EC1010 Review

Paul Scanlon

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Contents

Chapter 1

The Open Economy

1.1 International Accounting

To begin, keep in mind that the current/capital accounts are just like *double entry accounting* from accountancy. The current account records trade in *imports/exports*.[1] The capital account[2] records *private* (that is, not to do with the central bank) trade in *assets* (bonds, equities, FDI etc). It records capital inflows and outflows to purchase these assets. All of this is best explained with an example. Imagine the U.S. imports $100 worth of goods from China; then the U.S. will have a current account *deficit* of 100, while China will have a current account *surplus*. When the Chinese reinvest those dollars back in the U.S.—remember the boomerang principle?—they enter as a capital account *surplus* of 100. Meanwhile, for China, the current account is 100 and the capital account is -100. In this case the *balance of payments* in the U.S. is given by:

$$\boxed{BOP = Current\ Account + Capital\ Account = 0 = -100 + 100}$$

In most cases like above, every transaction in the current account is matched by a

[1] It also includes income received on domestically held assets abroad and unilateral transfers (such as gifts from other countries and repatriated incomes, but ignore these.)

[2] This is also known as the *financial account.*

similar transaction in the capital account, and therefore the balance of payments is zero. So far so good.

Now things get a little trickier. Sometimes when the money enters China, the Chinese government prints money and purchase some of the dollars themselves.[3] In this case, the Chinese government takes the dollars and invests them *themselves* in the U.S. economy. Typically the Chinese Bank purchases risk-free US Treasury bonds, and these holdings are called China's *foreign reserves.* Continuing the example above, suppose the Chinese government purchases 20 of the dollars, while the remaining 80 is invested in the U.S. by private citizens. In this case, for the U.S., the current account is -100, the capital account is 100 (as before.) Now contrast this with China where there *is* intervention. For China, the current account is 100, the capital account is -80 and foreign reserves are 20. Foreign reserves tell us what the central bank is accumulating/decumulating in its reserves. In this case, the balance of payments for China is

$$\boxed{BOP = Current\ Account + Capital\ Account = 20 = 100 - 80}$$

Finally, keep in mind that capital account deficits (i.e., purchase of foreign assets) increases the *international investment position* of a country. This is the sum of all domestically owned assets held abroad.

1.2 Exchange Rates

So far, I have implicitly assumed all trade was in a single currency (for what we did above, this assumption was innocuous.) Yet in reality countries have different currencies. We define the *nominal exchange rate*, e, as the number of units of foreign currency per unit of domestic currency. For example, if we are dealing the the euro and the dollar, and if $e = 5$, then one euro purchases 5 dollars. Then if a good in New York costs \$20, then it

[3]By doing this, they create artificial demand for dollars, which keeps the dollar strong and the yuan weak. This increases demand for Chinese exports.

costs 4 euros. By the same reasoning, it follows that the price I pay for a foreign good that I import from abroad is $\frac{P^*}{e}$, where P^* is the price denominated foreign currency. If one currency appreciates against another, then the other must depreciate against it; exchange rates are just relative prices.

Definition 1 (Nominal exchange rate) *e indicates how many units of foreign currency you get for one unit of domestic currency. So if $e = 9$, then one euro purchases 9 dollars. A rise in e represents a euro appreciation since we now get more dollars for each euro. Analogously, a fall in e represents a dollar depreciation.*

1.2.1 Determination of Exchange Rates

There is almost 2 trillion of foreign exchange traded each *day* on the foreign exchange (forex) market. You might wonder, what determines the value of the nominal exchange rate? To understand exchange rate determination, we must consider the forces of supply and demand. Demand for domestic currency arises from *foreigners* purchasing our goods and assets: see, to purchase our assets in euro terms, they must convert their currencies into euros. On the other hand, *supply* of domestic currency arises from *domestic residents* purchasing foreign goods and assets.

Graphically, the demand curve for our currency is downward sloping. As e rises, our currency appreciates, making it more expensive for foreigners to purchase goods and assets in the home country. As a result, demand for our currency falls, implying the demand curve is downward sloping. Similarly, the supply curve is upward sloping. As e rises, then the home currency appreciates, which implies that domestic residents get lots of foreign currency for each unit of domestic currency. As a result, they respond to this by purchasing more goods and assets abroad, and so the supply of domestic currency rises. Figure 1.1 illustrates the basic setup, and Figures 1.2—1.4 present examples.

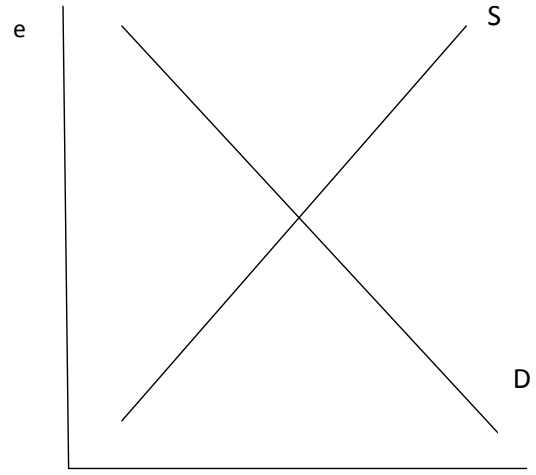

Figure 1.1: Equilibrium in the Foreign Exchange (Forex) Market. Keep in mind that supply is determined by domestic residents, while demand is determined by foreigners.

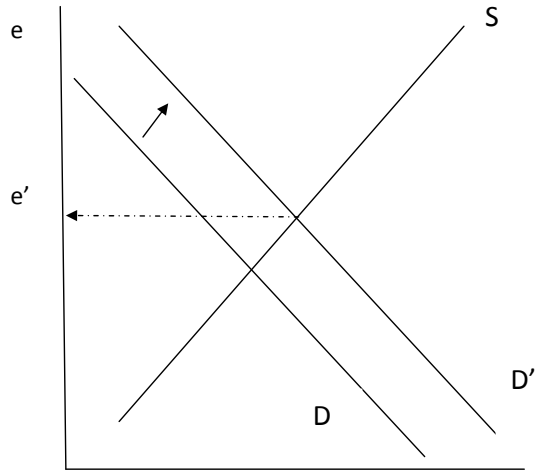

Figure 1.2: A rise in demand for domestic goods by foreigners; this could be caused by an economic boom abroad. To purchase our goods, they increase demand for domestic currency, causing it to appreciate.

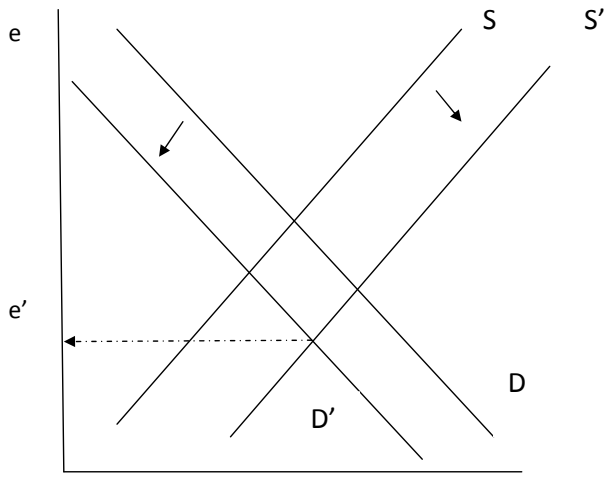

Figure 1.3: A fall in domestic interest rates. This has two effects. First, demand by foreigners for our assets falls, thereby causing the demand for our currency to fall. Second, because of higher returns abroad, domestic residents now invest relatively more abroad, causing the supply of currency in the forex market to rise (as the convert domestic currency into foreign currency.) Note that a rise in foreign interest rates would have the same effect: what matters is the interest rate differential.

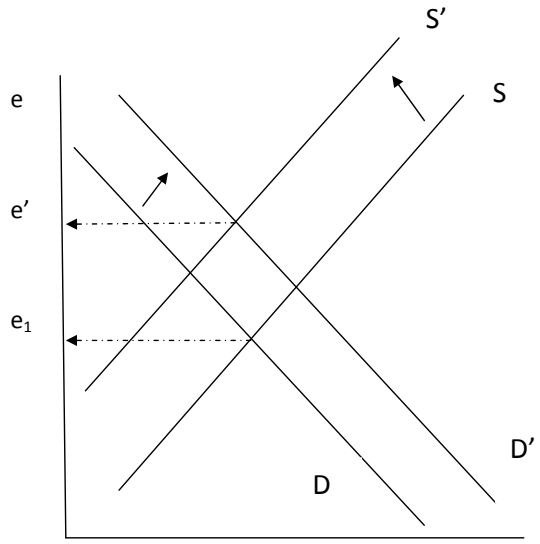

Figure 1.4: A fall in the domestic price level. This has two effects. First, demand for our exports rises, causing demand for our currency to rise. Second, domestic residents now purchase more goods domestically, which causes a fall in the supply of domestic currency to the forex market. As a result, the exchange rate appreciates from e_1 to e'.

Application: Interest rates and exchange rates

As shown in Figure 1.3, lower domestic interest rates causes the domestic currency to depreciate. According to the that analysis, a fall in domestic interest rates causes a *capital outflow* as domestic investors exploit better investing opportunities abroad; in addition foreigners invest less in our economy.[4] Because demand for domestic currency then falls, this induces a *depreciation* of the exchange rate (which in turn raises net exports.[5]) This is an important relationship. Conveniently, you can just think of the interest rate and the exchange rate moving in the *same direction* in that a lower interest rate weakens the exchange rate and vice versa. By contrast, a rise in domestic interest rates increases the attractiveness of investing domestically. Because investors sell foreign currency and purchase domestic currency they need to buy our assets, this bids up the value of the our currency in the foreign exchange markets.

Key Idea 1 *A rise in domestic interest rates leads to a capital inflow and thus leads to an exchange rate appreciation.*

1.2.2 Fixed and Flexible Exchange Rates

Because the exchange rate was free to move around as supply and demand for it varied, the above analysis is really a description of a world of *flexible* exchange rates. While most industrialized countries today operate under flexible exchange rate regimes, this wasn't always the case. Up until 1973 many countries operated under what's known as *fixed exchange rate regimes*. Within such a system, the monetary authority is obliged to prevent any deviation of the exchange rate from a previously committed level. For example, if the French central bank committed to pegging its currency at 10 francs to one dollar, then

[4] More formally, we can write *capital inflows* as $CF = \beta(r - r^*)$, so a rise in domestic interest rates, r, above foreign interest rates, r^*, causes capital inflows—and demand for domestic currency—to rise.

[5] It's really the *real exchange rate* that determines net exports, but given the real and nominal exchange rates typically move together in the short run (since prices are fixed) for now we will just talk about "the exchange rate."

it had to take whatever measures necessary to maintain that *peg*. Specifically, it would have to increase or decrease the supply of francs on the foreign exchange markets, so as to manipulate the price of francs (i.e., the currency value). For instance, if the French franc started to rise above the pegged value (that is, to *appreciate*), then the central bank would have to print money and purchase dollars on the forex market; this way the franc would depreciate again, while the dollar would appreciate. This is just *supply and demand*. Notably, *there is no limit to which the central bank can weaken its currency*. It can print money *ad infinitum* and so reduce its value to *any* desired level. Figures 1.5 and 1.6 illustrate these dynamics.

By contrast, if the French franc started *falling* in value below the peg, then the central bank would have to buy up francs on the forex market. To buy up francs, though, it needs to have foreign currency to buy them with; for this it must use it *foreign exchange reserves*.[6] However, because it cannot print foreign currency, if the central bank runs out of reserves, it can no longer intervene to defend a weakening currency. At this point, there's what's called a *currency crisis* and the peg collapses.

Definition 2 (Flexible Exchange Rates) *With flexible exchange rates, market forces determine the value of the nominal exchange rate on the foreign exchange markets. In particular, there is no intervention by the central bank.*

Definition 3 (Fixed Exchange Rates) *With fixed exchange rates the central bank commits to maintaining a fixed rate of conversion for its currency. It typically may not deviate from that rate. If the domestic currency starts to weaken, say, the central sells foreign reserves and purchases domestic currency (so the domestic money supply falls). This reduces the relative supply of domestic currency, which causes it to strengthen again towards the fixed conversion rate.*

[6] If the bank held its reserves in the form of assets denominated in the foreign currency—like the why the Chinese authorities hold U.S. Treasury bonds—it can sell these easily in exchange for foreign currency. With that currency, it can then buy their own currency on the forex market.)

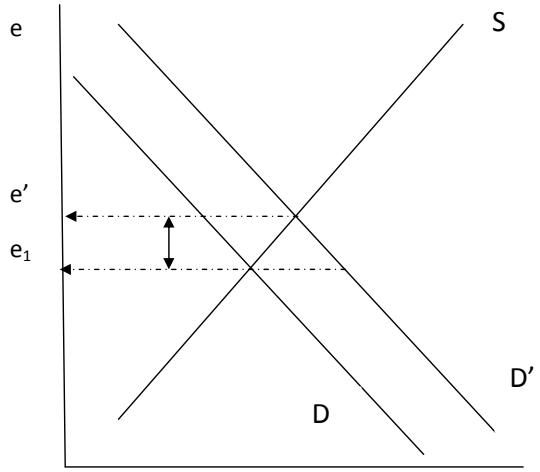

Figure 1.5: An increase in demand causes the exchange rate to appreciate to e', above the pegged level e_1.

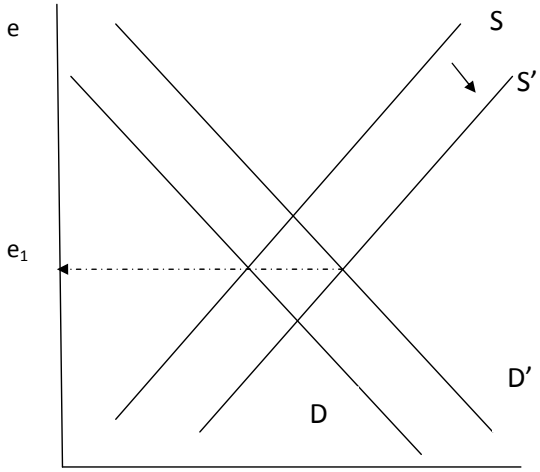

Figure 1.6: To maintain the peg, the central bank sells domestic currency on the forex market. This increases supply and the exchange rate depreciates from e' towards its pegged level e_1.

Why fixed exchange rates?

Why would a country want to *fix* its exchange rate? Well, there are two main reasons. First, it maintains exchange rate stability and so might promote trade. Another goal of a fixed exchange rate is that it acts as a *commitment device*: it signals to financial markets that a country is serious about averting inflation. You see, if a country maintains a fixed exchange rate, it can't *print money* when it so wishes. Because printing money creates an excess supply of currency, it causes the currency to *depreciate*, violating the peg. Yet because the central bank is committed to maintaining a *fixed* exchange rate, this is not permitted. For this reason, a fixed exchange rate regime ties its hands and acts as a commitment device, promoting responsible policy.

1.3 The Real Exchange Rate

Moving on, suppose the cost of a good in the U.S. is 100 dollars. Lets call this P^*. Let's say the exchange rate e is 2; that is, one euro purchases 2 dollars. Then in euro terms, the cost of the good is $\frac{100}{2} = \frac{P^*}{e} = 50$. Suppose now the good costs 60 at home; lets call this P. Then the good is relatively expensive domestically. Formally, the relative price of the good at home is

$$\frac{P}{\frac{P^*}{e}} = \frac{eP}{P^*} = \epsilon$$

Because of its importance, the term above is called the *real exchange rate.* When calculating the real exchange rate, we are not really interested in comparing the prices of individual goods; rather, we are concern about the relative prices of *baskets* of goods. Therefore, the prices in the formula refer to *price levels* such as the CPI. The real exchange rate is a true measure of *competitiveness* of a country. If the real exchange rate is high, foreign goods are relatively cheap, and domestic goods are relatively expensive. And you know what this means? Net exports will fall, and hence we often write $CA(\epsilon)$; i.e., the current account is a (decreasing) function of the real exchange rate.

What causes the real exchange rate to change? A fall in ϵ can be attributable to three things a) a rise in P^* or b) a fall in e ;i.e., a currency depreciation, and c) a fall in the domestic price level, P. Note that each of these movements makes us *more competitive.* As such, a fall in ϵ is a good thing. Conversely, a rise in ϵ makes us less competitive vis-à-vis the foreign country.

Definition 4 (Real Exchange Rate) *The real exchange rate ϵ is the relative price of a basket of goods in the domestic economy relative to that in the foreign country (when denominated in the same currency.) Mathematically, $\epsilon = \frac{eP}{P^*}$.*

Key Idea 2 *A rise in ϵ represents an real exchange rate appreciation. As a result, this makes us less competitive and decreases net exports/the current account.*

1.4 Purchasing Power Parity

If the price of a basket costs the same in both countries, then

$$P = \frac{P^*}{e}$$

According to the theory of *purchasing power parity* (PPP), exchange rates adjust until this holds. In other words, PPP predicts that exchange rates eventually adjust until baskets of goods cost the same when denominated in the same currency. PPP provides us with an indication of where exchange rates tend towards in the long run. For instance, if the domestic price level falls, PPP predicts that e will rise (assuming P^* remains fixed.) What is the economic rationale for this? It is quite simple: lower domestic prices raise demand for our goods and hence our currency, causing it to appreciate. This appreciation will continue until it is no longer a "good deal" for foreigners to purchase our goods. Note that this is just what we showed above in Figure 1.4, so PPP merely formalizes something we could have derived from analysis of the forex market. Observe finally that PPP predicts that the real exchange rate should equal one, $\epsilon = 1$.

From the equality above, it can be shown that

$$\%\Delta e = \pi^* - \pi. \tag{1.1}$$

where $\%\Delta e$ denotes the percentage change in e. Therefore, if there is higher inflation abroad than at home, then we should see an appreciation of our currency. Intuitively, if foreign goods are rising in price via inflation, then to preserve PPP above, there has to be an offsetting appreciation of our currency (as foreigners demand more of *our* relatively cheaper goods, and as we import less.) This way, we converge to a situation where goods remain the same price when denominated in the same currency.

PPP implicitly assumes that people readily switch to purchasing abroad if domestic prices rise. However, if there are transportation costs and barriers to trade, people still mightn't engage in such trade, and so there could be permanent price differentials for similar goods across countries. Because there *are* in fact often large transportation costs to trade, PPP is a *Pretty Poor Predictor* of exchange rate movements when price differentials are rather small. Typically, PPP only holds when there are large and persistent deviation in price levels across countries.

Definition 5 (Purchasing Power Parity) *This theory predicts that the nominal exchange rate adjusts so as to equate the price of the same basket of goods across countries.*

Chapter 2

The Labour Market

"I like work; it fascinates me. I can sit and look at it for hours".

Jerome K. Jerome

Definition 6 (Labour Force) - *those actually working and those available and seeking work.*

Definition 7 (Labor Force Participation Rate) - *the labour force as proportion of working age population.*

Definition 8 (Unemployment rate) *The proportion of the labour force who don't have work.*

Definition 9 (Discouraged workers) *Workers who are unable to find work, and leave the labor force. The number typically rises in times of high unemployment, suggesting that unemployment rates underestimate the degree of unemployment.*

2.1 Long Run Determination of Real Wage Rates

The analysis of the labour market is remarkably simple. First, there is an upward sloping supply curve, indicating that labour supply rises as the *real wage* rises. Most importantly, what matters for labour supply is the real wage: what can workers actually purchase with their wage? Second, there is a negatively sloped demand curve, indicating that labour demand falls as the real wage rises: higher real wages reduce the attractiveness of employing workers. Figure 2.1 illustrates the basic labour market equilibrium. Figure 2.2 shows the consequences of an increase in labour demand; a rise in demand causes the real wage to rise. Because the real wage also induces a rise in labour supply, the level of employment also rises. In practice, the labour supply curve is relatively steep. Over time, labour demand continually rises, causing real wages to rise fairly steadily over time.

Because workers have different characteristics, it is often useful to break our analysis of the labour market into different sub-markets. Figure 2.3 illustrates the market for unskilled labour. Over the past thirty years, a number of developments have occurred to stem increases in real wages for unskilled workers in developed economies. First, the increase in globalization and trade has lowered demand for unskilled workers across developed economies. Goods which were previously manufactured (largely by unskilled workers) domestically are now imported. As a result, labour demand falls. Second, there has been an increase in technological progress. Technology has a similar effect to trade: for example, computers now effectively substitute for work previously done by many unskilled. Finally, increases in immigration (of relatively unskilled workers) to developed economies increase labour supply, also tending to depress real wages.

2.2 Unemployment

There are there main types of unemployment:

- *Cyclical* - This is unemployment associated with economic fluctuations/the business

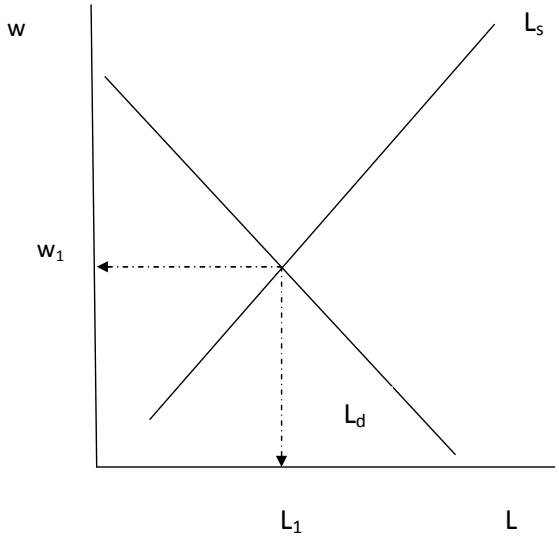

Figure 2.1: Equilibrium in the Labour market, with labour demand L_d equal to labour supply L_s. The equilibrium wage is w_1, and the equilibrium level of employment is L_1.

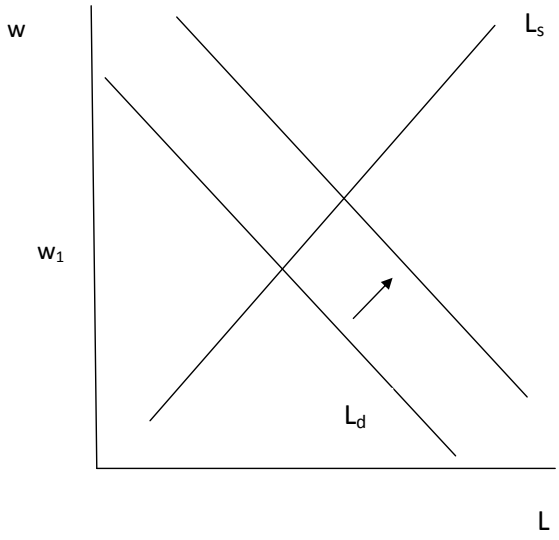

Figure 2.2: An increase in labour demand, causing the real wage to rise above its initial level w_1. Because of an induced rise in labour supply, the equilibrium level of employment also rises.

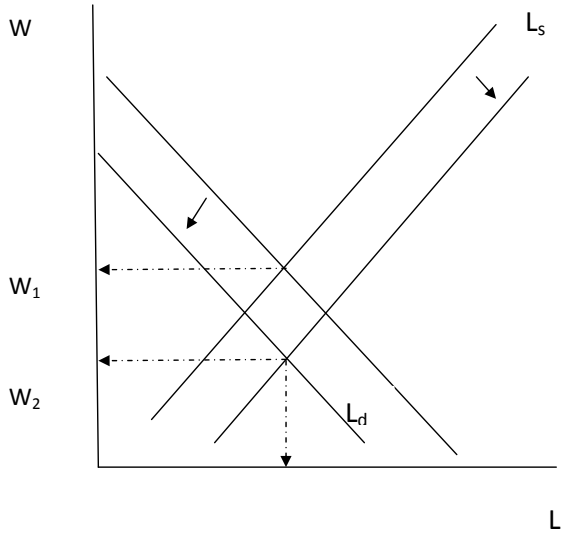

Figure 2.3: The labour market for unskilled workers in recent times.

cycle.

- *Frictional* - This is unemployment associated with *job search.* This can be beneficial and is analogous to looking for partner (we don't want a *bad* match.) However, because they reduce the incentive to find work, generous welfare systems (long benefit duration etc) can increase frictional unemployment to unhealthy levels. For example, welfare benefits in Europe are of very long duration and can often pay up to 90% of the original salary, creating a disincentive for job search; this causes greater frictional unemployment.

- *Structural* - This is unemployment caused by the real wages above their equilibrium level. Why are wages above the market-clearing level?

    1. Trade unions fight for high real wages for their members. Meanwhile, those high real wages make firms reluctant to higher new workers. Unionization rates differ internationally; e.g., it is 16% in US and 33% Germany.
    2. Efficiency Wages: firms pay high wages to engender greater effort and loyalty

to the firm. But paying such high wages also makes them reluctant to hire many workers.

3. Almost by construction, minimum wages legislation maintains real wages above the market-clearing level.

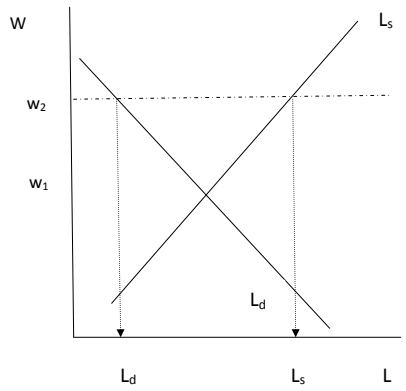

Figure 2.4: Structural Unemployment, where real wages of w_2 are above the market-clearing level w_1. As a result, there is an excess of labour supply L_s over labour demand L_d, causing an unemployment level of $L_s - L_d$.

Frictional and structural unemployment constitute the *NAIRU* or natural rate of unemployment (about 5% in U.S. today, almost half that of Continental Europe). This is basically the long run average rate of unemployment. Most importantly, the NAIRU is not attributable to business cycle fluctuations. Any unemployment above the NAIRU is said to be *cyclical* or induced by recessions. Cyclical unemployment, however, is typically a short-run issue; people have lost jobs due to some recession, and eventually equilibrium will be restored with unemployment reverting to the NAIRU. One issue, however, arises if cyclical unemployment lasts a long time. If this is the case, those unemployed might become *deskilled* in that they're deprived of all the on-the-job training which enhances one's skills. Thus after some time, they can truly become completely *unemployable*. This phenomenon, called *hysteresis*, suggests the cyclical unemployment can in fact leave permanent scars on an economy.

Fundamentally, the NAIRU is due to factors endemic to the economy such as government policies and labor market institutions - the strength of trade unions, the generosity of welfare payments, and so on. Yet the NAIRU *can* change over time. Because they facilitate better matching, more employment agencies, for instance, can reduce the NAIRU. By reducing frictional unemployment, reducing social welfare benefits would also have the effect of reducing the NAIRU.

In Europe, the NAIRU is relatively high relative to the U.S.; this is largely reflection of different labour market legislation (such as minimum rates), different degrees of unionization, together with different levels of unemployment benefits. Yet another issue is there's a multitude of employment protection regulations in Europe making it vary hard to fire workers; as a result, labour demand falls, reducing the level of job creation and employment. The fact that European labour markets are so regulated and inflexible is called *Eurosclerosis.*

2.2.1 Okun's Law

Okun's law is:

$$U = U_n - .5\left(\frac{Y - Y_n}{Y_n}\right),$$

where U denotes the level of unemployment, Y the level of output, U_n the NAIRU, and Y_n the level of potential output. Basically, Okun's law says there is an inverse relationship between unemployment and output. In other words, once we know what's happening to output, we also know what's happening to unemployment. A positive output gap (i.e., $Y > Y_n$) is associated with unemployment below the natural rate/NAIRU (i.e., $U < U_n$). Think about it: an increase in real GDP raises demand for labor, so an increase in output leads to a fall in U. If we are at potential (i.e., $Y = Y_n$), then $U = U_n$. To summarize, note the following important relationships that Okun's Law gives us:

$$\boxed{Y > Y_n \Leftrightarrow U < U_n \quad \text{and} \quad Y < Y_n \Leftrightarrow U > U_n \quad \text{and} \quad Y = Y_n \Leftrightarrow U = U_n}$$

Chapter 3

The Short Run

> *"The long run is a misleading guide to current affairs. In the long run we are all dead. Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is long past the sea is flat again."*
>
> - Keynes, *A Tract on Monetary Reform.*

To start with, recall that growth theory sought to explain the evolution of potential output, and ultimately human welfare over long stretches of time—and, really, what could be more important than that? Yet, in that long-run analysis, there was no discussion of such issues as unemployment or the periodic deviations of output from potential. In the next chapters, we seek to analyze those deviations and economic fluctuations.

We are now going to examine goods market equilibrium in the short run. Now, in our analysis of the long run (i.e., the Solow model), we implicitly assumed that prices were flexible and adjusted instantaneously to clear markets and ensure that aggregate demand is equal to potential output; thus, there was no talk of recessions or booms. Yet the assumption of *perfectly flexible prices* was a big assumption, though. If we indeed had this kind of price flexibility we would not have recessions or unemployment at all, since prices

and real wages would just drop, respectively, until aggregate demand was again equal to potential.

Motivated by the Great Depression, Keynes argued that that the classical, long-run theory was inappropriate for analyzing short run fluctuations. Rather than prices adjusting, he argued that *output* adjusted instead. Central to this theory was the idea that prices were *sticky* (due to so-called "menu-costs") in the *short run*, and that the price adjustment process takes possibly years, and would only occur in the *long run*. Arguing that this was simply too long, he famously quipped that "we're all dead in the long run." This chapter analyzes the short run and what has become called *Keynesian economics*.

3.0.2 Basic Keynesian Idea

To illustrate the basic Keynesian insight of *demand-determined* output, I present an example. Imagine some baker, Brad, produces 100 muffins a day. This is his *potential output*. His price is \$1 a muffin, so on a normal day he makes \$100. Yet, one day—let's call it day one—people are feeling a bit down or depressed, and only demand 70. As a result, aggregate demand on day one is just 70. Brad thus has inventory accumulation (these are "stay fresh" muffins) of 30. What should he produce on day 2? Perhaps day one was a real bad day, and people couldn't make it in or something. Or perhaps people have developed an acute distaste for his produce. Who knows?

Not knowing quite what's going on, Brad produces produces 75 muffins on the second day (he still has 30 left over from yesterday). But, alas, demand on day two is still 70. So, now he has more unsold stock, this time 35 muffins left over. Finally, the message begins to sink in that demand for his stock is only 70 a day. So eventually we reach a stage where he simply produces 70 muffins a day to meet to new lower level of aggregate demand. According to Keynesian economics, this is our equilibrium output (formally, where inventories do not accumulate.) Below are the key insights from this simple tale:

- Crucially, the price is stuck. The big question is, why doesn't Brad lower his price

so as to raise aggregate demand to 100? Because there are "menu costs" to price adjustment, he keeps in prices fixed. (Speaking of which, menu costs is a broad term, incorporating all the costs to changing menus, but more subtly it could refer to the fact the firms might be reluctant to lower prices for fear of perceived quality reductions.) Unlike in conventional micro, the market here doesn't clear. The price ($1) is *not right.*

- The sticky price equilibrium is not optimal in that the economy may settle at a point where output is less that potential. In this case, our equilibrium represents a recession, since we have an output gap, $Y^* - Y$, of 30. If Brad had other people working for him, he would surely lay some off, causing unemployment to rise above the NAIRU (this is just Okun's law.)

- With sticky prices, equilibrium output is *demand-determined.* In this case demand is 70, and this indeed is equilibrium output. *Output falls to equal demand.* Thus in the Keynesian equilibrium, output equals the level of aggregate demand. In contrast, with flexible prices, output is *supply-determined.* Supply is given by potential output (100 in this case) and prices adjust to ensure that aggregate demand just equals 100. Yet here the quantities adjust, not the prices.

- We assume that the flexible price case will prevail in the *long run.* After months/years of producing 70 muffins he'll eventually scratch his head and say "I'm capable of producing 100. I'll just lower my price of muffins from $1 to 80 cents, say, and I'll sell all of what I can supply." Yet in the meantime, we're mired in recession.

Key Idea 3 *In the short run, prices are sticky or fixed. In this case, output is not determined by potential. Instead, it is determined by the actual level of demand in the economy. The price is stuck and does not adjust to clear the market. In other words, the price is not right.*

3.1 The Keynesian Model

I now present the Keynesian model. This wont hurt (much.) To start with, we write aggregate consumption as $C = a + mpc\ (Y - T)$ where a is a catch-all term for non-income factors affecting consumption; e.g., interest rates, consumer confidence, expectations, household wealth, future income, and so on. This is called *autonomous consumption*. $Y - T$ is simply *disposable income*, while *mpc* denotes the *marginal propensity to consume*; that is, the fraction of disposable income that is consumed. Y denotes income, and as we know from earlier on in the course, this also equals the level of production.

Our equation for expenditure/aggregate demand is simply $AD = C + I + G + NX$. Investment here denotes actual investment demand, and does not include inventory investment.[1] To keep things simple, I will assume a closed economy, so $NX = 0$, and also that $T = 0$. Noting that our Keynesian consumption function is $C = a + mpc\, Y$ our expression for aggregate demand becomes

$$AD = C + I + G = a + mpc\, Y + I + G$$

Now, in equilibrium the level of production is equal to aggregate demand. That is,

$$\boxed{Y = AD.} \tag{3.1}$$

The latter is our equilibrium condition and at this point, firms sell exactly what is demanded. Writing this out in full we have

$$Y = a + mpc\ Y + I + G$$

Because Y lies on each side, we can use our equilibrium condition to solve for our equilibrium output, Y. Solving for Y, we get equilibrium output of

$$Y = \frac{a + I + G}{1 - mpc}.$$

[1] Recall from before that items not sold were regarded as inventory investment.

Yet there is nothing inherently favorable about this equilibrium; for instance, the economy could indeed settle in a recession.

3.1.1 The Multiplier

Using our expression for equilibrium output above we have

$$\frac{\partial Y}{\partial G} = \frac{1}{1 - mpc} > 1$$

That is, the increase in equilibrium output is *greater than one* when government expenditure increases by one. This is the famous *multiplier* effect. To understand this, suppose the government raises expenditure by ΔG. That injection itself represents an increase in demand of ΔG. As a result, the owner of the firm the government purchases from receives ΔG. Because his marginal propensity to consume is greater the zero, he too is going to spend some fraction (mpc ΔG) of it, and likewise for the next recipient, and so on. And the process just goes on and on, as the money is spent and respent or simply *recycled* across the economy. As a result, the ultimate increase in income is indeed *greater* than the initial ΔG. To take a numerical example, say I give you \$100. Then you spend \$80 of it (assuming $mpc = .8$), and then the next person spends \$64, and so on. Thus the initial expenditure of \$100 has already increased expenditure by \$244. So the multiplier effect amplifies the effect of the initial stimulus. To see this mathematically, consider the equilibrium condition $Y = AD = C + I + G$. You see, an increase in G leads to an increase in Y, *but since* C *itself is a function of* Y, this causes an increase in C, which leads to further increases in Y, and so on.

3.1.2 Expansionary Fiscal Policy

According to Keynes, in a recession the government ought to increase expenditure so as to rein the economy back to potential. That is, government expenditure ought to be *countercyclical*: it should rise in recessions, and fall in booms. One important implication

of the multiplier is that the fiscal authorities need only embark in *moderate* spending increases so as to mitigate recessions (and eliminate the so called *recessionary gap*); the multiplier process will take over thereafter and spur *further* increases in economic activity. Moreover, because tax revenues would rise as economic activity increased, part of the stimulus would effectively be self-financing. Keynes argued that government should spend money on anything—*anything*—so as to generate subsequent rounds of spending in the economy. On this note, Paul Krugman, an economist at Princeton, writes about fiscal policy in Japan in the nineties:

> *"In* 1996 *Japan spent about* $300*bn on infrastructure, compared with only* $180*bn in the US..... Superb roads run through sparsely populated regions, ferries to small islands have been replaced by bridges, and many of the country's riverbeds have been paved..."*

Key Idea 4 *In the short run, prices are sticky or fixed, and output is determined by the actual level of demand in the economy. To close the output gap, Keynes advocated that the government increase expenditure via expansionary fiscal policy; this increase, he argued, would have a multiplier effect on demand and output.*

Chapter 4

Fiscal Policy

"If you think health care is expensive now, wait until you see what it costs when it's free".

P.J. O'Rourke

The budget balance is given by:

$$T - G$$

i.e., taxation minus expenditure. This is simply the governments net income; what they receive in taxes less what they spend.

Definition 10 (Actual Budget Balance) *This is the budget balance when the economy is at its present level; i.e., what's reported in the media.*

Definition 11 (Structural Budget Balance) *This is the budget balance when the economy is at potential output, Y_n. It is also called the cyclically-adjusted budget balance.*

This gives the balance that's solely due to endemic features of government policy such as the normal level of government taxation and the normal level of governmental discretionary expenditure. The structural balance should not be negative; a negative balance indicates that fiscal policy is currently unsustainable.

Definition 12 (Cyclical Budget Balance) *This is given by the actual balance minus the structural balance.*

The cyclical budget balance is the part of the actual balance that's attributable to the business cycle. For instance, government revenues always decline in a recession due to less economic activity and greater unemployment benefits. These kind of shortfalls represent cyclical once-off imbalances, and are not due to fixed structural factors. To see what I'm talking about, let's take an example. Suppose that the *structural* budget balance is -10, and the *actual* budget balance is -50; in this case the *cyclical* budget balance is -40. This basically means that the economy would *normally* have a balance of -10, but due to a recession, is running the deficit of -50, which is 40 less than it would be ordinarily.

Because it indicates the *scale* of the deficit, it is common to give the ratio of the budget deficit to GDP. Since the level of GDP provides a rough indication of how much tax revenue the government can raise, this ratio is useful for ascertaining whether deficits are *sustainable.* Speaking of which, the stock of debt indicates how much debt the government has accumulated; persistent deficits, therefore, ultimately lead to a high stock of debt. The debt may be owed to domestic residents or foreigners; very crudely, debt owed to domestic residents is deemed to be less serious, since it's the "country" owing debt to itself. The debt to GDP ratio is frequently cited as an indicator of the tax burden for future generations; ultimately, all the debt must be paid off by taxpayers in the future. Investors who purchase government bonds use the debt to GDP ratio as providing an indictor of likely default in the future; for instance, is the imposition of the future tax burden politically feasible for the government? An unusually high debt to GDP ratio suggests not, in which cause investors would raise the risk premium they would charge the government for borrowing.

4.1 Issues with Fiscal Policy

- By the time the government approves an expenditure programme, the economy could be *above* potential again, in which case the stimulus would only *destabilize* the

economy.

- To stimulate an economy, the government should direct tax cuts at those with high high marginal propensity to consume, who are typically low income earners.

- Note that any fiscal expansion could be partly spent in imports and need not stimulate the domestic economy. So fiscal policy has become less potent with increasing globalization/trade. For example, for a small open economy like Ireland, fiscal policy would only have moderate effects.

- Automatic stabilizers refer to the fact that fiscal policy *automatically* becomes more expansionary in a recession. In particular, unemployment benefits rise and, because of less economic activity, tax revenues fall. For both reasons, the government takes less away from an economy in a recession.

- According to Keynesian theory, governments should run surpluses in booms. Yet this is almost politically impossible, as people lobby for readily available funding in booms. This leads to a situation where there are budget deficits in booms and recessions, causing government debt to rise.

- Financing government expenditure invariably entails raising taxes in the future. Raising taxes introduces distortions in economies as people try to evade the tax. In turn, this may reduce work effort/labour supply, investment, and so on. As a result, high tax rates can reduce potential output. Fiscal expansions are not a free lunch.

- Expansionary fiscal policy can have various perverse effects. The very prospect of higher taxes in the future might cause an increase in saving today, completely offsetting the increase in government expenditure. This anti-Keynesian theory follows from the permanent income hypothesis, where people consider their *lifetime* income when they consume *today*.

- In the basic Keynesian analysis, prices and interest rates are fixed. Yet, in reality, these do change a little in the short-run, which reduces the size of the multiplier. Empirical estimates of the multiplier vary wildly, but most estimates are relatively small.

4.2 Supply Side Economics

So far, most of our discussion of fiscal policy has been concerned with with increasing the level of demand to attain a given potential output level. However, another school of thought, *supply side economics*, emphasizes supply of labour and savings. Supply-siders see tax cuts, not as a way to stimulate demand, but rather as a means to stimulate work effort and investment. Namely, by raising wages and profits, lower marginal tax rates on labor and capital gains should stimulate more labor force participation and entrepreneurship, thus raising potential output. Many supply siders contend that lower tax rates would stimulate so much economic activity that tax revenues could in fact *rise*. The Laffer Curve, shown in Figure 4.1, illustrates this cute idea. According to the Laffer curve, there is some tax rate (on any good, most obviously labour) that maximizes tax revenue. Any increase beyond the optimal rate will deter economic activity and thereby *lower* tax revenue. The relatively low rate of corporate tax in Ireland is a good example of how a low tax rate can raise revenue.

Supply-side economists also worry about the supply side effects of unemployment insurance, which reduce the incentive to find work. Moreover, to finance the welfare state, governments must tax heavily those who *do* work, prompting *them* to work less too. Indeed, Edward Prescott, a Nobel Laureate and prominent supply-sider, has argued in a widely cited paper that *"Americans now work fifty per cent more than do the Germans, French and Italians."* He attributes almost all of this to differentials in tax rates across these countries.

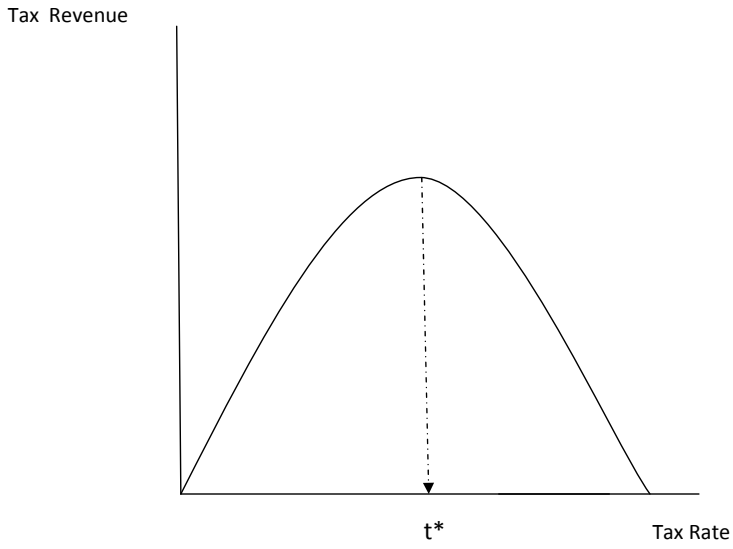

Figure 4.1: The Laffer Curve: The tax rate t^* maximizes tax revenue. Any rate above this will greatly deter economic activity and so reduce tax revenue.

Tax Rates

The simplest form of tax is a lump-sum tax, which means everyone simply pays some fixed amount to the government that is independent of their income. Yet rather than being lump-sum, in reality most taxes depend on income.

Definition 13 (Progressive tax rate) *This is when the tax rate rises with income. Most tax systems are progressive, but such systems have the implication that they might deter the most the most highly paid workers—often the most skilled ones—from working and investing.*

Definition 14 (Regressive tax rate) *This is when the tax rate falls as income rises. For example, a tax on smoking is often considered regressive; namely, smoking is most prevalent among low income people, yet the tax rate on tobacco is extremely high.*

Definition 15 (Flat tax rate) *This is when the tax rate is independent of income.*

Chapter 5

The AS-AD Model

The AS-AD analysis indicates the short-run output effects of various changes, and then indicates what happens as the economy adjusts to its long-run equilibrium. In particular, it indicates what happens to output in the short run, and what ultimately happens to the price level (e.g., the CPI) in the long run. To start with, the AD curve indicates the level of aggregate demand in the economy for each price level. It slopes downwards because:

- A high price level leads to a high level of the real exchange rate, and this reduces net exports. Because net exports are a component of aggregate demand, a fall in net exports causes aggregate demand to fall.
- A high price level causes negative "wealth effects"; namely, a high price level reduces the purchasing power of peoples' money, which makes them feel poorer; in turn this reduces consumption, which reduces aggregate demand.
- A high price level means people need more money to buy goods and services. Confronted with higher prices, people place less money in the loanable funds market. This leads to higher real interest rates, which reduces investment and consumption, and hence aggregate demand.
- If the price level is high today, people might expect it to fall in the future. For

this reason, they might postpone expenditure until the future, leading to a fall in aggregate demand *today.*

Anything that changes the level of aggregate demand for a given price level *shifts* the curve. For example, if consumers become more optimistic and consume more, this would shift the curve outwards. Both monetary and fiscal policy shift the AD curve.

The long-run aggregate supply curve (LRAS) indicates the level of potential output; this is given by the production function in the Solow model. Consistent with the classical dichotomy, this is independent of the price level, and so the curve is vertical. Changes in the economy's *ability* to produce good and services shift this curve. The economy's long-run equilibrium is given by the intersection of the AD and LRAS curves.

The short-run aggregate supply (SRAS) curve simply indicates the level of prices in the economy at any point in time. Because it indicates that firms will supply any amount of output at the given price level in the short run—as in the Keynesian model—it is called the short-run aggregate supply curve. As firms change their prices, the line moves up and down; it is convenient to simply consider it a *price adjustment* line. In particular, when output is above potential, the economy "overheats" and firms' costs rise—e.g., they must pay overtime to workers, while trade unions have more bargaining power due to labour shortages. The rise in costs induces firms to ultimately raise their prices. Conversely, costs fall in a recession, which eventually motivates firms to lower prices.

When combined with the AD curve (as in Figure 5.1), the SRAS curve simply picks out a point on the AD curve, and shows the equilibrium level of output in the short-run. More generally, the economy's short-run equilibrium is given by the intersection of the SRAS and AD curve.

In this analysis, I assume prices are fixed for a year, say, and then prices adjust slowly towards the long-run equilibrium; which is given by the intersection of the AD and LRAS curves. Throughout, I implicitly assume that the level of potential GDP growth and the long-run rate of money growth are both zero.

Key Idea 5 *The economy's long-run equilibrium is given the intersection of the LRAS and AD curves. In the long run, the economy is always at potential. In the long run, the burden of adjustment falls on prices.*

Key Idea 6 *The economy's short-run equilibrium is given by the intersection of the SRAS and AD curves. In the short run, the price level is fixed, and the burden of adjustment falls on output.*

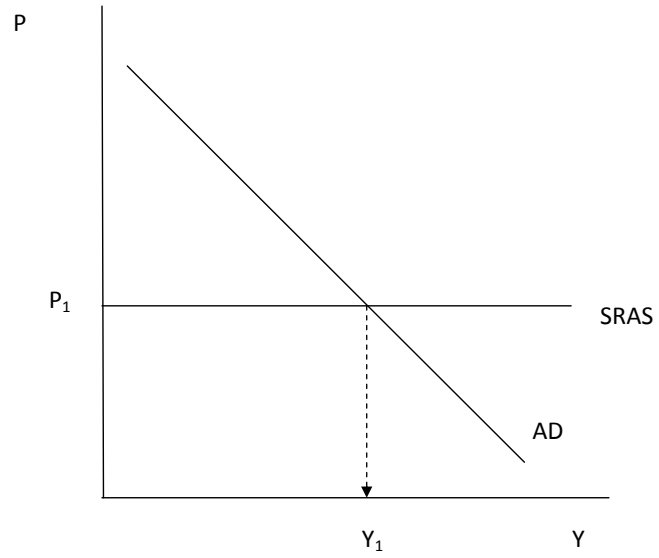

Figure 5.1: The intersection of the AD and SRAS curves gives the short-run equilibrium. Here the price level is P_1, while output is Y_1. However, this level of output is not necessarily equal to potential.

5.0.1 Analyzing the Model

In the short run the price level is fixed, and output changes. If output is not at potential, prices will eventually either rise or fall until $Y = Y_n$. Price adjustment is the way the economy returns ultimately to potential output. Graphically, the SRAS curve adjusts until we return to potential. The economy *always* reverts to this potential; this is the *natural*

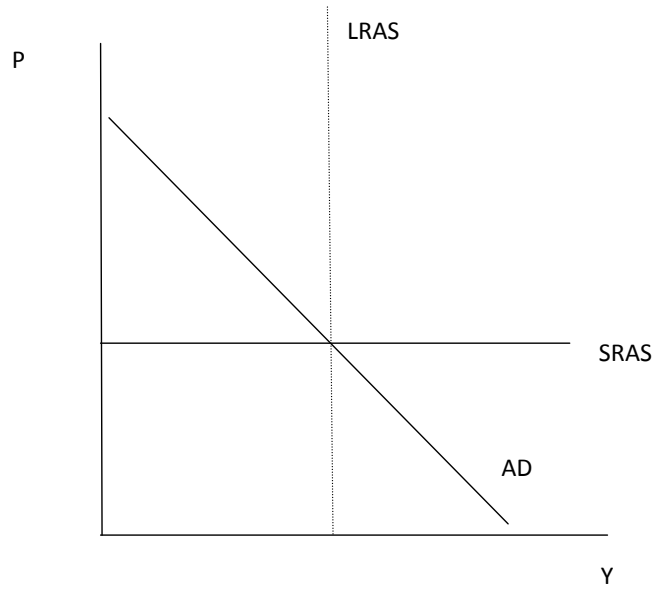

Figure 5.2: In the long-run equilibrium, the AD, SRAS, and LRAS curves all intersect.

rate hypothesis. Yet the price adjustment process can take years; as Keynes famously quipped "*we're all dead in the long run.*" Although the economy returns to potential, policies and economic developments can *permanently* affect the price level. In addition, some economic polices may also alter potential; e.g., a fall in the NAIRU would raise the number of workers and so shift the LRAS curve to the right.

Key Idea 7 *The economy will always revert to potential (to $Y = Y_n$), while unemployment will revert to the NAIRU. This is the natural rate hypothesis.*

Key Idea 8 *What $Y > Y_n$, the economy is in a boom and prices will rise. So when $Y > Y_n$, the SRAS line shifts upwards. Analogously, if $Y < Y_n$, then prices will fall and the SRAS curve will shift downwards.*

Key Idea 9 *The magnitude of the movement of the SRAS curve is proportional to the discrepancy between current output and potential. For instance, the deeper the recession, the greater the subsequent deflation.*

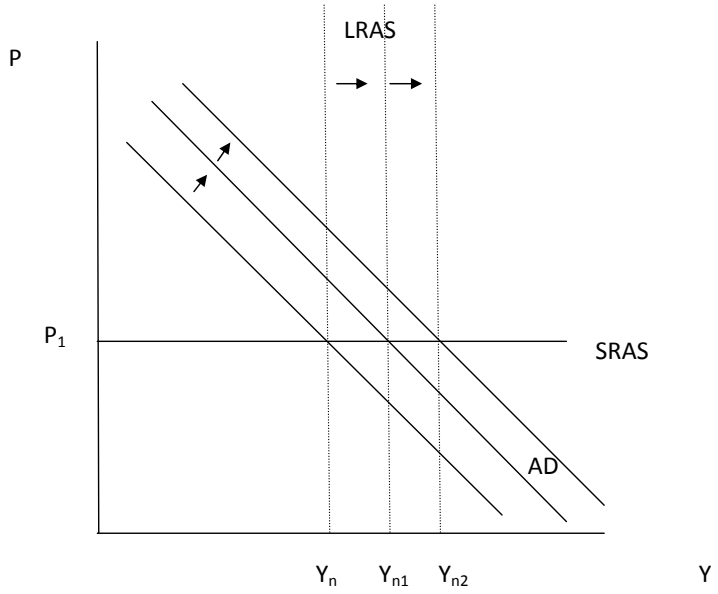

Figure 5.3: Long-run money and output growth. In reality, potential output grows over time, while the central bank is always increasing the money supply. As drawn above, both forces can maintain a stable price level.

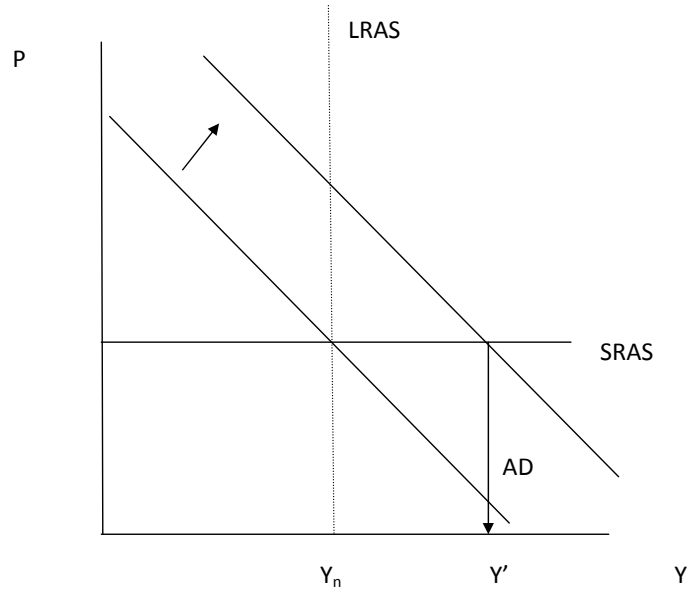

Figure 5.4: Expansionary Fiscal Policy: Short-Run Response. Note that the difference between Y_n and Y' is a function of the multiplier.

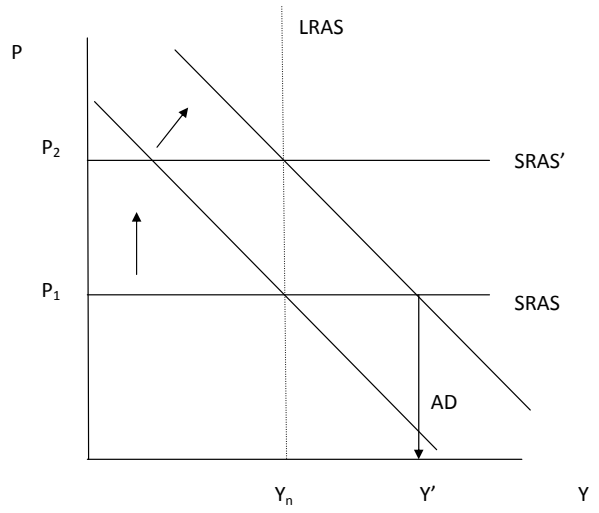

Figure 5.5: Expansionary Fiscal Policy: Long-Run Response. The policy causes prices to rise eventually, and the economy reverts to potential. Yet now the price level is higher.

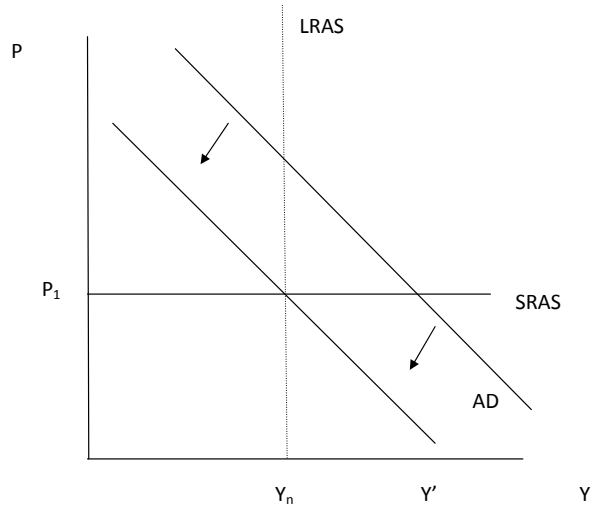

Figure 5.6: If the economy starts off in a boom with output at Y', the central bank will likely contract the money supply and shift the AD curve inwards. This way, it averts the impending rise in inflation. Good monetary policy is preemptive.

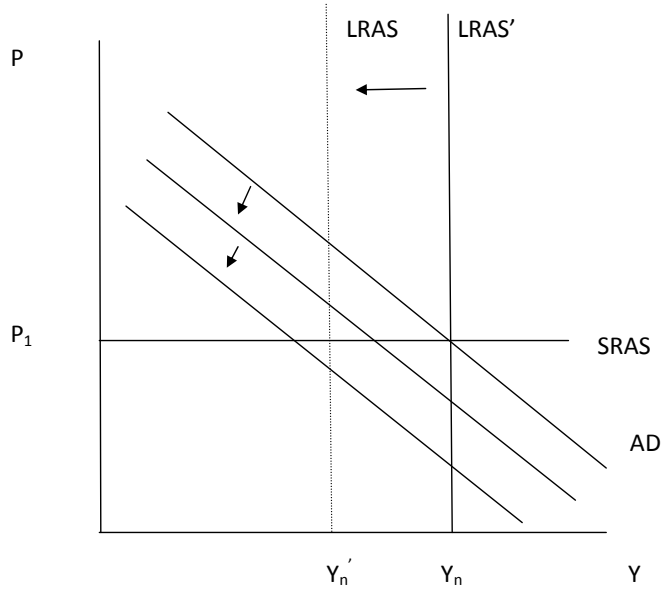

Figure 5.7: During the Great Depression, aggregate demand fell due to a large fall in consumption demand and a contraction of the money supply. In addition, because the government rose tax rates to extremely high levels, labour force participation fell, which caused potential output to fall.

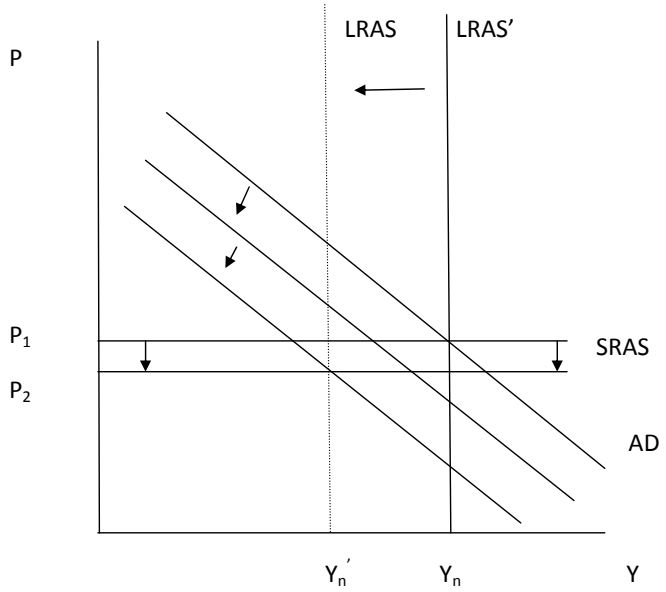

Figure 5.8: Price Adjustment during Great Depression: prices fell until the economy returned to its new lower level of potential output.

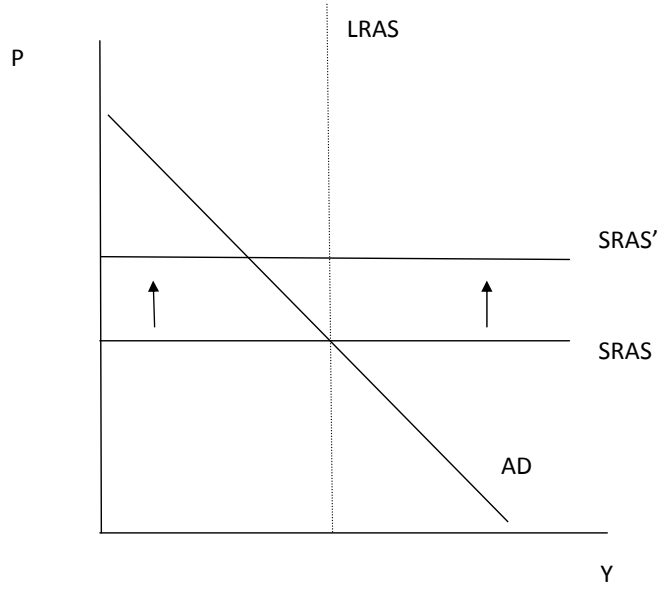

Figure 5.9: A supply shock: e.g., a large increase in oil prices forces firms to raise their prices. This leads to a higher price level and a recession, and is called stagflation (i.e., a stagnant economy and inflation.)

5.1 The Phillips Curve

We derive the Phillips curve from the AS-AD model. When the economy is in recession and when unemployment is above the NAIRU, the AS-AD model predicts the economy will experience deflation. In contrast, when output is above potential and when unemployment is below the NAIRU, the AS-AD model predicts the economy will experience inflation. When unemployment is at the NAIRU, there is no inflation.[1] The Phillips curve just illustrates these respective relationships between inflation and unemployment. Figure 5.10 illustrates the basic relationship. Often the Phillips curve is described in terms of a tradeoff faced by policymakers; namely, the can attain unemployment below the NAIRU, but at the cost of inflation. Yet the tradeoff only holds in the short run. In the long-run, the economy will always revert to potential, while unemployment will revert to the NAIRU. Formally, we say the long-run Phillips curve is vertical; in other words, there is no relationship between inflation and unemployment in the long run (this is just the classical dichotomy. See?)

Figure 5.11 illustrates a more common depiction of the Phillips curve. This is the case, where there is a positive rate of money growth (and inflation) in the long run. What this basically says is the economy experiences inflation higher than its long-run rate in a recession, while the opposite holds for a boom.

[1] Indeed, this is where the term NAIRU comes from; the Non-Accelerating Inflation Rate of Uemployment.

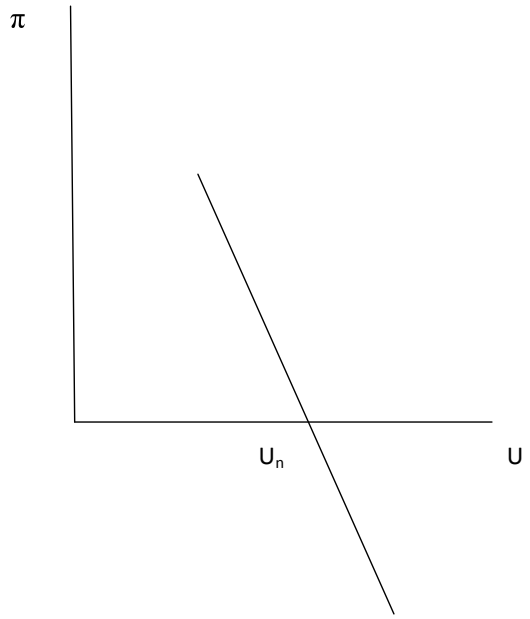

Figure 5.10: The Phillips Curve: when unemployment is above the NAIRU U_n, inflation π is negative, and vice versa.

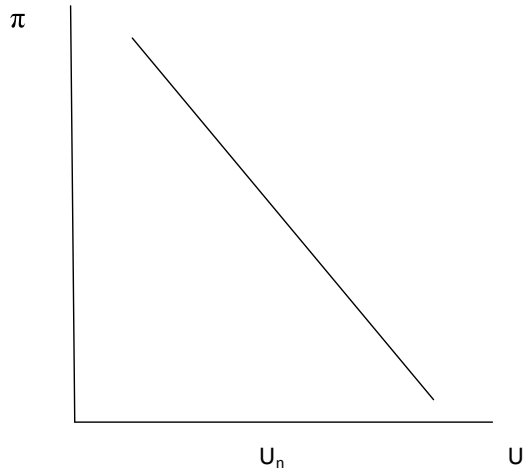

Figure 5.11: The more general Phillips Curve, when there is always some positive level of money growth. In this case, there is inflation even when the economy is at potential. In a boom, however, inflation rises above the long-run equilibrium rate (caused by permanent money growth).

Chapter 6

Monetary Policy

"The Federal Reserve's job is to take away the punch bowl just as the party gets going".

William McChesney Martin

6.1 Money

Briefly, the money supply comprises anything that can be used to pay for goods and services. Most importantly, when determining what the money supply is, we wish to know what can potentially cause *demand* for goods to rise. For example, if apples were regularly used in transactions, then they too would be regarded as a component of the money supply. Of course, the most basic and natural measure of the money supply is called the *monetary base* (or sometimes called *high-powered money*); this is the amount of physical currency is circulation and held in banks' reserves. The central bank has direct control over the monetary base.

The most common measure of the money supply is $M1$; this measure of the money supply includes all currency and chequing account balances. All of these can be used to make transactions. Because cheques can be used to purchase goods and services, the sum of all chequing account deposits also constitutes part of the money supply.

6.1.1 Money Creation at Banks

To see how banks "create" money, consider this example. Suppose I sell a book to someone and I receive 100 euros (this is the *monetary base.*) So far, the money supply is 100. Then I go to a bank, and put the money in a chequing deposit. Now, each bank must maintain a certain fraction of new deposits on reserve—to meet *reserve requirements*—and may lend out the rest. Assuming the required reserve ratio is .8, the bank now lends out 80 to someone. That person then purchases something off you, and you then deposit the 80 in another chequing deposit in another bank. That bank then lends out 64 of that, and so on. Formally, we say the *money supply* or $M1$ is

$$M = 100 + 80 + 64 + \dots$$

You can view this as simply the sum of currency and what's lent out (or more formally, the sum of what's been deposited in chequing accounts.) Note that the money supply is a multiple of the physical amount of currency, i.e., the 100 euros. Mathematically, we say that

$$M = \mu MB,$$

where M denotes the money supply, MB the monetary base, and μ the *money multiplier.* Roughly, the money multiplier gives an indication of the degree to which the monetary base is "recycled" by banks throughout the economy.

For a high money multiplier, we need two things. First, banks must be willing to lend, rather than simply holding cash in reserves; this way, money is "recycled" more. Second, people must be happy to deposit money in banks (rather than keeping it under the proverbial mattress.) These features result in lots of "recycling" and so yields a high money supply. Note that, although the central bank has direct control over the monetary base, it has only *indirect control* over the money *supply.* For convenience, however, we often assume the central bank has direct control over the money supply; yet keep in mind

this is only true if the money multiplier is constant. So from now on, I assume the central bank controls the money supply.

6.1.2 Changing the Money Supply

How does the Bank increase the money supply (or more specifically the monetary base)? Quite simply, it just prints money and *buys stuff.* In practice, to increase the money supply, the central bank prints money to buy *government bonds* from banks, thereby putting more money into circulation. These are called *open market operations.* Likewise, to contract the money supply, it sells bonds to banks, thereby withdrawing money from circulation. It is important to keep in mind that open market operations are almost always done with *banks*, not private citizens. Point is, if the central bank purchases bonds from banks, the banks end up awash with funds and are thus more willing and able to lend. This is really the route through which the money ultimately enters our pockets. To summarize, the central bank really controls the money supply *indirectly* via the banks.

6.2 Monetary Policy and Interest Rates

Although central banks can engage in open market operations to increase the money supply at any time, in practice they almost always change the money supply in response to developments in *federal funds market.*[1] This is the market where banks lend and borrow from each other for a short duration. You see, banks are often short of funds, and need to borrow to meet their reserve requirements. On any day, some banks will be short of reserves, while others will have excess reserves. The federal funds market is the place where banks can borrow and lend reserves to each other. Like any market, the interest rate on the federal funds market is determined by the interaction of supply and demand.

How does the central bank control this rate? Well, it does so by indirectly by controlling the level of reserves the banks hold. By engaging in open market operations with individual

[1]The is the term used for the market in the U.S.

banks, the central bank can raise or lower the level of reserves each bank holds; this in turn affects the level of reserves each bank can place on the federal funds market. Ultimately, this affects the *federal funds rate*; i.e., the cost of borrowing reserves. And when banks can borrow money/reserves cheaply, they typically pass that onto consumers. (After all, banks compete to make loans to customers; it's usually in their interest to attract borrowers.) Moreover, with access to cheaper reserves, they will lend more, increasing the money supply. Conversely, if the federal funds rate is high, banks will then pass that onto their customers through higher borrowing rates; this way, the federal funds rate affects the interest rate that borrowers pay for funds. For this reason, we often say the central banks controls "the interest rate" in the short run.[2] *Most importantly, increases in the money supply leads to reductions the interest rate.* Lower interest rates in turn stimulate investment, consumption, and aggregate demand.

6.2.1 Taylor Rule

What determines the level of the federal funds rate the central bank will aim for? According to the Taylor Rule, the target for the federal funds rate, which is consistent with good monetary policy, is:

$$r^* = \gamma + \pi + .5(\pi - \pi^*) + .5(y - y_n),$$

where γ is a constant, π denotes inflation, π^* the inflation target, y output, and y_n potential output. For example, if output is below potential (i.e., $y - y_n < 0$), then the Taylor rule dictates that the central bank should lower the interest rate; this way, by reducing the cost of borrowing, aggregate demand should rise. In addition, if inflation exceeds target, the bank should try to contract the economy and raise the interest rate; we already know from the AS-AD model that this contractionary policy will reduce aggregate demand and hence inflation. Finally, if $i = 0$ and the central bank wishes to reduce rates further, the central bank is faced with a *liquidity trap*. In this case, the bank engages in unconventional *quantitative easing*, whereby the bank increases the money supply by purchasing an array of assets—such as foreign currency—from the private sector.

[2] In the long run, the increase in the money supply will cause prices to rise, which in turn will increase demand for loanable funds. This will cause the interest rate to rise again. Therefore, the bank can only affect interest rates for as long as prices are fixed; i.e., in the short-run.

Chapter 7

The IS-LM Model

"We have not succeeded in answering all our problems. The answers we have found only serve to raise a whole set of new questions. In some ways, we are as confused as ever, but we believe we are confused on a higher level and about more important things."

- Anonymous

The ISLM model is a simple model designed to illustrate how monetary and fiscal policy combine to affect economic activity *in the short run.* Basically, it is used to determine the effect on output of various policies. Unlike the AS-AD analysis, it only deals with the short run and ignores price adjustment. Central to the model is the idea that a low interest rate stimulates aggregate demand and in turn production. Before going on, note that all interest rates are henceforth subsumed into a single rate, "the interest rate", so we're abstracting away from a multiplicity of issues like real/nominal, risk and maturity, the yield curve, and so on. Generally speaking, most interest rates do in fact move in tandem, so this assumption is reasonable enough. Most importantly, we assume the central bank controls the interest rate.

7.1 Derivation

Our first relationship is the IS curve, which indicates a negative relationship between output and the interest rate. Figure 7.1 presents the basic setup. There are three main reasons for the negative relationship:

1. By making borrowing more costly, high interest rate makes investment less attractive. This reduces investment demand and hence aggregate demand and production.

2. A high interest rate reduces consumption, especially consumption of durable goods such as furniture (i.e., i.e., the goods people tend to borrow for.)

3. As indicated in Chapter 1, a high interest rate causes the exchange rate to appreciate. Recall that a rise in the interest rate induces capital inflows, causing an exchange rate appreciation; this in turn raises the real exchange rate and reduces net exports. Hence, as the interest rate rises, net exports fall, so we can regard net exports as decreasing in r. The fall in net exports reduces aggregate demand and hence output/production.

Having dealt with the slope, I now turn to shifts (relax). Anything that raises demand for a *given* interest rate causes the IS curve to shift outwards to the right; e.g., an increase in investment demand unrelated to interest rates would shift the IS curve outwards. Because monetary policy entails a changing interest rate, it does not affect the IS curve.

Key Idea 10 *The IS curve is downward sloping because a higher interest rate reduces investment, net exports, and consumption, and thereby reduces income or GDP.*

7.2 The LM Curve

The IS curve shows a range of combinations of interest rates and output. You might wonder, which interest rate do we settle at? Well, this is where monetary policy enters the

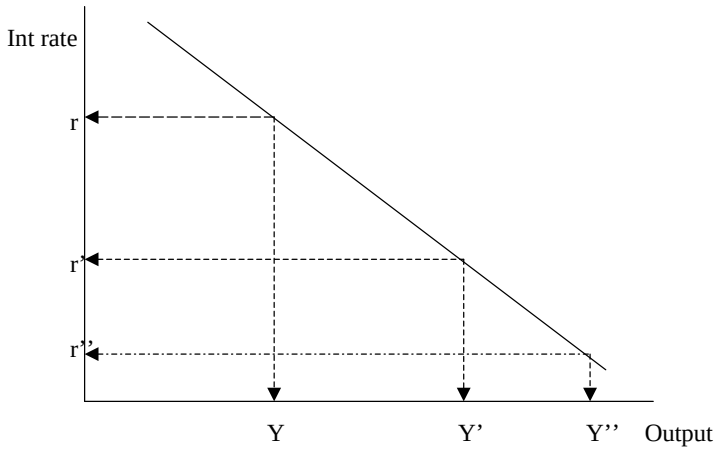

Figure 7.1: Suppose we start off at an interest rate of r. A fall in the interest rate from r to r' stimulates investment, consumption and net exports. Hence aggregate demand rises, leading to a higher level of equilibrium output Y'. If the interest rate fell to r'', aggregate demand would rise again, and equilibrium output would rise to Y''. Combining all the equilibrium combinations from above ($(Y, r), (Y', r'), (Y'', r'')$, and so on) yields the IS curve.

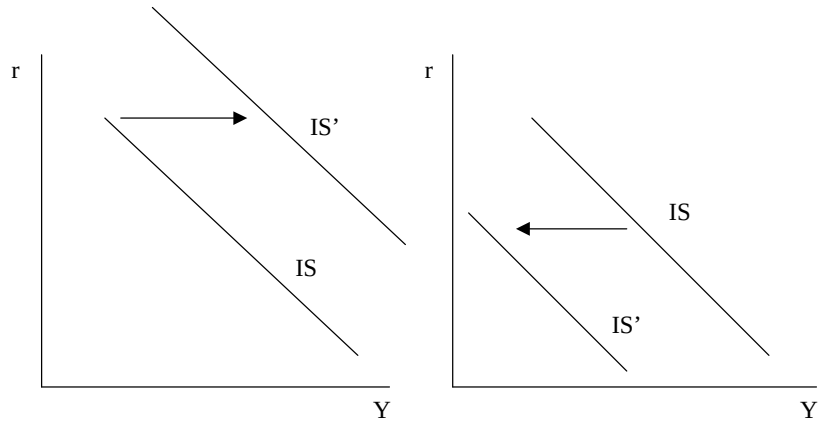

Figure 7.2: An outward movement of the IS curve is expansionary, while an inward movement is contractionary.

picture. We assume the central bank has control over the interest rate and adjusts it in accord with economic conditions (and specifically in accord with the *Taylor rule.*) The LM curve is simply a horizontal line indicating the interest rate chosen by the central bank. Although the central bank controls the federal funds rate, that rate affects the interest rate banks charge their customers. For this reason, we simply assume the central bank controls interest rates in the short run.

7.3 ISLM Model

Figure 7.3 illustrates the basic model; here output is at potential. The remaining figures illustrate various changes and the associated monetary policy responses. More generally, we could have a variety of possible combinations. For example, we could have a combination of an contractionary fiscal policy (causing the IS curve to shift inwards) and an expansionary monetary policy (a shift downwards of the LM curve.) Indeed, this was the situation in the U.S. in the early nineties with Bill Clinton's deficit reduction programme (a fiscal contraction) and Alan Greenspan's reduction in interest rates. Another example is German economic policy after reunification; there was a combination of expansionary fiscal policy (an outward shift of the IS curve) and contractionary monetary policy (a shift upwards in the LM curve). In all cases, the ISLM model gives us a good indication of what happens to output.

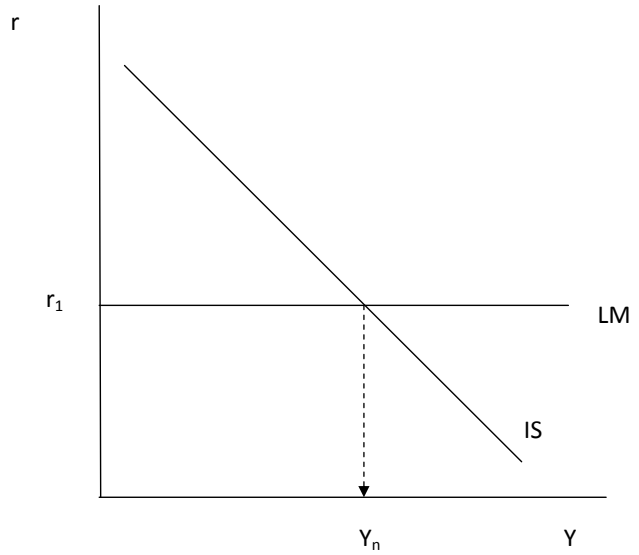

Figure 7.3: The basic model. This depicts an initial equilibrium where output is at potential Y_n.

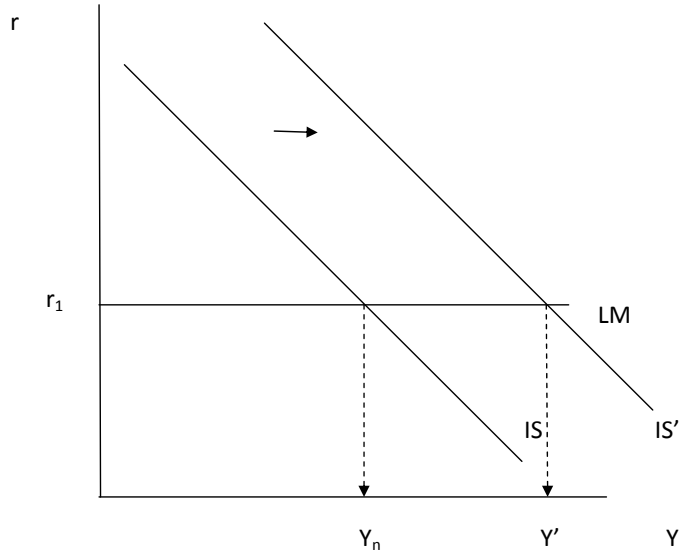

Figure 7.4: A fiscal expansion causes the IS curve to shift outwards, causing output to rise above potential.

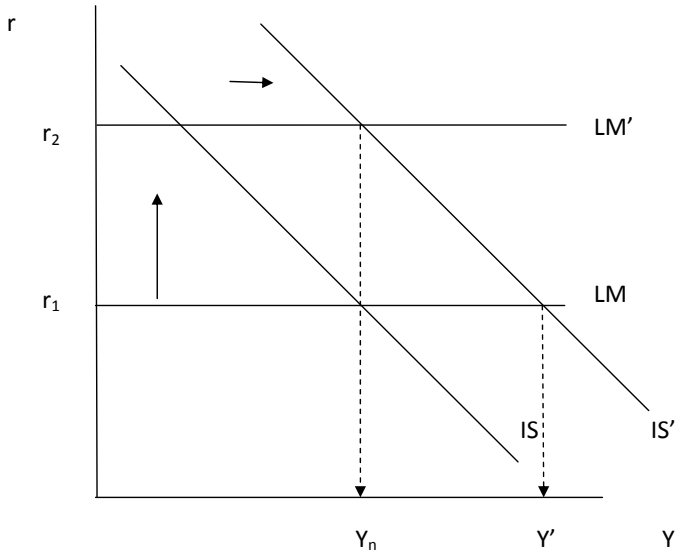

Figure 7.5: Because output is above potential, the central bank will attempt to avert a rise in inflation and therefore raise the interest rate from r_1 to r_2. For this reason, the LM curve shifts upwards.

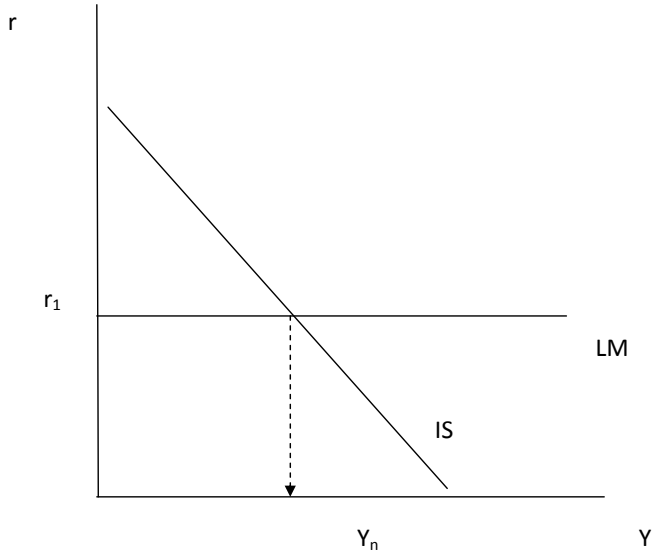

Figure 7.6: An initial equilibrium where output lies below potential Y_n. The next figure illustrates the response from the central bank.

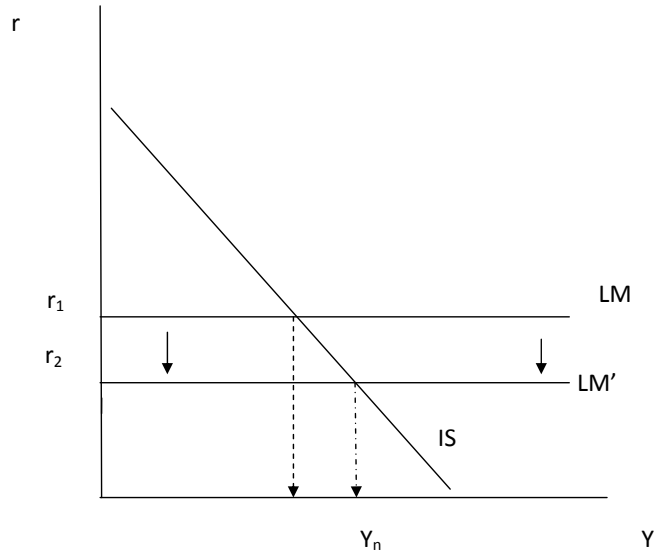

Figure 7.7: Expansionary monetary policy. Because output was below potential, the central bank lowers interest rates in accord with the Taylor rule. By reducing the interest rate from r_1 to r_2, aggregate demand and hence production increase to the level of potential output.