The Phillips Curve - Part 1

EC 313, Macroeconomics

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Book Chapter 8

Overview

Overview

Monetary Goals

The Federal Reserve works to **promote a strong U.S. economy**.

Congress has directed **the Fed** to conduct the nation's monetary policy to support **three specific goals**:

1. Maximum sustainable employment. (**output - Y**)
2. **Stable prices. (price - P)**
3. Moderate long-term interest rates. (**implied by 2.**)

Note the second goal relates to our focus of this lecture.

Overview

Brief History

- In 1958, **A.W. Phillips** plotted the historical relationship between the **inflation rate** and the **unemployment rate** in the **United Kingdom** between 1861 and 1957.
- He found strong evidence of a **negative relationship between inflation and unemployment**.
- That is, when **inflation is high, unemployment is low**. And when inflation is low, unemployment is high.
- In 1960, **Paul Samuelson** and **Robert Solow** found evidence of the same relationship using **U.S. data**.

Overview

The Phillips Curve

- The **negative relationship** between the inflation rate and unemployment.
- **In the 1970s**, however, this **relationship broke down**. Both high inflation and high unemployment (stagflation).
- Phillips curve still is the **primary framework** for understanding and **forecasting inflation** used in central banks.

Inflation

Functions of Money

Before we start talking about price and changes in price (inflation), let's talk about money.

There are three functions of money:

- The medium of exchange.
- Store of value.
- Unit of account.

Functions of Money

Economists like to argue that money belongs in the same class as the wheel and the inclined plane among **ancient inventions of great social utility**.

Price stability allows that invention to work with minimal friction.

Why Stable Price

The Dual Role of Price Stability

- Price stability plays a dual role in modern central banking: It is both
- **An end (goal) of monetary policy**
- **A means of monetary policy**

Price Stability - Goal

- Fundamentally, price stability preserves the **integrity and purchasing power** of the nation's money.
    - People can hold money **without having to worry that inflation will eat away at the real value of their money balances**.

Price Stability - Goal

- Equally important, stable prices allow people to **rely on the dollar as a measure of value** when **making long-term contracts, engaging in long-term planning, or borrowing or lending** for long periods.
    - Price stability permits **tax laws, accounting rules** to be expressed in dollar terms without being subject to distortions arising from fluctuations in the value of money.

Price Stability - Means

When price stability likely to

- **Enhance Long-term Economic growth** (related to goal 1)
- **Matain stable Long-term interest rates** (related to goal 2)

Price Stability - Means

Price stability helps maintain **long-term economic growth** by...

- **reducing concern** about unpredictable fluctuations in the purchasing power of money.
- **improving economic activities**
- **making sure markets operate efficiently**.

Price Stability - Means

Price stability helps maintain **long-term economic growth** because

- The dollar provides a reasonably **secure gauge** of **real economic values only when inflation is low and stable**.
- High and variable inflation degrades the quality of the signals coming from the price system
- Producers and consumers find it difficult to distinguish **price changes arising from changes in product supplies and demands** from **changes arising from general inflation**.

Price Stability - Means

Price stability helps maintain **long-term interest rate**.

To understand this, we need to understand **Fisher Equation**

Let i be the nominal interest rate, r be the real interest rate, and π be the inflation rate.

The Fisher Equation is:

$$i = r + \pi$$

Conclusion:

Stable π is necessary for stable i.

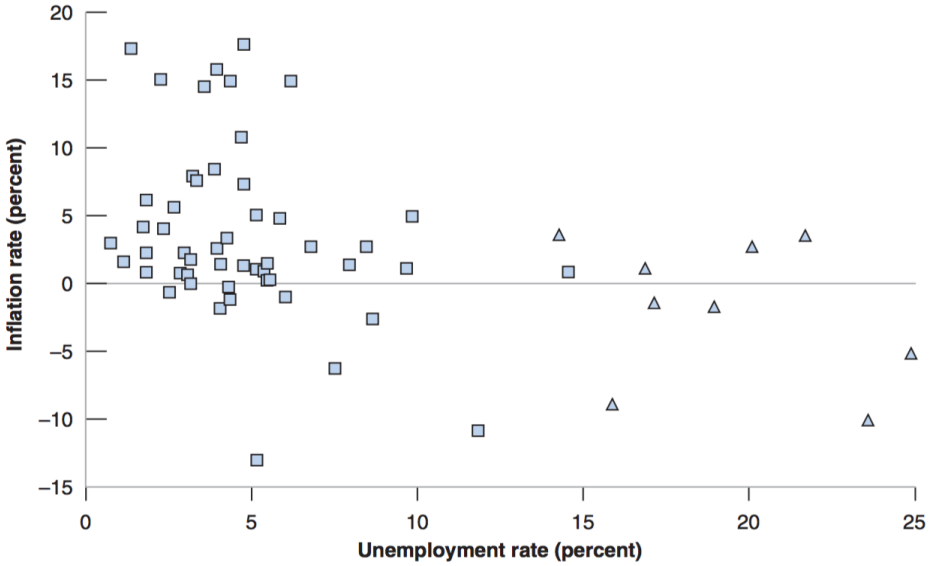
Phillips Curve

Phillips Curve

Empirical Discovery

During the period **1900–1960** in the United States,

- **A low unemployment rate** was associated with **a high inflation rate**
- **A high unemployment rate** was associated with **a low inflation rate.**



Phillips Curve

Empirical Discovery

Why is the Phillips Curve an important discovery?

- It states that there is a trade-off between the unemployment rate and the inflation rate.
- The Fed wants **a low sustainable unemployment rate**.
- The Fed wants **a low sustainable inflation rate**.
- The Phillips Curve gives the Fed **a guidance on how to reach a balance between these two goals**.

Phillips Curve

Theory

In Macroeconomics, we **can't run controlled experiments**; we rely on models to explain what we observe in the data.

The theory supporting the Phillips Curve is coming from the **Labor Market Equilibrium**. Assuming technology A = 1, we have labor supply (WS) and labor demand (PS):

$$\begin{aligned} \text{WS} : W &= P^e F(u, z) \\ \text{PS} : P &= (1 + m) W \end{aligned}$$

The Labor Market Equilibrium states:

$$P = (1 + m) P^e F(u, z)$$

Phillips Curve

Theory

The Labor Market Equilibrium states:

$$P = P^e(1+m)F(u,z)$$

Recall that $F(u,z)$ is a decreasing function in u and an increasing function in z.

To make life easier, we assume

$$F(u,z) = 1 - \alpha u + z$$

where $\alpha > 0$.

$$P = P^e(1+m)(1-\alpha u + z)$$

Phillips Curve

Theory

We need to go from **price to inflation**. Recall inflation: **The growth rate in prices over time.**

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

$$\pi_t = \frac{P_t}{P_{t-1}} - 1$$

$$1 + \pi_t = \frac{P_t}{P_{t-1}}$$

We can perform the **same analysis** for expected inflation π_t^e at time t:

$$1 + \pi_t^e = \frac{P_t^e}{P_{t-1}}$$

Phillips Curve

Theory

The Labor Market Equilibrium

$$P = P^e(1+m)(1-\alpha u + z)$$

$$P_t = P_t^e(1+m)(1-\alpha u_t + z)$$

$$\frac{P_t}{P_{t-1}} = \frac{P_t^e}{P_{t-1}}(1+m)(1-\alpha u_t + z)$$

$$1+\pi_t = (1+\pi_t^e)(1+m)(1-\alpha u_t + z)$$

$$1+\pi_t = 1+\pi_t^e + m - \alpha u_t + z$$

$$\pi_t = \pi_t^e + (m+z) - \alpha u_t$$

I won't make you do this derivation in the exams.

Phillips Curve

Theory

Now we have our Labor Market Equilibrium written in terms of inflations.

$$\pi = \pi^e + (m + z) - \alpha u$$

- Increase in expected inflation --> Increase in actual inflation
- Increase in z --> increase in actual inflation
- Increase in m --> Increase in actual inflation
- Increase in unemployment --> decrease in inflation (Phillips Curve)

Phillips Curve

Theory

Incease in expected inflation --> increase in actual inflation

- **Expected Inflation increases**...
- The expected price is higher in the next period...
- Workers ask for a higher wage (**WS Relation**)...
- More costly for firms to produce goods because labor is more expensive...
- Firms set **higher price** in the next period (**PS Relation**)...

Phillips Curve

Theory

- **Increase in z --> increase in actual inflation**
- **Increase in z**...
- Workers ask for a higher wage (**WS Relation**) in the next period...
- More costly for firms to produce goods because labor is more expensive...
- Firms set **higher price** in the next period (**PS Relation**)...

Phillips Curve

Theory

- **Increase in m --> increase in actual inflation**
- **Increase in m**...
- Firms will set a **higher price** because firms have a **higher mark-up** in the next period.

Examples for **m**:

1. **Monopoly Power**.
2. **Higher Input Price**.

Phillips Curve

Theory

- **Increase in the unemployment rate --> decrease in inflation (Phillips Curve)**
- **Higher unemployment rate**
- Workers ask for a lower wage (**WS Relation**)
- It is less costly for firms to produce goods because labor is cheaper...
- Firms will set a **lower price** in the next period.

Phillips Curve

Theory

Recall the Phillips Curve is

$$\pi = \pi^e + (m + z) - \alpha u$$

We need to use **time indexes** so that we can refer to variables like inflation, or expected inflation, or unemployment, **in a specific year**.

$$\pi_t = \pi_t^e + (m + z) - \alpha u_t$$

The data doesn't tell us anything about the **inflation expectation** π_t^e.

The theory tells us how **inflation expectation** π_t^e influences the actual inflation rate.

Expectation Formation

Expectation Formation

Recall the Phillips Curve is

$$\pi = \pi^e + (m + z) - \alpha u$$

We need to use **time indexes** so that we can refer to variables like inflation, or expected inflation, or unemployment, **in a specific year**.

$$\pi_t = \pi_t^e + (m + z) - \alpha u_t$$

To connect the **theory to data**, we need to infer how expectations are formed.

- **Expectation formation is difficult to study.**
- **It's brain activity.**

Expectation Formation

Models

Eventually, we want to find the best mathematical model to describe expectation formation. Here is how we should proceed:

- Consider **a large selection of expectation selection models**
- Combine **each one of the expectation formation model** with the **theory**

$$\pi_t = \pi_t^e + (m + z) - \alpha u_t$$

- Back out how the model-theory combo **implies** π_t
- Check if the implied π_t **matches the data** or **makes sense** (rational).

Expectation Formation

Static Expectations

$$\pi_t^e = 0$$

- I observe the current price level
- I assume that future prices will be the same as they are today.

Expectation Formation

Adaptive Expectations

$$\pi_t^e = f(\pi_{t-1})$$

- Next year's inflation depends on this year's inflation.
- I expect inflation to be similar to what it was last period.

Expectation Formation

Rational Expectations (Not Required)

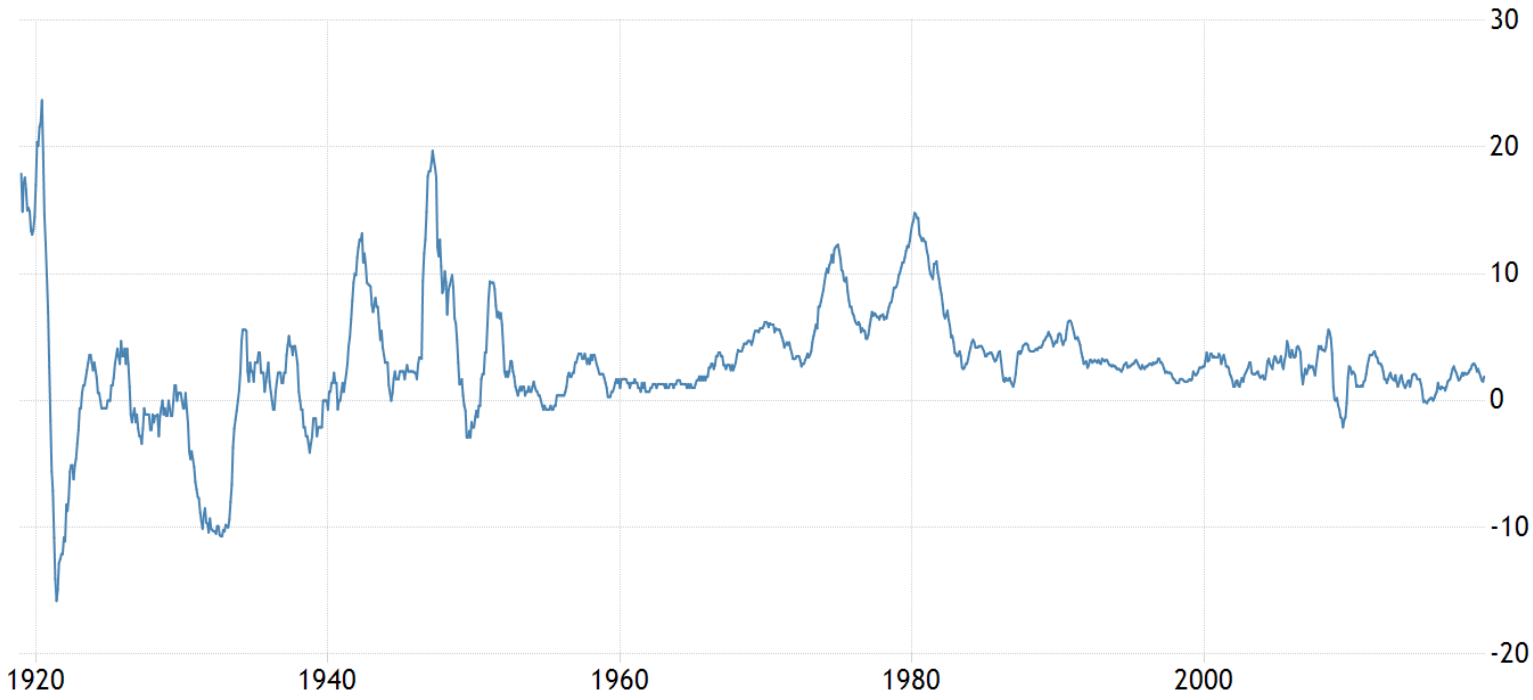
π_t^e is the **true, statistical expectation** of π_t.

- I know the entire distribution of possible inflation rates
- I know the probabilities of each of these rates occurring
- I can calculate the true expected inflation rate.

Modern Macroeconomic Modeling almost entirely relies on Rational Expectations!

Phillips Curve

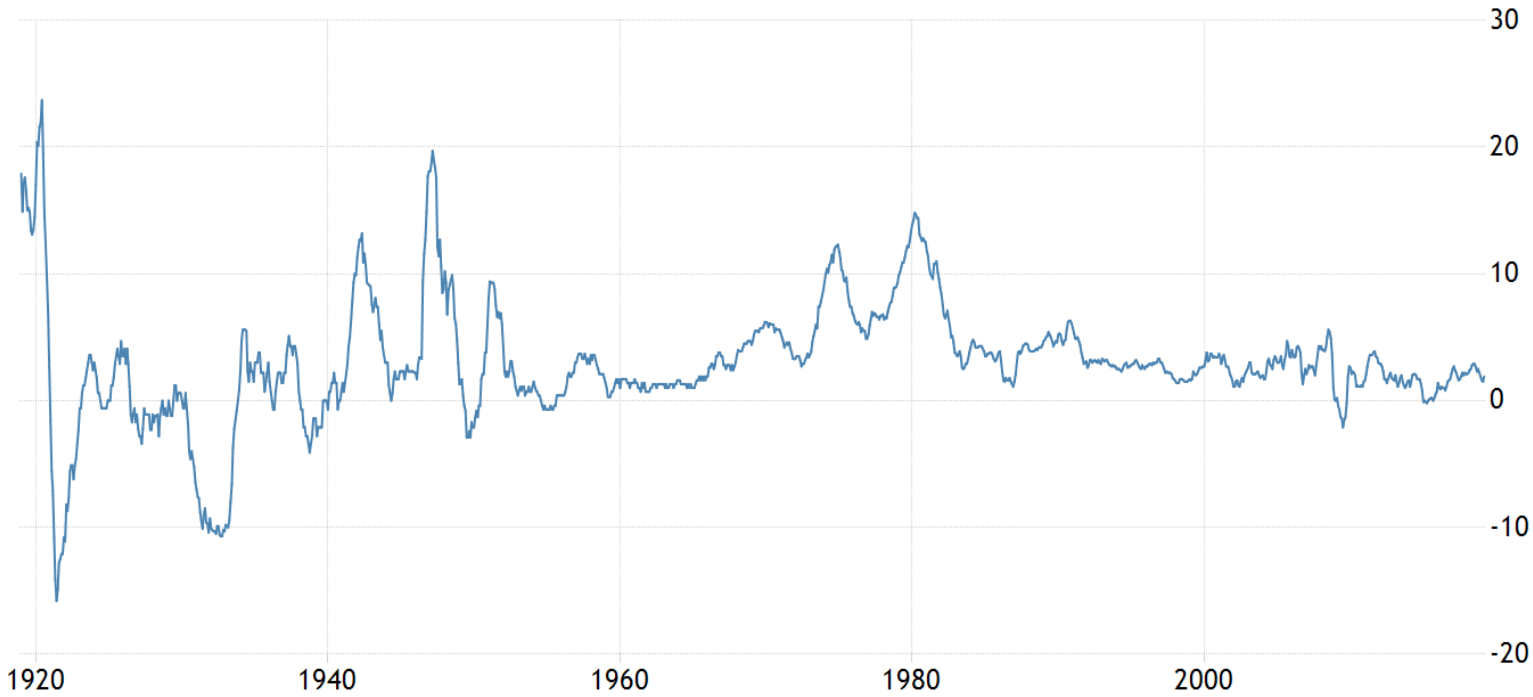
Inflation History



Note: **Before 1960** (when Phillips Curve was first discovered), inflation was positive in some years and negative in others, on average it was around zero.

Phillips Curve

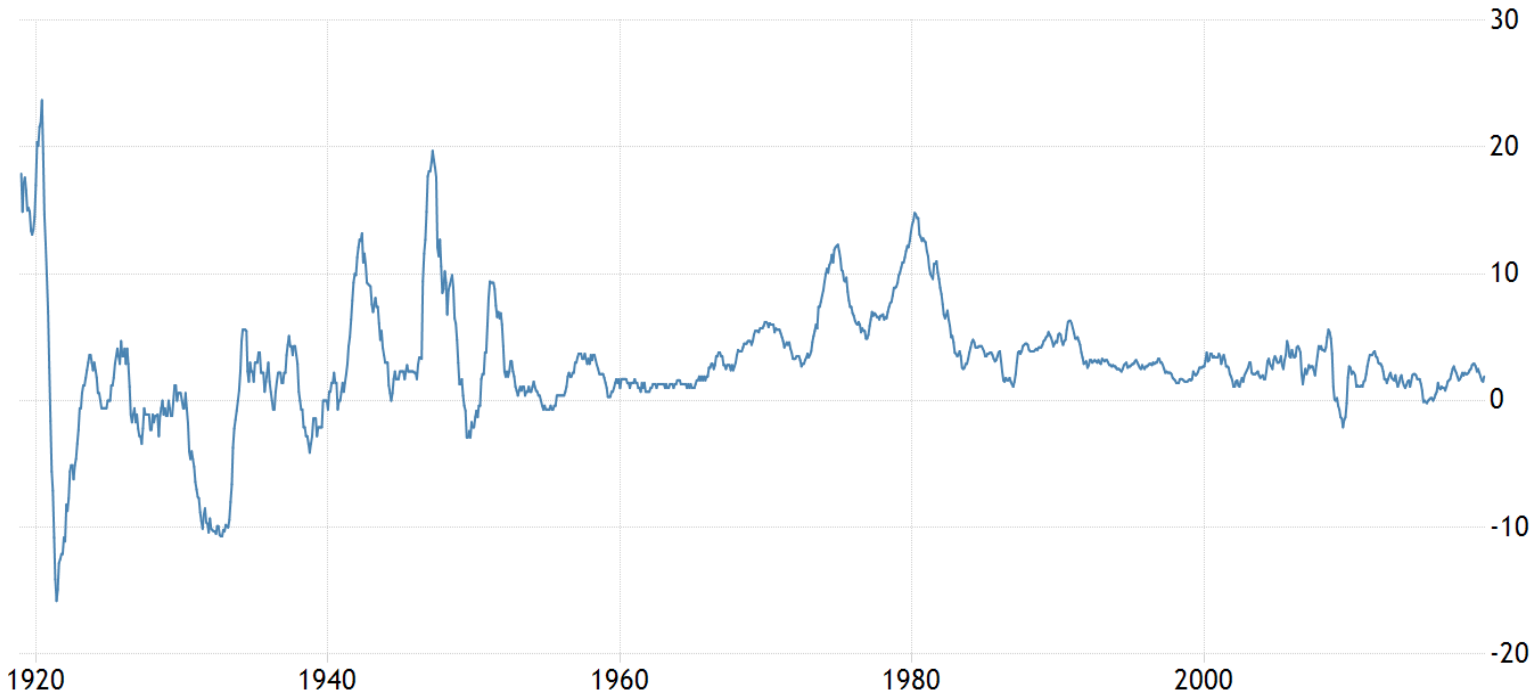
Inflation History



Note: **During the 70s** hit twice in the 1970s by **a substantial Increase in the price of oil**. Inflation, in general, maintained at a higher level.

Phillips Curve

Inflation History



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Phillips Curve

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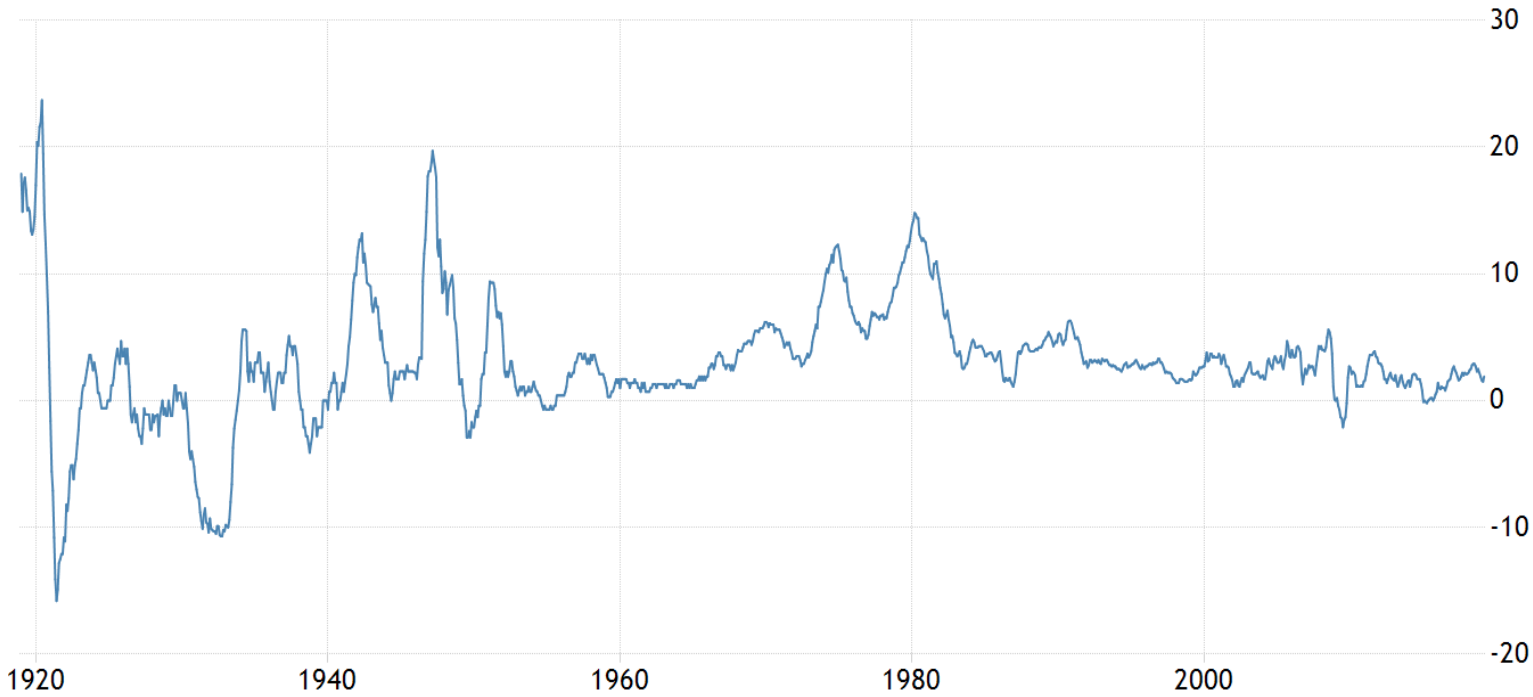


Note: **Since 1990** inflation, in general, has been **roughly stable at a lower level**. (Except for the year when great recession happened.)

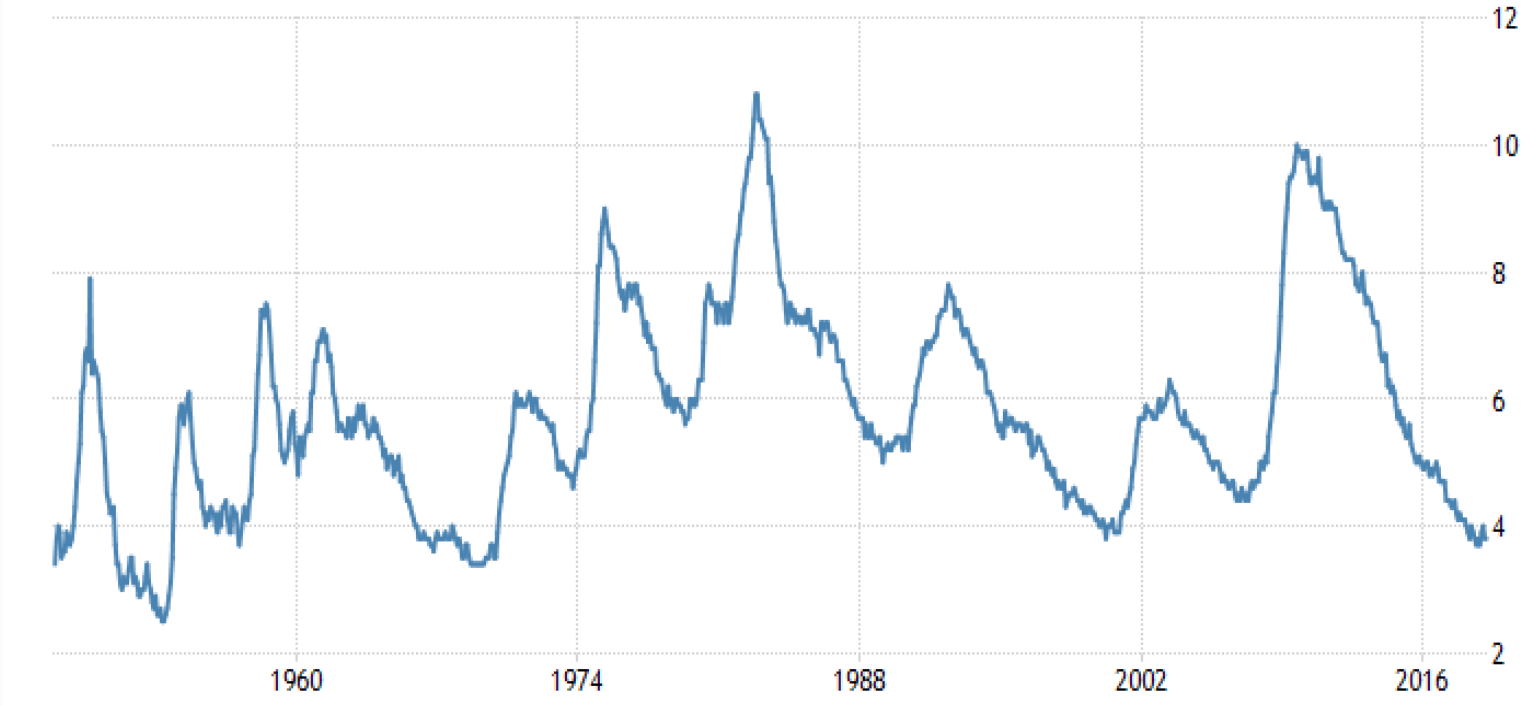
Inflation History

How do you think **people formed their expectations for inflation before the 60s**?

- **Before 1960** (when Phillips Curve was first discovered), inflation was positive in some years and negative in others, on average it was around zero.
- It is reasonable for people to expect that **inflation will be equal to zero over the next year** as well.

Phillips Curve

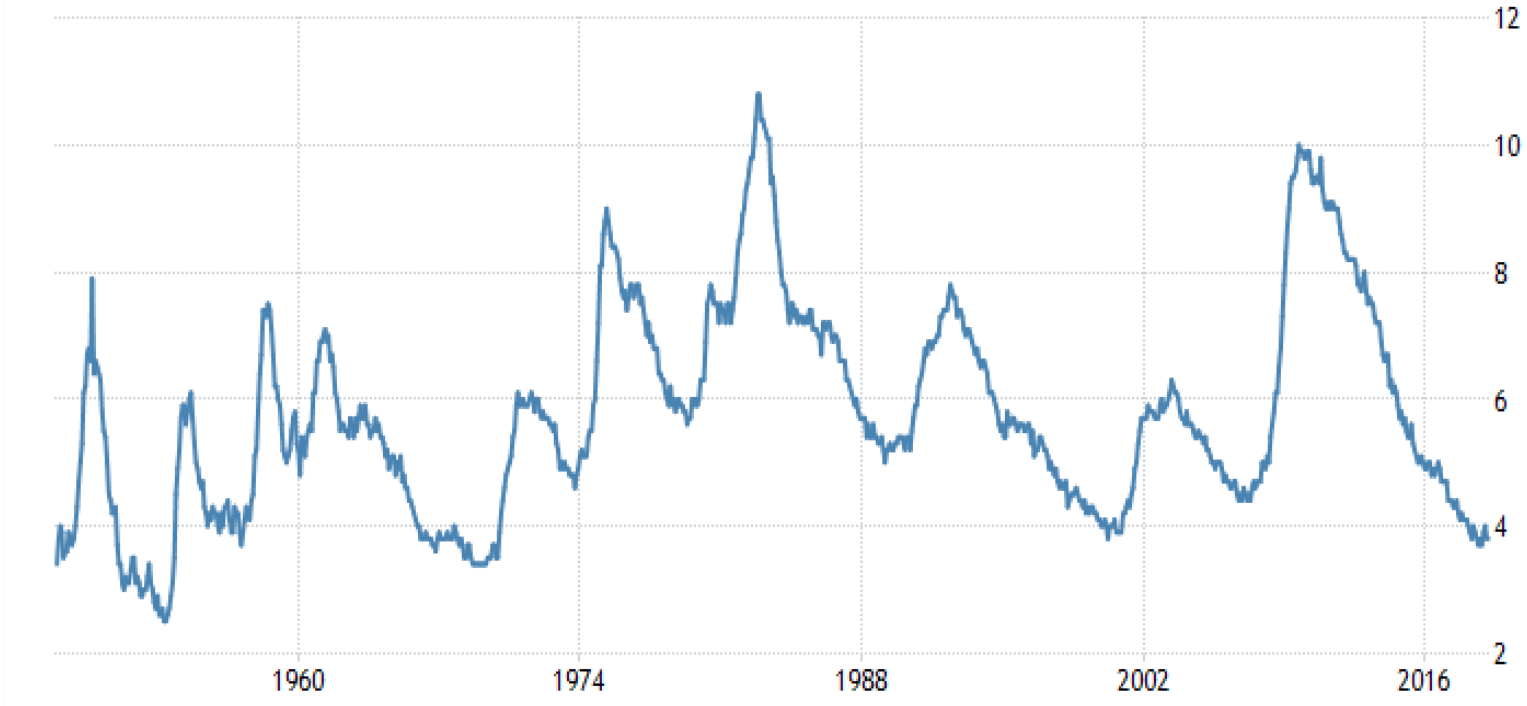
Unemployment History



Note: **During the 70s** hit twice in the 1970s by **a substantial Increase in the price of oil**. The unemployment rate increased.

Phillips Curve

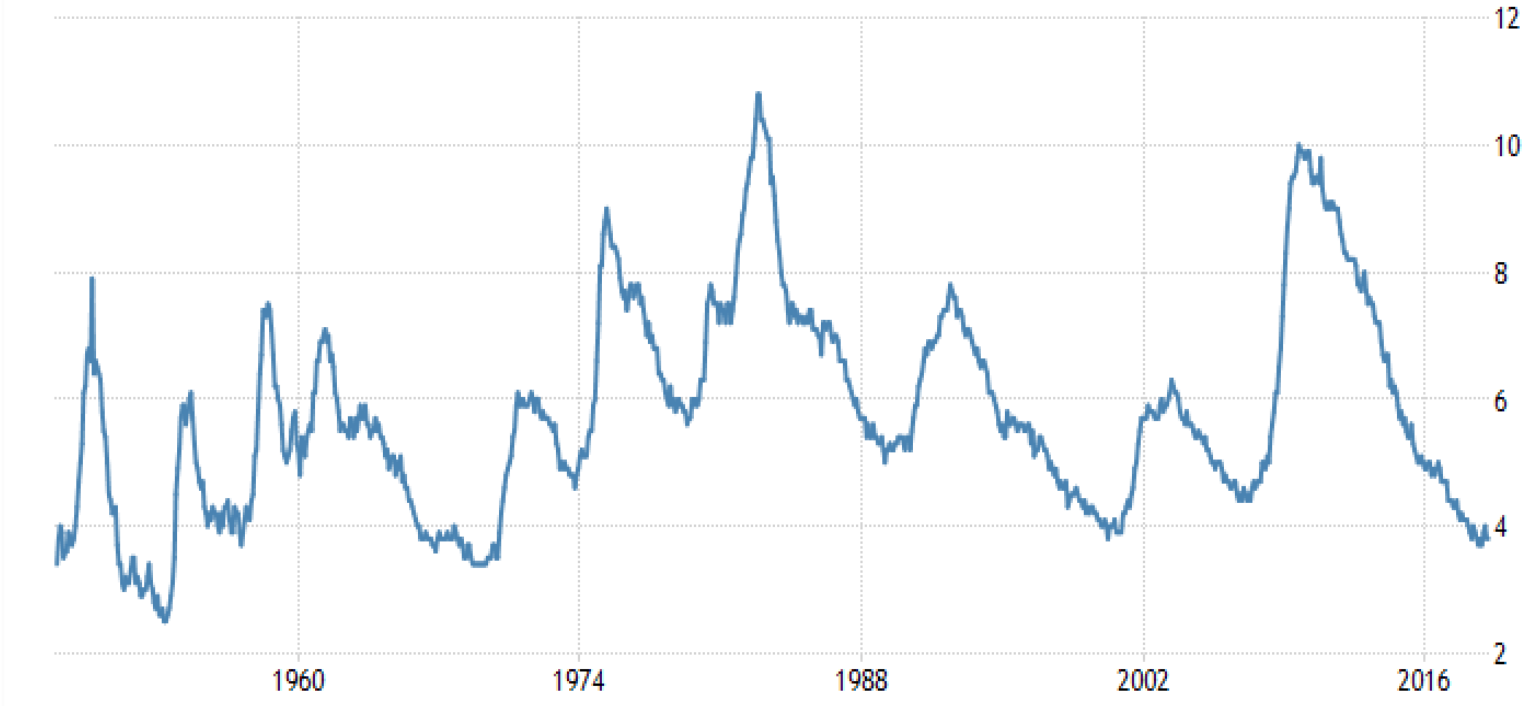
Unemployment History



Note: **In general**, we can see that there is a **bussiness cycle** in terms of the unemployment rate.

Phillips Curve

Unemployment History



Note: **In general**, we can see that there is a **bussiness cycle** in terms of the unemployment rate.