

**Problem 1.** Potential GDP is defined as:

- (a) the maximum GDP the economy could possibly produce
- (b) GDP produced when the economy is fully utilizing all of its resources
- (c) GDP produced when unemployment is zero
- (d) GDP produced when natural unemployment is zero

**Answer 1: b.** The economy can temporarily produce above potential GDP, but in the long run can only produce potential GDP.

**Problem 2.** Define the following terms:

- (a) cyclical unemployment
- (b) natural unemployment
- (c) frictional unemployment
- (d) structural unemployment
- (e) minimum wage unemployment
- (f) efficiency wage unemployment

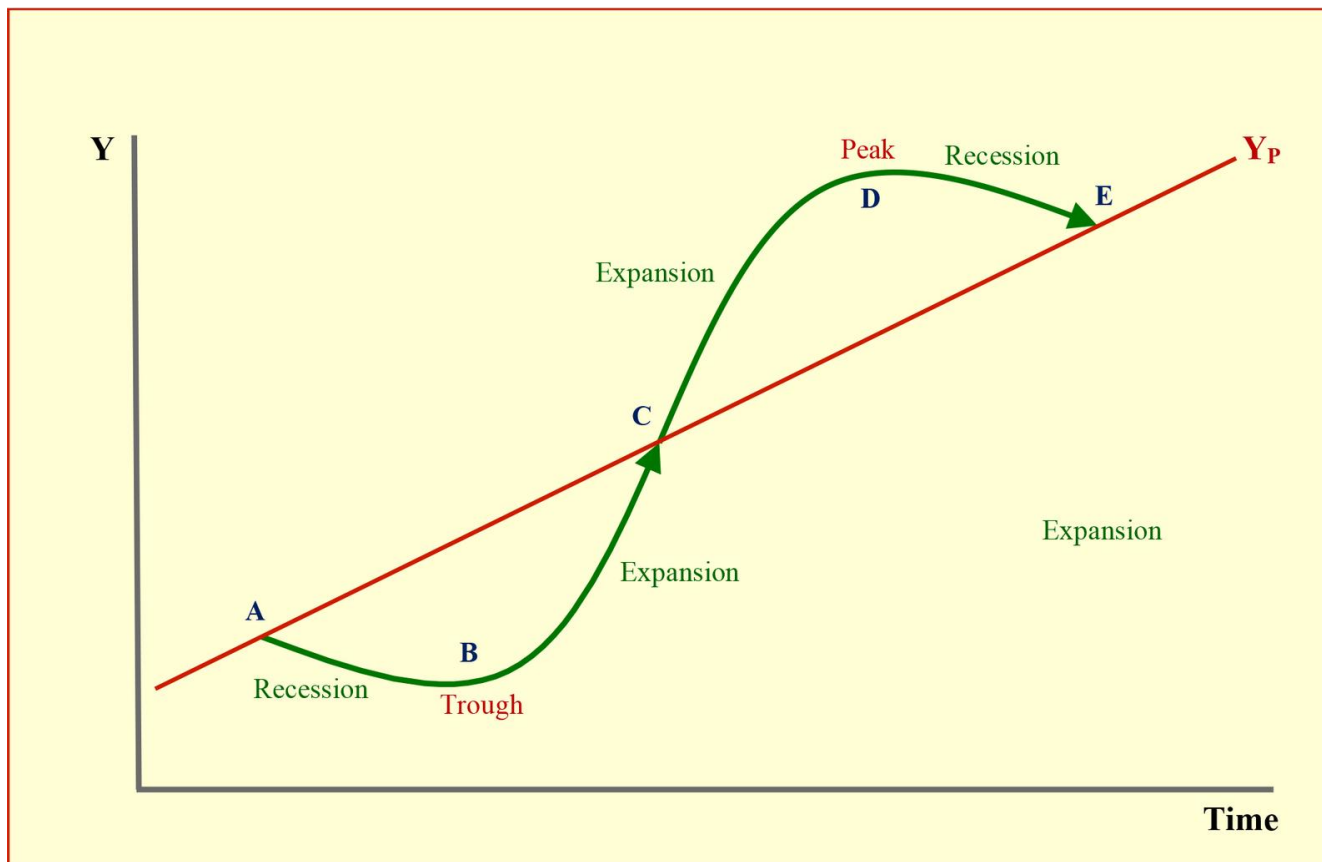
**Answer 2.**

- (a) Cyclical unemployment occurs when actual real GDP  $<$  potential GDP. Caused by short-run business cycles and real wage rigidities.
- (b) Natural unemployment occurs regardless of the state of actual real GDP relative to potential.
- (c) Frictional unemployment occurs because 1) it takes people time to find a job (search unemployment), and 2) some jobs become obsolete or move elsewhere (sectoral shift). Occurs even at equilibrium.
- (d) Structural unemployment occurs when the real wage is generally above the equilibrium real wage. (Minimum wage, labor contract, efficiency wage theory.) Can be long-run.
- (e) A minimum wage above the equilibrium wage causes labor supplied to exceed labor demanded, i.e. unemployment
- (f) Firms offering wages above the equilibrium wage—an efficiency wage—causes labor supplied to exceed labor demanded.

Note that the economy is at potential GDP and full employment if and only if cyclical unemployment is zero. (Natural and thus overall unemployment will likely be positive, however.)

**Problem 3.** Define a recession and an expansion.

**Answer 3.** Ups and downs of GDP constitute *business cycles*. A short-run increase in GDP is called an *expansion* because GDP is expanding (much like my waistline); a decrease is a *contraction* or a *recession* because GDP is receding (much like my hairline).



**Problem 4.** According to Keynes, the real wage is

- (a) pro-cyclical
- (b) counter-cyclical
- (c) acyclical
- (d) bicyclical
- (e) none of the above

**Answer 4: b.** According to Keynes, the real wage is counter-cyclical. This means it moves in the opposite direction of real GDP. Hence if there is a recession and real GDP is falling, the real wage will increase. This leads to cyclical unemployment. This is the theory we will be using.

Some believe, however, that the real wage is pro-cyclical. If labor demand decreases (shifts to the left) during a recession, then the real wage will go down as well and thus real GDP and real wage move in the same direction.

An acyclical variable is one that does not respond to changes in real GDP. Bicyclical isn't a thing.

**Problem 5.** Consider a country with the following statistics:

Population ( $Pop$ )      250,000

Employed ( $E$ )      182,000

Unemployed ( $U$ )      18,000,

where the population given is the civilian population. What is the labor force participation rate (LFPR)?

**Answer 5.** The labor force consists of employed plus unemployed, so

$$LF = 182k + 18k = 200k.$$

The labor force participation rate is the percentage of people in the population who are actually in the labor force, i.e.

$$LFPR = \frac{LF}{Pop} = \frac{200k}{250k} = 80\%.$$

**Problem 6.** Consider a country with the following statistics:

Population ( $Pop$ )      250,000

Employed ( $E$ )      182,000

Unemployed ( $U$ )      18,000,

where the population given is the civilian population. What is the unemployment rate? What is the employment-population ratio?

**Answer 6.** The unemployment rate is the percentage of people in the labor force who are unemployed, so

$$u = \frac{U}{LF} = \frac{18k}{200k} = 9\%.$$

The employment-population ratio is the percentage of people in the population who are employed, so

$$EPR = \frac{182,000}{250,000} = 72.8\%.$$

**Problem 7.** Consider a country with the following statistics:

Population ( $Pop$ )      250,000

Employed ( $E$ )      182,000

Unemployed ( $U$ )      18,000,

where the population given is the civilian population. If the natural rate of unemployment was 5% and the frictional rate of unemployment was 2%, then what is the cyclical rate of unemployment?

**Answer 7.** The total unemployment rate is the sum of natural and cyclical unemployment, giving

$$u = u_n + u_c \implies 9\% = 5\% + u_c \implies u_c = 4\%.$$



**Problem 8.** Consider a country with the following statistics:

Population ( $Pop$ )	250,000
Employed ( $E$ )	182,000
Unemployed ( $U$ )	18,000,

where the population given is the civilian population. If the natural rate of unemployment was 5% and the frictional rate of unemployment was 2%, then what is the structural rate of unemployment?

**Answer 8.** We can decompose natural unemployment into the sum of frictional and structural unemployment, that is,

$$u_n = u_f + u_s \implies 5\% = 2\% + u_s \implies u_s = 3\%.$$

**Problem 9.** Consider a country with the following statistics:

Population ( $Pop$ )      250,000

Employed ( $E$ )      182,000

Unemployed ( $U$ )      18,000,

where the population given is the civilian population. If the natural rate of unemployment was 5% and the country produced the potential level of GDP, then what will be the number of employed workers?

**Answer 9.** If we are at potential GDP, then there is zero cyclical unemployment—this is a *definition*. This means that  $u = u_n$ . We are told that  $u_n = 5\%$ , which means that even with potential GDP and full employment there still exists unemployment of

$$U = LF \times u = 200k \times 0.05 = 10k.$$

And therefore  $E = 200k - 10k = 190k$ .

**Problem 10.** Consider a country with the following statistics:

Population ( $Pop$ )	250,000
Employed ( $E$ )	182,000
Unemployed ( $U$ )	18,000,

where the population given is the civilian population. If the natural rate of unemployment is 5%, cyclical unemployment is 4%, and each worker could produce 3 units of output, then what is potential GDP?

**Answer 10.** Potential GDP occurs when there is full employment, i.e. zero cyclical unemployment. This means that we get potential GDP when  $U = 200k \times 0.05 = 10k$  people are unemployed, and therefore when  $E = 190k$  people are employed. Each worker produces 3 units of output, and therefore potential GDP is

$$190k \times 3 = 570k \text{ units of output.}$$

**Problem 11.** The size of the labor force is 100,000 and the number of people registered as unemployed equals 10,000. There are currently 1,000 discouraged workers. What is the “true” unemployment rate, i.e. the one that includes the discouraged workers?

**Answer 11.** Note that discouraged workers are those who have not actively looked for a job in the last four months – they’ve given up and are no longer considered part of the labor force, and thus no longer considered unemployed.

Just add the discouraged workers back into the labor force and back into the pool of unemployed. Then we have

$$\frac{U + D}{LF + D} = \frac{10,000 + 1,000}{100,000 + 1,000} = \frac{11,000}{101,000} \approx 10.9\%.$$

Notice that this is *higher* than the official unemployment rate of

$$\frac{U}{LF} = \frac{10,000}{100,000} = 10\%.$$

This should be intuitive—in the official measurement we are ignoring people who, in at least a common-sensical way, could be considered unemployed. With the “true” measurement, we are taking them into account again.

**Problem 12.** Consider the following unemployment statistics:

$$u_f = 3\% \quad u_s = 2\% \quad u_m = 0\% \quad u_e = 0\% \quad u = 4\%$$

How does potential GDP compare to actual real GDP?

**Answer 12.** Potential GDP happens when  $u_c = 0$ . In our case, we have

$$\begin{aligned} u &= u_c + u_f + u_s + u_m + u_e \\ \implies u_c &= u - u_f - u_s - u_m - u_e \\ &= 4\% - 3\% - 2\% = -1\%. \end{aligned}$$

Negative cyclical unemployment is a double negative – we essentially have *positive* cyclical *employment*. The economy is producing *above* potential GDP because the number of people working *exceeds* the number of people who would be working with no cyclical unemployment. Think of potential GDP as being the highest value GDP can be *sustained* at – it can be temporarily exceeded.

**Problem 13.** In a country, the overall rate of unemployment is 11% and the natural rate of unemployment is 5%. Assume that the Okun's coefficient is  $\alpha = 2$ . Find the percentage GDP gap in this country.

**Answer 13.** Recall that **Okun's Law** says

$$\frac{Y_p - Y}{Y_p} = \alpha \times u_c,$$

where  $Y_p$  is potential GDP,  $Y$  is actual GDP,  $u_c$  is cyclical unemployment, and  $\alpha$  is **Okun's coefficient**. The **GDP gap** is the difference between potential and actual GDP, and the “percentage” GDP gap<sup>1</sup> is the LHS

$$\frac{Y_p - Y}{Y_p}.$$

The cyclical rate of unemployment is  $u_c = 11 - 5 = 6\%$ . Therefore

$$\alpha \times u_c = 2 \times 6\% = 12\%.$$

---

<sup>1</sup>I put the word percentage in scare quotes because the percentage would actually be  $\frac{Y_p - Y}{Y_p} \times 100$ , but in our class is given without the  $\times 100$  and so is technically the proportional GDP gap. *Therefore these can be tricky due to decimal places, so I recommend practicing a few more until you know when to use a percentage and when to use the proportion, i.e. 2% or 0.02.*