

Inflation

We have found that in choosing the targeted rate of interest in the economy, it attempts to drive the rate of inflation of the Canadian economy on a pre-specified growth rate. The principal reason for this tact is that much of economic decisions as made by economic agents, such as yourself and firms, rely on the rate of growth of prices, i.e. inflation. Accurate forecast based on a stable inflation rate allows more informed investment decisions. Consider for example your choice of investing in a house now or some distant future if you foresee the purchasing power of your savings halved!

As discussed from the onset on the Macroeconomic segment that ***inflation is a process in which the price level is rising and money is losing value***. It is not the change in the price of just one good nor some goods, but most goods traded in an economy. It is an ongoing process, so that a single period jump in price and subsequently staying at that price is not inflation. You should recall that there are several ways in which prices are measured, depending on the types of goods we wish to use as indicators.

1. Raw Materials Price Index
2. Consumer Price Index
3. GDP Deflator

For all intents and purposes, since final goods and services prices aptly captures changes in factor input prices in used in production decisions. We typically use the GDP deflator and CPI to measure inflation. Further, since the former does not rely on a fixed basket of goods, and consequently more versatile since consumption habits do change across time, it is the most commonly used indicator of operative prices in the economy. To measure inflation rate, we calculate the annual change in price level. Let index t be the initial year, and $t + 1$ be the following year, then the inflation rate between this two years is just,

$$\frac{P_{t+1} - P_t}{P_t} \times 100$$

where P is just the price index used.

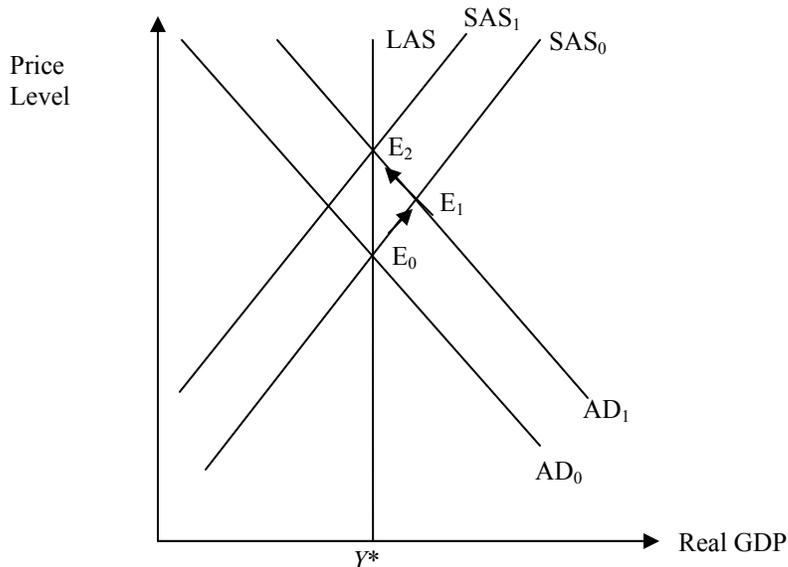
Inflation can be induced by either an AD shock, or an AS shock. The former gives rise to the ***Demand-Pull Inflation***, and the latter the ***Cost-Push Inflation***.

Demand-Pull Inflation

This can arise from any changes in the elements or variables that affect your aggregate expenditure, and consequently the AD, including an increase in the quantity of money (Why? Consider the following argument. Based on your money Demand-Supply diagram or model, when money supply increases, interest rates is driven down. This consequently reduces the cost of borrowing, and leads to an increase in investment. Consequently AE increases, and AD increases.). As the name suggests, this kind of inflation is initiated by shifts in AD.

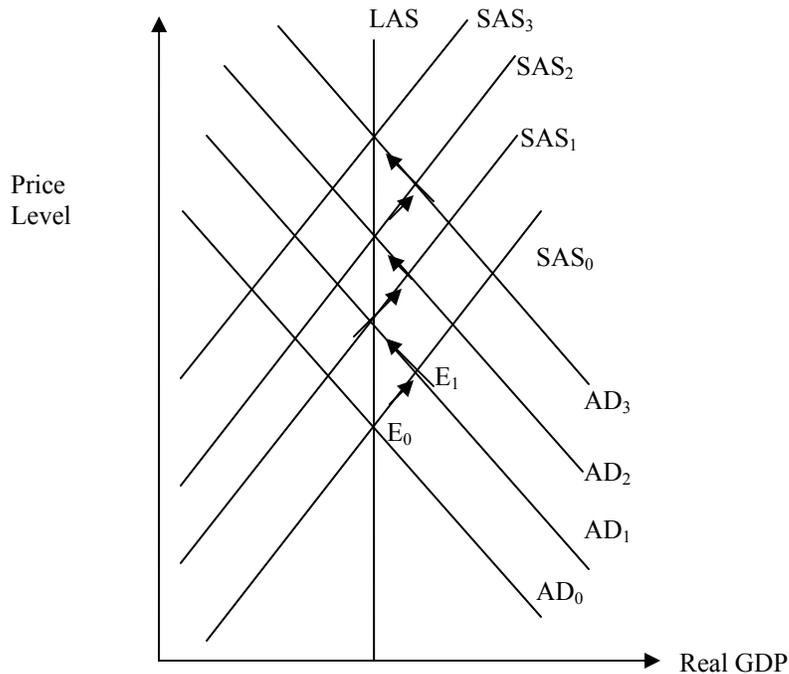
Let the economy's initial equilibrium be E_0 with a potential level of output at Y^* . Consider an unexpected increase in aggregate demand that shifts the AD from AD_0 to AD_1 . (For example, due to buoyant bullish expectations for Canadian economic future, more investments flow into Canada.)

1. This **expansionary AD shock** drives price up, and pushes the production of the economy above the potential level of output (creating an **inflationary gap**), Y^* , moving equilibrium from E_0 to E_1 .
2. Assuming prices and wages are sufficiently flexible, since there is an inflationary gap, unemployment is low, and there is excess demand for labor. This drives wages up. This increases the cost of production.
3. Due to the increase in cost of production in the economy, SAS falls from SAS_0 to SAS_1 . This takes the economy back to the potential output level. Note that a price change such as this in and of itself is not inflation.



4. However a persistent AD shock would yield inflation such as that below. An example of such a persistent inflation rate is when a government runs a persistent

budget deficit, and finances it via sale of bonds. Recall that the Bank of Canada is the Banker to the government. When the Bank of Canada buys these bonds, they are effectively lending money to the government through raising the supply of money in the economy. This is tantamount to financing a budget deficit via printing of money.



Cost Push Inflation

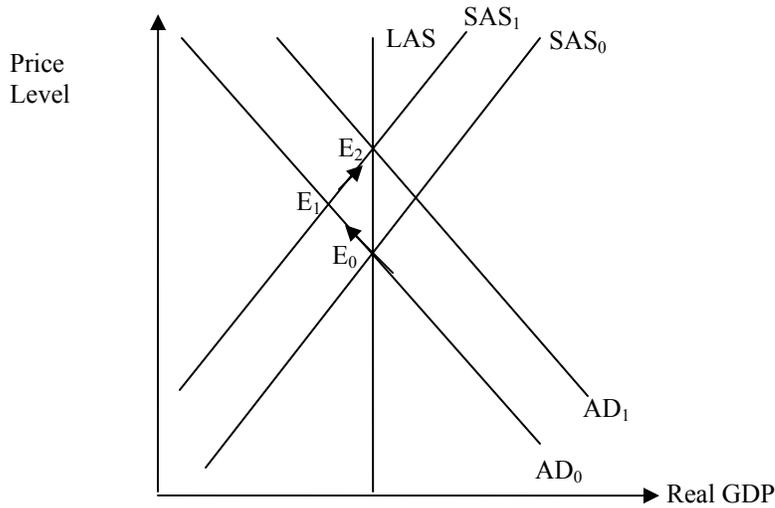
The main sources for increases in costs, and consequently shifting SAS are

1. Increase in nominal wage rates
2. Increase in the nominal prices of raw materials

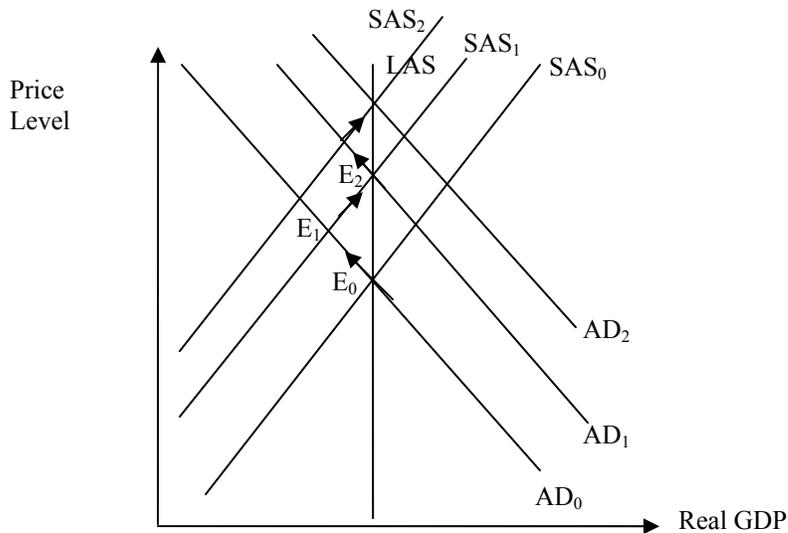
Consider a AS shock such as that created by the oil shocks of the 1970s induced by OPEC,

1. The initial shift in SAS due to a *contractionary AS shock* reduces SAS, and creates a recessionary gap.
2. This recessionary gap forces the economy to operate below the potential output level, and raises the unemployment rate. This however is nothing but a one time shock as in the initial AD shock we had above. For inflation to occur, we must have persistent increase in price level, such as would occur if this initial shock changes into a process of money growth, and consequently inflation.

3. Suppose Bank of Canada chooses to raise money supply, thereby reducing interest rates, raising investments, and consequently driving AD up.



4. Suppose OPEC had initially raised the prices to raise their profits. Should every economy in the world used monetary policy or fiscal policy to combat the recession the oil shock induced, OPEC would in turn find the prices of their imports rise. Should they decide to raise oil prices again, the economy would be subject to another round of adjustments like the above. The Canadian inflation rate did in fact rise during the oil shocks of the 1970s for this reason, going as high as 10% in the mid 1970s.



Quantity Theory of Money

What you would observe from the above analysis is that regardless of the initiating shock AD must increase in order for inflation to occur, else what we would observe would be a one period price level change. Although based on the multiplier model there are a lot of other factors that can shift AD, only one item, and it is not a variable in the AE equation, can persistently increase across time; *the quantity of money*. This then gives us a long run theory of inflation: *The Quantity Theory of Money*. Its main proposition is that *in the long run, an increase in the quantity of money brings about equal percentage increase in the price level*.

We will discuss some key ideas that the theory requires:

1. **Velocity of Circulation (V):** It is the number of times a dollar of currency is used annually to buy an economy's output. Recall that in our calculations of GDP, we are accounting for the quantity of final goods and services produced by an economy, which in our diagrams is typically noted as Y . To get the total value produced, all we need to do is multiply the that total output by the price level, $P \times Y$. What do we use to buy this output is the money/currency you hold in your wallet/purse and bank accounts. But that same note or currency gets circulated several times in any period. Therefore the total money floating in an economy at any time is just $M \times V$, where V is the number of times a note gets circulated. Since the value of goods and services we purchase must be equal to the total currency we have, we get the following relationship/equation:
2. **The Equation of Exchange:** $M \times V = P \times Y$, in words it is just Quantity of Money \times Velocity of Circulation = Price Level \times Real GDP. This is known as quantity theory of money is the quantity of money does not influence
 - a. The Velocity of Circulation
 - b. Potential GDP

When this is true, we get our proposition that an increase in money, M , leads to an equal percentage increase in price level, P . Technically,

$$P = \frac{V}{Y} M \Rightarrow \Delta P = \frac{V}{Y} \Delta M \Rightarrow \frac{\Delta P}{P} = \frac{\frac{V}{Y} \Delta M}{\frac{V}{Y} M} = \frac{\Delta M}{M}$$

3. A pertinent question you could ask is if this theory valid in reality?
 - a. It has been found that on average, the money growth rate exceeds the inflation rate. The principal reason is that real GDP has been growing

across time. So that for the equation or equality to hold, inflation rate must be slower.

- b. The money growth rate is correlated with the inflation rate: more precisely the movement in money growth rate is in the same direction as the inflation rate. When one increases (decreases), so does the other. Note that this does not say that one causes the other: it just seems that they are moving in a similar fashion as the equation of exchange suggests. It could very well be that something not considered, a particular variable, moves money and prices in the same direction.

So what's the big deal with Inflation?

Regardless of what initiated inflation in the economy, and whether it is a AD or AS shock, if we do not (as agents in the economy) correctly *anticipate* its occurrence, we will make the wrong decisions. This will impose costs on the labor and capital markets.

1. ***Unanticipated Inflation in the Labor Market:*** This has two main effects,
 - a. ***Redistribution of Income:*** If inflation is unanticipated by the labor force (such as when you bargain over your contract, expecting a particular level of inflation, and the true inflation rate became higher due to imprudent monetary policy) such that the contract does not account for it, when it does occur, the wages paid in real terms would be lower, while in turn employers would enjoy a higher level of profits. This implies a redistribution of income from the workers to the firms. Alternatively, if the contract over accounted for inflation, the redistribution is from firms to workers.
 - b. ***Departure from Full Employment:*** Deviations from the potential output level as a result of inflation will cause firms to operate not at their potential, which imposes a cost on the firms and in the end everyone. Suppose an unanticipated shock pushes the economy into an inflationary gap, and this turns into an unanticipated sustained growth in inflation. This means then that real wages are low, which in turn would mean that firms will have a harder time hiring, if wages cannot match the growth rate in inflation. If the firms are unable to hire workers, they may be forced to incur overtime to meet demand, which necessitate more frequent maintenance of equipment on account of the overtime work. At the same time, you could imagine poor worker morale, which encourages higher turnover, imposing yet another cost on firms. The arguments are similar in

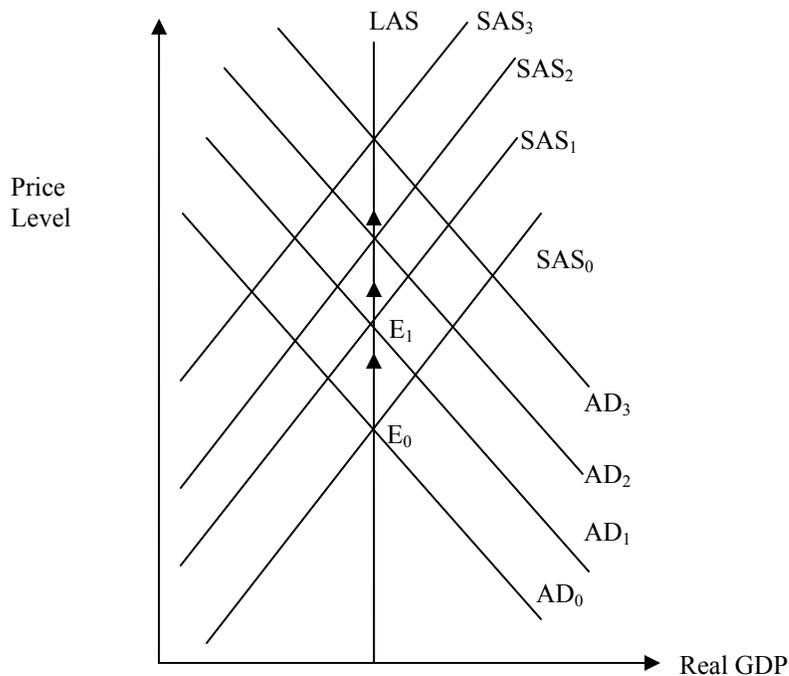
the case when the inflation was initiated by a AS shock which creates inflation and recessionary gap, noting that due instead to redistribution of income from firms to workers, it is the firms who will be laying workers off on account of higher real cost of production

2. Unanticipated Inflation in the Market for Financial Capital

- a. Redistribution of Income: When inflation occurs, earning from loans by lenders is worth less. To compensate themselves, they would raise interest. However, if inflation is unanticipated, interest rates are not set high enough, and you get redistribution of income from lenders to borrowers. On the other hand, if inflation fails to occur when it is expected, then the redistribution is reversed from borrowers to lenders.
- b. Disequilibrium in Capital Market: When the nominal value of interest are too high (too low) due to incorrect expectations of inflation (when nominal interest rates are too high, it implies the expected inflation rate was too high, or true inflation is lower), due to a volatile inflation rate, the real interest rate would be too high (too low). When this occurs, lenders would have wanted to lend more (less), but did not, while borrowers wished they would have borrowed less (more). These “miscalculations” are costs to borrowers and lenders.

These cost of inflation in both labor and capital markets means and explains why we are preoccupied with forecasting inflation, and try to keep monetary policy at an even keel. But what does it mean when inflation rate is perfectly anticipated. We will now justify why Bank of Canada’s policies are so vital to the economy.

When inflation is anticipated, the market fully expects what would happen to prices, and would make the correct adjustments. Consider the following, suppose the labor force fully expects that inflation will be at a exact rate, they would have negotiated this expectation in their contract so that when inflation, say due to AD increasing occurs, the AS falls to account for inflation perfectly because workers has already negotiated a nominal wage increase of the correct rate. The diagrammatic representation is depicted below.



Is there a cost nonetheless to anticipated inflation? Why can't there be zero inflation?

The cost of an anticipated inflation depend on its rate so that an anticipated rate of between 2-3% such as in Canada is small, whereas one in the double digits is large. But what costs are we talking about?

1. **Transactions costs:** When inflation rates are high, due to lower future value of money, spending rises to reduce money holding into the future. This thus means that the velocity of money circulation increases. Primarily, if all our preoccupation is to spend our wages (and to some of you, this is a good thing!) it ultimately diverts resources, your labor, away from productive activity, and decreases potential output. Another way to think about this is the following, as you recall, savings is one of the primary ways in which an economy achieves growth, since it is with this money that capital investment is financed. Without it, potential output cannot grow.
2. **Tax Effects:** Suppose initially we have 4% real interest rate with a 50% tax rate. With zero inflation, the real after tax interest rate is 50% of 4% or 2%. Now suppose we have an inflation rate of 4%, and suppose the nominal interest rate would be set above that at 8% to account for inflation. This means the nominal after tax rate is 50% of 8% which is 4%. However, the real after tax interest rate

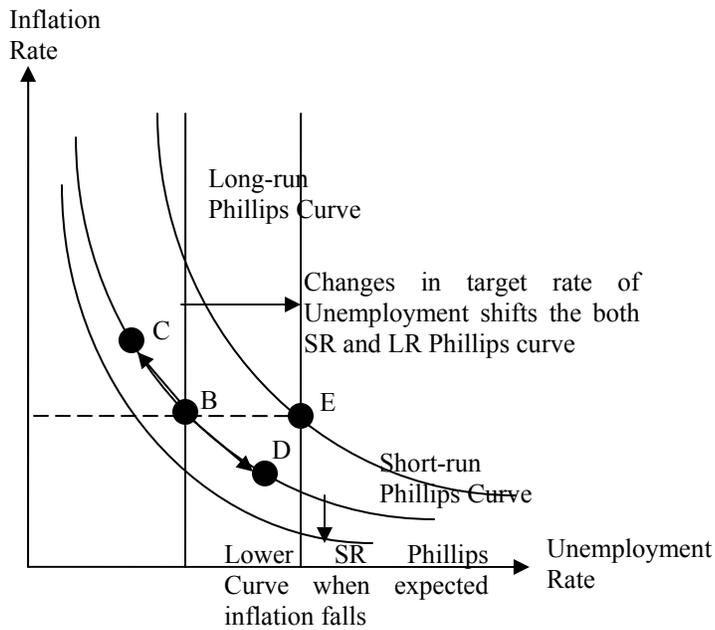
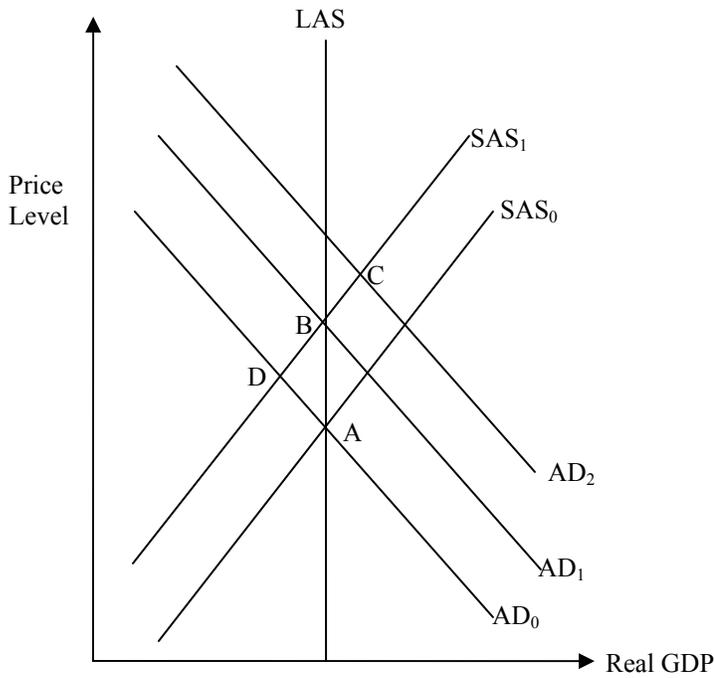
has to account for inflation, which hence gives $4\% - 4\% = 0\%$! This means we would be facing a 100% tax rate on interest income! In short, anticipated inflation interacts with the tax system, and creates distortions in incentives. If you know that your money in the bank is worth the same in your wallet, and you do not trust the banking system anyways, you might just install a Chubb vault in your basement then! Or prefer to spend the money rather than saving it, which again affect an economy's potential output.

3. **Increased Uncertainty:** When inflation rates are persistently high, focus is diverted away from longer term prospects of investment, and raising productivity in the long run, thereby raising potential output as we noted earlier. From the perspective of research and development which are long term in nature, a high inflation rate would discourage investment in these areas, thereby impeding economic growth through raising potential output.

The Relationship between Unemployment and Inflation Rate: The Phillips Curve

There is a negative relationship between unemployment and inflation rate, and the graph plotted of this relationship is known as the *Phillips Curve*. The AD-AS framework focuses its analysis on the movement of demand and supply throughout the market as a whole, but does not place inflation and unemployment as the central concern, though it does give us an indication of the relationship. Consequently, we can draw from the AD-AS framework, the relationship between unemployment and inflation rate. Such a graphed relationship is known as the Phillips curve. This curve has two time frames, short and long run.

The short-run Phillips curve shows the relationship between inflation and unemployment at a given expected inflation rate, and a given natural rate of unemployment. Consider the AD-AS diagram below where the economy is initially at potential output level and equilibrium A, which in turn is associated with unemployment level U_1 and an inflation rate of F_1 on the Phillips Curve. If inflation from an AD shock is perfectly anticipated, the economy would arrive at point B, which corresponds to point B on the Phillips curve as well. However, if the AD shock were to be larger than what was expected, the economy would arrive at point C on both diagrams where the economy has low unemployment rate but higher inflation than what would have been anticipated. If however the AD shock that was anticipated never arrives, the economy would instead arrive at point D on both diagrams, and where there would be a recessionary gap with lower inflation rate but higher unemployment levels.



The Long-Run Phillips curve shows the relationship instead between inflation and unemployment when the actual inflation rate equals the expected inflation. The latter statement means that we are always spot on with our expectations, real output at any time cannot deviate from potential, and all that changes is the inflation rate. Since an economy

targets their output at the potential output level, the long run Phillips curve must be a vertical line. It is considered long run since only in the long run we will always be at the potential output level.

When the expected inflation rate falls, within the AD-AS framework, all that it means is that the shifts in AD-AS are smaller, yielding smaller price changes, hence corresponding with lower rates of inflation, and smaller deviations in unemployment from target rate of unemployment rates. This would correspond with a lower short-run Phillips curve as shown above.

If instead the target rate of unemployment changes, say to a higher level, then every rate of inflation corresponds with a higher level of unemployment. At the same time, the Long-Run Phillips curve would also shift to the new target rate as well. Similarly, as an economy progresses, such that the target rate of unemployment falls, due to better trained workforce, and greater ability of the economy to absorb workers faster, with perhaps lower levels of inflation rate, would yield leftward shifts in both the long and short run Phillips curves.