# Farmer, Chapters 1-3

## Chapter 1

The theory of growth focuses on why economics produce more each year on average, whereas the theory of business cycles explains why real GDP and employment fluctuate from year to year (page 4).

Economic growth is a sustained increased in a nation's standard of living. It is measured by the average rate of change of the real GDP per person (page 5).

The business cycle is an irregular, persistent fluctuation of real GDP around its trend growth rate, which is accompanied by the highly coherent co-movements of many other economic variables (page 11).

Movements in GDP and its relationships to other variables define the business cycle. When GDP is below trend for a number time of periods in a row, we say the economy is in a contraction, or a recession. When it is above for a number periods in a row, we say that the economy is in a boom, or an expansion (page 12).

The NBER Business Cycle Dating Committee defines a recession as a recurring period of decline in total output, income, employment, and trade, usually lasting six months to a year, and marked by widespread contractions in many sectors of the economy (page 12).

Measuring Inflation: (page 17).

1. The consumer price index (CPI) measures the average cost of a standard bundle of consumer goods in a given year.

2. The producer price index (PPI) is a weighted average [of a] bundle of goods is selected from an earlier stage in the manufacturing process. For example, the producer price index includes the producer price of wheat and pork, as opposed to the consumer price of bread and bacon.

3. The GDP deflator is the most comprehensive index. It includes all of the goods and services produced in the United States weighted by their relative values as a fraction of GDP.

4. The GDP price index is similar to the GDP deflator in that it includes all of the goods and services produced in the United States. It differs from the GDP deflator in the way it weights different commodities.

5. The PCE price index is like the GDP price index, but it contains only consumer goods and not producer goods. PCE stands for “personal consumer expenditure”.

Inflation is related to GDP price index in the following way: When the GDP price index is higher in one year than in the previous year, inflation is positive; when the GDP price index is lower than in the previous year, inflation is negative (page 17).

Inflation is widely accepted as being caused when a country increases its money supply faster than the rate of increase of money demand (page 17).

When unemployment [is] high, money wages [tend] to fall, and when unemployment [is] low, wages [rise]. The relationship between inflation and unemployment is called “the Phillips curve,” and soon after its discovery, the Phillips curve became accepted as a fact to be explained by economic theory (page 20).

Milton Friedman and Edmund Phelps pointed out that even if historically high inflation is observed to accompany low unemployment, do not expect this kind of relationship to be sustainable over long periods of time. The Phelps-Friedman theory was called the “natural rate” hypothesis because they argued that the unemployment rate should be determined by the factors that determine the supply and demand for labor (page 20).

Phelps and Friedman argued that inflation would be associated with low unemployment only if the inflation was unanticipated, and their argument brought the idea of expectations to the forefront of modern business-cycle theory (page 21).

**Conclusion**

What determines economic growth?

What are the causes of business cycles?

What determines inflation?

Economic growth is the sustained increase in a nation’s standard of living. Business cycles are irregular, persistent fluctuations of real GDP around its trend growth rate, accompanied by highly correlated co-

movements in many other economic variables. Inflation rate is the rate of change of the average level of prices (page 21).

Economic growth is important because small differences in growth rate can have very big differences in the standard of living when growth is compounded over several years. Business cycles are important because during recessions unemployment increases, and there are associated increases in a variety of social problems, such as homicides and poverty. It is important to avoid inflation because high inflation is associated with loss of output and related social problems. In practice, central banks usually act to remove inflation before it reaches this stage, but the policies required to do this may generate a recession (page 21).

**Key Terms**

**Base year** – The year whose prices are used to value goods and services through bilateral exchange of commodities.

**Boom (expansion)** – A period of time during which the growth rate of real GDP is above trend.

**Business cycles** – The tendency of many economic time series to display coherent, persistent swings from one period to the to the next.

**Consumer price index (CPI)** – A measure of the cost of a standard bundle of consumer goods in a given year.

**Contraction (recession)** – A period of time during which the growth rate of GDP is below trend.

**Countercyclical** – One that tends to decrease when real GDP increases and increase when real GDP decreases.

**Deflation** – A negative inflation rate.

**Detrending** – The process of separating a time series into two components—a trend and a cycle.

**Disinflationary** – A policy of lowering the inflation rate.

**Gross domestic product (GDP)** – The value, at market prices, of all final goods and services produced within a nation's borders during a given time period.

**GDP deflator** – A price index computed as the ratio of nominal GDP to real GDP.

**GDP price index** – Similar to the GDP deflator in that it includes all of the goods and services produced in the United States. It differs from the GDP deflator in the way it weights different commodities.

**Hyperinflation** – A period of very rapidly increasing prices.

**Inflation** – The average rate of increase of prices.

**Linear detrending** – The process of decomposing a time series into trend and cycle by drawing the best straight line through the data.

**Macroeconomics** – The study of the working of the economy as a whole.

**Microeconomics** – The study of the behavior of individual producers and consumers in markets.

**Nominal GDP** – GDP measured using current prices.

**Persistence** – The tendency of a time series to be highly correlated with its own past values.

**PCE price index (PPI)** – The PCE price index is like the GDP price index, but it contains only consumer goods and not producer goods. PCE stands for "personal consumer expenditure".

**Real GDP** – GDP measured using base-year prices.

**Rule of seventy** – Take the growth rate of a variable that is experiencing compound growth and divide it into 70 to gauge how fast a quantity will double in size.

**Standard of living** – represented by GDP per person (Mike's definition, based on page 7)

**Time series** – A collection of values of an economic variable recorded at regular intervals over a period of time.

**Variables** – Measurable quantities that record the values of economic concept, such as real GDP or unemployment, at different points in time.

# Chapter 2

The commerce department arrives at the GDP using three methods: the income method, the expenditure method, and the product (or value added) method (page 28).

Final goods are those that are sold directly to end users, as opposed to intermediate goods, (or inputs), which are produced by one firm and used as an input by another. The value added is the difference between the value of the output that a firm sells and the value of the intermediate goods used to manufacture that output (page 28).

We call the income that is earned by the supply of labor services labor income and the income that is earned from applying the services of capital rent. By adding up all of the income earned by the factors of production, we arrive at the income method of computing GDP (page 29).

Domestic expenditure on final goods and services refers to the purchase of final foods by households and firms. By adding up all of the expenditures on final goods and services, we arrive at the expenditure method of computing GDP (page 29).

For each firm in the economy, the product method computes the difference between the value of the firm's output and the cost of its expenditures on intermediate inputs; this difference is called the firm's value added (page 29).

To computer GDP in a closed economy, we must add up the values of private consumption expenditure, private investment expenditure, and total government expenditure (on both consumption and investment goods). To compute GDP in an open economy, we must also add the value of exports (goods produced domestically but sold abroad) and subtract the value of imports (goods consumed domestically but produced abroad) (page 29).

Saving is the act of abstaining from consumption. Investment is the result of purchasing a new capital good (a commodity which help to produce more goods in the future) (page 31).

The GDP of a closed economy is equal to the income earned by its residents (page 32).

“GDP accounting identity.”

$$Y = C + I + G$$

We can further divide government purchases into government spending on investment goods, I^(gov), and government spending on consumption goods, C^(gov). Using these terms, we can rewrite GDP as follows:

$$Y = I^{(nat)} + C^{(nat)}$$

Where C^(nat) = C + C^(gov), and I^(nat) = I + I^(gov)

In common usage, the words “savings” and “investment” refer to the same thing. Using this definition, national saving is defined as:

$$S^{(nat)} = Y - C^{(nat)}$$

If we combine the definition of the components of GDP with the definition of saving, it follows that national saving and investment must be equal in a closed economy:

$$S^{(nat)} = I^{(nat)}$$

(Page 34).

A deficit is an excess of expenditure over income (page35).

When exports exceed imports, we say that the nation enjoys a trade surplus. We also call this net exports (page 35).

[We need] an additional term to account for the difference between the value of the goods sold abroad and the value of foods imported:

**Y = C^(nat) + I^(nat) + NX**

Where NX represents net exports and is defined as exports, EX, minus imports, IM. This equation together with the definition of national saving to investment in an open economy:

**S^(nat) – I^(nat) = NX**

means that when a country saves more that it invests at home, saving results in a flow of commodities out of the country; that is, exports exceeds imports.

(page 36).

National saving can be divided into government and private saving. To define private saving, first we need to introduce the term "disposable income"—the income that is available to the private sector after the government takes out taxes and puts back transfer payments to individuals and firms. Disposable income is defined as

$$YD = Y + TR – T$$

where YD is disposable income. TR is transfer payments, and T is taxes. We can now definite private saving as

$$S = YD – C$$

If we put the definitions of private saving and disposable income back into [S^(nat) – I^(nat) = NX] and use the earlier definitions of national saving and national investment, we arrive at the following breakdown of saving and investment between public and private sectors.

$$(S – I) + (T – TR – G) = NX$$

This equation tells us about the interaction of the government, the private sector, and the rest of the world.

(Page 36).

There are two ways the government can generate a surplus. It can borrow from U.S. residents—this happens when saving, S, is greater than private investment, I; or it can borrow from the rest of the world—this happens when imports, IM, are greater than exports, EX; and hence net exports, NX, are less than zero (page 37).

The concepts of GDP and its component parts are examples of flows. Wealth is a stock and is measured by a system of balance sheet accounting (page 40).

There are two kinds of economic variables: stocks and flows. A stock is a variable measured at a point of time; a flow is a variable measured per unit of time. A flow is often the rate of change of a stock.

(page 40).

An important economic example is the relationship of government debt, a stock, to the government budget deficit, a flow (page 40).

The portion of gross investment that contributes to increases in the stock of capital is called “net investment.” The portion devoted to replacing worn-out capital is called “depreciation.” (page 45).

As long as gross investment exceeds depreciation, the capital stock will keep increasing. But if the gross investment is smaller than depreciation, then the level of capital stock will fall (page 46).

Growth rate of GDP in year t = [(Yt – Yt-1)/Yt-1](100)

(page 48).

**Conclusion**

The world economy is a collection of national economics, each of which can be analyzed as open or closed. The domestic economy can be divided into a public sector; and the private sector can, in turn, be divided into households and firms.

The most important measure of productivity capacity of an economy is GDP, which can be measured in three ways: the income method, the expenditure method, and the value-added method. The GDP of a closed economy is equal to consumption plus investment. In an open economy it equals consumption plus investments plus net exports.

Wealth of an economy is a stock, a variable measured at a point in time (page 48).

There are two kinds of investment: gross and net. Gross investment is net investment (additions to capital) plus depreciation (replacement of worn-out capital) (page 49).

**Key Terms**

**Budget deficit** – An excess of expenditures over revenue.

**Capital goods** – Are commodities which help to produce more goods in the future.

**Circular flow of income** – The idea that GDP and income for the whole economy are different ways of measuring the same thing.

**Consumption goods** – Commodities used to meet immediate needs.

**Domestic economy** – The economy of a single country of interest.

**Domestic expenditure** – Expenditure of goods and services produced in the domestic economy.

**Expenditure method of computing** GDP – A method of measuring GDP by adding up expenditures on final goods and services.

**Factor services** – Services of the factors of production that households supply to firms in exchange for income.

**Final goods** – One sold directly to the final user.

**Firm** – An economic organization that produces commodities

**Households** – A group of individuals who live together and make collective economic decisions.

**Income method of computing GDP** – A method if measuring GDP by adding up all the income earned by the factors of production.

**Intermediate goods** – A good produced by one firm and used as an input by another.

**Investment** – The result of purchasing a new capital good.

**Labor income** – The income earned by labor services.

**National Income and Product Accounts (NIPA**) – A set of data on GDP and its components, published by the U.S. Department of Commerce.

**Net Exports** – The difference in exports over imports.

**Open economy** – An economy that trades with the rest of the world.

**Private sector** – Composed of household and firms.

**Public sector** – The government sector.

**Rent** – The income that is earned from supplying services of capital.

**Saving** – The decision not to consume.

**Trade surplus** – When exports exceed imports.

**Value added** – The difference between the value of the output that a firm sells and the value of the intermediate goods used to manufacture that output.

**Value-added method** – A method for measuring GDP by computing the difference between the value of the firm's output and the cost of its expenditures on intermediate inputs.

# Chapter 3

Persistence records how closely a variable is related to its own past history. Coherence measures how closely two variables related to each other (page 53).

The theory of economic growth focuses on what determines the low-frequency movements (a trend) in economic time series, and the theory of business cycles studies the causes of their high-frequency movements (deviation of the series from its trend) (page 55).

Correlation coefficient measures the strength of a statistical relationship. The correlation coefficient is used in two ways: to measure the strength between two variables and to measure the strength of the relationship between a single variable and its own history (page 59).

We call the strength of a relationship between two variables their degree of coherence. We call the strength of the relationship between a single variable and its history its degree of persistence (page 59).

If a correlation coefficient is close to +1, then the big deviation from trend will persist for a long time; and if it is close to zero, the series will quickly return to trend (page 61).

The correlation coefficient is defined by the formula

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}}$$

A person is either employed, unemployed or out of the labor force. People who are working or looking for work are part of the labor force. People who are not employed or who are not looking for a job are out of the labor force (page 65).

The employment rate is the fraction of the population employed. The unemployment rate is the fraction of the labor force looking for a job (page 68).

The employment rate and unemployment rate can move independently of each other because the employment is the ratio of employed people to the population, whereas unemployment is the ratio of the unemployed to the labor force (page 68).

Chain weighted GDP growth. Calculate real GDP twice. Use the year t as the base year to calculate real GDP growth from year t to year t+1. Then use year t+1 as the base year to calculate real GDP growth from year t to year t+1, then average the two (Mike's interpretation, page 72).

Inflation is the average rate of change of the price level (page 73).

There are three alternative kinds of price indices: Laspeyres, Paache, and Superlative. The CPI, the PPI, and the GDP deflator are all Laspeyres indices; of these, the CPI has been the benchmark measure of inflation since World War I. The GDP price index and personal consumer expenditure (PCE) price index are Superlative indices. Because Laspeyres index uses historical weights, it tends to overstate the importance of inflation (page 73).

Overstatement of inflation occurs [when using a Laspeyres index] because consumers adjust their spending habits more rapidly than the CPI updates the basket of goods it uses to measure inflation. Consumer habits change month to month, but the CPI updates its basket of commodities every 10 years (page 74).

The CPI is the index most commonly used to measure inflation. Its greatest shortcoming, however, is that the CPI overstates inflation because it uses a historical set of weights that is infrequently updated (page 75).

Inflation is neither procyclical nor countercyclical; its coherence with GDP is not significantly different from zero (page 76).

**Conclusion**

To analyze time series, we split them into a low-frequency (the trend) and high-frequency component (the cycle). The three principle ways of decomposing a time series are linear detrending, flexible detrending, and differencing (page 78).

We measure the strength of the statistical relationship between two series with the correlation coefficient. A time series that has a high correlation coefficient with its history is persistent; two series

that have a high correlation coefficient with each other are coherent. Coherence can be positive (both series go up and down together) or negative (one series moves up as the other moves down). If a series is positively correlated with GDP, it is procyclical; if it is negatively correlated with GDP, it is countercyclical (page 79).

The employment rate is the percentage of the population that are employed; the unemployment rate is the percentage of the labor force that are unemployed. The unemployment rate and employment rate can increase at the same time (see the labor force during post-WWII) (page 79).

Until recently, real GDP was measured by computing the values of all goods and services produced in a given year, valued using prices from a single base year. More recently, GDP has been measured by the chain weighted method (page 79).

There has been controversy over the best way to measure inflation because some prices are increasing faster than others. Inflation was procyclical before WWII but has been countercyclical since then (page 79).

**Key Terms**

**Coherence** – A measure of the degree to which two variables move together over time.

**Compound growth (exponential growth)** – A process of growth by which a variable increases each period by a fixed percentage of its level.

**Correlation coefficient** – A measure of the strength of association between two variables.

**Differencing** – The process of calculating the changes in a time series variable to its own past values.

**Employment rate** – The fraction of the adult population that is employed.

**Expansion** – The period between a trough and its subsequent peak is called a business cycle expansion.

**Flexible trend** – The low-frequency that results from decomposing a time series into a trend and a cycle using a flexible detrending method. Flexible detrending is computed using a formula determined by demand and supply.

**High-frequency component** – The part of a time series that remains after removing a linear or flexible trend or after differencing the series.

**Labor force** – All individuals who are either working or looking for work.

**Labor force participation rate** – The fraction of the civilian population over the age of 16 that is in the labor force.

**Leading Indicators** – Many economists watch the PPI closely, since price increases that occur in the PPI often eventually end up in the CPI. Times series that have this property are said to be leading indicators, and the PPI is a leading indicator of inflation.

**Linear cycle** – The component of a time series that remains after removing a linear trend.

**Linear trend** – Linear detrending accomplishes this task (separating movements) by fitting the best straight line through the graph of the logarithm. This fitted line is called the linear trend.

**Low-frequency component** – A slowly moving component of a time series.

**Peak** – The point in a business cycle at which the difference of real GDP from trend begins to decline.

**Recession** – The period from the peak of a business cycle to the subsequent trough.

**Scatter plot** – A graph in which each point represents an observation on two different variables at a given point in time.

**Trend** – (see *Low-frequency component*.)

**Trough** – The point in a business cycle at which the difference of real GDP from trend begins to increase.

**Unemployment rate** – The fraction of the labor force that is unemployed.