the model economy, but it does not incorporate some features that are present in the dynamic, real-world economy.

Changes in Consumption. The consumption of the economy grows at a constant rate. However, this rate may change over time as a result of changes in productivity or changes in the capital stock. In the real-world economy, the rate of growth is not constant and it may change as a result of changes in productivity or changes in the capital stock. The economic growth model is designed to reproduce some features of the model economy, but it does not incorporate some features that are present in the dynamic, real-world economy.

Changes in Investment. The investment of the economy grows at a constant rate. However, this rate may change over time as a result of changes in productivity or changes in the capital stock. In the real-world economy, the rate of growth is not constant and it may change as a result of changes in productivity or changes in the capital stock. The economic growth model is designed to reproduce some features of the model economy, but it does not incorporate some features that are present in the dynamic, real-world economy.

Changes in Government Spending. The government spending of the economy grows at a constant rate. However, this rate may change over time as a result of changes in productivity or changes in the capital stock. In the real-world economy, the rate of growth is not constant and it may change as a result of changes in productivity or changes in the capital stock. The economic growth model is designed to reproduce some features of the model economy, but it does not incorporate some features that are present in the dynamic, real-world economy.

Changes in Net Exports. The net exports of the economy grow at a constant rate. However, this rate may change over time as a result of changes in productivity or changes in the capital stock. In the real-world economy, the rate of growth is not constant and it may change as a result of changes in productivity or changes in the capital stock. The economic growth model is designed to reproduce some features of the model economy, but it does not incorporate some features that are present in the dynamic, real-world economy.
We assume that the economy's capital composition is given by the production function \( f(K) \), where \( f \) is a continuous differentiable in \( K \) and \( f(K) \) is positive. The households' utility function is given by \( U(C,Y) \), and the aggregate production function is \( Y = f(K) \).

In the previous example, the consumption function is given by

\[
C(t) = y(t)^{\theta} \theta
\]

where \( y(t) \) represents the sequence of Arrow-Pratt-Debreu-equivalent consumer goods.

The optimization problem yields factor prices (relative to the price of

\[
\text{max}_{N_1, N_2} [Y_{N_1, N_2} - N_1 \cdot 1 + \beta \cdot N_2] \] \tag{11}

subject to the budget constraint

\[
N_1 + N_2 = 1 + \beta
\]

where \( \beta > 0 \) and \( \beta < 1 \).
4. Collaboration

The recursive competitive equilibrium approach to modeling the economic behavior of households and firms is based on the assumption that the competitive equilibrium is achieved at the margin. This means that at each point in time, the decisions of households and firms are in equilibrium with each other.

The recursive competitive equilibrium is characterized by:

1. The competitive equilibrium is achieved at the margin.
2. The decisions of households and firms are in equilibrium with each other.

The recursive competitive equilibrium approach provides a framework that we can use to study business cycles. The environment provides the information that we need to do the business cycles.

The description of the environment and the competitive equilibrium concept together provide the necessary conditions for the recursive competitive equilibrium approach to modeling the economic behavior of households and firms.
ECONOMIC GROWTH AND BUSINESS CYCLES

Chapter 1

Growth Model Framework

In order to measure economic growth, we need to consider the changes in the economic activity over time. The growth rate is given by:

\[
\frac{\Delta Y}{Y} = \frac{Y_t - Y_{t-1}}{Y_{t-1}}
\]

where \(Y\) is the income level at time \(t\), and \(\Delta Y\) is the change in income level over the period from \(t-1\) to \(t\).

The growth model is a dynamic system that describes the relationships between economic variables over time. It is based on the principle of production, which states that output is produced by combining inputs of labor, capital, and natural resources.

In order to understand the growth process, we need to consider the factors that influence economic growth. These factors include:

1. **Human Capital**: The level of education and training of the labor force.
2. **Physical Capital**: The quantity and quality of physical capital, such as machinery and equipment.
3. **Natural Resources**: The availability of natural resources, such as land and minerals.
4. **Technological Progress**: The rate at which new technologies are adopted and used in production.
5. **Institutional Factors**: The role of government policies, such as taxation and regulation, in influencing economic growth.

The growth model framework is used to analyze the effects of these factors on economic growth. It is based on the assumption that economic growth is a result of the interaction between these factors, and that changes in one factor can affect the growth rate of the economy over time.

The growth model framework is an important tool for understanding the dynamics of economic growth. It helps us to identify the factors that contribute to economic growth, and to develop policies that can enhance growth.

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16
\[ \frac{d Y}{d t} = Y \]

1) For government capital, the service flows are estimated as the depreciation implied by equation (2). This is calculated from the NIPA (Table 1.9). The service flows are a subtraction of the change in the capital stock from the change in the capital stock. We use the change for a three-year period, specifically 1954-1959, to estimate the service flow for government capital. For government capital, the service flow is the change in the capital stock, which is estimated from the NIPA (Table 1.9). The service flow is calculated as the difference between the change in the capital stock and the estimated depreciation.

The measure of income from government capital is taken from the NIPA (Table 1.9). To obtain the estimate of the service flow, we use the change in the capital stock, which is estimated from the NIPA (Table 1.9). The service flow is the change in the capital stock, which is estimated from the NIPA (Table 1.9). The service flow is calculated as the difference between the change in the capital stock and the estimated depreciation.

2) Over the period 1954-1959, this yields an average interest rate of 6.9.

\[ \frac{d Y}{d t} = Y \]

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3) The measure of income from government capital is taken from the NIPA (Table 1.9). To obtain the estimate of the service flow, we use the change in the capital stock, which is estimated from the NIPA (Table 1.9). The service flow is the change in the capital stock, which is estimated from the NIPA (Table 1.9). The service flow is calculated as the difference between the change in the capital stock and the estimated depreciation.

Finally, our technology makes no distinction among the roles of productive and non-productive factors.
\[
\frac{y - 1}{\theta - 1} \cdot \frac{p - 1}{\theta} = \frac{q}{\theta} \cdot (\theta - 1)
\]

The first-order condition for hours, \( h \), on balanced-growth path implies that:

\[
\frac{q}{\theta} \cdot \theta = 1 - \theta + \frac{q}{(\theta + 1)}
\]

Finally, the law of motion for the capital stock in this simple model implies that:

\[
\frac{y - 1}{\theta - 1} \cdot \frac{p - 1}{\theta} = \frac{q}{\theta} \cdot (\theta - 1)
\]
The two constraints describe the evolution of the market functions for problem (3), where \( p \) is a vector of competition and \( (p', p'') \) is a vector of competition. The evolution of the market functions is based on the Nash equilibrium, which is the optimal value function. The Nash equilibrium satisfies:

\[
(p', p'', x) g = \lambda
\]

where \( y = (x', x'') \) is a vector of consumption.

We have outlined our main results in the competitive equilibrium framework.

5. Computing the Recursive Competitive Equilibrium

We summarize our calibrated parameters in the accompanying table.

We found the competitive equilibrium, which is similar to the value calibrated in the previous section, using the same set of parameters. These results are given in Table 1. The table shows the key parameters that were used to calibrate the model. We have also included the key parameters that were used to calibrate the model for the first time. These results are given in Table 1. We have also included the key parameters that were used to calibrate the model for the first time.

The key parameters that were used to calibrate the model for the first time are shown in Table 1. The table shows the key parameters that were used to calibrate the model. We have also included the key parameters that were used to calibrate the model for the first time.

We have found that the competitive equilibrium is similar to the value calibrated in the previous section. These results are given in Table 1. We have also included the key parameters that were used to calibrate the model for the first time.
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Representing the Business Cycle

There are several different ways to represent the business cycle. One common approach is to use a phase diagram, where the phases of the business cycle are represented as different regions on a graph. Another approach is to use a time-series analysis, where the data is plotted over time to show how the economy moves through different phases of the business cycle.

Economic Growth and Business Cycles

The economic growth and business cycles are closely related. During periods of economic growth, businesses tend to expand and employment increases. However, during periods of economic downturn, businesses may contract and unemployment rises. Understanding these cycles is crucial for policymakers and businesses alike, as it allows them to better prepare for future economic conditions.
The ends of 1920s cycle (for scale)

Figure 1: Log of real GDP and its growth component

Correspondingly, if we also see that the H-P filtered data display more erratic expected since the latter effect emphasizes the high-frequency movements more after that leads to more short-term fluctuations than does the H-P filter. This is also consistent with the theory that the H-P filtered cycle component contains the residual movements. Therefore, Figure 1 shows the H-P filtered growth component of real GDP, along with the cycle component derived from data differentiated real GDP. Figure 1 also shows a plot of real GDP and its H-P filtered growth component and both cycle components. The parameter α was set at 1.60 for this exercise. One can see that the cycle component is well before the H-P filtered growth component. Figure 1 shows the correlation between the cycle component and the original series. The cycles are closely related.
### Table 1.1

<table>
<thead>
<tr>
<th>Variable</th>
<th>SD%</th>
<th>(x(-5))</th>
<th>(x(-4))</th>
<th>(x(-3))</th>
<th>(x(-2))</th>
<th>(x(-1))</th>
<th>(x)</th>
<th>((x+1))</th>
<th>((x+2))</th>
<th>((x+3))</th>
<th>((x+4))</th>
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<td><strong>Output component</strong></td>
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<td>GNP</td>
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<td><strong>Consumption expenditures</strong></td>
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<td>CONS</td>
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<td>.52</td>
<td>.28</td>
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<td>-.18</td>
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<td><strong>Labor input based on household survey</strong></td>
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<td>HSAVGHRS</td>
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<td>.37</td>
<td>.23</td>
<td>.09</td>
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| HSEEMPLMT            | 1.14| -.10      | .04       | .23       | .46       | .69       | .85   | .86       | .76       | .59       | .40       | .18       |
| GNP/HSHOURS          | 0.90| .06       | .14       | .20       | .30       | .33       | .41   | .19       | .00       | -.18      | -.25      | -.24      |

**Labor input based on establishment survey**

| ESHOURS              | 1.69| -.12      | .07       | .38       | .54       | .78       | .92   | .90       | .78       | .63       | .42       | .21       |
| ESAVGHRS             | 0.48| .14       | .26       | .42       | .58       | .68       | .62   | .45       | .22       | .05       | -.15      | -.30      |
| ESEEMPLMT            | 1.41| -.19      | -.01      | .22       | .47       | .72       | .89   | .92       | .86       | .73       | .55       | .34       |
| GNP/ESHOURS          | 0.73| .35       | .44       | .44       | .45       | .34       | .34   | .10       | -.09      | -.30      | -.38      | -.42      |

**Average hourly earnings based on establishment survey**

| WAGE                  | 0.757| .20       | .35       | .47       | .58       | .66       | .68   | .59       | .46       | .29       | .12       | -.03      |

**Average hourly compensation based on national income accounts**

| COMP                  | 0.55| .24       | .25       | .21       | .14       | .09       | .03   | -.07      | -.09      | -.09      | -.09      | -.10      |

Notes: GNP—real GNP, 1982$; CONS—personal consumption expenditure, 1982$; CND$—consumption of nondurables and services, 1982$; CD—consumption of durables, 1982$; INV—gross private domestic investment, 1982$; INVF—fixed investment, 1982$; INVN—nonresidential fixed investment, 1982$; INVR—residential fixed investment, 1982$; Ch. INV—change in inventories, 1982$; GOVT—government purchases of goods and services, 1982$; EXP—exports of goods and services, 1982$; IMP—imports of goods and services, 1982$; HSHOURS—total hours of work (Household Survey); HSAVGHRS—average weekly hours of work (Household Survey); HSEEMPLMT—employment (Household Survey); ESHOURS—total hours of works (Establishment Survey); ESAVGHRS—average weekly hours of work (Establishment Survey); ESEEMPLMT—employment (Establishment Survey); WAGE—average hourly earning, 1982$ (Establishment Survey); COMP—average total compensation per hour, 1982$ (National Income Accounts). The Establishment Survey sample is for 1964:1–1991:II.
The findings of the model economy for the over-all growth are important measures alone which make sense to think of measures as compared by scores to productivity. The production of the model economy is assessed to be accurate in the case of the business cycle. The model economy does not reflect the actual economy. It does not reflect the actual economic growth. The model economy is assessed to be accurate in the case of the business cycle. It does not reflect the actual economy. It does not reflect the actual economic growth.

7. The findings from the stochastic growth economy

earnings that will be added and studied in later chapters. These are all not included a government sector and thus no extra tax sector. These are all not included a government sector and thus no extra work sector. If does not allow for a separate choice of hours and employment, it does

ECONOMIC GROWTH AND BUSINESS CYCLES

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1. E. COOLEY & E. PRESSCOM
8. Conclusion and Summary

The model economy gives us only a glimpse of what it is possible to learn and accomplish by taking the basic neoclassical growth model seriously.

At least for a model economy is decoupled from a world economy. An alternative approach that can be used to come up with something like an equilibrium process in a world economy is described in Killian and Pissarides (1994). Some other efforts to model the world economy are described in Cukierman (1994). They describe a process that is described in Cukierman and Eichengreen (1994). They describe a process that is described in Cukierman and Eichengreen (1994). The process is described in Cukierman and Eichengreen (1994). The process is described in Cukierman and Eichengreen (1994). The process is described in Cukierman and Eichengreen (1994). The process is described in Cukierman and Eichengreen (1994). The process is described in Cukierman and Eichengreen (1994). The process is described in Cukierman and Eichengreen (1994).
ECONOMIC GROWTH AND BUSINESS CYCLES

Section 10, by K. Geert Roelofs, is devoted to asset-pricing issues.

Chapter 6, by Peter Drucker and Jon Donaldson, is an analysis of the mechanism for monetary shocks.

Chapter 5, by John Robert, drives the conversational models based on the transactional framework.

Chapter 4, by J. Robert and Michael Woodard, considers the interaction between business cycles and monetary frameworks.

Chapter 3, by John Robert and Michael Woodard, provides an analytical framework of their empirical analysis in the context of the economic downturn and commodity models described to assess the sustainability and damping of the business cycle.

Chapter 2, by J. Robert and Michael Woodard, reviews the empirical analysis of their framework to set a propagation model.

Chapter 1, by J. Robert and Michael Woodard, presents the conversational models of the business cycle and commodity models.

NOTES
1. Introduction

Business Cycle Models

Chapter 2

Computing Equilibrium of Recursive Methods