

## Unit 15 Inflation, Unemployment, & Monetary Policy

In this unit we will introduce price dynamics. This is the final extension that we will make to our model of the macro economy. By the end of the unit you will be able to discuss the 3 key outcomes that reside at the core of Macroeconomics- what determines the value and fluctuations of employment, output, and prices.

Recall, in last week's lecture from unit 14 we used the multiplier model to solve for output and employment, both of which are determined by the level of aggregate expenditures. In unit 9, we solved for the equilibrium level of employment, this is the level of employment that generates stable prices, not the actual level of employment experienced by the economy. What remains is the determination of prices to which we now turn.

Spoiler alert, when employment determined by the multiplier model is greater than the equilibrium level of employment determined in the labor market, positive price pressures emerge.

When the actual level of employment is greater than the equilibrium level, there is a gap between the  $wsc$  and the  $psc$ . The gap that exists between the  $WSC$  and  $PSC$  is the bargaining gap and represents inconsistent claims on output.

When unemployment is low, the wage goes up. Holding the markup constant, the higher wage is translated into higher costs.

The final piece of the story we introduce in this unit is to make explicit the role of the central bank. The central bank is an inflation targeting regime who uses the interest rate to guide the economy towards the level of employment which generates stable prices.

### A. Introduction

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#### The context for this unit

Last week we studied the role of the government in addressing the instability that plagues the capitalist system. Fluctuations in expenditure drive fluctuations in output and employment, and as we will see in this lecture, fluctuations in output also affect prices.

Keep these questions in mind as we progress through the lecture.

#### This unit

The key concepts that we will study are inflation and its effects on the economy, the empirical relationship between inflation and unemployment, the role of monetary policy in addressing fluctuations in the economy, and how communication from the central bank can influence expectations.

### B. Inflation

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## Inflation: key concepts

The first three definitions refer to rates of change in the price level- that is, prices increased by 2% this period; while disinflation refers to a change in the rate of inflation: prices increased by 1% less than the previous period.

## What's wrong with inflation?

The fed has explicitly stated that they want to achieve 2% inflation, but if they chose 3,4, or 5% it would not make too much difference. The most important thing is that prices increase at a stable rate. Uncertainty is problematic for many important decisions that must be made in a capitalist system; thus, stability is more important than the whether the rate of inflation is 2% or 6%.

## What's wrong with deflation?

Deflation is much more problematic than inflation. Deflation reduces expenditure through its impact to asset values and the reduction to household's actual wealth relative to their target; deflation also impacts the financial sector's decision about extending credit. Recall that the interaction between lender and borrower is a principal agent problem. TO align interests, the principal often requires collateral, but if asset values are falling how do you think that would impact the behavior of the financial sector?

## Causes of inflation

Here we are looking at our model of the aggregate labor market. This model determines the equilibrium level of employment- the level of employment which generates stable prices. Our presentation of inflation comes from a political economy framework- distribution between labor and capital is a conflictual process, it is a social interaction beset by power dynamics.

For each of the three scenarios, assume that the actual employment, as determined in the multiplier model, is equal to the equilibrium level of employment in the labor market. When actual employment equals equilibrium employment, prices are stable.

In scenario 1, the price setting curve shifts. With labor as the only input, there are two situations where the psc will shift- a change in the apl and a change in the markup. Here we assumed an increase in the markup which shifts the psc down. Holding employment constant, price stabilizing employment is now lower, the wsc is above the psc which generates positive price pressures. When the wsc is above the psc, the wage necessary to motivate labor is greater than the profit maximizing real wage. To keep labor in line, making sure the rent is sufficient, the capitalists raise the wage. However, price is determined as a markup over cost, so if costs which includes wages goes up, so too do prices.

In scenario 2, the wsc shifts. Anytime employment rent changes that is not due to a change in the unemployment rate, the wsc will shift. In this example we assumed that the employees power increased relative to the employers. The equilibrium level of employment is now lower than before. Again, holding employment constant, we have the wsc above the psc and positive pressures on prices.

In scenario 3, we have a change in the actual level of employment due to a change in AD. Here we assume a positive shock to expenditures which shifts the AD line up, increasing output and employment. At the new level of employment, the Wsc is above the psc and we have upward pressure on prices.

## C. The Phillips Curve

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### Inflation and employment

Our model predicts that as employment rises so too will prices. Here we can see that our model is consistent with the empirical evidence.

### Inflation and AD

In the previous slide we saw the empirical relationship between employment and inflation. But what determines employment, that's right aggregate demand. when AD is high, employment is high. High employment reduces the employment rent and so employers must pay higher wages to re-establish the employment rent. Our assumption that labor is the only input means that increases in wages causes a proportional increase in prices so that the real wage stays constant and a wage-price spiral causes persistent inflation.

### Stale price level

Here we are looking at the model of the aggregate labor market. The equilibrium employment determined here represents the inflation stabilizing rate of employment. It is only at the equilibrium level of employment that the capitalists claim to the product of labor plus labors claim to its own product equals the actual product. If actual employment diverges from equilibrium, then forces emerge which results in changing prices.

### Bargaining gap

When the claim to the product of labor by the two groups- labor and capital- is not equal to the actual product, a bargaining gap emerges. When the actual employment lies to the right of the equilibrium, there is a positive bargaining gap and inflation follows. If the actual level of employment resides to the left of the equilibrium, a negative bargaining gap emerges and either deflation or disinflation follows. Only when actual employment equals equilibrium employment are prices stable.

### Philips curve and the business cycle

The Philips curve represents the empirical relationship between employment and prices. Correlation is not causation. The Philips curve only represent the positive correlation which is observable between employment and prices.

When AD is at the normal level, passing through point A we have actual employment equal to the equilibrium and stable prices. If AD is high, passing through point B, then actual employment is greater than the equilibrium. In this scenario, the wsc is above the psc, a positive bargaining gap emerges, and inflation follows.

Can you describe what happens when AD is low and passes through point C?

## Philips curve over time

Here we can see that the empirical relationship between employment and inflation is not stable. Why? Because expectations matter. We will treat expectations as adaptive, whatever inflation was last period is what you expect inflation will be this period. If we find ourselves in a situation where actual employment is greater than the equilibrium level and stays there period after period, then inflation will accelerate with each period.

## Role of expectations

Expectations will cause the Philips curve to shift because we have now defined inflation to be equal to expected inflation + bargaining gap. At the labor market equilibrium when unemployment = 6%, there is no bargaining gap and inflation = expected inflation of 3%. However, if AD was high and unemployment was at 3% so that we have a 2% bargaining gap, then inflation = expected inflation of 3% + bargaining gap of 2%. If we stayed at 3% unemployment, then next period our expected inflation is revised upwards to 5%, but actual inflation equals the expected inflation plus the bargaining gap of 2%. In this scenario, the claims to the product of labor continues to exceed the actual product and inflation increases.

## Causal chain of inflation

Familiarize yourself with the causal chain for what is called cost-push inflation: this type of inflation results from rising costs.

## Expected inflation and bargaining gap

Here we assume that a bargaining gap of 2% emerges at time period 1 and persists at least through time period 6. Inflation rises every period because the previous periods inflation feeds into expected inflation and therefore into wage and price inflation.

## Supply shock

When we are playing in the labor market, we are holding the level of output, income, and employment constant- nothing is changing in the multiplier model. Holding actual employment constant, a supply shock will shift the psc and will affect price dynamics. Assume that actual employment is equal to the equilibrium value A. Then we introduce a supply side shock that comes in the form of an increase in the cost of an input to production. The psc shifts down and the new equilibrium employment is less than the actual employment and positive price pressures result.

What's that you say....that's right we have introduced another input besides labor. We will now consider how the model changes when we include a second input- an imported good.

## Video: change in price with second input

Price is determined as a markup over cost

- $p = (1 + m)(unit\ costs)$

Holding the markup constant at say 10%, then this equation tells us if the unit costs is \$3 then the price is \$3.3. If unit costs increase 5% then the price will increase 5%, it is proportional.

Now assume that we now use labor and imported material in the production process. In terms of distribution, we now have three groups in conflict over their claim to the product of labor. This change also raises the question what happens to the price when only one part of costs changes, like say an increase in the cost of imported goods.

- $p = (1 + m)(umc + ulc)$

The percentage change in price is equal to the percentage change in total unit costs

- $\frac{dp}{p} = \frac{(1+m)d(umc+ulc)}{(1+m)(umc+ulc)}$
- $\frac{dp}{p} = \frac{dumc}{(umc+ulc)} + \frac{dulc}{(umc+ulc)}$
- $\frac{dp}{p} = \frac{dumc}{uc} + \frac{dulc}{uc}$

Now multiple all terms by 1

- $\frac{dp}{p} = \frac{dumc}{(umc+ulc)} \left(\frac{umc}{umc}\right) + \frac{dulc}{(umc+ulc)} \left(\frac{ulc}{ulc}\right)$

$$\frac{dp}{p} = \frac{dumc}{umc} \frac{umc}{uc} + \frac{dulc}{ulc} \frac{ulc}{uc}$$

The percentage change in price is equal to the percentage change in imported material (umc) times its share of unit costs (umc/uc) plus the percentage change in labor costs times its share in total costs

Question: let m=60% uc=\$5 ulc=\$4 umc=\$1

Price = 1.6\*5=\$8. wages = 80% of costs, if wages increase by 10% price rises by 80%\*10%=8%.

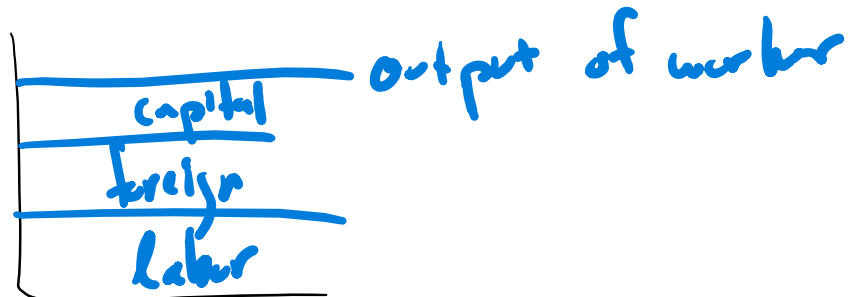
Uc = 4.4+1=5.4 and price = 1.6\*\$5.4=\$8.64

## Video: Additional input and price setting curve

- $ulc = \frac{W}{q}$
- $q$  is unit of output per worker
- $uc = umc + ulc$
- $\mu = \frac{P - umc - ulc}{P}$

share of the price that goes to the capitalists in the form of profits, but now we have an additional group who lays claim to the output of the worker, q must be divided between labor, capital, and the foreign sector

- $\mu = 1 - \frac{umc}{P} - \frac{ulc}{P}$
- $\mu = 1 - \frac{umc}{P} - \frac{W/q}{P}$



- $\frac{W}{P} = q(1 - \mu - \frac{umc}{P})$

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## Oil price shocks and inflation

Now that we have seen how this shock will affect the psc algebraically, let's look at it one more time graphically. We start at pt. A and assume an increase in the price of oil- positive shock to imported material. Both the output of the worker and markup are being constant, this means that the share going to the capitalist is not changing, the share to foreign sector is increasing, so then what must happen to the share going to labor. That's right it decreases, the psc shifts down and the new equilibrium employment is lower than the previous. If actual employment was equal to the previous equilibrium, then we would now have a positive bargaining gap.

## D. Monetary policy

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### Transmission mechanism

In the US, the federal reserve is in charge of monetary policy. The fed has a dual mandate to maximize employment and stabilize prices. By maximum employment, what I really mean is to move our economy as close as possible to the level of employment which stabilizes prices- the equilibrium value determined in the model of the labor market. One of their primary tools is control of the interest rate. What channels does the interest rate operate through to affect inflation.

We have seen in previous units that the interest rate will affect expenditure decisions of AD, specifically I and C.

When the interest rate goes down, financial asset prices rise and vice versa.

The fed also practices forward guidance, by being transparent and through calculated communication, the fed tries to manipulate expectations. Recall that investment is much more sensitive to changes in expected profitability than changes in interest rates. Consumption also depends on expectations- specifically the autonomous component.

We will go through each of these in more detail in the slides that follow.

### Market interest rates

IF the fed uses the interest rate in attempt to guide our economy towards the price stabilizing rate of employment, how does it decide what interest rate it set.

It works backward. What level o expenditures will yield the desired employment, then determine what interest rate is necessary to achieve that level of spending.

## Financial asset prices

The interest rate controlled by the fed influences all interest rates in the us financial system. There exists a negative relationship between interest rates and financial asset prices.

If the fed drops the interest rate, asset prices rise. Households who own assets will experience an increase in their actual wealth relative to their target. The change in their wealth will affect their spending, when actual wealth rises, the autonomous component of expenditure will increase, and consumption expenditure rises.

## Profit expectations

Consider the multiplier model. Assume a negative shock to consumption which lowers AD. The fed responds by lowering the interest rate.

The lower interest rate will cause a movement along the investment function and increase investment. But remember, investment is not very sensitive to changes in the interest rate. This is why the fed also tries to be consistent and use communication to influence expectations. A change in the expected profitability of investment yields a much larger impact on AD than a change in the interest rate.

## Monetary policy in the multiplier model

Here we see a negative shock and the fed responding with lower interest rates to stimulate spending. Do not be fooled into thinking that the economy is such a simple beast. First of all, there are all kinds of noisy signals which make it difficult to discern if a shock represents a temporary blip or is suggestive of a long-term structural weakness. Rather these models are intended to help us understand causal links and which policies may be warranted.

## Monetary policy limitations

There are limitations to monetary policy. What can the fed do in a situation like our current one where the interest rate is already at 0? The fed has other tools it can use to stabilize the economy. One of these tools is quantitative easing. QE is a balance sheet operation in which the fed purchases financial assets. It is essentially asset swap between the fed and commercial banks, the fed receives a financial asset like a mbs and the bank receives base money. The balance sheet of the banks swells with reserves. Like slashing the interest rate, QE intends to encourage spending by increasing the reserves held by banks with the hope that banks will increase lending. There are two problems with this. First, as the saying goes you can lead a horse to water, but you can't make it drink. However, the bigger problem is that banks do not lend reserves to household's or firms. Increasing reserves will not increase lending, as banks have already made all the loans, they were willing to make to their credit-worthy borrowers. In the extraordinary circumstance we find ourselves in now, the fed is also able to lend.

Let me be clear, the fed has lending power, not spending power.

## Video: J. Powell on Covid & Monetary Policy

<https://www.federalreserve.gov/newsevents/pressreleases/monetary20200323b.htm>

<https://youtu.be/9iKLpbMk5Ko>

## Inflation targeting

The federal reserve operates as an inflation targeting regime. Congress has granted the fed independence which allows them to operate much more quickly and free from political concerns.

## Capacity constraints

We have talked about a tradeoff between inflation and employment. But recall that this empirical relationship, referred to as the Philips curve, is not a stable relationship. Inflation is not and has not been a primary concern of policy makers for over a decade. Since the great recession, the fed struggled to reach their 2% target even with the extremely low unemployment rates we had before the covid pandemic, inflation was barely above the target.

## Summary

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