Topic 4 : Medium-Term Analysis

EE312 Section 046402

Read: Mankiw Ch.5, 15

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Contents

1 Stylized-fact of inflation

1.1 What are the Stylized-facts?

Inflation is a rise in general price level. i.e. if price level is increasing at a constant rate, inflation rate is constant.

Stylized fact 1 : Positive (average) inflation is a global phenomena

- average inflation rate is positive; overtime, cost of living has increased.

Stylized fact 2 : Inflation outcome has varied across countries

- Inflation rates among the advanced economies have been lower than those in emerging markets
- Lower average inflation rate tends to be associated with lower inflation volatility

Stylized fact 3 : Declining trend of infltion rate has been a global phenomena

- Inflation rate has slowly declined among different countries; average inflation during the 2000s has been much lower than that of before 2000s

Stylized fact 4 : Along with declining trend, inflation volatility has reduced too

- Since 2000, most countries have been successful in maintaining the price stability, i.e. achieving low and stable inflation rate.

Stylized fact 5 : CPI inflation exhibits some cyclical patterns

- From business cycle perspectives, actual inflation rate moves around (downward) trend and positively related to output gap

  $P = sP^e + \frac{(1-s)}{s}[a(Y - \bar{Y})]$

- Core inflation is less volatile than headline inflation
- Both core and headline inflation are positively related.

1.2 Stylized-fact : Key Questions?

Based on the facts, economists aim to explain the cause and process of inflation from two perspectives.

1. Long-run perspective :
   - What drive the average inflation? (Quantity theory of money)
2. Business cycle perspective :
   - How to explain the cyclical relationship of inflation? (Phillip relation)
   - What explain the moderation in the inflation rate and inflation volalilty? (Good luck/ Good policy/ Secular factors)

2 General Theory of Inflation : Long-run perspective

2.1 The Quantity Theory of Money

How do economists explain the long-run (sustained) inflation?

- In the long-run, economists "strongly" believe that money growth drives the "sustained" inflation rate.
- The famous theorem used to explain the average inflation is the quantity theory of money.

$$M \times V = P \times Q$$

$$\%\Delta M - \%\Delta Q = \%\Delta P$$

- "Inflation is always a monetary phenomena. This usually occurs when money growth is higher than output growth."

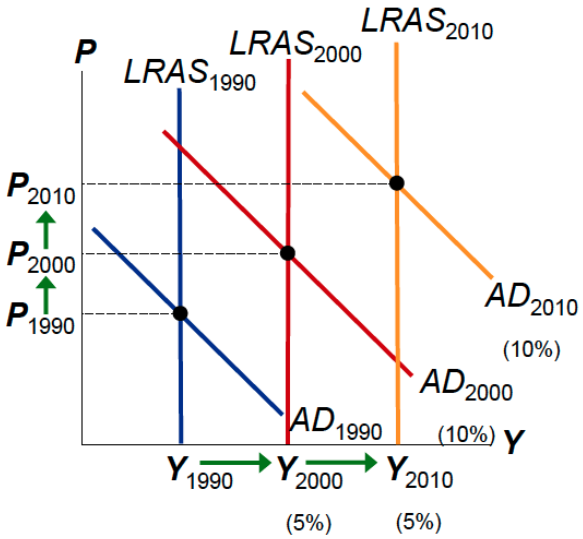
2.2 AD-AS model and Long-Run Inflation

1. Constant money growth; contant inflation rate

Over the long-run, technological progress shifts LRAS to the right

and growth in the money supply shifts AD to the right.

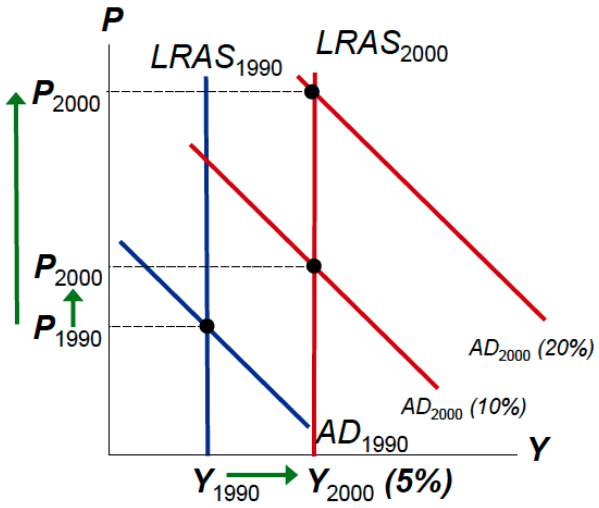
Result : ongoing inflation and growth in output.



2. Higher money growth; Higher inflation rate

With higher money growth, AD grows more over time.

Result : "Higher" long-term inflation .



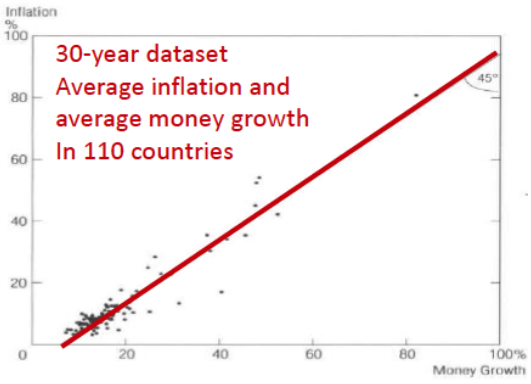
2.3 How well does the theory explain facts?

- The answer depends on time horizon; how long is the long-run?
- Adjusted money growth is defined as money growth minus real GDP growh.
- For long horizon data, many studies with cross-country comparison confirm the validity of the quantity theory.

Chart 1

Money Growth and Inflation: A High, Positive Correlation

Average Annual Rates of Growth in M2 and in Consumer Prices During 1960–90 in 110 Countries



Source: International Monetary Fund

Table 1

Correlation Coefficients for Money Growth and Inflation*

Based on Data From 1960 to 1990

Sample	Coefficient for Each Definition of Money		
	M0	M1	M2
All 110 Countries	.925	.958	.950
Subsamples			
21 OECD Countries	.894	.940	.958
14 Latin American Countries	.973	.992	.993

*Inflation is defined as changes in a measure of consumer prices.
Source of basic data: International Monetary Fund

- Money growth positively correlates with inflation rates.

3 Business Cycle Perspective and Inflation Dynamic

- Inflation dynamic concerns with the movement of inflation rate over the course of business cycles
- The famous theorem widely cited to explain the inflation dynamic is the Phillips relation.
  - negative relation between inflation and unemployment
- The relation was one of the most controversial issues in economics
  - is the negative relation stable? Policy implications?
- Nowadays, old debates seem to be settled, but now being replaced by other newer debates.
  - puzzle after the Global Financial Crisis: why has the negative relation between inflation and unemployment been less strong?

The New York Times

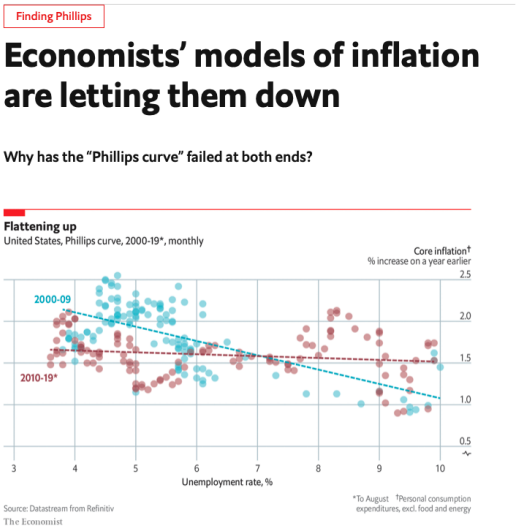
ECONOMIC VIEW

Yes, There Is a Trade-Off Between Inflation and Unemployment

Tim Cook

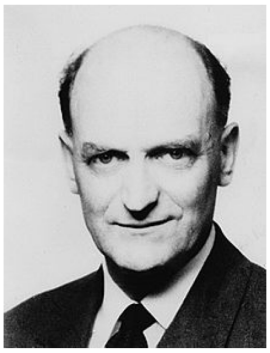
By N. Gregory Mankiw

Aug. 9, 2019



3.1 A brief history of theory of inflation dynamic

Phillips relation : comovement between inflation and " real economic activities". The relation was first mentioned in 1958 by A.W. Phillips

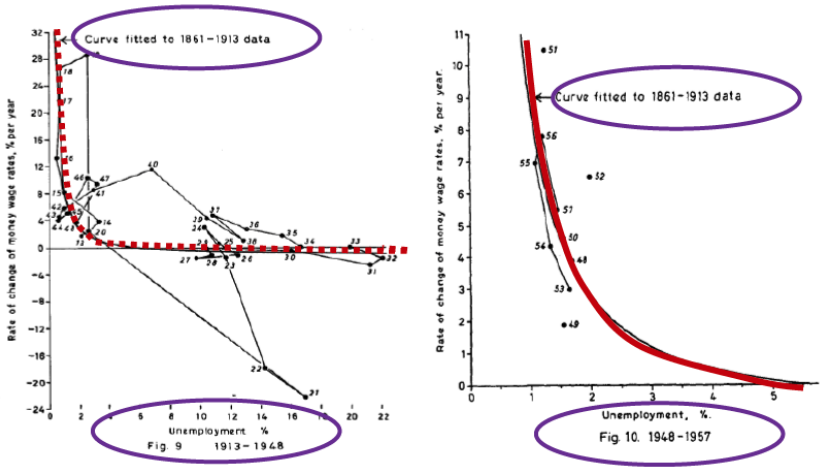


Alban William Phillips (1914-1975), the London School of Economics.

- He discovered the inverse relationship between the rate of unemployment and the rate of increase in money wages.
  - wage inflation decreases with unemployment rate
- Studies based on the UK data for 1861- 1958
  - the relation has been highly stable

- What do we mean by the highly stable relation?

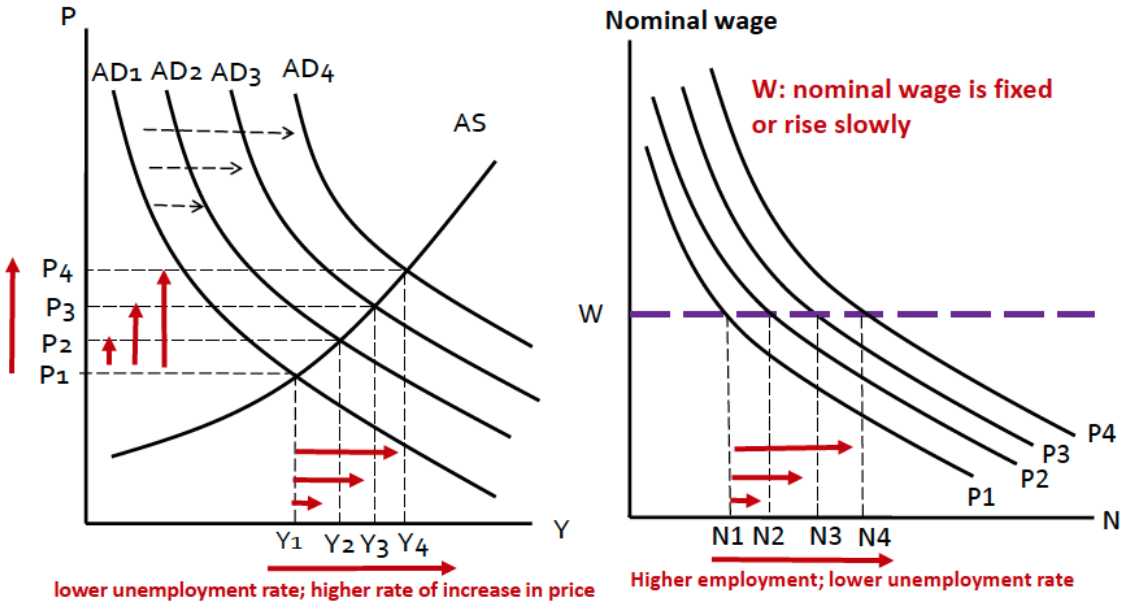
  >> : highly predictive (forecasting) performance



- The name "Phillips curve"
  - 1960 Paul Samuelson and Robert Solow found a similar relation in the US data for 1900 - 1960.
  - To give the credit to Phillips the relation is dubbed "the Phillips curve"

3.2 Keynesian Interpretation : Phillip Curve

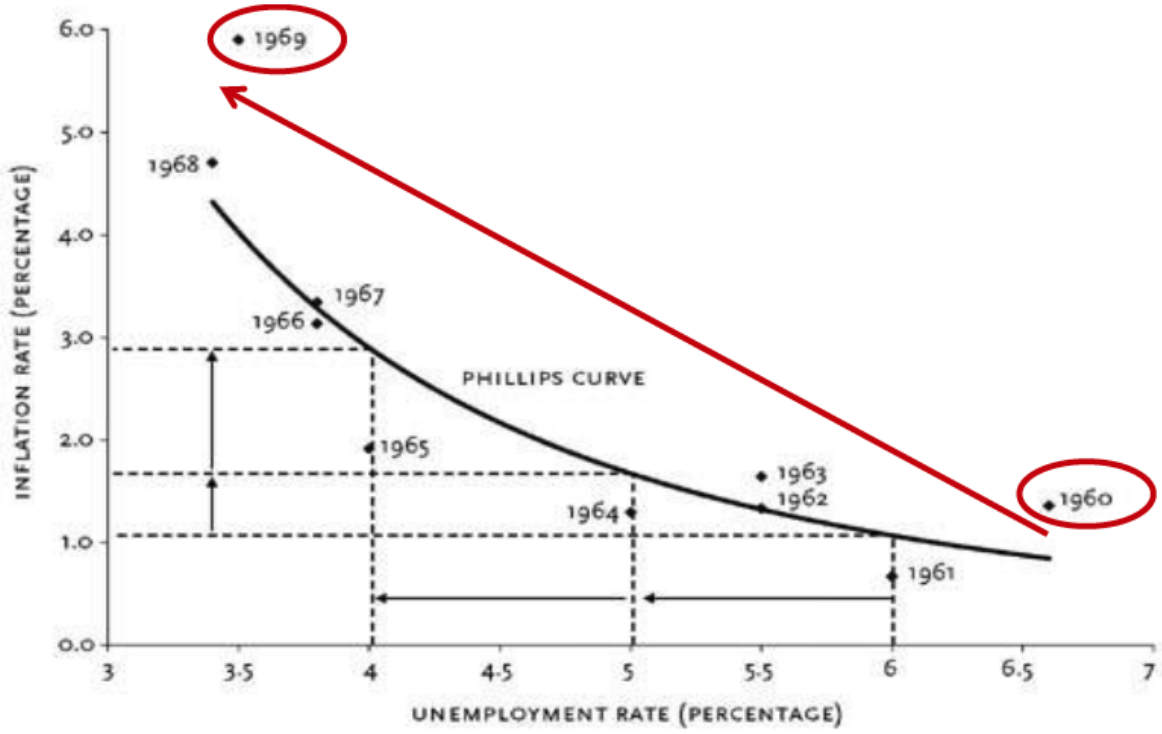
- Keynesian economist interpreted the Phillips relation using the nominal rigidities concept; demand-pulled effect



3.3 How important was the discovery of Phillips relation?

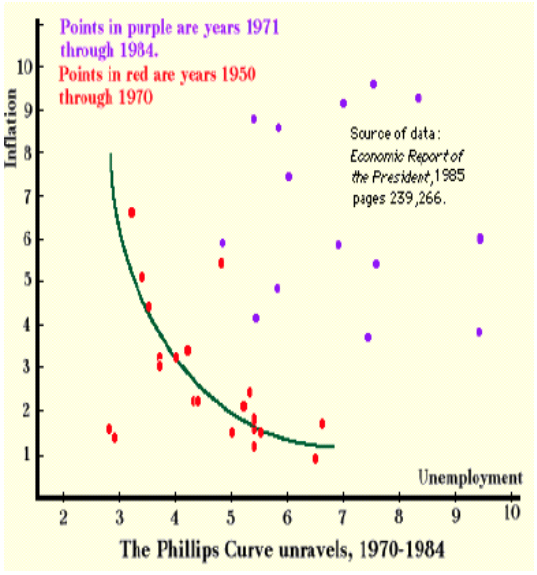
The discovery greatly influenced the thinking paradigm of many policy makers; they became more interventionist.

- Because of the negative relationship, economists, as well as policy makers, believed in the trade-off between *inflation and unemployment*
  - Higher unemployment $\rightarrow$ Lower inflation
  - Lower unemployment $\rightarrow$ Higher inflation
- The trade-off is permanent and can be exploited
- Policymakers can choose between different *combinations of inflation and unemployment*, based on *preferences*.
  - (oberved) Outcomes determined by preference.
  - During the 1960s, policymakers exploited the trade-off, and pursued aggressive expansionary policy, i.e. pro-growth policy


1969
1968
1967
1966
1965
1964
1963
1962
1961
1960
PHILLIPS CURVE
INFLATION RATE (PERCENTAGE)
UNEMPLOYMENT RATE (PERCENTAGE)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3
3.5
4
4.5
5
5.5
6
6.5
7

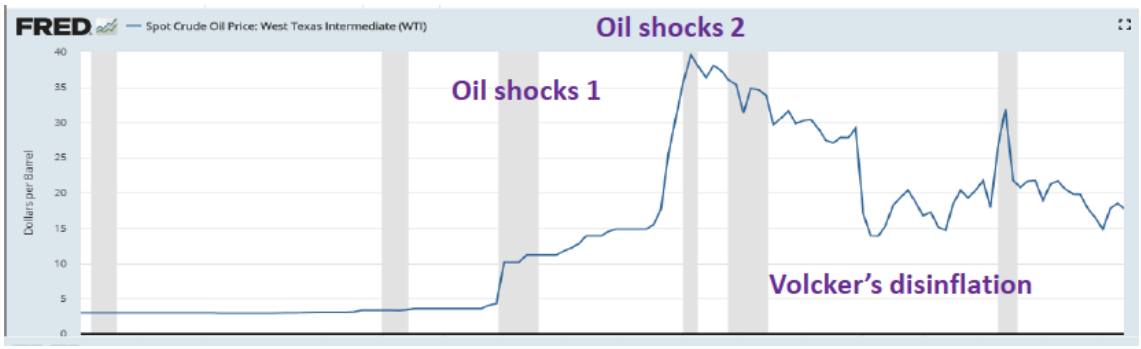
3.4 The Breakdown of Phillips curve : Oil shocks

- 1970s was a good test for the Phillips curve; unfortunately Phillips relation had seemed to have a wreckage at the first place

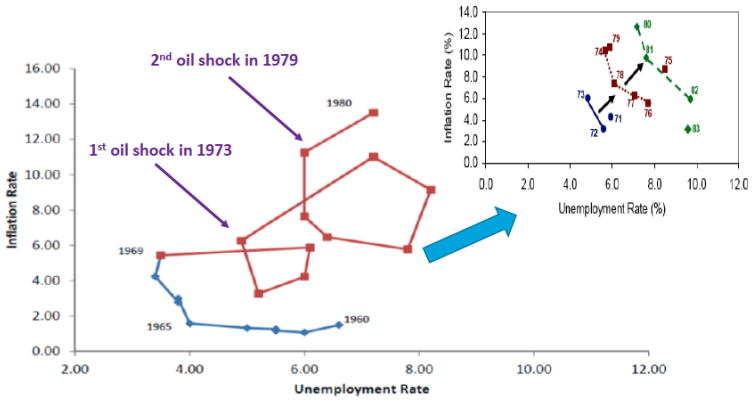


- High inflation and high unemployment – stagflation
  - oil price hikes by the OPEC
  - inflation rises and high unemployment
- Should't this be obvious? The stagflation? Why break down?

- Even the oil price had reached its new stable high with no further increase, and the recession had been over, inflation rate did not come down.



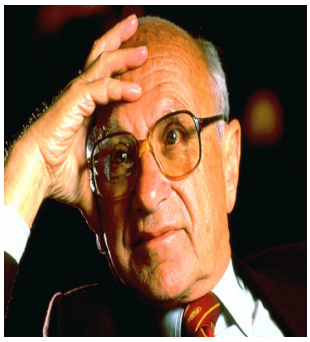
- There seemed to be an inflation spiral during the 1970s; this suggested thatthe concept of inflation might be more complicated than economists though they had known.



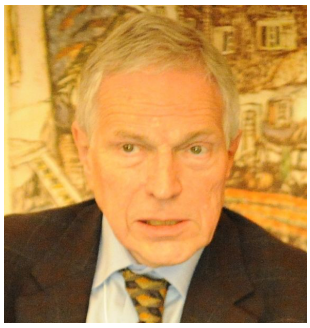
3.5 The Expectation-Augmented Phillips curve.

3.5.1 The Rise of expectation-augmented Phillips curve.

- Some economist had earlier warned that the Keynesian-based Phillips relation, and the conception on permanent tradeoff may be superficial.



Milton Friedman (1912-2006), University of Chicago Nobel Prize 1976.



Edmund S. Phelps, Jr. (b1933), Columbia University Nobel Prize 2006.

- The accelerating inflation during 70s was the result of the misconception on the knowledge of inflation dynamic.
- Friedman and phelps argued that there had been No sunc thing as a permanent tradeoff; the tradeoff exists in the short-run, but cannot be exploited.
- Friedmand and Phelps argued for the role of the natural rate of unemployment and inflation expectation as additional factors that importantly explain the inflation dynamic.

3.5.2 The expectation-aumented Phillips curve: Equation

The Phillips Curve states that π depends on

1. Expectation, π^e
2. Cyclical unemployment : the deviation of the actual rate of unemployment from the natural rate

$$\pi = \pi^e - \beta(u - u^n)$$

π = the inflation rate at period t
π^e = the expected inflation rate for period t.
u = the unemployment rate at period t
u^n = the natural rate of unemployment at period t

where $\beta > 0$ is an exogenous constant

- if the $\pi = \pi^e$ then $u = u^n$
- if the $\pi > \pi^e$ then $u < u^n$
- if the $\pi < \pi^e$ then $u > u^n$

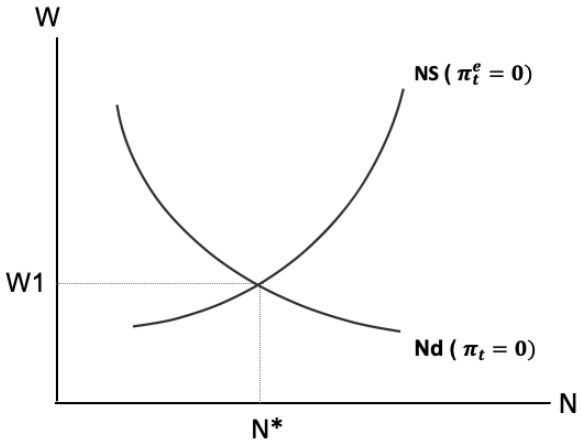
Note : Comparing SRAS and the Phillips curve

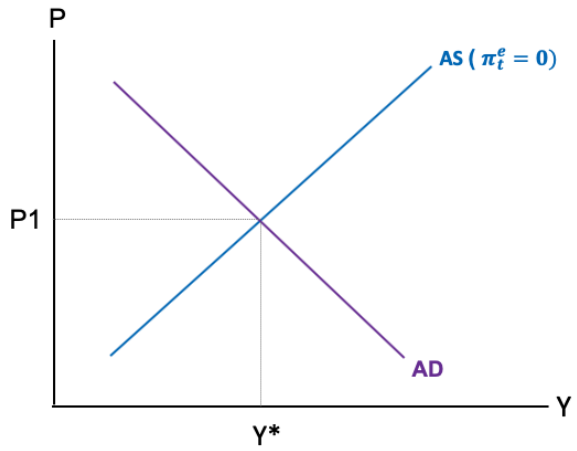
$$\begin{aligned} SRAS: \quad Y &= \bar{Y} + \alpha(P - P^e) \\ P &= P^e + \frac{1}{\alpha}(Y - \bar{Y}) \\ \text{Phillips Curve:} \quad \pi &= \pi^e - \beta(u - u^n) \end{aligned}$$

- SRAS curve : output is related to unexpected movement in the price level.
- Phillips curve : Unemployment is related to unexpected movements in the inflation rate.

3.5.3 The expectation-augmented Phillips curve : Derivation

1. Suppose we started from the natural level (N^*, Y^*)
2. Assume that workers expected a 2% inflation rate, and incorporated the expectation into the wage-setting and labor supply decision. Show the effect on the graphs below.



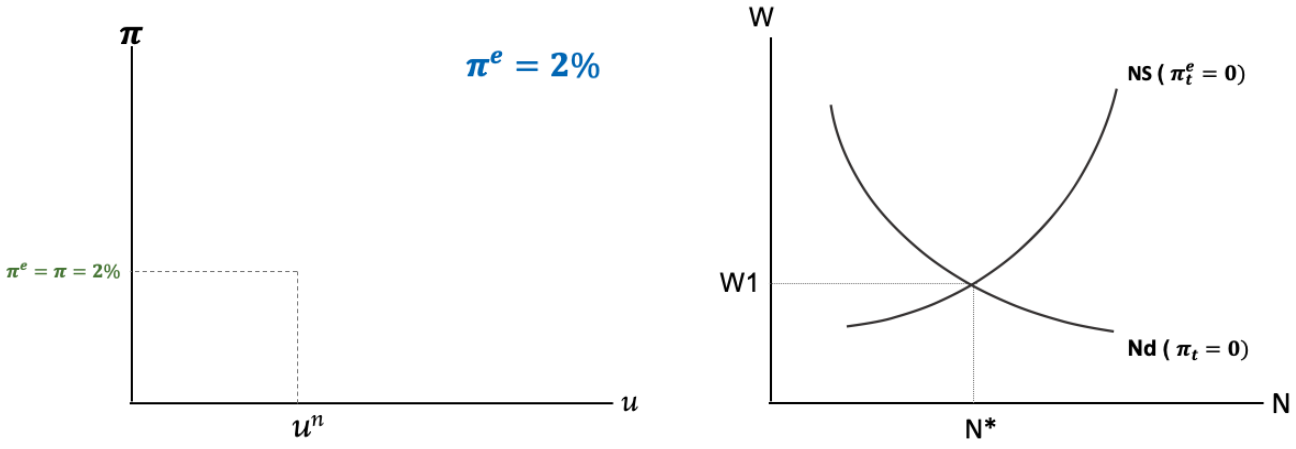


3. Suppose money growth ensure that the actual level of inflation is 2%
4. 2% increase in price will increase demand for labor; real wage is kept the same, and hence the level of employment and output. Show the effect on the graph.
   - For simplicity, suppose the original real wage is equal to "1" and the economy was operating at the natural rate of unemployment.
   - With 2% expected inflation, workers should require for more pay, at least equal to 2%.
   - Recall that higher price will result in higher demand for kabor; if the actual inflatin is also 2%, demand for labor will increase to sufficiently result in a proportionate increase in nominal wage.
   - Economy will continue to produce at the original N^*, i.e. natural rate of unemployment
5. But if actual inflation is 3%, then what?

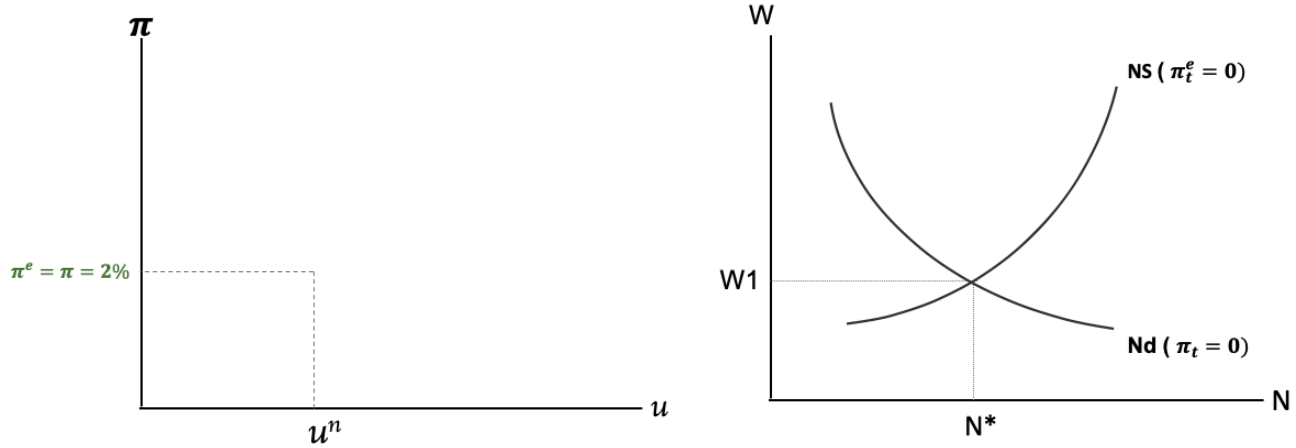
- Show the effect on the graph above.
- Workers were lead to believe that inflation will be 2%; They should have asked for an even more higher pay if they had known about this.
- Real wage is lower than expected.
- Overemployment : $u < u^n$

6. Suppose workers expected 2% inflation rate ($\pi^e = 2\%$). Plot the relationship between inflation and unemployment.

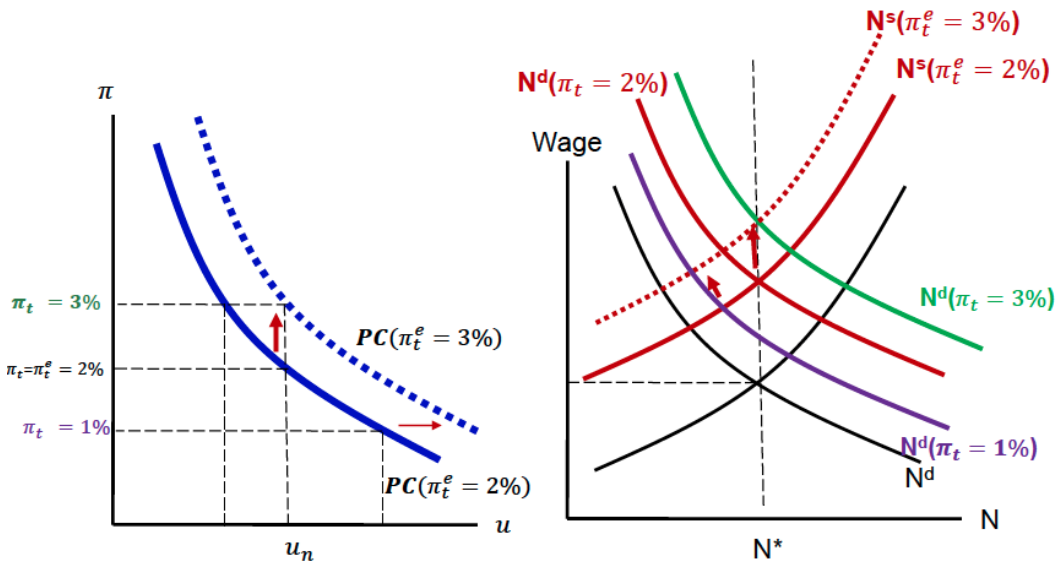
   $\pi = \pi^e - \beta(u - u^n)$



7. Suppose workers's expected inflation rate is higher. Suppose workers expected 2% inflation rate ($\pi_t^e = 3\%$). π^e increases from 2% to 3%. How does this affect phillips curve?

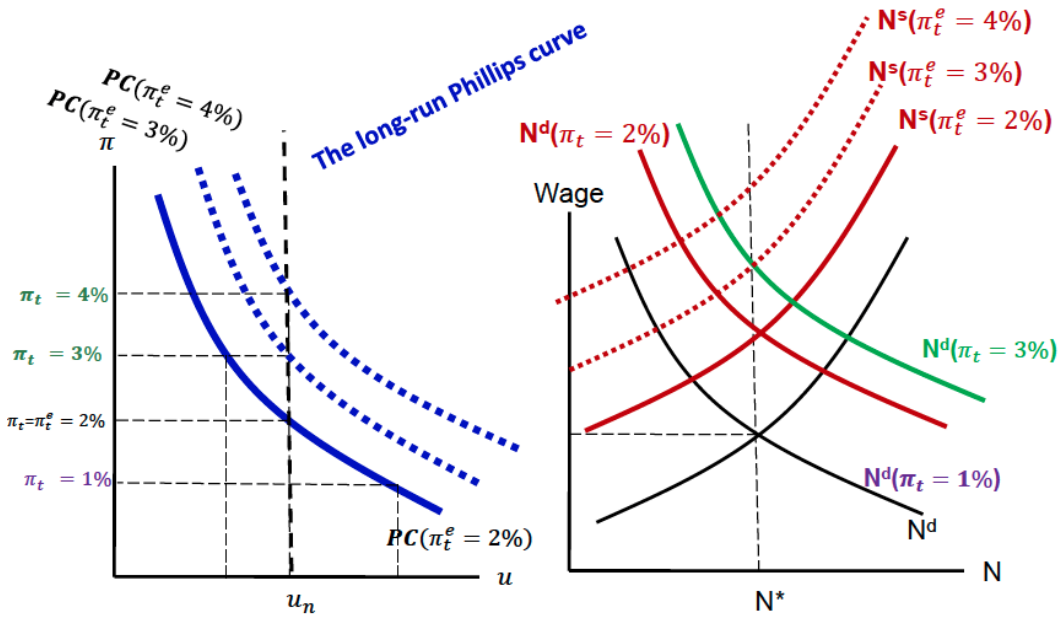


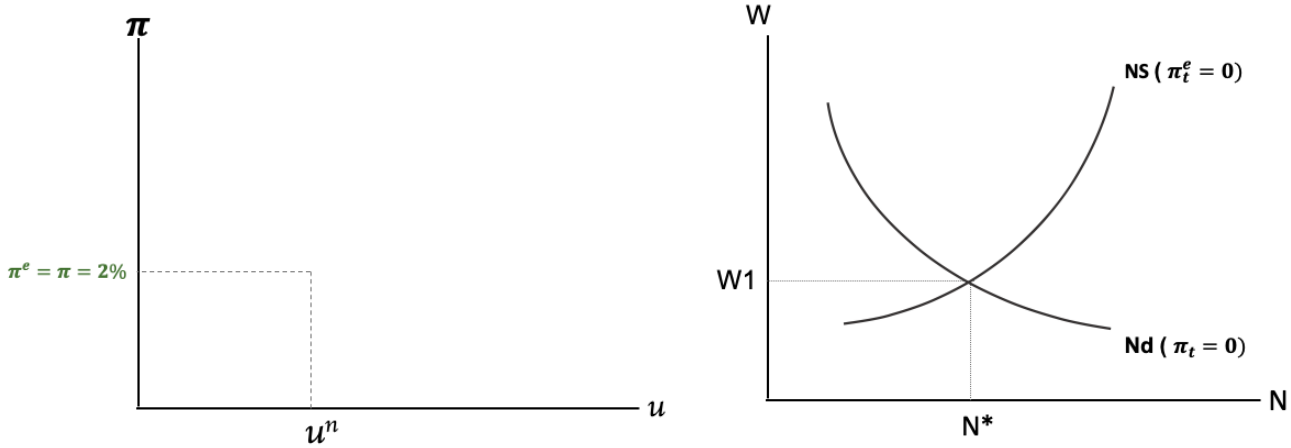
- Higher expected inflation will shift up the Phillips curve; higher unemployment rate for the same actual inflation


π
π_t = 3%
π_t=π_t^e = 2%
π_t = 1%
$PC(\pi_t^e = 3\%)$
$PC(\pi_t^e = 2\%)$
u
u_n
$N^s(\pi_t^e = 3\%)$
$N^s(\pi_t^e = 2\%)$
$N^d(\pi_t = 2\%)$
Wage
$N^d(\pi_t = 3\%)$
$N^d(\pi_t = 1\%)$
N^d
N
N*

3.5.4 The expectation-aumented Phillips curve : Long-run

- Given correct expectation, higher expected inflation will lead to higher inflation; however, the unemployment rate remains the same.





3.6 The Modified Phillips Curve and Adaptive Expectations Hypothesis

3.6.1 Adpative Expectation and the Modified Phillip Curve Equation

- Recall : the traditional Phillips curve

  $\pi_t = \pi_t^e - \beta(u_t - u^n)$

  Adaptive Expectation : (Friedman and Phelps) The agent gradually learns from the past and predicts current inflation based on past inflation – a behavioral-based expectation

  $$\pi_t^e = \theta\pi_{t-1}$$

  where $0 \leq \theta \leq 1$

  Substitute into the traditional Phillips curve equation.

  $\pi_t = \theta\pi_{t-1} - \beta(u_t - u^n)$

The Equation: Modified Phillips curve $\pi_t = \theta\pi_{t-1} - \beta(u_t - u^n)$

  $\theta = 0$: stable relation between inflation and unemployment — traditional Phillips curve.

  $\theta > 0$: current inflation depends on past inflation and unemployment.

  $\theta = 1$: the unemployment rate affects the rate of change in the inflation rate, given u^*.

3.6.2 The Modified Phillips Curve : inflation is near zero, θ is near zero

- The UK and US economies before 1970 had very low inflation, very close to zero.
- Agents are sometimes inattentive.
- So when inflation rate is closed to zero, they don't bother , θ is near zero

  $$\pi_t = \pi_t^e - \beta(u_t - u^n)$$

  $$\pi_t^e = 0$$

  $$\pi_t = -\beta(u_t - u^n) = \beta u^n - \beta u_t$$

- This made the inflation dynamic look very much like a simple downward-sloping relationship between inflation and unemployment rate
- The traditional Phillips curve is valid

3.6.3 The Modified Phillips Curve : $\theta = 1$

- High persistent inflation from 1970
- The case for augmented-expected inflation began to receive the support in 1970s.
- People change the way they form inflation expectations.
- The value of θ was rising quickly and finally close to 1.
- This-year inflation is expected to be the same as last-year inflation.
- The original Phillips curve (and trade-off) broke down.

$$\begin{aligned} \pi_t &= \theta\pi_{t-1} - \beta(u_t - u^n) \\ \theta &= 1 \\ \pi_t - \pi_{t-1} &= -\beta(u_t - u^n) \end{aligned}$$

  - When $u > u^n$, decelerating (decreasing) inflation
  - When $u < u^n$, accelerating (increasing) inflation
  - When $u = u^n$, inflation is constant

- Example : $u^n = 0.25$, $\beta = 0.5$, $\pi_{t-1} = 0.2$

	$u_t = 0.25$
π_t	
π_{t+1}	
π_{t+2}	
π_{t+3}	
....	

	$u_t = 0.25$
π_t	
π_{t+1}	
π_{t+2}	
π_{t+3}	
....	

3.6.4 Implication for policy design

1. Maintaining low inflation is good for the long-term ⇒ **anchoring low expected inflation**.

   - Following the principle 1, inflation is driven by expected inflation.
     $\pi_t = \pi_t^e - \beta(u_t - u^n)$
     $\pi_t = \pi_t^e \quad if \quad u_t = u^n$
   - **Committing to a low inflation rate will bring about a low inflation rate then**.
   - **Why low inflation is good?**
     - Inflation affects consumers' welfare.
       * Price stability is preferred by consumers and firms.
     - Stable price (and low inflation) is favorable to the private sector's smooth growth.
       * High inflation is typically associated with high volatility in inflation rate, followed by costly management to avoid the inflation risk.
     - If negative shocks hit inflation, credible commitment of low inflation would mitigate the impact of negative shocks.
       * Agents believe that it will be temporary. They won't drastically revise their inflation expectation.

2. Rule v.s. discretion

   - To anchor low stable inflation, **monetary policy rules are recommended.**
   - Two competing approaches: Rule V.S. Discretion
     - Discretionary monetary policy is difficult and costly; targets are missed most of the time.
     - Persistent high inflation in the 1970s discredited such policy.
   - Rule-based approach to monetary policy make the way inflation expectation gets anchored much more easier than under the discretion approach.