

Lecture Note 1: Introduction
ECON 110B: Short-Run Macroeconomics
Summer Session I 2023
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In contrast to ECON 110A, which focuses on basic concepts and long-run growth, this course is about short-run fluctuations at business cycle frequencies. This lecture is our first exposure to the notion of short run.

I. What Is Short Run?

A salient feature of modern economy is the sustained growth observed in numerous aggregate variables. Figure 1 plots the quarterly real GDP data of US in log scale. Recall that with the log scale, the slope of the curve at each data point approximates the growth rate of the variable

$$\log(Y_t) - \log(Y_{t-1}) \approx \frac{Y_t - Y_{t-1}}{Y_{t-1}}$$

where Y_t is the measurement of variable Y (in this case real GDP) at time t . The roughly straight upward-sloping curve in Figure 1 thus highlights the steady growth of the US economy since the middle of 20th century.

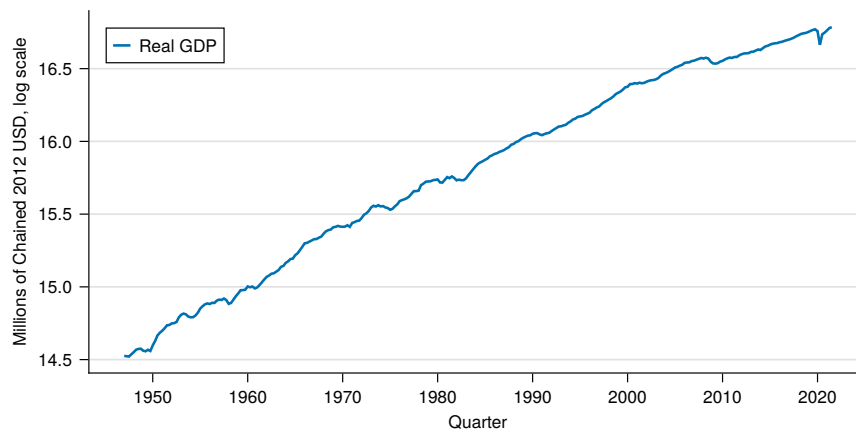


FIGURE 1: QUARTERLY REAL GDP IN US, 1947–2021

Source: National Income and Product Account from US Bureau of Economic Analysis.

However, a closer look at Figure 1 suggests that this path of GDP growth is not entirely smooth. There is time in which the curve goes downward for a few quarters and then returns to its trend. Sometimes, the slope seems to be a bit steeper. Loosely speaking, these wiggles are capturing what

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we call short-run fluctuations. We can view original data as a combination of two components

$$\text{Actual Level} = \text{Long-Run Trend} + \text{Short-run Fluctuation}.$$

The *actual level* of a variable is what we obtain from data. In other words, the actual level is the measurement for real-world economic activities. As users of the data, we take the values in data as given. In practice, it is often the case that the measurement in dollar terms, for example, needs to be transformed in some way (often by taking the log) in order for the data to be more useful. The transformed data are still considered as the actual level if the transformation is simply a one-to-one mapping. The more complicated task here is to *estimate* the *long-run trend*. These trends are *not* directly observed, because unlike the values provided in data, which are typically obtained via some measurement procedure on real-world activities, the trends are conceptual objects that reflect a specific way of how we *interpret* the data. In particular, depending on the purposes, there can be different ways of estimating the trends. We will revisit that with more details in the next lecture. Once we taken out the trend component from the actual level of a variable, the residual component becomes what we consider as short-run fluctuation. Notice that, since there is no such a unique way of defining the trends (in the mathematical/statistical sense), there is no unique definition of short-run fluctuations. For most of the course, we are *not* going to deal with the specific procedures of extracting short-run fluctuations from data. However, it is important to be aware that short-run fluctuations are conceptual objects rather than something concrete that can be directly measured by observation.

To show you an example of short-run fluctuations without getting too much technical details, Figure 2 plots the short-run fluctuations of real quarterly GDP obtained via a specific procedure. Notice how the curve connecting the values looks dramatically different from what is shown in Figure 1. Since the trend component has been removed, the resulting curve no longer looks like an upward-sloping line with wiggles. Instead, what we see in Figure 2 are changes in real GDP that keep going up and down around zero. Furthermore, the unit of values are now in percentage terms relative to the trend.¹ The level of the GDP per se is not of interest here. By using percentage changes around the trend, we focus on short-run fluctuations.

Why Does Real GDP Fluctuate Around Trend? Going back to the factors that determine potential output in the long-run, could changes in those explain the short-run fluctuations?

1. Population growth: Shrinking populations are an unlikely explanation, as most countries have experienced uninterrupted population growth.
2. Capital accumulation: Declines in the capital stock are also an unlikely explanation: Most firms run at excess capacity, so the capital stock is rarely used at full capacity.
3. Technological progress: Do recessions forget that we temporarily forget how to be productive?

¹More precisely, it is what is often called “log points”, the difference between two levels in log scale, instead of arithmetic percentage points. Recall that when the log points are small, they are similar to percentage points. In practice, it is popular to use “%” for log points, although strictly speaking they are not equivalent.

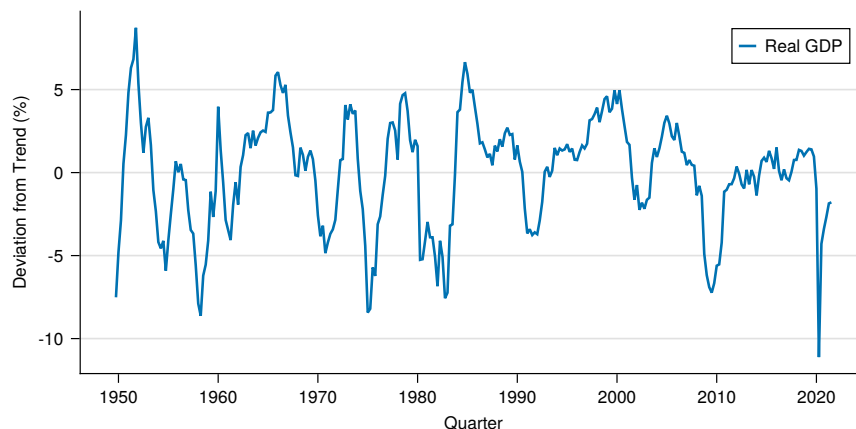


FIGURE 2: SHORT-RUN FLUCTUATIONS IN US REAL GDP, 1947–2021

This is also an unlikely explanation, as it is hard to make that case.

Although the long-run factors certainly have impact on the economy, they are unlikely to be the sole reasons for why we see the fluctuations plotted in Figure 2. We need additional toolkits to understand short-run fluctuations.

One way to think about short-run fluctuations is to view the economy as being constantly hit by *shocks* that alter the effective use of resources by economic agents. What do macroeconomists mean by “shocks”? This terminology has been widely used for decades, although the definition was not entirely unified historically. According to Bernanke (1986), the shocks are primitive *exogenous* forces that are *uncorrelated* with each other and *economically* meaningful. By being uncorrelated, knowing the magnitude of a shock does not help us predict some other shock. Otherwise, they cannot be primitive forces and we cannot tell for sure the changes are induced by a specific shock. Meanwhile, we require shocks to be interpretable. White noise produced by statistical procedures are not helpful for understanding the economy.

One example of the shocks is the oil embargo in the 1970s that are considered to be a major cause of the ensuing recessions in the US. According to the US Office of the Historian:

During the 1973 Arab-Israeli War, Arab members of the Organization of Petroleum Exporting Countries (OPEC) imposed an embargo against the United States in retaliation for the U.S. decision to re-supply the Israeli military and to gain leverage in the post-war peace negotiations. Arab OPEC members also extended the embargo to other countries that supported Israel including the Netherlands, Portugal, and South Africa. The embargo both banned petroleum exports to the targeted nations and introduced cuts in oil production. Several years of negotiations between oil-producing nations and oil companies had already destabilized a decades-old pricing system, which exacerbated the embargo’s effects.

If we are only looking at the domestic US economy, it is reasonable to consider the rise of US oil prices as induced by an exogenous force that is uncorrelated with others. It is also economically interpretable,

because the oil price changes can be attributed to the embargo. Other examples of shocks include the dramatic rise of military spending due to unexpected challenges encountered in Korean War, the 2011 Tōhoku earthquake and tsunami, the fall of Lehman Brothers, the COVID-19 outbreaks and so on. Notice that all these examples are valid only by the “surprising” components of them. If an event is well anticipated in advance, it is not a shock, although the *news* of this event might be a shock.

Shocks push actual output away from potential output. The output of an economy is of particular interest. Because of that, we have a dedicated name for short-run fluctuations in output, called *short-run output*:

$$\tilde{Y}_t \equiv \log(Y_t) - \log(\bar{Y}_t) \approx \frac{Y_t - \bar{Y}_t}{\bar{Y}_t}$$

Short-run output is the percentage change in output (or difference in log scale) after removing estimated trend component. A recession begins when actual output falls below potential ($\tilde{Y}_t < 0$).

As short-run output changes, we typically see unemployment moves in the opposite direction. This negative correlation is called Okun’s Law. A 1% increase in short-run output is associated with a decrease in cyclical unemployment rate by 0.5%:

$$u_t - \bar{u}_t \approx -\frac{1}{2}\tilde{Y}_t. \tag{1}$$

Here, cyclical unemployment rate is the difference between unemployment rate and natural unemployment rate.

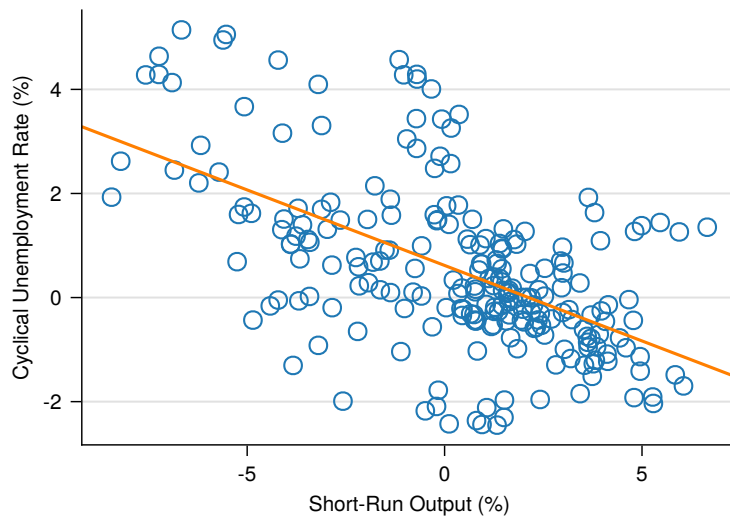


FIGURE 3: CYCLICAL UNEMPLOYMENT RATE AND SHORT-RUN OUTPUT, 1960–2015

Okun’s Law is a *reduced-form* relation, meaning that it does not explicitly tell us the forces behind movement of \tilde{Y}_t and u_t . In fact, the coefficient of $-\frac{1}{2}$ in Equation (1) is not very stable. Depending on sample periods and the economy under consideration, the coefficient estimates may be far from $-\frac{1}{2}$ in a statistical sense. This is expected, as the composition of forces behind the negative correlations may well change over time and across economies. Despite this, changes in unemployment

rate is often used as an alternative measure of short-run output because of Okun's Law.

II. Why Care?

Should we care about short-run fluctuations? Historically, the answer to this questions has gone through intensive debate. It is not as obvious as what you might initially think. Yet, a compelling argument made by John Maynard Keynes points out an important reason for why we should care about the short run:

But this long run is a misleading guide to current affairs. In the long run we are all dead. Economists set themselves too easy, too useless a task, if in tempestuous seasons they can only tell us, that when the storm is long past, the ocean is flat again.

Nobody lives in the long run. Although things grow over time, we still need to counter the crisis immediately arising in front of us. To that end, we need to gain better understanding on the nature of short-run fluctuations.

The cost of a recession is substantial. The textbook estimate is about \$12,000 per family of four, or 1.5 to 3 million "lost" jobs from the employment aspect. This back-of-envelope estimation relies on many simplifying assumptions. The true real-world difficulties are very hard to estimate. Despite that, we commonly believe that the cost of a recession is an important reason for why we should care about short-run fluctuations.

Recessions have persistent effects on inequality. That is to say, even years after the end of a recession, the affected people may still suffer losses that are caused by the recession. Oreopoulos, von Wachter and Heisz (2012) find that "the cost of recessions for new graduates is substantial and unequal. Unlucky graduates suffer persistent earnings declines lasting ten years. They start to work for lower paying employers, and then partly recover through a gradual process of mobility toward better firms."; and that "more advantaged graduates suffer less from graduating in recessions because they switch to better firms quickly, while earnings of less advantaged graduates can be permanently affected by cyclical downgrading." Stuart (2022) find that "For individuals age 0–10 in 1979, a 10 percent decrease in earnings per capita in their county of birth reduces four-year college degree attainment by 15 percent and earnings in adulthood by 5 percent. Simple calculations suggest that in aggregate, the 1980–1982 recession led to 1.3–2.8 million fewer college graduates and \$66–\$139 billion less earned income per year." The persistent impact is not restricted to young people, other less advantaged people may be disproportionately affected. Heathcote, Perri and Violante (2020) find that "...recessions imply a potential double-whammy for low skilled men. This group is disproportionately likely to experience unemployment, which further reduces skills and potential earnings via a scarring effect."

Can policy intervention play a role in reducing the negative impact from short-run fluctuations? The answer is yes. We will get more on that later in the course.

III. Summary

Here is a summary on what we have learned so far:

- In the short run, the economy is constantly being hit by shocks.
- Shocks are primitive exogenous forces that are uncorrelated with each other and economically meaningful.
- Short-run output is an important measure for short-run fluctuations.
- Okun's law says that a 1% increase in short-run output is associated with a decrease in cyclical unemployment rate by 0.5%.
- We care about short-run fluctuations because a substantial amount of output is lost in recessions and recessions have persistent effects on inequality.
- Later in the course, we will learn how policy intervention is helpful.

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