Introductory Macroeconomics

Richard Povey

June 3, 2007

Contents

I The Long Run and the Classical Model 9

1 Introduction 11
1.1 What is macroeconomics? 11
1.2 Key concepts and conventions 13
1.2.1 Timescales 13
1.2.2 Real and nominal variables 14
1.3 Gross domestic product and the circular flow 15
1.4 National income accounting 19
1.5 Average and marginal propensities 21

2 The Closed-Economy Classical Model 23
2.1 Assumptions 23
2.2 The supply side and the AS curve 23
2.3 The AD curve and the quantity theory of money 26
2.4 Analysis using accounting identities 28

II The AD Curve and the IS-LM Model 31

3 The Keynesian Multiplier Model 33
3.1 Assumptions 33
3.2 Policy analysis 35
3.2.1 Increase in government spending 36
3.2.2 Increase in autonomous consumption 37
3.2.3 An increase in autonomous investment 37
3.2.4 An increase in the private savings rate 37
3.2.5 An increase in the proportional income tax rate 38

3.2.6 An increase in government spending whilst raising taxes to keep the budget balanced . . . 38
3.2.7 Summary of results . . . 38
3.3 The microeconomics behind the multiplier . . . 39

4 The IS-LM Model and the AD curve 43
4.1 The IS curve . . . 43
4.2 The LM curve . . . 45
4.3 IS-LM policy analysis . . . 48
4.3.1 A loss in investor or consumer confidence . . . 48
4.3.2 An increase in the marginal propensity to save or the proportional income tax rate . . . 50
4.3.3 An increase in government expenditure . . . 51
4.4 The closed economy AD curve . . . 52

5 The Money Market 55
5.1 Money supply . . . 55
5.2 Money demand . . . 57
5.2.1 A reduction in the riskiness of bonds . . . 59
5.2.2 The introduction of interest on demand deposits . . . 60
5.2.3 The individual becomes self-employed . . . 60
5.2.4 A rise in the expected rate of inflation . . . 60
5.2.5 An increase in the price level . . . 60
5.3 Monetary Policy . . . 61
5.3.1 Fixed money supply . . . 61
5.3.2 GDP growth targetting . . . 63
5.3.3 Inflation targetting . . . 64

III The AS Curve and the Labour Market 67

6 The Labour Market and the AS Curve 69
6.1 The labour market . . . 69
6.2 Sticky wages . . . 70
6.3 Worker price misperception . . . 71
6.4 Sticky prices . . . 73
6.5 Strengths and weaknesses of the models . . . 73
6.6 Demand side and supply side shocks . . . 75

6.7 SRAS with worker price misperception 77

7 The Phillips Curve and the AS curve 81
7.1 Inflation control 81
7.2 The challenge of hysteresis 85
7.3 Gradualism vs. "Cold Turkey" 86

IV The Open Economy 89

8 The Mundell-Fleming IS-LM Model 91
8.1 Open economy concepts 91
8.1.1 Fixed exchange rates 93
8.1.2 The balance of payments 94
8.2 The Mundell-Fleming Model 95
8.2.1 A fiscal expansion 98
8.2.2 A monetary expansion 99
8.2.3 An increase in the world interest rate 100
8.3 Derivation of the aggregate demand curve 102

V Macroeconomic Policy Issues 109

9 Macroeconomic Policy Issues 111
9.1 Fiscal policy and budget deficits 111
9.1.1 Overview 111
9.1.2 Ricardian equivalence 111
9.1.3 The desirability of government budget deficits 115
9.2 Fixed vs. floating exchange rates 116
9.3 Central bank independence 120
9.4 Conclusion 121

List of Figures

1.1 The circular flow model 17

2.1 Classical labour market equilibrium 24
2.2 The quantity theory of money - AD-AS equilibrium 26
2.3 Investment in a closed economy classical model 28
2.4 A decrease in the saving rate s_1, decrease in taxation t or increase in government spending g 29
2.5 An increase in the saving rate s_1, increase in taxation t or decrease in government spending g 29

3.1 Inter-temporal choice with perfect consumption smoothing . . 40

4.1 Derivation of the IS curve from the Keynesian cross 44
4.2 The liquidity trap and the classical case 47
4.3 A loss in investor or consumer confidence 49
4.4 An increase in the saving rate or income tax rate 51
4.5 An increase in government expenditure 52
4.6 Derivation of AD curve 53

5.1 Fluctuations in fixed money supply 57
5.2 Goods market fluctuations with interest rate targetting 58
5.3 Potential destabilizing effect of fixed money supply 62
5.4 Fiscal and monetary policy co-ordination 65

6.1 Classical labour market equilibrium 70
6.2 "Downwards sticky" nominal wages 71
6.3 Worker price misperception 72
6.4 Monopoly power and nominal price rigidities 74
6.5 Demand side shock 77
6.6 Supply side shock 78

6.7 SRAS with worker price misperception 80

7.1 AS curves in an economy with inflation 83
7.2 “Cold turkey” inflation reduction 87

8.1 Fiscal expansion in Mundell-Fleming model 99
8.2 Monetary expansion in Mundell-Fleming model 100
8.3 Increase in world interest rate in Mundell-Fleming model . . . 101
8.4 Mundell-Fleming with floating exchange rates 105
8.5 AD curve with floating exchange rate in Mundell-Fleming model 106
8.6 Mundell-Fleming with fixed exchange rates 107
8.7 AD curve with fixed exchange rate in Mundell-Fleming model 108

Part I

The Long Run and the Classical Model

Chapter 1

Introduction

1.1 What is macroeconomics?

Macroeconomics is the branch of economics which seeks to model the economy as a whole. Like microeconomics, macroeconomics is a **social science**, in that it tries to model and predict human behaviour. Macroeconomics sets itself a highly ambitious task. Human economies are not only highly complex entities, human behaviour is also inherently reflexive; what we believe about the social world determines how we behave, which in turn shapes the social world itself. This feature of human social life is recognized in many social sciences. In macroeconomic theory, the most common example is the way in which **expectations** about the future affect current behaviour. On top of this, the consequences of getting things wrong can mean human misery on a vast scale.

At its most advanced theoretical level, macroeconomics shades into microeconomics, in that microeconomic methods are ultimately needed to justify macroeconomic theories. However, the relationship is more like that of biology to chemistry rather than, say inorganic to organic chemistry, in that we cannot simply see the one as a more complex application of the other. This is primarily because of the problem of **aggregation**; there is not a full consensus about the best way to piece together a microeconomic model of all the different components of the economy to build a coherent and satisfying macro model (which is not to say that a great deal of progress has not been made towards this goal). Different philosophies about this among macro-economists can lead to very different normative policy conclusions.

At its core, macroeconomic theory is about three key markets: the **goods market**, the **money market** and the **labour market**[1]. We usually lump all consumer goods together into a single good, which can be thought of as a "bundle" containing appropriate proportions of all the goods needed to survive in an economy (e.g. food, transport, housing). Hence we think of there being a single goods market. The money market concerns the determinants of the supply and demand of fiat money (coins and bank notes). However, things are more complicated than this because other financial assets, such as government bonds or corporate equity, are substitutes for money. So, in order to model the money market we must model their effect on it. Also, money is often held in private bank accounts, which means that some of the actual coins and notes are being held as reserves by the bank, not by individuals.[2] Despite these complications, thinking of the money market as a single market gets us a long way. A similar simplification is made with the labour market; even though there are many different types of worker, as a first stab at analysing this complex situation we model them all as being part of a single labour market.

Suppose that the assumptions of the First Theorem of Welfare Economics[3] were to hold (no externalities or monopoly power, perfect information and all goods traded). In this case, the goods, money and labour markets would all clear and the outcome would be Pareto efficient. There would be little need for macroeconomics as a separate subject. Macroeconomics as a discipline is therefore closely connected with the theoretical possibility and empirical reality of **market failure**. Unemployment, under-utilization of resources, "sticky prices", and the sometimes capricious role of expectations are all instances of market failure, and can only be comprehended once we drop the assumption that markets always operate correctly and beneficially.

There is a spectrum of theoretical opinion among macro-economists, which directly relates to a spectrum of political opinion about the best way to conduct macroeconomic policy. One key feature of this is beliefs about how

[1] In the open economy we add to these the market for exports and the foreign exchange market.

[2] Deposits in bank accounts are analysed as an additional "layer" of money created by the private sector.

[3] See a microeconomics textbook such as Varian.

pervasive and persistent these market failures are. There is a consensus that the money market clears the most quickly of the three (for the purposes of this book, you can think of it as always clearing instantaneously). This is because financial assets can be moved around and converted very rapidly (this was perhaps less true in the past, before the advent of modern information technology). Most economists believe that the goods and labour markets also clear in the **long run**. However, there is disagreement over how long it takes to get to the long run. It could be a matter of days, months or decades. (The idea of **hysteresis**, discussed in part III, would suggest that the short run always has long run consequences, and so there is never a long run.) The broad consensus view is that the long run is a matter of years, not decades.

The longer the short run is believed to be, the higher the premium that will be put upon macroeconomic **demand management policies**. These are the levers that the government can use to stimulate demand in the economy, and thus potentially correct for any market failure which is leading to underproduction. On the other hand, the shorter is the short run, the greater the importance of **supply side policies**. These policies concern the functioning of the supply side when the labour and goods markets clear. The analysis here is more recognizably similar to microeconomics. For example, the labour market can be distorted by monopoly behaviour of unions or employers in a similar way to the standard story in microeconomics. Most economists believe that both types of policy are important.

1.2 Key concepts and conventions

1.2.1 Timescales

Throughout this book, a number of terminological and mathematical conventions will be used. We will firstly summarize the concepts of the very short run, short run and long run:

In the very short run, the price level is completely fixed. This is sometimes called the **Keynesian short run**, because it reflects the original and simplest interpretation of Keynes' work. Fixing the price level is useful in understanding the Keynesian model, but it is too unrealistic to be adequate for any serious analysis. In the short run, prices can vary, but the labour

Table 1.1: Very long, long, short and very short runs.

	Price level	**Markets**			**Pop.+ cap.st.**
		Money	**Goods**	**Labour**	
Very short run	Fixed	Clears	Doesn't clear	Doesn't clear	Fixed
Short run	Varies	Clears	Doesn't clear	Doesn't clear	Fixed
Long run	Varies	Clears	Clears	Clears	Fixed
Very long run	Varies	Clears	Clears	Clears	Varies

and goods markets still fail to clear. This becomes important when we look in more detail at the reasons for failure in the labour market. The short run can be thought of as persisting for some time, perhaps a number of months or years. In the long run, the labour and goods markets have fully adjusted. This does not necessarily in general mean that the outcome is Pareto-efficient, because this will still depend upon the correct long run supply side policies being followed. However, it is safe to begin our analysis by thinking of the long run as where market failures have been fully "ironed out".[4] Finally, in the very long run, the population and the capital stock can change, enabling economic growth.

1.2.2 Real and nominal variables

One of the most important conceptual tools in macroeconomics is the distinction between nominal variables, which are measured in the price level of the day, and real variables, which are measured in terms of the abstract aggregated bundle which is outputted from the goods market. This distinction is necessary due to the occurrence of changes in the price level over time, usually in the form of inflation. In order to compare the real values of goods between two different time periods, it is necessary to express them at a common price level. Often, this is done by expressing values from certain years at the price level which pertained at a certain year. For example. suppose that we knew the nominal values of all cars sold in the U.K. in 2000, 2001 and 2002, X_{2000}, X_{2001} and X_{2002} respectively, and the price of an identical bundle of goods in each year P_{2000}, P_{2001} and P_{2002}. We could then express

[4] We are therefore implicitly assuming that the government has followed the appropriate supply-side policies to ensure that there is no monopoly power in the labour market, so that it is perfectly competitive in the long run. We will consider what the appropriate policies to achieve this would be in part III.

the value of cars sold in 2001 in £2000 as $X_{2001}^{£2000} = \frac{X_{2001}}{\left(\frac{P_{2001}}{P_{2000}}\right)}$. Here, $\frac{P_{2001}}{P_{2000}}$ is called the **deflator** (so called because we usually make nominal values smaller when we express them at the price level of a previous year). We can also compare values in real terms by converting them simply into the number of abstract bundles. This is equivalent to dividing by the deflator P_{2001}.

The convention throughout this book will be to identify all nominal variables with uppercase characters and all real variables with lowercase characters. So, nominal investment would be I and real investment will be i.[5] Coefficients in equations[6] will be expressed in Greek characters. The only exception for this will be the interest rate, where the convention is to identify the nominal interest rate as ι (this is the Greek "i", called "iota") and the real interest rate as r.

A variable marked with a star always represents an equilibrium variable, implying some kind of optimizing behaviour by economic agents. For example, Y^* is used to indicate the long run level of nominal output when the goods market and labour market are in equilibrium. A variable marked with a tilde above always represents a per capita variable. For example, $\tilde{y}$ represents real output per capita. These can be combined, so that $\tilde{y}^*$ is long run equilibrium real output per capita.

1.3 Gross domestic product and the circular flow

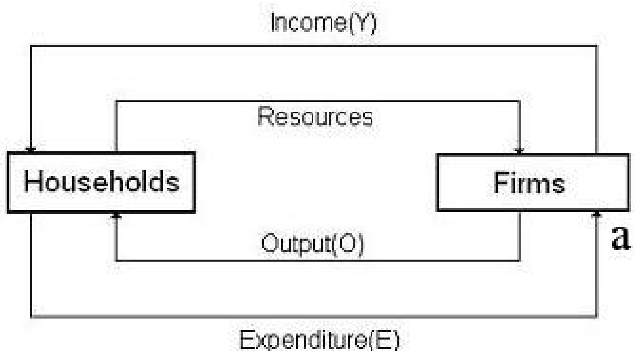
Gross domestic product (GDP) is defined as the net value of all final goods and services produced in the economy within a given period. One of the problems which arises when measuring GDP is the possibility of double counting. For example, if a firm manufactures the wheels for a car and then sells them on to the firm which builds the car, if the government counts both sales as part of GDP then the value of the wheels will be counted twice. We get

[5] So, with the price level fixed at year t, $I_t = i_t P_t$. Therefore dividing I_t by the deflator P_t gives real investment expenditure.

[6] Which are like "levers" or "switches" which alter the outcome of the model, and whose value must be plugged into the model endogenously.

around this problem either by only counting value added (i.e. the difference between the final sale value of the car and the sum of the prices of all the intermediate components bought by the car firm), or by only counting sales of final goods. Double counting can occur in other ways. If the government counts both the value of total factor income (wages, share dividends, etc.) and the total value of the goods bought using that income, then the whole of GDP will be double counted. The circular flow model provides a tool for thinking about how to avoid this kind of double counting. If you take any point on the large circle and then follow the path around the circle, there are leakages in and out of the total demand for final goods. However, once we get back to the same point after travelling round the entire circle, the total leakages will, by definition, cancel out. This means that we can consistently measure different components of GDP by choosing different points around the circle.

Suppose we begin at point a and move clockwise around the circular flow diagram. GDP can be thought of as the total amount of revenue earned by domestic firms from selling final goods. (If some firms only produce intermediate products, then we only count the value added of the final goods sold by the firms to which these intermediate goods are sold.) We assume that the whole of this revenue is paid to households in the form of various factor payments (including profits retained by firms, which, we must remember, are ultimately owned by households). A certain amount of this will be taken by the government in taxes. We can see that later in the circle, the government puts demand back into the circular flow by making government purchases of goods and services (which will be counted as part of the original GDP figure). What happens if the government taxes more than in spends (i.e. runs a budget surplus)? Well, in that case the government must either be buying assets from the private sector (e.g. bonds - government debt to the private sector - or other assets) or acquiring assets abroad (this is assuming for simplicity that interest payments to and from the foreign and domestic private sector are balanced, implying that the current account and net exports are equal). This means either that the private sector is running down its assets, or the stock of national assets abroad is increasing. So, either net exports are positive, or net private investment is positive (i.e. private savings are less than private sector investment, implying that private sector assets are shrinking), or both. By the definition of the accounting system, the surplus in the government sector must be exactly offset by the balance in



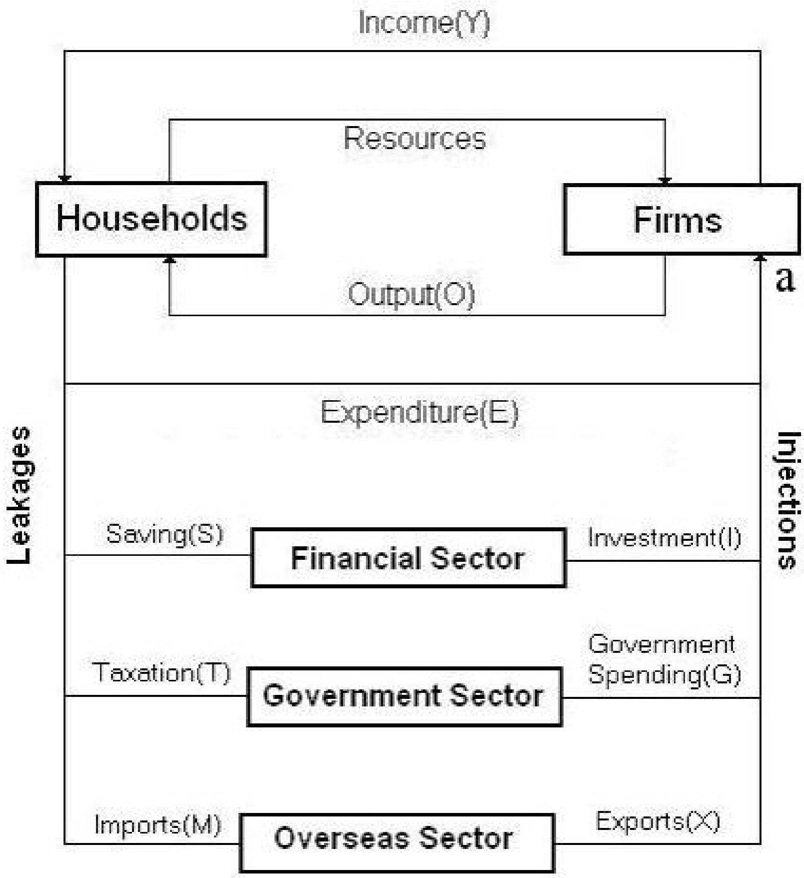


Figure 1.1: The circular flow model

the other two sectors. Similarly, if the government runs a deficit, then either net private investment is negative, or net exports are negative, or both.

By the time we have made a full circuit, we have started with total net revenue from final sales, and assumed that this will be paid by firms to consumers as pre-tax income in one form or another (either wages, rents or profits). We have then aimed to make all the adjustments necessary to transform this income back into expenditure in final goods. We have subtracted government taxes, added in government transfers (e.g. welfare benefits), subtracted private sector savings (e.g. payments into bank accounts), added in private sector investment (e.g. firms borrowing money from banks to finance capital investment), subtracted imports (leakages of income which are spent abroad and so do not count as part of GDP) and, finally, added in exports (injections into domestic demand from incomes earned abroad). If all of these factors are properly counted, then we will end up back where we started, with final expenditure on domestic goods and services. This fact about the circular flow model, that a full circuit takes us back to where we started, leads to the three main alternative ways to measure GDP:

1. Total expenditure on final goods

2. Total value added

3. Total income (i.e. total pre-tax factor payments)

Another issue concerning GDP is the degree to which it actually measures the total economic welfare generated in a particular geographical area in a particular period. Since GDP is calculated using the market prices at which goods sell, it relies on the assumption that markets are competitive and complete (basically, the assumptions of the First Theorem of Welfare Economics) if prices are to accurately reflect the valuations placed upon goods by consumers. This means that in countries where markets do not really function adequately (e.g. the old Soviet Union), GDP measured at market prices will probably be hopelessly inadequate. In fact, even if markets are competitive and complete, prices only reflect the marginal valuations placed upon goods by consumers, so even then GDP will not be an entirely accurate measure of the consumers' and producers' surplus generated from consuming a good. The microeconomic basis of GDP becomes even more doubtful when we consider the prevalence of externalities and the existence of bads. For example, goods like clean air and water which do not have well defined property rights are not paid for and therefore do not enter into GDP. Expenditure on prisons and national defence count as part of GDP, even though their existence is purely to alleviate a bad rather than to produce net economic welfare. Also, the value of people's leisure time, which is by definition unsold labour, is not counted in GDP. This had led some economists to attempt to develop more refined measures of economic welfare which take into account these factors.

Once we attempt to place a value on non-marketed goods such as pollution or an equal distribution of income, the problem is that of determining what this value should be. This may be ultimately a practical problem (e.g. presumably pollution does have a cost, even if it is difficult to measure), but it may be an even more fundamental obstacle (e.g. the value placed upon equality is at least partly a subjective matter over which individuals inevitably and legitimately disagree, even if there may be measurable benefits to a more equal society). The advantage of GDP remains, therefore, that it is fairly straightforward and unambiguous compared to the alternatives. For many macroeconomic questions, it is most useful as a measure of total output rather than as a tool for welfare economic analysis. From a macroeconomic standpoint, we hope that government policy will be correctly designed at the micro-level to roughly offset these externalities so that GDP will still roughly be a measure of overall welfare. Macroeconomics generally concerns itself with how to reduce the welfare losses from unemployment and inflation. It is reasonable in this context to simplify away the many other welfare orientated issues which are the concern of microeconomic policy.

1.4 National income accounting

National income accounting concepts provide a conceptual framework for breaking up the output from the economy's goods market - GDP, represented by Y (nominal GDP) and y (real GDP) - into components that perform different macroeconomic roles. In a closed economy, the three components most commonly used are private consumption (C), private investment (I) and government consumption (G).[7] In the open economy, we add net exports (NX). The national income accounting concepts are intended to be

[7] An important point to bear in mind is that government consumption is *not* the same as government spending. For example, benefits paid out to private citizens play the role of negative taxation, because the government is not purchasing goods with that money, it is only redistributing it.

exhaustive; everything sold will either be classified as private consumption, private investment or government spending. There will, of course, always be marginal cases. For example, is a hospital built under the public-private partnership private investment or government spending? The key point is that the national income accounts provide a useful way of further subdividing the goods market. However, we are still massively simplifying the reality of many different goods being bought and sold.

The national income accounting identities are one of the most useful tools in macroeconomics because they apply all of the time and in every model. Hence they are *identities*, not *equations* (whereas market equilibria are defined by equations, which *do not* hold when the market is out of equilibrium). These identities therefore always provide a way of explaining and understanding what is going on in a particular situation, and for comparing the assumptions and outcomes of different models.

The central identity is $Y = C+I+G+NX$. If we define the tax burden as T, and private savings as $S = Y - C - T$[8], we can then rearrange the central identity to give $Y = (C + T) + I + (G - T) + NX$ and make $I + NX$ the subject to give $I + NX = (Y - C - T) + (T - G)$, finally yielding $I + NX = S+(T-G)$. In the closed economy, which we will examine in the next chapter, this simplifies to give $I = S+(T-G)$ because NX will always be 0. S is private saving and $T - G$ is the government budget surplus, or government saving. NX can be thought of as "foreign investment" because, as we shall consider in more detail in chapter 8, if the domestic economy is exporting more than it is importing then it must be building up foreign assets, either in the form of foreign currency, or the foreign bonds, equities and other financial assets that can be bought with foreign currency. So, total investment (private domestic investment plus foreign investment) equals private saving plus government saving. This identity shows us that if any economy wishes to invest more in its future prosperity, either individuals must save more, the government must tax them more (without raising expenditure) or the government must cut its expenditure (without lowering taxes).[9] Another way to write this

[8] This identity is saying that whatever income is not consumed or taxed is saved.

[9] Note here we are assuming, for simplicity, that government spending G does not add to the future prosperity of the economy. In reality, *some* of G should be considered in this way, such as investment in schools and hospitals.

identity would be NS $= S - I = G - T + NX$ where NS is private sector *net* savings. In the closed economy, this becomes $NS = G - T$. So, an excess of private sector savings always implies a government budget deficit in a closed economy, whereas it can be reflected instead in positive net exports (i.e. a trade surplus) in an open economy.

1.5 Average and marginal propensities

When modelling a component of aggregate demand, it is often necessary to distinguish between the average and marginal rates. For example, in the Keynesian model[10] consumption depends upon income Y according to the equation $C = C_0 + c_1 Y$. Here, **autonomous consumption** is C_0 (so called because it is autonomous from income Y) and the **marginal propensity to consume** (MPC) is c_1 (so called because it is the amount of an additional unit of income that will be consumed in this linear model). The **average propensity to consume** in this case is $\frac{C}{Y} = \frac{C_0}{Y} + c_1$.

[10] Leaving out the proportional tax rate here deliberately, for simplicity.

Chapter 2

The Closed-Economy Classical Model

2.1 Assumptions

The closed economy classical model provides the simplest framework in which to integrate the goods market, the labour market and the money market into a coherent framework. It is a long run model, in that it assumes that all markets clear but treats the population and the capital stock as fixed, so it is not concerned with economic growth which occurs in the very long run.

2.2 The supply side and the AS curve

Let the population in an economy be n and the accumulated capital stock be $\bar{k}$ (this is treated as fixed for this period, hence the bar). Let the production function be $y = f(k, l)$, which is homogeneous of degree 1[1] The inputs k and l and output y are measured in units of the same abstract bundle. We assume that all workers are identical in terms of their preferences and productivity. The equilibrium in the labour market in conjunction with the production function and the fixed capital stock determines the amount of output in the goods market.

Consider first the supply side of the labour market. In any given period there will be a maximum possible amount of labour which could be utilized, $\hat{l}$, which will be determined by the productivity of lanour, the total number

[1] Therefore it exhibits **constant returns to scale** (CRS).

of hours which could be worked and the population size. If we imagine that all workers are identical, then provided the individual labour supply curve is not backwards-bending, a rise in the real wage $w = W/P$ (where W is the nominal wage) will cause a rise in the amount of labour supplied by each individual[2]. The labour supply curve will go to an asymptote at $\hat{l}$ as shown in the diagram below:

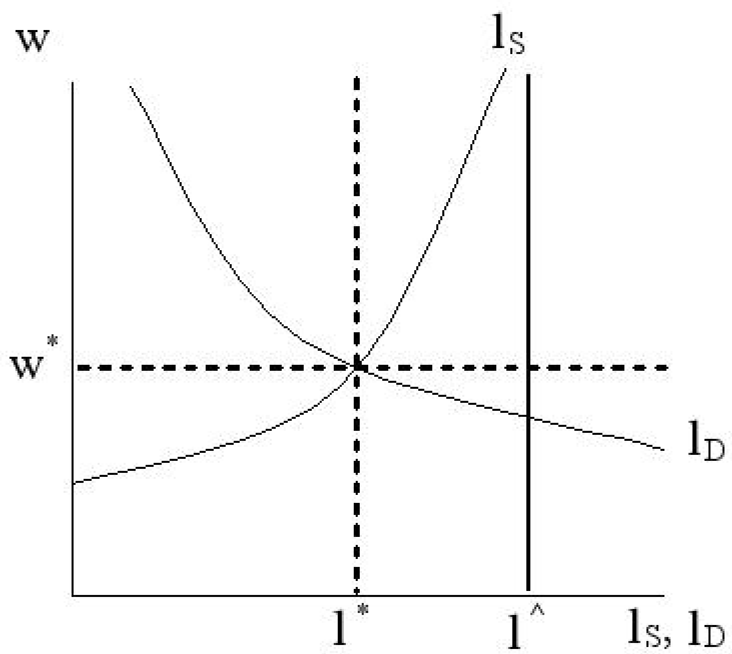


Figure 2.1: Classical labour market equilibrium

The downwards sloping labour demand curve can be derived from the production function and the assumption that all firms in this economy are perfectly competitive. Suppose that the economy is made up of m identical firms. The output of each firm will then be $\frac{y}{m} = \frac{f(k,l)}{m}$. Since the production function is CRS, this can be further simplified to give $\frac{y}{m} = f(\frac{k}{m}, \frac{l}{m})$. Since all firms are identical, we let $\breve{k} = \frac{k}{m}$ and $\breve{l} = \frac{l}{m}$. The profit function for an individual firm is therefore given by $\pi = Pf(\breve{k}, \breve{l}) - W\breve{l} - R\breve{k}$, where W is the

[2]In terms of the two-good consumption-leisure model of individual labour supply, it is the real wage which determines the slope of the budget constraint.

nominal wage and R is the nominal cost of capital. Taking the first derivative with respect to $\breve{l}$ and forming the condition for profit-maximization yields:

$$\frac{\partial \pi}{\partial \breve{l}} = P\frac{\partial f}{\partial l} - W = 0$$

Dividing through by P gives:

$$\frac{\partial f}{\partial l} - \frac{W}{P} = 0 \Longrightarrow MPL = w$$

Provided that the MPL is declining in l (i.e. $\frac{\partial^2 f}{\partial l^2} < 0$), w will also be declining in l. Therefore the labour demand curve will be downward sloping. Bringing together the labour supply and labour demand curves will result in an equilibrium l^*. The amount of labour supplied per worker will be $\tilde{l}^* = \frac{l^*}{n}$.

To further illustrate how the production function will determine output and its distribution as income to the different productive factors, we can use the Cobb-Douglas production function $y = k^{1-\alpha}l^{\alpha}$. Here α is the income share that labour takes, usually around $\frac{2}{3}$. We can see this by finding the MPL at the labour market equilibrium, which is $\alpha\left(\frac{\bar{k}}{l^*}\right)^{1-\alpha}$. Multiplying this by l^* yields the total real wage bill at the labour market equilibrium, which simplifies to give $\alpha\left(\bar{k}\right)^{1-\alpha}\left(l^*\right)^{\alpha} = \alpha y^*$. The share of factor income to capital can similarly be shown to be $(1-\alpha)y^*$. The output (real GDP) per worker will be given by:

$$\tilde{y}^* = \frac{y^*}{n} = \left(\frac{\bar{k}}{n}\right)^{1-\alpha}\left(\frac{l^*}{n}\right)^{\alpha} = \tilde{k}^{1-\alpha}\left(\tilde{l}^*\right)^{\alpha}$$

The real wage per worker will be:

$$\frac{\alpha y^*}{n} = \alpha\tilde{y}^* = \alpha\tilde{k}^{1-\alpha}\left(\tilde{l}^*\right)^{\alpha}$$

So, living standards per capita depend on the amount of capital available per worker and the number of hours worked per worker, which makes sense intuitively.

2.3 The AD curve and the quantity theory of money

The simplest classical model of aggregate demand is the quantity theory of money. Although the classical model does not preclude more complex models of the money and goods markets, which we will examine in part II, the quantity theory of money is the best way to introduce the spirit of the classical view of the role of money in the economy. The quantity theory of money is a simple market equilibrium model. The demand for money in this model is the transactions that must be supported by the nominal money in circulation. This is given by nominal output $Y = yP$, where y is determined by the supply side of the economy, as described in the previous section. The supply of money is equal to the amount of nominal money M, multiplied by the velocity of money circulation, V. So, the equilibrium condition is: $P^*y^* = MV$. The P and y are the only variables that are starred because it is the price level that must adjust in equilibrium, as the other two variables M and V are exogenously fixed (by the government and by assumption). So, the usual form to express this equation is: $P^* = \frac{MV}{y}$. This equation describes the downwards sloping aggregate demand (AD) curve is (y,P) space, which is illustrated below, along with the vertical aggregate supply (AS) curve, determined by the long run equilibrium in the supply side:

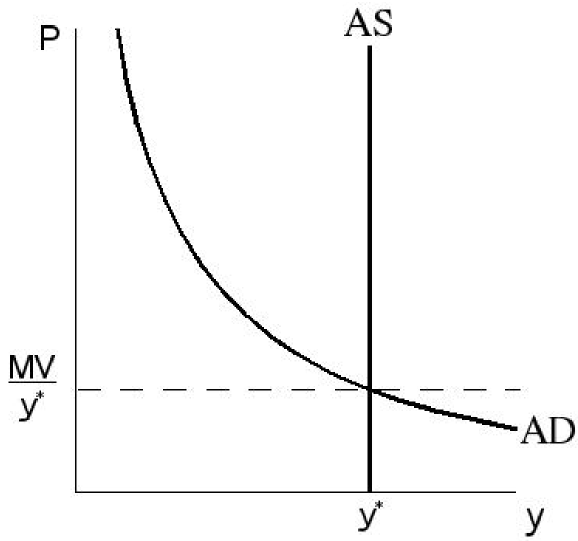


Figure 2.2: The quantity theory of money - AD-AS equilibrium

The intuitive interpretation of the quantity theory of money is that the price level always adjusts instantaneously to ensure that the amount of goods being "chased by the money" is equal to the amount of money to "do the chasing". If there is an excess supply of money, the price is immediately bid up so that more chasing must be done at the equilibrium real output level y^*. If there is excess demand for money at the current price level, the price level will immediately be bid down.

The implication of the quantity theory of money is that nominal GDP, Y, will always be equal to MV. Hence, assuming constant V, the growth rate of nominal GDP will be equal to the growth rate of the money supply. This is called **money neutrality** or the **classical dichotomy**; real variables such as y do not affect nominal variables such as Y, and nominal variables such as P and M do not affect real variables such as y. It is as if there are two separate economies, a real one and a nominal one, unable to affect one another. The more realistic model of the demand side which we will build over the rest of this book will see this as only a long run relationship. In the long run, nominal GDP growth will be determined by the growth of the money supply, not by any real factors. In a short run disequilibrium model[3], however, nominal GDP growth can reflect real GDP growth, because the economy may have been under-utilizing its resources previously and is now coming out of recession. (The key assumptions in the very short run are that y is *not* fixed, and that the price level *is* at $\bar{P}$ so that $Y = \bar{P}y$ can only increase if y does. Here we see an example of how important the assumptions underlying models are.)

Nominal GDP per capita will be given by $\frac{MV}{n}$ and nominal real wages will be given by:

$$\alpha\tilde{y}^* \times P^* = \alpha\tilde{y}^* \times \frac{MV}{y^*} = \alpha\frac{MV}{n}$$

Again, we see that none of the nominal quantities depend upon current real quantities (although they are still shaped by parameters in the production function).

[3]Such as the Keynesian multiplier model.

2.4 Analysis using accounting identities

Even with this simple model, with its limiting assumptions about instantaneous market clearing, constant population size and highly simplified supply side and demand side, we can do some interesting analysis and introduce some macroeconomic policy concepts in a cursory way. To do this, we make the additional simplifying assumption that nominal private saving is $S = s_1 Y$ and real private saving is $\frac{S}{P} = s = s_1 y$[4], where s_1 is both the marginal and average propensity to save out of pre-tax income, since there is no autonomous saving. Since nominal private saving is simply real private saving multiplied by the price level, if the price level were fixed, it would not really matter which we use for the analysis, and in the Keynesian very short run introduced in the next chapter it is usual to think about the nominal value of goods production being the variable of interest. In the classical model, however, it is real private saving that is of macroeconomic importance due to its determination of real private investment via the accounting identity $i = s_1 y + (t - g)$ (nominal private saving is in this classical model simply a fixed proportion of nominal GDP, which depends only upon the nominal money supply and velocity of circulation and has no relationship to the real value of investment expenditure).

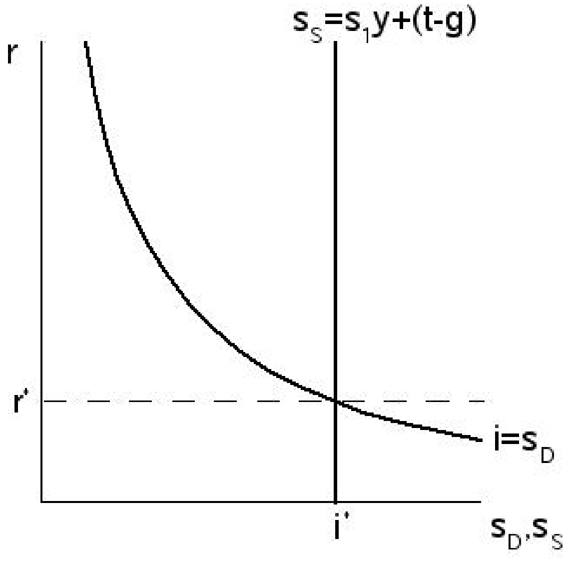


Figure 2.3: Investment in a closed economy classical model

[4]Note that s_1 is the same for both nominal and real saving.

From this, we can see the long-run impact upon real invesment expenditure, i, of changes in g, t and s_1:

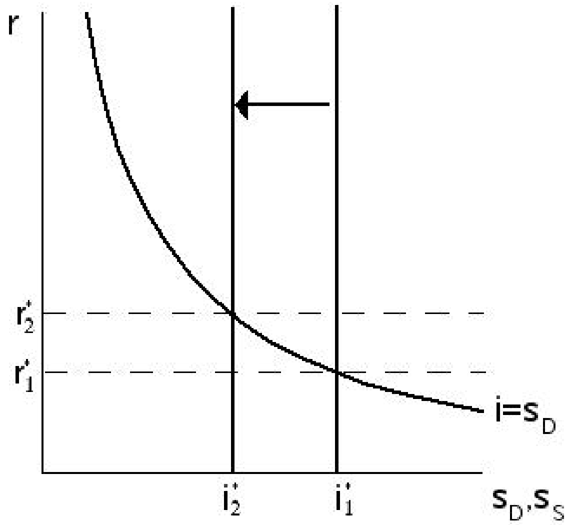


Figure 2.4: A decrease in the saving rate s_1, decrease in taxation t or increase in government spending g

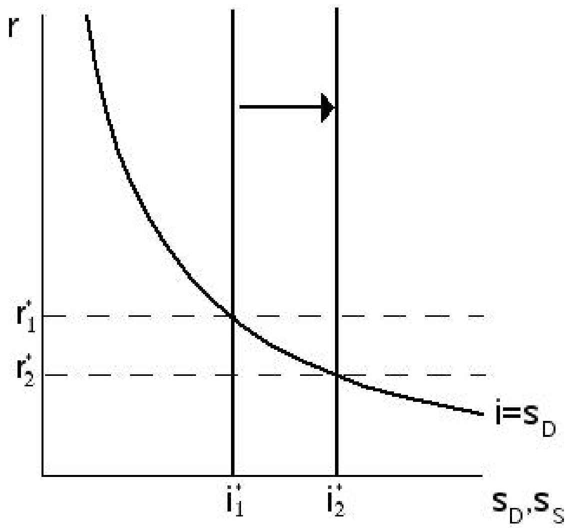


Figure 2.5: An increase in the saving rate s_1, increase in taxation t or decrease in government spending g

Part II

The AD Curve and the IS-LM Model

Chapter 3

The Keynesian Multiplier Model

3.1 Assumptions

We now build a very short run Keynesian multiplier model. This model will be the basis of our model of the goods market for the rest of the book. The key assumption behind this model is that the price level $\bar{P}$ is fixed. This is turn implies that nominal GDP $Y = \bar{P}y$ is proportional to real GDP y. Therefore we can deal with the nominal goods market without worrying about converting to real variables. So, throughout this chapter and subsequent ones, until we return to consider the supply side of the economy in more detail in part III, we will stick to using nominal values for GDP components, represented by uppercase letters.

The Keynesian multiplier model is based on the equilibrium condition between **planned expenditure**, which can be thought of as "demand for income/output", Y^e and income Y. The equilibrium condition of this model is an equilibrium in the sense that if there is unplanned expenditure (e.g. unplanned investment in unsold stocks) then we are out of equilibrium (so, the $Y = Y^e$ condition is *not* an identity). It is the downward adjustment of output if there is excess supply or the upward adjustment if there is excess demand that provides the equilibration mechanism. However, it is not a microeconomic equilibrium in the sense that it is derived directly from optimizing behaviour by economic agents. The "equilibrium" in the Keynesian multiplier model can reflect microeconomic disequilibrium, such as when, for example, prices are too high so that the corresponding real output level y is below the long run potential output level y^*.

Let $Y^e = C_0 + c_1(1-t_1)Y + I_0 + G_0$. The equilibrium condition $Y = Y^e$ therefore implies that $Y(1 - c_1(1-t_1)) = C_0 + I_0 + G_0$. The expression $c_1(1-t_1)$ is therefore the marginal propensity to consume out of pre-tax income.[1] If we define the marginal propensity to save (out of pre-tax income) as $s_1 = 1 - c_1(1-t_1) - t_1$ then the equilibrium condition is:

$$Y = \kappa A_0 = \frac{1}{1 - c_1(1-t_1)}(C_0 + I_0 + G_0) = \frac{1}{s_1 + t_1}(C_0 + I_0 + G_0)$$

The coefficient κ is called the **Keynesian multiplier**, and is the key to understanding the model. The Keynesian multiplier is the derivative of the output level with respect to the three autonomous components C_0, I_0 and G_0. So, $\frac{\partial Y}{\partial C_0} = \frac{\partial Y}{\partial G_0} = \frac{\partial Y}{\partial I_0} = \kappa$. The variable $A_0 = C_0 + I_0 + G_0$ is called **autonomous expenditure** as it does not depend upon income Y. It provides the "injections" into the circular flow model whereas the Keynesian multiplier describes the "leakages" that lead to the size of the multiplier effect (the higher the leakages, the smaller the multiplier, as can be most clearly seen from the equation $\kappa = \frac{1}{s_1+t_1}$, where s_1 and t_1 are the leakages due to saving and taxes respectively).

In the analysis that follows, we will need to use the derivatives[2] of the multiplier with respect so s_1 and t_1, and so will note them here[3]:

$$\frac{\partial \kappa}{\partial t_1} = -c_1\kappa^2$$

$$\frac{\partial \kappa}{\partial s_1} = -\kappa^2$$

[1] Note the importance of the distinction between the MPC out of pre-tax and post-tax income. It is the MPC out of pre-tax income that determines the size of the multiplier. In an economy with proportional income taxation, this is likely to depend on both the tax rate and the MPC out of post tax income (and, in an open economy, the marginal propensity to import also).

[2] These are derived using the chain rule.

[3] Note that the derivative with respect to t_1 is derived by holding c_1 constant. Holding s_1 constant would result in a different derivative because holding s_1 constant will imply that c_1 must change when t_1 changes. The derivative with respect to s_1 is derived by holding t_1 constant.

A number of features of the Keynesian multiplier model are immediately noticeable. Firstly κ is always greater than one. Hence, when there is an increase in autonomous consumption, investment or government spending with c_1, t_1 and s_1 remaining unchanged, the impact upon output is always amplified. This is because when new people are hired to produce output, they consume some of their new income, which leads to more hiring to produce new output, and so on. Note that this analysis is only plausible if there is excess labour supply willing to work to produce the extra output. Keynes' original model was explicitly designed to describe the situation of a recession.

Secondly, a rise in the tax rate and the savings rate lead to a decline in output. This creates the **paradox of thrift**; whereas in the classical model increased private or government saving leads to greater investment and no change in output, in the Keynesian multiplier model, investment is fixed at I_0 and output declines as a result of a tax rise, cut in government spending, or rise in the private savings rate. So, at this stage, the predictions of the classical and Keynesian model are seriously at variance. We will see in subsequent chapters how a more advanced framework, which brings in the money market, and eventually the markets for exports and foreign exchange, can be used to reconcile these differing predictions into a coherent framework.

Thirdly, we see the role of the proportional income tax rate as an **automatic stabilizer**; by reducing the size of the multiplier it reduces the volatility of output to exogenous shocks (e.g. to C_0 or I_0). This happens because, with fixed government consumption G_0 and fixed t_1, when there is a drop in Y, there is an automatic worsening of the budget deficit. This injects demand into the economy, thus reducing the effect of the recession. In the real world economy, both the tax system and the benefit system produce this effect because when unemployment goes up, not only do taxes go down, benefit payments also go up.

3.2 Policy analysis

For now, the priority is to understand in detail the predictions of the Keynesian multiplier model. We will analyse a series of policy changes and their impact upon (i) output Y, (ii) consumption $C = C_0 + c_1(1 - t_1)Y$,

(iii) the government budget deficit $B = G_0 - t_1 Y$ and (iv) net private saving $\text{NS} = s_1 Y - C_0 - I_0$:

3.2.1 Increase in government spending

An increase in government spending G_0 (whilst holding the tax rate t_1, and all other variables, fixed) will clearly result in an increase in output equal to $\kappa \Delta G_0$ where ΔG_0 is the increase in government spending. The impact upon consumption is also easy to see: $\Delta C = c_1(1-t_1)\kappa \Delta G_0$. The impact upon the government budget deficit is more complex, because although G_0 increases, so does Y, raising the tax revenue and reducing the deficit. We can find out which effect dominates by finding the derivative of the budget deficit with respect to G_0:

$$\frac{dB}{dG_0} = 1 - t_1 \frac{dY}{dG_0} = 1 - t_1 \kappa = 1 - t_1 \frac{1}{1 - c_1(1-t_1)} = \frac{1 - c_1(1-t_1) - t_1}{1 - c_1(1-t_1)}$$

This is clearly positive, but less than 1, showing that the budget deficit increases, but by less than the increase in government spending. Intuitively, this is because some of the money spent on the higher spending comes back to the government in the form of greater tax revenue, but never all of it because some is saved in each “round” of the multiplier effect. Finally, the impact upon net private saving of the increase in G_0 can be seen to be positive and equal to $s_1 \kappa \Delta G_0 = \frac{1-c_1(1-t_1)-t_1}{1-c_1(1-t_1)} \Delta G_0 = (1 - t_1\kappa)\Delta G_0$. Here we see that the increase in the government budget deficit will be precisely the same as the increase in net private saving. This is due to the identity $S - I = G - T$ which always holds in any model. We will therefore see the same identity occurring in all of the subsequent subsections. So, we have established that increased government spending will still lead to an increased government budget deficit in the Keynesian model, in spite of the resultant increase in output Y, along with increased private sector net saving to finance this. Importantly, the rise in G_0 has the additional effect of boosting output and consumption. Thus fiscal policy can be used to boost aggregate demand in this model, potentially helping the economy get out of a recession. We see later that the expansionary effect of fiscal policy will occur even if the government raises taxes so as to balance its budget.

3.2.2 Increase in autonomous consumption

An increase in autonomous consumption C_0 will have similar impact upon output to an increase in G_0; $\Delta Y = \kappa \Delta C_0$. The impact upon consumption will be even more pronounced because $\Delta C = \Delta C_0 + c_1(1-t_1)\kappa\Delta C_0$. This expression for the impact upon consumption can be further rearranged to yield $\Delta C = \frac{1-c_1(1-t_1)+c_1(1-t_1)}{1-c_1(1-t_1)}\Delta C_0 = \frac{1}{1-c_1(1-t_1)}\Delta C_0 = \kappa\Delta C_0$. This makes intuitive sense because I_0 and G_0 are fixed and so the entire increase in output must be accounted for by the increase in consumption. The impact upon the government budget deficit will be to reduce it by $t_1\kappa\Delta C_0$. The impact upon net private saving will be to increase it by $s_1\kappa\Delta C_0 - \Delta C_0 = (1-t_1\kappa)\Delta C_0 - \Delta C_0 = -t_1\kappa\Delta C_0$.[4] So, for an economy in recession, for the government to boost autonomous private consumption in some manner would be attractive as it would stimulate demand without requiring the government going into deficit. However, such an outcome is likely to be difficult to achieve because the private sector consumers will consume according to their expectations about the future, and in a recession they are likely to have pessimistic expectations about their future income.

3.2.3 An increase in autonomous investment

An increase in autonomous investment could be caused by increased business confidence. Output will increase by $\kappa\Delta I_0$. Consumption will increase by $c_1(1-t_1)\kappa\Delta I_0$. The government budget deficit will reduce by $t_1\kappa\Delta I_0$. Net private saving will change according to its derivative $\frac{\partial \mathrm{NS}}{\partial I_0} = s_1\kappa\Delta I_0 - \Delta I_0 = -t_1\kappa\Delta I_0$. Again, an investment led recovery is attractive from the government viewpoint, but may be very difficult to achieve if investor confidence has collapsed.

3.2.4 An increase in the private savings rate

An increase in s_1 will reduce output, since the derivative of Y with respect to s_1 is: $\frac{\partial Y}{\partial s_1} = \frac{\partial \kappa}{\partial s_1}A_0 = -\kappa^2 A_0 = -\kappa Y$. Consumption must be reduced by the same amount because G is fixed at G_0 and I is fixed at I_0. The government budget deficit increases by $\frac{\partial B}{\partial s_1} = -t_1\frac{\partial Y}{\partial s_1} = t_1\kappa Y$. By identity, private sector net saving must increase by the same amount.

[4] Again, we see that the identity $S - I = G - T$ holds as the two changes are identical.

3.2.5 An increase in the proportional income tax rate

The increase in output will be $\frac{\partial Y}{\partial t_1} = \frac{\partial \kappa}{\partial t_1} A_0 = -c_1\kappa^2 A_0 = -c_1\kappa Y$. So, output decreases. Consumption will decrease by the same amount because investment and government spending are fixed. The derivative of the government budget deficit will be[5]: $\frac{\partial B}{\partial t_1} = -t_1\frac{\partial Y}{\partial t_1} - Y = -t_1\frac{\partial \kappa}{\partial t_1} A_0 - Y = c_1 t_1 \kappa^2 A_0 - Y = -(1 - c_1 t_1 \kappa)Y$. By identity, the derivative of NS will be identical. So, both the government budget deficit and private sector net saving go down by the same amount. The government can improve its fiscal position by raising taxes, but this does not feed through into greater investment, because investment is fixed. Instead it registers in less private sector savings due to the decrease in output Y.

3.2.6 An increase in government spending whilst raising taxes to keep the budget balanced

If the government raises spending whilst maintaining the same fiscal balance B_0, then it sets t_1 so that $B_0 = G_0 - t_1 Y$. Therefore: $t_1 = \frac{G_0 - B_0}{Y}$. This can be substituted into the $Y = Y^e$ equation to yield $Y = C_0 + I_0 + G_0 + c_1(1 - \frac{G_0 - B_0}{Y})Y$. This can be further simplified to give: $Y = \frac{1}{1-c_1}(C_0 + I_0 + B_0 c_1) + G_0$. From this expression, we can see that the **balanced budget government spending multiplier** is 1. The intuition for why this is the case can be seen by comparing a situation where the government raises taxes and gives the money straight back to the public as benefits, against the case where the government does this but purchases goods instead of just paying out benefits. In the first case, the government's actions create no additional demand in the economy, only redistributing existing "purchasing power". In the second case, the only additional demand is created by the initial goods purchased. Hence the balanced budget multiplier is 1. Since the increase in output is the same as the increase in government spending, it must be the case that investment and consumption remain constant.

3.2.7 Summary of results

The table below qualitatively summarizes the results from the previous subsections. It should be borne in mind that all of these results depend upon the key assumption that investment is fixed, and does not depend upon the

[5] Using the product rule once to differentiate $-t_1 Y$.

interest rate. Therefore, in essence, we have assumed that the interest rate is fixed. This will be useful to bear in mind when we come to think about the derivation of the IS curve from the Keynesian multiplier model in chapter 4.[6]

Table 3.1: Responses of aggregate demand components in multiplier model

	Y	**C**	**NS=S-I=B=G-T**
$\mathbf{G_0} \uparrow$	$\uparrow$	$\uparrow$	$\uparrow$
$\mathbf{C_0} \uparrow$	$\uparrow$	$\uparrow$	$\downarrow$
$\mathbf{I_0} \uparrow$	$\uparrow$	$\uparrow$	$\downarrow$
$\mathbf{s_1} \uparrow$	$\downarrow$	$\downarrow$	$\uparrow$
$\mathbf{t_1} \uparrow$	$\downarrow$	$\downarrow$	$\downarrow$
$\mathbf{G_0} \uparrow \mathbf{t_1} \uparrow$	$\uparrow$	-	-

3.3 The microeconomics behind the multiplier

The Keynesian multiplier model provides a useful framework for analysing the manner in which demand for goods circulates in the economy. However, it is desirable to have some firmer theoretical basis for the marginal propensity to consume, as the value of this parameter is key to driving the model by determining the size of the multiplier. We can do this using microeconomic theory by building a **representative consumer model**[7] of the consumption sector.

We will begin by making very restrictive assumptions, and then consider the impact of relaxing these. Suppose that our representative consumer has to decide how much to consume in two periods, and has the utility function $U = min\{c_1, c_1\}$, where c_1 and c_2 are consumption in periods 1 and 2 respectively. The interest rate is r and the consumer receives income m_1 in period and m_2 in period 2. Since consumption in the two periods are perfect complements for this consumer, they will choose to consume an equal amount in both periods at their optimal bundle. We can therefore solve for

[6] The final row is the balanced budget fiscal expansion.

[7] A representative consumer model approaches the aggregation problem by assuming, as a simplification, that the entire consumption sector behaves like a single rational consumer.

their optimal bundle by equating the budget constraint with the value of the amount consumed as follows:

$$c_1^* + \frac{1}{1+r}c_2^* = m_1 + \frac{1}{1+r}m_2 \Longrightarrow c^*\left(1 + \frac{1}{1+r}\right) = m_1 + \frac{1}{1+r}m_2$$

$$\Longrightarrow c^* = \frac{1+r}{2+r}m_1 + \frac{1}{2+r}m_2$$

The diagram below illustrates this relationship by comparing the impact of an increase in income by Δm in period 1 and period 2 respectively. The increase in income is always spread between both periods equally, but an increase in period 1 income allows consumption in both periods to rise by more than the same increase in period 2 because it can be saved for longer and thus earn more interest. An increase in both periods' income by Δm would increase consumption in both periods by the same amount.

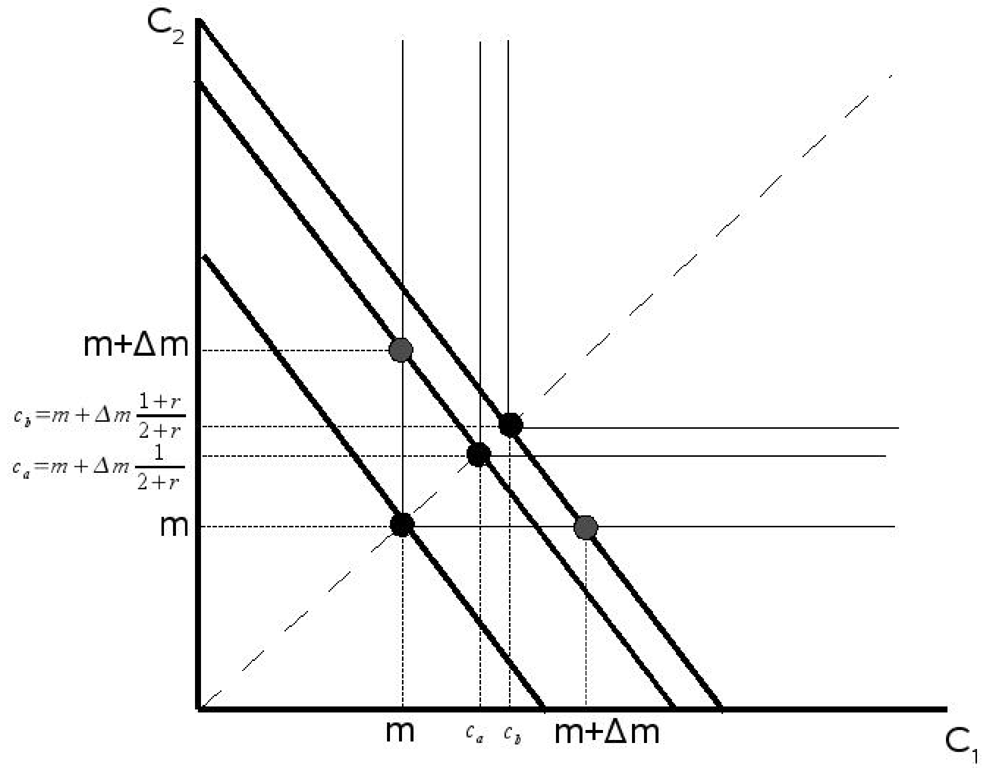


Figure 3.1: Inter-temporal choice with perfect consumption smoothing

If we extend this to an N-period model, but make the further simplifying assumption that the interest rate is 0, and also introduce initial wealth W, then the condition from the budget constraint (in present value terms) becomes $\sum_{i=1}^{N}[c_i] = W + \sum_{i=1}^{N}[m_i]$. This simplifies to give $c^* = \frac{1}{N}W + \frac{1}{N}\sum_{i=1}^{N}[m_i]$. This equation can be very straightforwardly related to both the Keynesian multiplier model and the permanent income hypothesis. If an income increase of Δm is expected to last for X periods out of a remaining lifetime of N periods, then the consumer will optimally increase their consumption per period by $\frac{X}{N}\Delta m$. So, the marginal propensity to consume will be $\frac{X}{N}$. Here, we see the key point that the MPC does not just come out of a hat. It will depend upon how long the increased income is likely to last, which will in turn depend upon expectations about the future.

Although the assumptions made to derive this very simple model of perfect income smoothing are very restrictive, loosening the assumption of a 0 interest rate and perfect complements utility function will not change the qualitative result that rational consumers will smooth their consumption over time. Therefore, the degree to which they consume out of current income will continue to depend about their expectations about the future, but now with a more complex interrelationship between their preferences and the available interest rate and projected income stream.

Chapter 4

The IS-LM Model and the AD curve

4.1 The IS curve

The IS curve is derived from the Keynesian multiplier model. The only additional assumption required in order to derive it is that investment $I(r)$ is a function of the real interest rate. The simplest way to introduce this is to have investment be a linear function of the interest rate $I = I_0 - \delta r$[1]. Here, δ is the **interest sensitivity of investment demand**. It is the real rather than the nominal interest rate that determines the level of investment demand because real assets such as factories will maintain their nominal value in line with inflation, and so the rate of return on them will be compared to the real rather than the nominal rate of return on financial assets such as government bonds by investors.[2]. The IS curve is plotted in (Y, r) space. To trace it out, imagine that the real interest rate r drops. The result will be an increase in investment and, via the multiplier effect, an increase in output. So, $\frac{\Delta Y}{\Delta r} = -\kappa\delta$. In other words, output will be more sensitive to interest rates the higher is δ, the sensitivity of investment to interest rates, and the higher is the Keynesian multiplier. Since injections into planned expenditure are now $G_0 + C_0 + I(r)$, there must be an $\hat{r}$ such that $G_0 + C_0 + I(\hat{r}) = 0$. This will be found from the inverse of the $I(r)$ function: $\hat{r} = I^{-1}(-G_0 - C_0)$. This corresponds to the y-axis intercept of the IS curve. In the case where

[1]This now replaces $I = I_0$ in our Keynesian multiplier model.

[2]As we shall see, however, it is the *nominal* interest rate that determines the demand for money.

$I = I_0 - \delta r$, $\hat{r} = \frac{C_0+G_0+I_0}{\delta}$. The significance of this point is that $\hat{r}$ does not depend upon the value of κ. Therefore any change in the value of the multiplier caused by changes in the MPC will cause a pivot of the IS curve around this point.

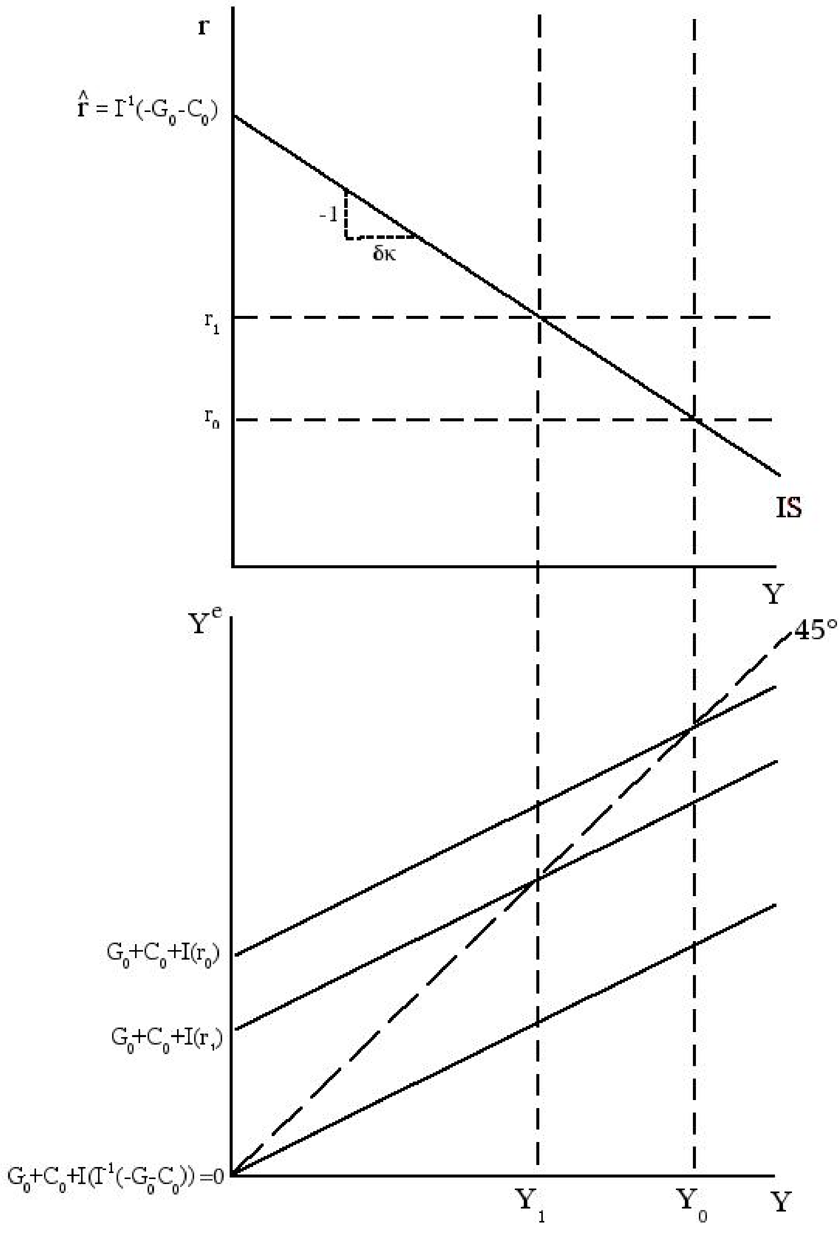


Figure 4.1: Derivation of the IS curve from the Keynesian cross

The equation for the IS curve with the linear investment function is: $Y = \kappa A_0 - \kappa\delta r$, where, as before, $A_0 = G_0 + C_0 + I_0$ is autonomous expenditure (autonomous of both income Y and the interest rate r). From this, we can see clearly the way in which the IS curve can be moved around. We have seen that decreases in the Keynesian multiplier (corresponding to faster leakages due to saving and taxes) cause inward pivots and increases in the Keynesian multiplier (corresponding to slower leakages) cause outward pivots. Increases in autonomous consumption C_0, government spending G_0 or investment I_0, meanwhile, produce parallel outward shifts of the IS curve. These autonomous components are the easiest way of introducing changes in expectations into the model. For example, if there is a collapse in consumer or investor confidence, this will be an inward parallel shift. Note also that the role of the proportional income tax rate as an automatic stabilizer can be seen as reducing the size of the horizontal shift in the IS curve brought about by such a change (and also making the IS curve steeper).

4.2 The LM curve

The LM curve shows all the points in (Y, r) space that are compatible with equilibrium in the money market. The demand for real money balances $m_D(Y, \iota)$ is assumed to depend positively upon output Y and negatively upon the *nominal* interest rate ι. We will look at the microeconomic basis for this model in the next chapter but for now will explain it intuitively. The positive relationship between Y and m_d comes about due to the **transactions demand for money**. The specific usefulness of money as compared to other financial assets is its **liquidity**: the fact that it can be rapidly exchanged for other goods. However, money is also one way of storing wealth, which competes with other assets, both real and financial. It is the nominal rather than the real interest rate which determines money demand because if we imagine an investor deciding whether to hold money rather than to invest in say, a factory or a government bond or a bar of gold, it will be rational to compare the nominal interest rate on these investments to the nominal interest rate of 0% on money. In an economy with ongoing inflation, assets such as bonds, bank account balances, factories and gold will in general see their nominal values inflate along with the price index. However, the same will not be true of money. So, money is always less attractive in an economy with higher inflation, ceteris paribus. One of the most damaging effects of high and volatile inflation is that it prevents money from performing its role as a liquid store of value able to "oil the wheels of the economy" by facilitating efficient market transactions. It does this by, in effect, increasing the real cost of the liquidity offered by money.

The fact that it is the nominal interest rate rather than the real interest rate that determines the demand for money means that the standard IS-LM model works best when we assume that there is no inflation so that $r = \iota$ (i.e. the nominal and real interest rates are the same).[3] We can then use the real interest rate in the money market diagram, and our LM curve will be fixed entirely by the nominal money supply, the price level, and the determinants of money demand.

If we assume that the government fixes the nominal money supply M_S, the real money supply will be $m_S = \frac{M_S}{P}$ where P is the price level. Since the money demand curve is drawn in (m_D, r) space, the money supply curve will be a vertical line. If we define money demand as a linear function of the interest rate: $m_D = m_{D0} + \alpha Y - \beta \iota = m_{D0} + \alpha Y - \beta r$ then the money market equilibrium condition $m_D = m_S$ will yield an LM curve with the equation $Y = -\frac{m_{D0}}{\alpha} + \frac{m_S}{\alpha} + \frac{\beta}{\alpha} r$.[4] From this equation, we can see firstly that the LM curve is upward sloping, whereas the IS curve is downward sloping. Secondly, we can see that an increase in the real money supply m_S (which can be brought about either by a drop in the price level or an increase in the nominal money supply) will cause an parallel outwards/rightwards shift in the LM curve (by increasing the horizontal intercept).

A few final comments should be made about the extreme cases of the IS and LM curves. Firstly, note that if $\delta = 0$, then the IS curve is vertical. This is the case of **interest-insensitive investment** and implies that regardless of the position of the LM curve, the output level is always the same. The implication is that monetary policy (i.e. changes in the money supply which shift the LM curve) cannot help the economy out of a recession; only fiscal

[3] It is possible to use IS-LM analysis when there is expected inflation, of which we shall see an example in our analysis of monetary growth rules in chapter 9, but this is more complex, and an understanding of the no-inflation model is needed first.

[4] Note that we have made Y the subject of the formula so that we can compare this to the IS curve equation, even though the convention is to place output Y on the x-axis.

policy can.[5] Secondly, if $\beta = 0$ then the LM curve will be vertical. This is known as the **classical case**, because the result is that whatever the position of the IS curve, the output level will always be the same. Hence any fiscal policy expansion (e.g an increase in G_0 or decrease in t_1) will cause immediate and complete crowding out by raising the interest rate. So, in this case fiscal policy can only alter the mix of output between C, I and G, not the level of Y. Monetary policy, on the other hand, is potent because it can shift the vertical LM curve to the left or the right. The third extreme case is if $\beta \to \infty$, in which case the LM curve is horizontal. This is known as the **liquidity trap** because increases in the money supply or changes in the price level will not be able to horizontally shift the LM curve (because it is already horizontal so they would result in exactly the same curve). Again, only fiscal policy or some other change to shift the IS curve (e.g. an improvement in confidence) will be able to get the economy out of a recession.

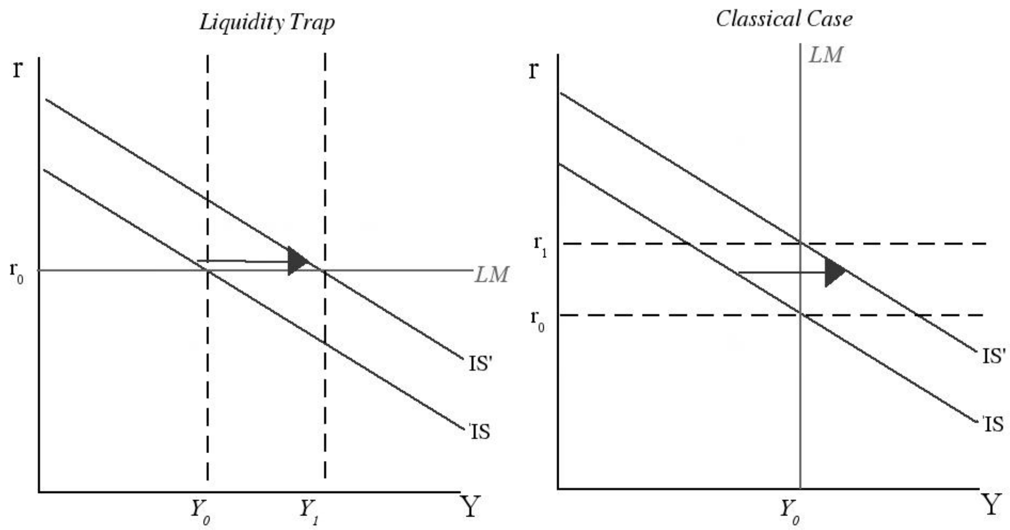


Figure 4.2: The liquidity trap and the classical case

[5]Note that this model is essentially the same as the Keynesian model with fixed investment.

4.3 IS-LM policy analysis

We are now in a position to use the IS-LM framework to analyse the effect of various changes in the determinants of the money and goods markets. The power of the IS-LM model lies in its ability to allow different scenarios and policy responses to be explored.

4.3.1 A loss in investor or consumer confidence

This can be modelled as a decrease in I_0 or C_0 respectively, resulting in an inward parallel shift of the IS curve from IS_0 to IS_1. The immediate impact will be a reduction in output from Y_0 to Y_1 and in the interest rate from r_0 to r_1. In both cases, it is clear that consumption $C = C_0 + c_1(1 - t_1)Y$ must decrease. Government spending must remain unchanged. The budget deficit $B = G_0 - tY$ must therefore increase in both cases because tax revenues must decrease.

In the case of a decrease in C_0, it is clear that investment $I = I_0 - \delta r$ must increase because the interest rate r has dropped and I_0 has not changed. Here we see that the introduction of the LM curve makes the paradox of thrift less severe. When C_0 decreases, consumers tighten their belts by increasing their average saving rate. In the Keynesian multiplier model with fixed investment, this leads to a greater level of net private saving exactly matched by an increased government budget deficit. In the IS-LM model, there is an additional drop in the interest rate, which boosts investment. So, even in the short run, greater thrift by consumers does lead to some increased investment, but also to a recession. (The size of the recession being greater the flatter is the LM curve and the larger is the Keynesian multiplier.) As we shall see later, a similar result occurs for an increase in the marginal propensity to save.

In the case of a decrease in I_0, it is clear that investment must decrease despite the drop in the interest rate because if the interest rate dropped enough to fully counteract the decreased autonomous investment (as it indeed would if the LM curve was vertical, as in the classical case) then there would be no drop in output Y.

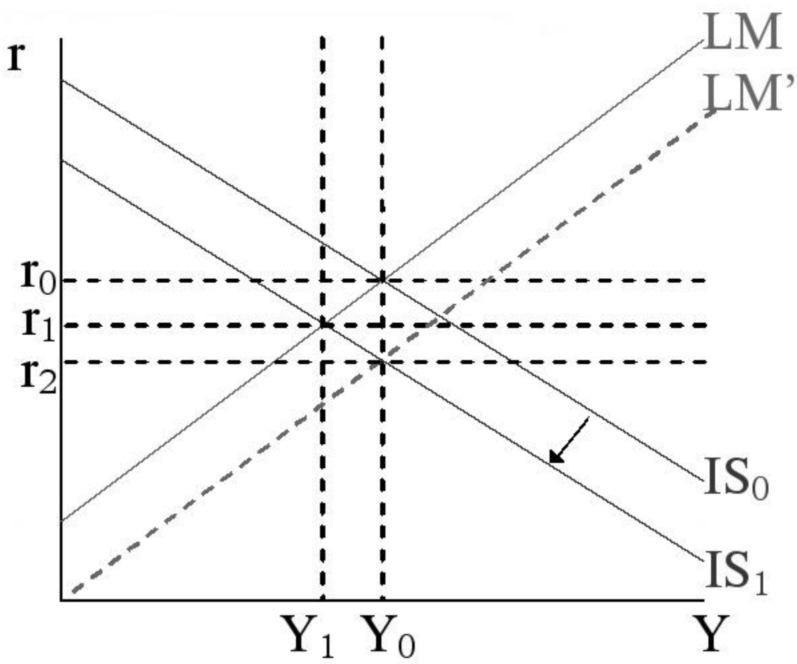


Figure 4.3: A loss in investor or consumer confidence

The correct policy response depends upon the priorities of the government. Assuming that they wish to return the output level to Y_0, the government could use fiscal policy, or monetary policy, or some combination of the two. Monetary policy could be used to shift the LM curve outwards to LM' by expanding the nominal money supply. This would result in a further drop in the interest rate to r_2, which would be sufficient for investment demand to pick up and fully replace the original decrease in I_0 or C_0. On the other hand, fiscal policy could be used to shift the IS curve back to IS_0 by increasing G_0. This would clearly result in an increased government budget deficit because output will be the same as it was originally whereas G_0 will now be higher. A third option would be to cut taxes. Again, the budget deficit will clearly end up bigger than it was originally. In both cases, the interest rate will end up back at r_0, and so investment will either be the same as it originally was (in the case of an initial decrease in C_0) or lower than it originally was (in the case of an initial decrease in I_0). Whether the government chooses fiscal policy or monetary policy will therefore depend upon its assessment of whether more government spending or more private investment would be more beneficial, and on its ability to take on more debt. (A more indebted government will have less latitude of action.) If the initial decrease was in I_0, it is more likely that the response should be mainly monetary, in order to return I to its original level.

4.3.2 An increase in the marginal propensity to save or the proportional income tax rate

An increase in s_1 or t_1 will cause an inward pivot of the IS curve. The immediate impact will be reduced output (from Y_0 to Y_1) and a reduced interest rate (from r_0 to r_1). Investment $I = I_0 - \delta r$ will therefore increase in both cases whilst consumption $C = C_0 + c_1(1 - t_1)$ will decrease. Again, we see that the government or consumers "tightening their belts" by cutting the budget deficit or saving more will result in higher investment even in the short run. However, there will again also be a recession. We know that an increase in t_1 will improve the government budget deficit because we saw that it does in the case of the Keynesian multiplier where r is fixed at r_0, and in this case r has dropped, stimulating investment and thus increasing tax revenue still further (hence, by identity, private sector net savings must decrease). An increase in s_1 will worsen the budget deficit because output and therefore tax revenue must decrease (hence, by identity, private sector net savings must still increase).

A policy response of expanding the money supply, in order to shift the LM curve to LM' is also illustrated. This is an example of **accommodatory monetary policy**, since this monetary loosening will accommodate the increased saving or increased tax rate in allowing the economy to remain at its original output level Y_0. The new interest rate will be r_2, and will have decreased so that investment can fully take up the "slack" created by the increased government saving (if t_1 has increased) or private saving (if s_1 has increased). This accommodatory monetary policy enables the long run classical outcome to be achieved instantaneously[6]

[6]We will see later how this analysis can be integrated with AD-AS analysis to fully reconcile the predictions of the Keynesian and classical models.

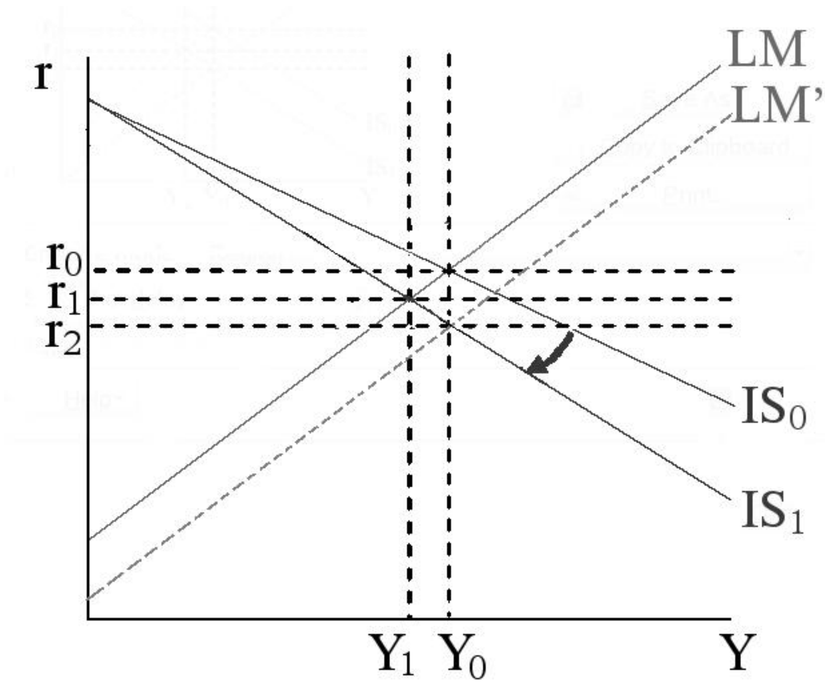


Figure 4.4: An increase in the saving rate or income tax rate

4.3.3 An increase in government expenditure

Another example of the importance of accommodatory monetary policy is an increase in government spending, or fiscal expansion. This is shown in figure 4.5 as a shift in the IS curve from IS_0 to IS_1. If the LM curve were to remain unchanged, as it would if there were no change in monetary policy stance, then the interest rate would be driven up and there would be partial crowding out. Private investment will decline. This may be undesirable, particularly if the fiscal expansion is intended to help boost the economy out of recession. By loosening monetary policy at the same time, the government can prevent the interest rate from rising by shifting the LM curve to LM_1. (Of course, if the economy were already at full capacity, the government may wish to increase the government's share of aggregate demand without boosting output. The appropriate monetary policy response in that case would be a *tightening* of monetary policy.)

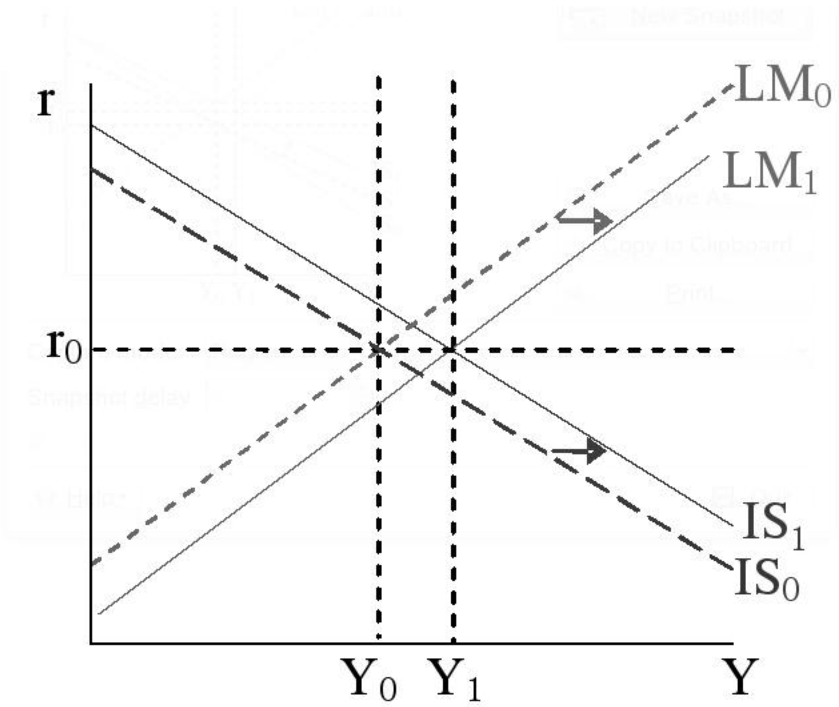


Figure 4.5: An increase in government expenditure

4.4 The closed economy AD curve

The AD curve is plotted in (Y, P) space where Y is output and P is the nominal price level. It represents all those points where both the goods market and the money market are in equilibrium for a given price level, nominal money supply and fixed position of the IS curve. The AD curve is thus derived from the IS-LM framework. This is done in the diagram below assuming that there is a fixed nominal money supply equal to M_S. When the price level drops from P_0 to P_1, this causes an increase in the real money supply. This is turn causes a rightward shift in the LM curve. This causes an increase in output and a decrease in the interest rate. The increase in output also shifts the money demand curve outwards. The AD curve is shifted by a number of factors. Firstly, any change in the position of the IS curve (via a change in the multiplier or autonomous expenditure) will shift the AD curve. Secondly, any change in the nominal money supply will shift the AD curve. Thirdly, any change any of the other variables (aside from output) which enter into the money demand function will shift the AD curve.

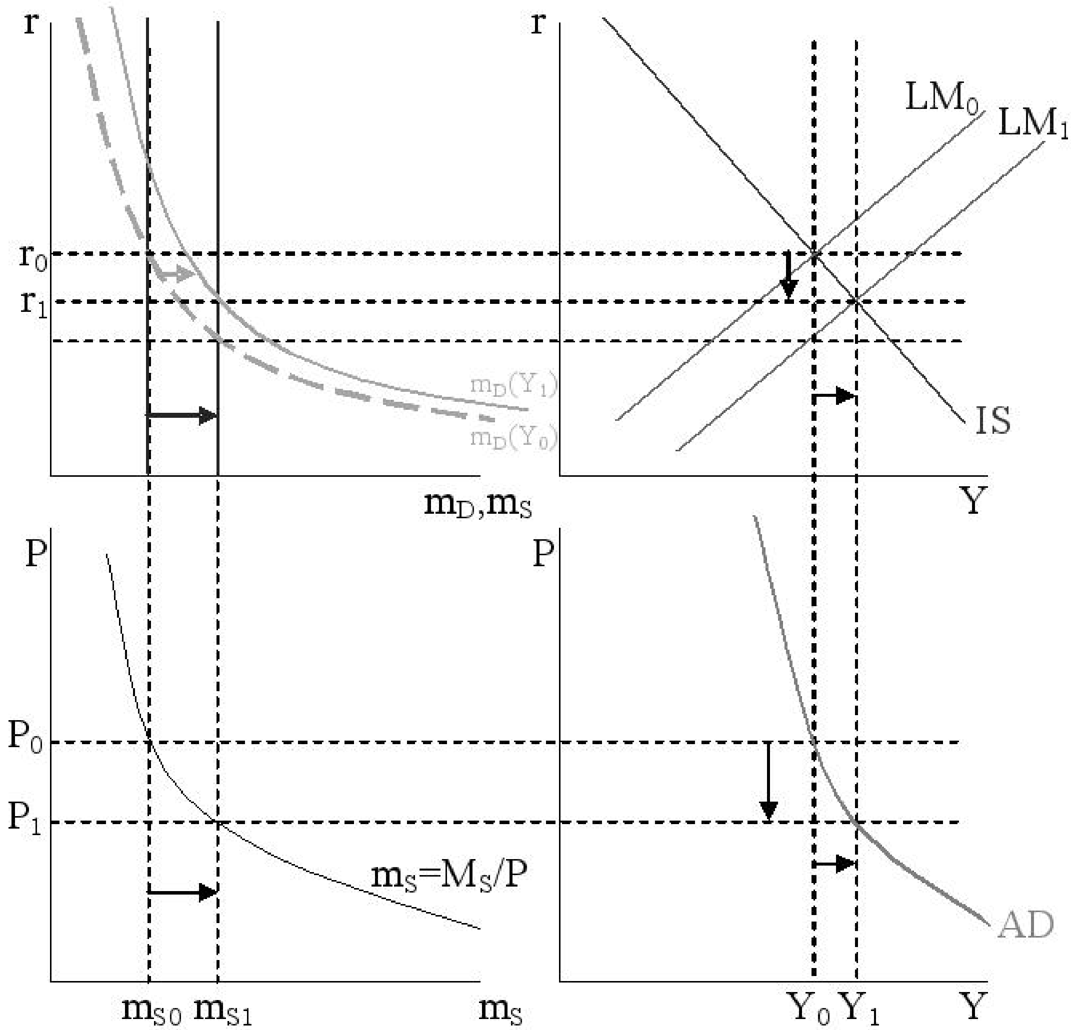


Figure 4.6: Derivation of AD curve

Chapter 5

The Money Market

5.1 Money supply

In modern market economies, the Central Bank can only indirectly control the supply of wider monetary aggregates. This is due to the intermediary operation of the commercial banking sector. Commercial banks only have to hold a fraction x_{re} (known as the reserve ratio) of their total deposits as currency, because people on average only withdraw a small part of their overall accounts in a given period. The reserve ratio x_{re} will depend both on the optimizing decisions of banks based on their anticipations of economic conditions, but is also legally regulated by the government (generally by a legal minimum reserve ratio). The public, through their optimizing behaviour, choose a balance between holding their wealth as currency and holding it in bank accounts. This determines a currency-deposit ratio which we represent by x_{cu}. The amount of high powered money is given by: H=currency+reserves. The amount of money M=currency+deposits. Now, if we let the amount of deposits be D, then we have $H = (x_{cu}+x_{re})D$ and $M = (x_{cu}+1)D$. Combining these two equations, we can express M as a function of H: $M = \frac{x_{cu}+1}{x_{cu}+x_{re}}H$. The part $\frac{x_{cu}+1}{x_{cu}+x_{re}}$ is known as the **money multiplier**. It is greater than 1, and decreasing in the reserve ratio and the currency ratio.

When additional high powered money is injected into the system, some of it will be deposited in private sector banks, because individuals will want to restore the ratio of deposits to currency to the desired level. Only some of this deposited cash needs to be held by the private banks, the rest will be lent back out to the public. Thus a second phase of the cycle begins, with some of the loan returning to banks as deposits. Hence we see that there is always a multiplier effect in the transmission mechanism from an expansion of the high powered nominal money supply to the effective aggregate nominal money supply.

We have now seen a simple model of how the supply of high powered money by the central bank determines the nominal money supply. However, the effective money supply depends on two other factors. The first is the price level. The real money supply m_S is equal to the nominal money supply divided by the current price level ($\frac{M_S}{P}$). Even if the Central Bank could fully control the real money supply, the amount of income supported by this quantity depends on the velocity of money circulation. This is a measure of how many transactions in a given period can be funded by a particular unit of money. The higher the velocity, the higher income must be to soak up a given supply of real money.

It should be clear from the above discussion that the Central Bank has only indirect control of the variables which lead its supply of H to create the effective amount of liquidity (i.e. money supply) in the economy. Although the Central Bank can in principle completely control the supply of high powered money, as it is the monopolistic supplier of it (this is obviously ignoring the possibility of forgery), it cannot directly control the currency-deposit and reserve ratios, or the price level, or the velocity of money circulation. It may have policy tools to influence these variables, and it can attempt to predict them, but this will necessarily be an inexact procedure. It is thus unlikely that the Central Bank will be able to hit a precise target for any of the wider monetary aggregate supply variables. We can represent the effect of this inaccuracy or uncertainty in the money supply by looking at the effect on the IS-LM equilibrium if the money supply curve is able to shift around. As can be seen from the graph below, the instability in the money supply line causes instability in interest rates and therefore investment and output in the IS-LM equilibrium. (Note that instability in the velocity of money would be represented as a shift in the m_D curve). This suggests that if the Central Bank could instead fix the interest rate it may be able to reduce this instability.

If the Central Bank fixes the interest rate instead of the money supply then the supply of money automatically adjusts to the demand. This is because the interest rate is essentially the price the central bank charges for borrowing high powered money, and fixing the price of a good means that the quantity must be sold that is demanded at that price. This means

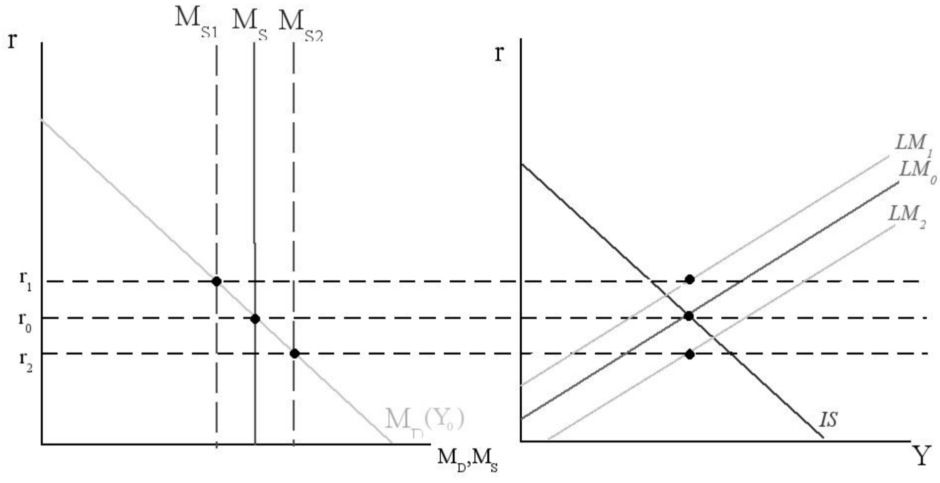


Figure 5.1: Fluctuations in fixed money supply

that the MS curve will always shift to meet the m_D curve at r_0, and hence the LM curve will shift about so that it always meets the IS curve at r_0. Effectively, the LM curve is horizontal. There is a price, however, to be paid for this reduction of instability in the LM curve. Suppose that the instability is instead in the IS curve (e.g. fluctuations in autonomous investment). If the IS curve shifts to IS_1 then the reduction in output is greater for the horizontal LM curve than for the diagonal LM' curve (which is where money supply rather than interest rates are targeted). This is because when money supply is targeted, part of the reduction in output is crowded out because the reduction in output reduces money demand and hence reduces interest rates. This cannot occur if interest rates are being directly targeted.

To conclude, neither a rigid money supply nor a rigid interest rate target are likely to be optimal policies for a central bank to use to regulate output (and therefore inflation). Most modern Central Banks use sophisticated economic models to predict the variables in the macroeconomy, and vary their interest rates over time in order to anticipate future inflationary and deflationary pressures.

5.2 Money demand

The most well-known simple model of money demand is the Baumol-Tobin model of cash management. This is a simple microeconomic model of the

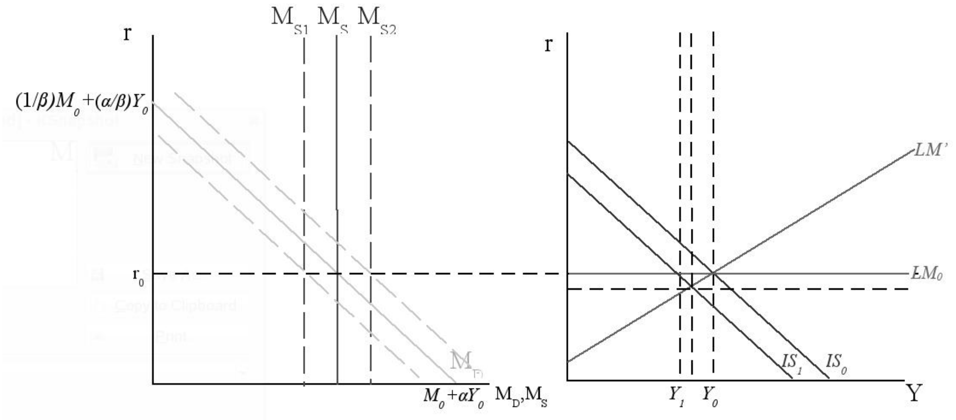


Figure 5.2: Goods market fluctuations with interest rate targetting

transactions demand for money of a rational individual. The easiest way to understand the model is to imagine we are in a world before the invention of cash machines, cheques or debit cards. Paying for goods and services requires the use of cash. The only way to get cash is to go to the bank and withdraw it. While money is in the bank it earns a nominal rate of interest ι. We assume that keeping money in a bank account is not the only way of investing wealth. The individual could use their savings to buy government or corporate bonds, or equities, or housing, or stockpiles of gold and diamonds (which, we assume, maintain their real value). Suppose there is inflation at annual rate π. If banks do not increase their nominal interest rate to account for this, then people will shift their wealth into other assets which hold their real value. So, banks would have to increase their nominal interest rate in line with inflation. So, we assume for simplicity that there is a core real rate of interest on all assets in the economy. Many bonds, equities and other assets will tend to have a higher average real interest rate than this core rate because they are riskier and so carry a risk premium. So what the core real interest rate r represents is the rate of return on a risk free, moderately liquid interest-bearing asset (e.g. an inflation-linked long-term government bond). The nominal interest rate paid by the bank will be equal to $\iota = r + \pi$.

Our individual's annual demand for money is equal to αY. The coefficient α would depend on specific individual characteristics such as the degree to which an individual earns their income by buying and selling goods. The individual chooses how many annual trips to make to the bank, which we denote as N. We assume that the individual plans to use up all their cash before they make each new trip to the bank. If we assume that cash is used up at a constant rate, this implies that the individual's average level of cash holdings over the year is equal to $\frac{\alpha Y}{2N}$ (because the average amount over a period is half the amount that was withdrawn at the beginning of the period).

To find the optimal number of trips to the bank, we need to define a cost function for the individual. Now, the average cost of holding wealth as cash rather than in the interest bearing bank account is the nominal interest rate that would have been earned on the average cash holding if it had been in the bank. This would be equal to $\frac{\alpha\iota Y}{2N}$. Let us suppose that there is also a fixed cost F each time the individual visits the bank. This will mean that our rational individual seeks to minimize the cost function $C = \frac{\alpha\iota Y}{2N} + FN$. To find the minimum, we take the first order condition and equate it with 0: $\frac{\partial C}{\partial N} = -\frac{\alpha\iota Y}{2N^2} + F = 0$. This implies that $N^* = (\frac{\alpha\iota Y}{2F})^{0.5}$. Given optimal money holding behaviour, the individual's average cash holding will be:

$$\frac{\alpha Y}{2N^*} = \left(\frac{\alpha Y F}{2\iota}\right)^{0.5} = \left(\frac{F\alpha Y}{2(r+\pi)}\right)^{0.5} \tag{5.1}$$

So, average cash holdings (i.e. money demand) will be positively related to the fixed cost of trips to the bank, the level of income and the coefficient α, but negatively related to the inflation rate and the core real interest rate.

Clearly the assumptions of this simple model are highly unrealistic. However, it does capture the essence of the idea that money demand is positively related to income but negatively related to the real interest rate and the rate of inflation. Aside from the obvious role of real income, the real interest rate, the inflation rate and the cost of going to the bank in the condition derived above, the subsections below illustrate some simple practical applications of the model.

5.2.1 A reduction in the riskiness of bonds

If bonds become less risky whilst their expected rate of return remains unchanged then they will become more attractive to a risk averse individual. This will mean that the effective core interest rate r rises, because the bank account must become more attractive to keep pace with the greater desirability of investing in bonds. This will mean that the individual's demand for money will decrease, ceteris paribus.

5.2.2 The introduction of interest on demand deposits

A payment of interest on demand deposits will (assuming we include demand deposits as money) increase the demand for money, since money is now more attractive relative to other assets. This could be represented by replacing ι in equation 5.1 with $(\iota - d)$ where d is the nominal rate of interest on demand deposits. This is because the foregone interest by holding wealth as money in deposit accounts is the nominal interest rate on a riskless bond minus the nominal interest rate on demand deposits. (This is assuming, for simplicity, that all money is now held in demand deposits, which would be the case if they were just as liquid as cash, but which is not quite true in the real world - as can be seen from the fact that we do hold a small amount of cash but hold most of our money wealth in our bank accounts.)

5.2.3 The individual becomes self-employed

If the individual chooses to become self employed, then they will probably need to use more cash to earn the same amount of income as a non self-employed individual. This would be represented by an increase in the coefficient α. Their demand for money will increase.

5.2.4 A rise in the expected rate of inflation

An rise in the expected rate of inflation reduces the real interest rate on money (makes it more negative in the case of cash). This will make it less attractive relative to real assets (e.g. housing, gold, diamonds), equities and inflation-linked government bonds (all of whose real rate of return is generally unaffected by inflation). We would thus expect the demand for money to decrease. In terms of the model, we can see this from the role of π in equation 5.1.

5.2.5 An increase in the price level

An increase in the price level can be seen to raise the individual's demand for nominal money balances because it depends upon the nominal income Y, where $Y = yP$. When the nominal price level goes up, with real income remaining unchanged, then the individual's demand for nominal money balances will increase.

5.3 Monetary Policy

5.3.1 Fixed money supply

We have already seen some of the problems which can arise if the government operares monetary policy by fixing the nominal money supply. We can illustrate a further problem with a fixed money supply using a linear IS-LM model with a constant rate of expected inflation π_e. This means that the nominal interest rate on bonds ι must be equal to $\pi_e + r$, where r is the real interest rate. The demand for real money balances $m_D(\iota, Y) = m_{D0} + \alpha Y - \beta\iota$ is a decreasing linear function of the nominal interest rate and an increasing linear function of the output level Y. The real money supply $m_S = \frac{M_{S0}}{P_0}$ where M_{S0} is the nominal money supply fixed by the central bank and P_0 is the price level (fixed by the assumption that we are in a Keynesian short run). By equating money demand and money supply ($m_D = m_S$), we know that $\iota = \frac{\alpha}{\beta}Y - \frac{1}{\beta}(\frac{M_{S0}}{P_0} - m_{D0})$. Therefore the LM curve is described by the equation $r = \frac{\alpha}{\beta}Y - \frac{1}{\beta}(\frac{M_{S0}}{P_0} - m_{D0}) - \pi_e$. It is therefore an upward sloping straight line.

An increase in the rate of expected inflation therefore has a similar effect to a decrease in the price level or increase in the nominal money supply in that it shifts the LM curve outwards/rightwards (since the LM curve is upward sloping). This is because an increased inflation rate automatically lowers the demand for real money balances, ceteris paribus, and therefore allows a higher level of output to be supported by any given real money supply. Note that this implies that an inflationary boom could be a self fulfilling prophecy; if private agents believe that the inflation rate will increase, and the government does not tighten monetary policy to correct the effect, then the effect of the expectations shift is as if the real money supply has been expanded. Inflation will therefore begin to accelerate, due to the increase in output above its potential level.

The potential destabilizing effect of a fixed money supply can be illustrated using an IS-LM panel diagram. The increase in the expected rate of inflation causes the origin in the money market equilibrium to shift downwards, because the nominal interest rate is equal to the real interest rate plus the expected inflation rate. With the usual upward sloping diagonal LM curve and downward sloping diagonal IS curve, output increases (from Y_0 to Y_1) and the interest rate decreases (from r_0 to r_1). These two changes both contribute towards bringing the demand for real money balances back into equilibrium. Here we have a simple story of one way in which rational private sector behaviour might cause a destabilizing inflationary boom in an economy which follows a monetary growth rule. (In an economy with ongoing inflation, the real money supply can only remain constant if the nominal money supply is growing at the same rate as the price level. The monetarist argument is therefore that if the economy wishes to see an inflation rate of 2.5%, it should rigidly stick to growing the money supply at a rate of 2.5%. However, this model suggests that this could fail to prevent an inflationary boom if private agents come to expect one. This is an argument for discretionary monetary policy, which adjusts interest rate from month to month, as we have in most economies today. This enables the monetary policy authorities to prick a bubble like this before it gets out of hand.)

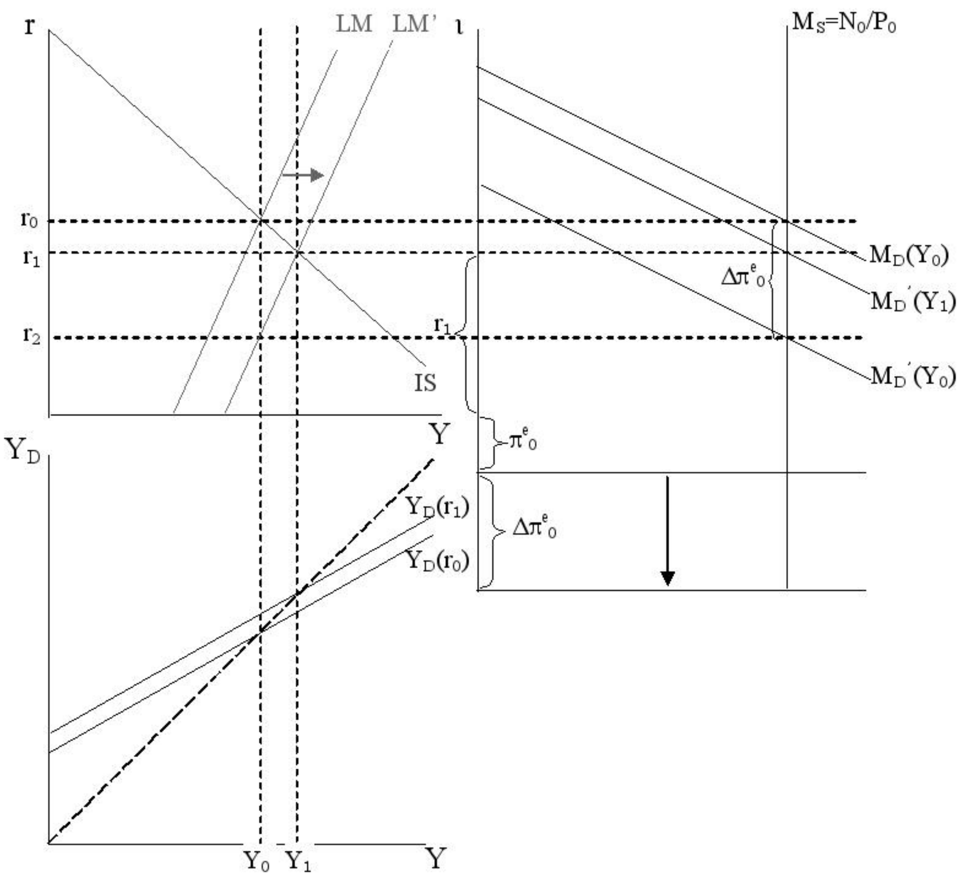


Figure 5.3: Potential destabilizing effect of fixed money supply

5.3.2 GDP growth targetting

A fixed money supply (or fixed monetary growth rule for an economy experiencing ongoing inflation) is not the only rule-based monetary policy regime that has been proposed. Other possibilities considered by economists have been that of nominal or real GDP growth targetting, and of targetting the rate of inflation. These would require the monetary authorities to expand or contract the money supply to ensure that the particular target is met in a given period. If we consider these three policies in the long run, when the classical model holds, then, with real growth of g and ongoing inflation of π then a real GDP growth target of g, an inflation target of π and a nominal GDP growth target of $g + \pi$ will be identical. The difference between them concerns the dynamics of the short run adjustment of monetary policy.

Suppose the economy were initially at the long run equilibrium described above, and the real growth rate of GDP were suddenly to drop to g'. Inflation targetting would require a contraction of monetary policy (i.e. a reduction in the growth rate of the money supply) to stabilize the inflation rate at π and the nominal GDP growth rate at $\pi + g\prime$. Real GDP growth targetting would require an *expansion* of the money supply in an attempt to restore the real growth rate to g. This might happen, but at the expense of higher inflation. On the other hand, if the real GDP growth rate was permanently lowered, a rule like this could lead to hyperinflation. Nominal GDP growth targetting would involve some monetary stimulus, until the inflation rate rises sufficiently to π' so that $g' + \pi' = g + \pi$. However, if this monetary stimulus succeeded in increasing g' part of the way back to g, then inflation need not rise by as much as $\pi' - \pi$ and if g fully recovered, then inflation need not be any higher in the long run.

From the above discussion, it should be clear that the appropriateness of the different monetary policy rules depends upon views about how volatile and pervasive are **supply side shocks** which alter the long run productive capacity of the economy (by causing changes in g in the above story). Real GDP growth targetting is problematic because a permanent drop in g would lead to hyperinflation. Nominal GDP growth targetting has advantages if changes in g are due to temporary factors which are correctable by an expansion of the money supply (for example, if hysteresis is a serious problem, as will be discussed further in chapter 7). However, if the real GDP growth rate is quite volatile, and these changes in the growth potential of the economy are quite persistent, then nominal GDP growth targetting will lead to a volatile inflation rate, denying the economy the full benefits of price stability. Hence inflation targetting has become the most common way of conducting monetary policy in contemporary economies. We will return to this issue in chapter 9.

5.3.3 Inflation targetting

In order to target a particular inflation rate, the monetary authorities must set the interest rate so that IS-LM equilibrium output is equal to potential output Y^*. The real interest rate required to achieve this will depend on the various components determining the position of the IS curve. For example, if autonomous consumption investment of government spending are higher, the equilibrium interest rate must also be higher in order to bring demand in line with potential output. Note also that once the IS curve is fixed, the real money supply is pinned down to a particular level. This is because given a certain position of the IS curve, to achieve non-accelerating inflation requires that the LM curve shift to intersect the IS curve at the real interest rate where IS-LM equilibrium output is the same as potential output. So, even a fully independent monetary policy authority[1] does not have ultimate power to set the real interest rate in the long run; it responds to the interest rate determined by the fiscal authority via government taxes, spending and other policy variables. However, as we saw from section 5.3.1 a self-fulfilling expectation of an inflationary boom (and the same thing can happen but in the opposite direction if deflation is expected), there is arguably a need for the monetary policy authority to fine tune interest rates in the short run in order to meet the inflation target and prevent destabilizing influences.

The diagram overleaf illustrates the ultimate need for fiscal and monetary policy coordination is to achieve a permanently lower real interest rate. By raising the proportional tax rate, the fiscal policy authority pivots the IS curve inwards. This would lead to decelerating inflation. Therefore the inflation targetting monetary authority is able to loosen monetary policy (i.e. by lowering the base rate, the nominal interest rate they charge for lending out high-powered money). This is equivalent to an outward shift in the LM curve, lowering the interest rate and restoring output to its potential level Y^*.

[1] We return to the issue of Central Bank independence in chapter 9.

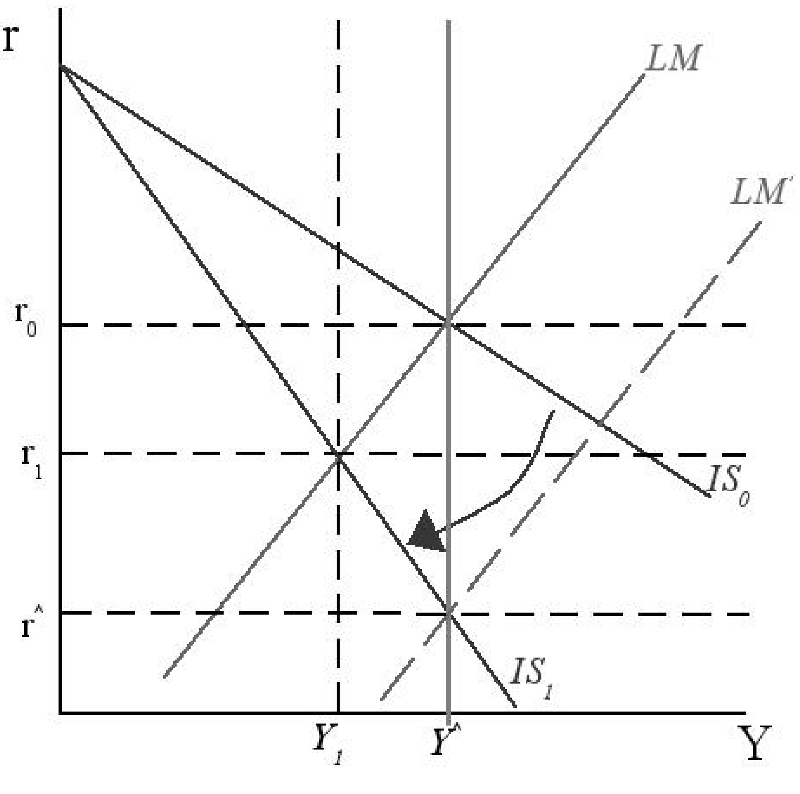


Figure 5.4: Fiscal and monetary policy co-ordination

Part III

The AS Curve and the Labour Market

Chapter 6

The Labour Market and the AS Curve

6.1 The labour market

In order to model the labour market at a microeconomic level, we simplify greatly by assuming that all jobs are the same in terms of disutility of work effort, benefits and any other factors that cannot be captured in the real wage. We can then put the number of workers in the labour force n_e along the x-axis and real wages $w = \frac{W}{P}$ along the y-axis. Each worker will have a reservation wage, which is the minimum real wage required to make them want to take a job rather than remain unemployed. This will differ from worker to worker depending on their individual characteristics (e.g. personal preferences, size of family, etc.) As real wages rise, more and more workers will want to enter the labour market. This generates the upward sloping labour supply curve n_{eS}. To relate this back to the classical labour market model in figure 2.2, if we make the further assumption that all workers who work work the same number of hours per week and are equally productive, so that they each provide $\tilde{l}$ units of labour then $l = n_e\tilde{l}$. We can then plot the labour demand curve n_{eD} as equal to the marginal product of labour evaluated at $l = n_e\tilde{l}$.

Using classical assumptions, the labour market clears where the n_{eS} and n_{eD} curves meet at n_e^*. The equilibrium real wage is w^*. The total number of potentially available workers is the population n. Equilibrium unemployment is $n_u^* = n - n_e^*$. All unemployment at the equilibrium is voluntary in the sense that none of the unemployed workers want to work at the current market wage. The following diagram illustrates the labour market equilibrium:

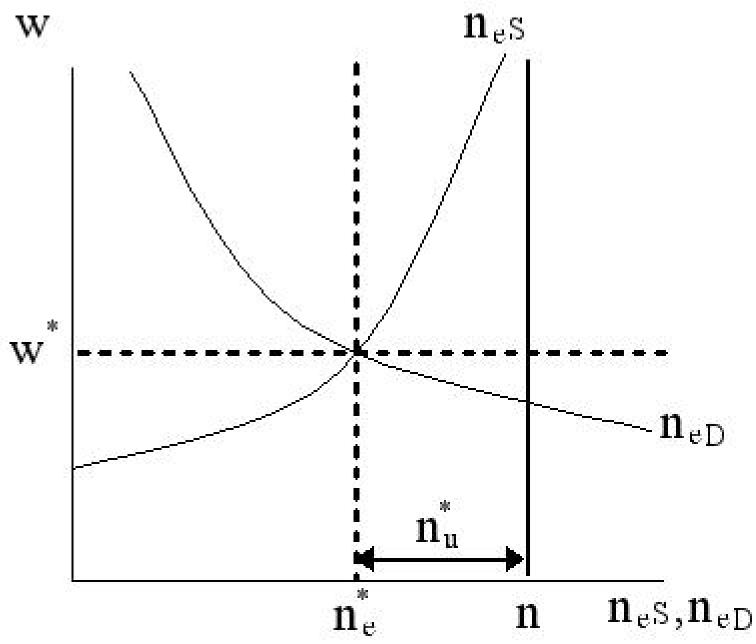


Figure 6.1: Classical labour market equilibrium

6.2 Sticky wages

When wages are sticky, we are referring to a situation where the price level has changed, but nominal wages have remained unchanged. For this to occur there must be some kind of nominal rigidity in the economy. This could be for a number of reasons. It could be because bargaining between firms and workers only occurs periodically, so that wages have not yet been renegotiated to take into account the altered price level. (Note that this explanation requires that we move away from the classical model, where each worker negotiates individually with their employer, so that the market clears instantly, to a model with trade unions or other kinds of bargaining institutions.) It could be because the unionized workers who have kept their jobs at the higher real wage are unwilling to accept a nominal wage cut. (Note that this explanation requires that firms for some reason cannot fire these workers and hire those willing to work for less, as would occur in the classical model.) The diagram below illustrates a situation where the price level has dropped, but nominal wages have remained stuck at their original level. This has resulted in a rise in the real wage above the market clearing wage to w. Only those workers who the firm is willing to hire (i.e. up to the n_{eD} curve) will be employed. There will now be involuntary unemployment as shown on the diagram. Note that the involuntary unemployment is more than the shortfall between the new level of employment and the equilibrium level $n_e{}^*$, because the real wage is higher, so even more people want to work than in the market clearing equilibrium, even though less are employed.

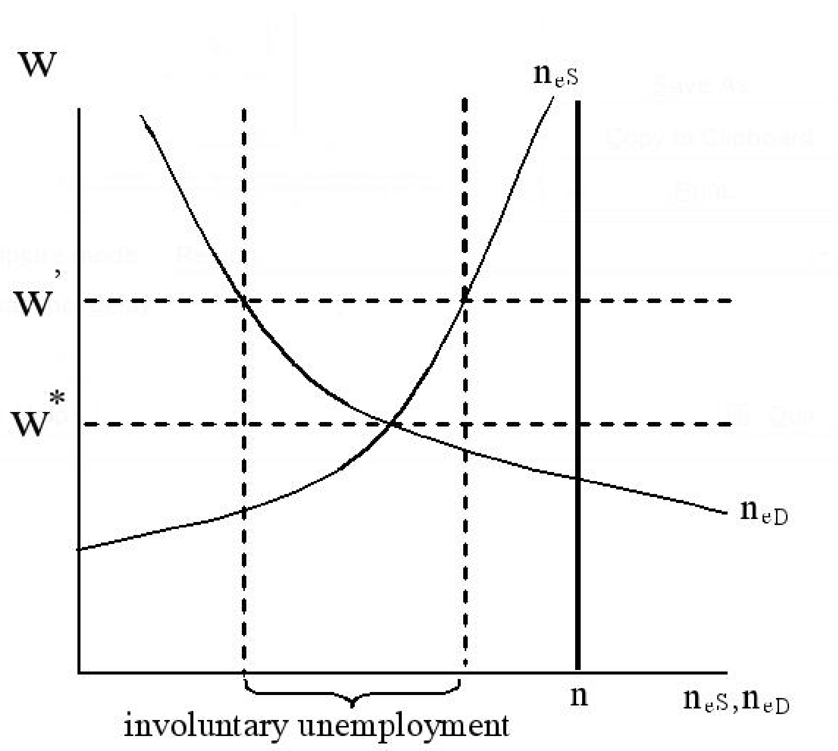


Figure 6.2: "Downwards sticky" nominal wages

6.3 Worker price misperception

An alternative to sticky wages in explaining why employment can deviate from the equilibrium level is a model where workers can misperceive the price level. For simplicity, we assume that firms know the actual price level, whereas workers have more limited information and so base their decisions on previously formed expectations. Suppose that there is surprise disinflation so that nominal wages drop, but so do prices so that real wages remain constant. If workers do not realize that the price level has also dropped, they will think that their real wages have dropped. This will have the same effect as if the n_{eS} curve were shifted upwards (the shift will be downwards if workers *underestimate* the price level). Since the labour demand curve remains fixed, this will result in a higher real wage and a lower level of employment than in the classical case. The additional unemployment here probably should not be classified as involuntary because all those workers who are willing to work at the market wage are able to do so. However, when they realize that the price level has dropped they will in retrospect realize that they have made a mistake, and should have been willing to work at a lower nominal wage.

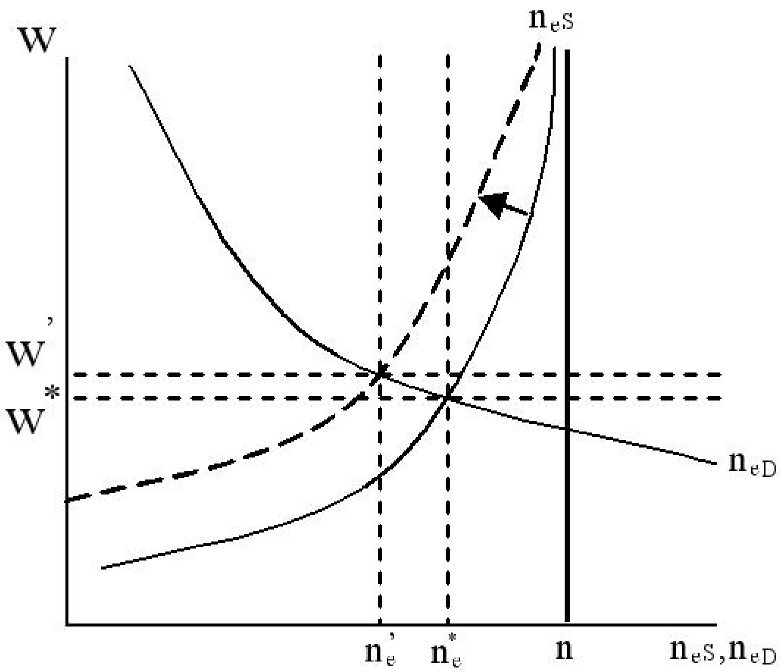


Figure 6.3: Worker price misperception

6.4 Sticky prices

A third explanation for fluctuations in employment and output around their market clearing values is that firms do not immediately adjust their prices. In terms of the classical labour market diagram, this can be thought of as shifting the n_{eD} curve. We can show this by supposing that the actual nominal price level is P but that firms have fixed their price level at $barP$. For clarity, we assume that workers fully perceive the price level and that there is no distortion of competition in labour supply. Hence we know that workers are definitely on their labour supply curve. Hence the nominal wage must be equal to the real wage multiplied by the price level: $W = wP$. A representative perfectly competitive firm's nominal profit function (assuming a fixed capital stock, for simplicity) will therefore be:

$$\pi = \bar{P}f(\bar{K}, L) - rP\bar{K} - wPL$$

The first order condition for profit maximization will be:

$$\frac{\partial \pi}{\partial L} = \bar{P}\frac{\partial f}{\partial L} - wP = 0 \Longrightarrow w = \frac{\bar{P}}{P}\frac{\partial f}{\partial L}$$

From this equation, we can see that if $\bar{P} > P$ then the real wage will be greater than the MPL at the firm's profit maximizing equilibrium. So, the firm will be operating above its labour demand curve. In other words, the *effective* labour demand curve is shifted inwards. This means that if some firms have their prices "stuck" above the actual price level, then they will underproduce relative to the efficient market clearing level, and there will be excess unemployment. Conversely, if $\bar{P} < P$ then the real wage will be lower than the MPL at the firm's profit maximizing level of labour demand, and so any firms with sticky prices will *overproduce* relative to the efficient level. The effective labour demand curve will be shifted outwards.

6.5 Strengths and weaknesses of the models

In the simple form presented here, all three of these potential explanations for output and employment fluctuations have problems. The sticky wage model does not explain why nominal wages are sticky. It seems more plausible that workers target real, not nominal wages. The worker price misperception model does not explain why workers allow themselves to be systematically duped by changes in the price level. Surely in a high and volatile inflation economy, it will be rational for workers and unions to gather accurate information about price changes so as to avoid this? The sticky price model is also weak in that there is no justification for why perfectly competitive firms would allow their nominal prices to be "sticky". Surely it would pay them to ensure that they make frequent and accurate changes to nominal prices to keep in line with inflation?

These three explanations, in the form of wage and price rigidities, and imperfect information, do however, continue to operate at the heart of modern macroeconomic modelling. This is because they can be given a much more realistic rationale once we drop the perfect information, perfect competition paradigm. Wages are sticky because overlapping contracts are an optimal response by employers and employee bargainers to the world they live in. Imperfect information implies a cost to information gathering, making it optimal for agents to make their "best guess", which can be wrong. Although nominal price rigidities are not plausible in a world of perfect competition, when firms have monopoly power, their profits are much less susceptible to sudden jumps if they set their price wrong. Since, by mis-setting their price (too low in the diagram below), firms only lose the difference between the single diagonal hatched and double diagonal hatched rectangles, small menu costs (costs of changing prices) can explain a lot of nominal rigidity:

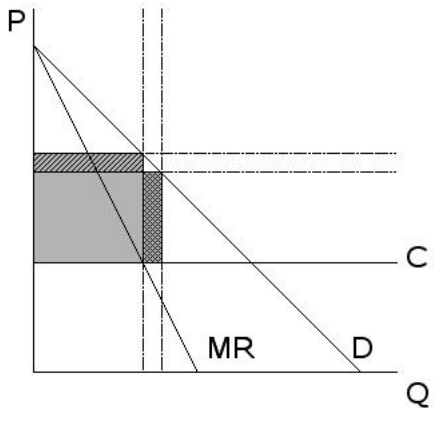


Figure 6.4: Monopoly power and nominal price rigidities

6.6 Demand side and supply side shocks

The diagram overleaf illustrates the effect of a decline in autonomous investment. The IS curve shifts to the left from IS_0 to IS_1. This causes the AD curve to also shift to the left. The short run AS curve SRAS is upward sloping because wages are sticky downwards in the short run. When the nominal price level reduces, the nominal wage level remains stuck, and so the real wage increases. (We assume for simplicity that nominal wages are sticky downwards but not sticky upwards, i.e. that firms have no problem raising nominal wages to a new market clearing level, only reducing them.) This leads to the employment level falling below the market clearing level L^*, and thus to output falling below the economys capacity level Y^* (which corresponds to the level of output produced when the labour market is in equilibrium, i.e. when there is no involuntary unemployment). The new lower employment level L_1 leads to a lower output level Y_1. The fall in the price level also causes the LM curve to shift outwards from LM_0 to LM_1 because the real money supply increases. The interest rate falls from r_0 to r_1, illustrating the fact that some but not all of the reduction in autonomous investment demand is compensated for by a lower interest rate. The new short run equilibrium of the economy therefore results in a recession as the economy moves from point a to point b, where there is involuntary unemployment. In the long run, however, the forces which lead to labour market equilibrium will win out (e.g. workers with jobs will be unable to prevent those who are willing to work for less from doing so indefinitely) and the economy will end up back on the LRAS curve, this time at the intersection with the new AD curve. As the nominal wage W is reduced from W_0 to W_2, the SRAS curve will shift downwards until the economy eventually ends up at long run equilibrium at point c. The LM curve will in the long run have shifted to LM_2, where the reduction in the price level has been sufficient to lead to a lowering of interest rates to r_2, sufficient to compensate for the initial decline in autonomous investment.

Assuming this model of the relationship between the supply side and the demand side of the economy is correct, then there is a role for monetary or fiscal policy to reduce or eliminate the damage done to the economy by the recession in the short term. If an investment subsidy were used to stimulate aggregate demand, the IS curve could be shifted back out to IS_0, thus re-establishing the original IS-LM and AS-AD equilibrium. It would, however, be difficult to target fiscal policy so precisely at investment expenditure. There would also be a deterioration in the government budget position. Perhaps more promisingly, an immediate increase in the nominal money supply could shift the LM curve directly to LM_2, without the need to wait for nominal wages and prices to drop. This would shift the AD curve back to AD_0, its original position. There would then be no short run recession and aggregate demand management policies would have immediately restored macroeconomic equilibrium.

A rise in the price of oil will result in a reduction in the optimal capital input K (because machinery is now more expensive to operate) and thus a reduction in the marginal product of labour. This will cause a leftward shift in the long run and short run aggregate supply curves. Assuming the nominal money supply remains unchanged, and (for simplicity and clarity) that the oil price shock has no effect on the demand side components entering into the IS curve, the position of the AD curve will remain unchanged. Assuming that nominal wages are only sticky downwards, the short run result of the supply side shock will be an immediate increase in nominal wages and the price level to point b. This is also a stable long run equilibrium. The increased price level has reduced the real money supply, and interest rates have increased from r_0 to r_1. This means the investment component of aggregate demand that has been reduced. The consumption component has also reduced (because $C = C_0 + c_1(1 - t_1)Y$ in the Keynesian multiplier model) but government expenditure has remained unchanged. The supply side shock produces a recession which looks similar to that of a demand side shock, the major difference being that it is accompanied by inflation, not deflation. Suppose the government treated the supply side shock like a demand side shock and attempted to stimulate the economy using fiscal or monetary policy to shift the AD curve (e.g. to AD'). Under the assumption that wages are only sticky downwards, this would simply cause even more inflation, taking the economy to point c. We conclude that aggregate demand stimulation in not the correct response to a supply side shock, certainly if not accompanied by other policies to increase the output capacity of the economy.

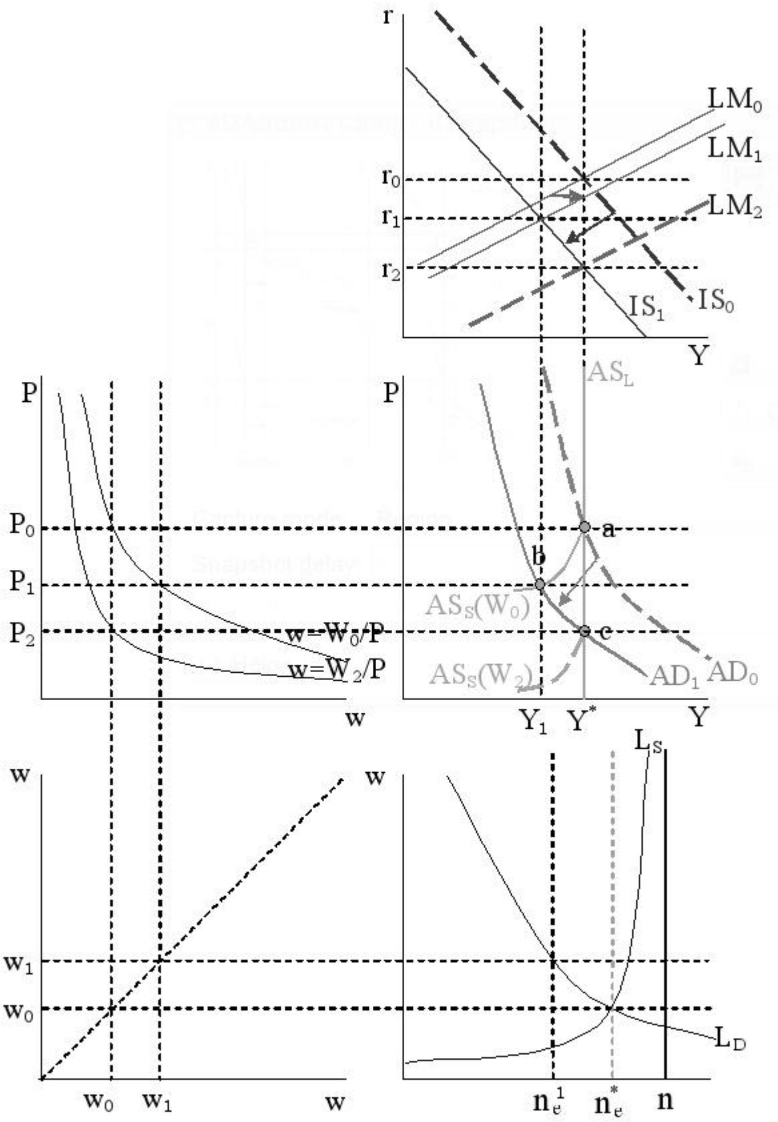


Figure 6.5: Demand side shock

6.7 SRAS with worker price misperception

The easiest way to generate an upward sloping short run aggregate supply curve using a rigorous foundation is to use Friedman's idea of worker price misperception, or money illusion. Although sticky nominal wages work reasonably well to explain involuntary unemployment (because nominal wages do not fall enough there is excess labour supply), the problem with using

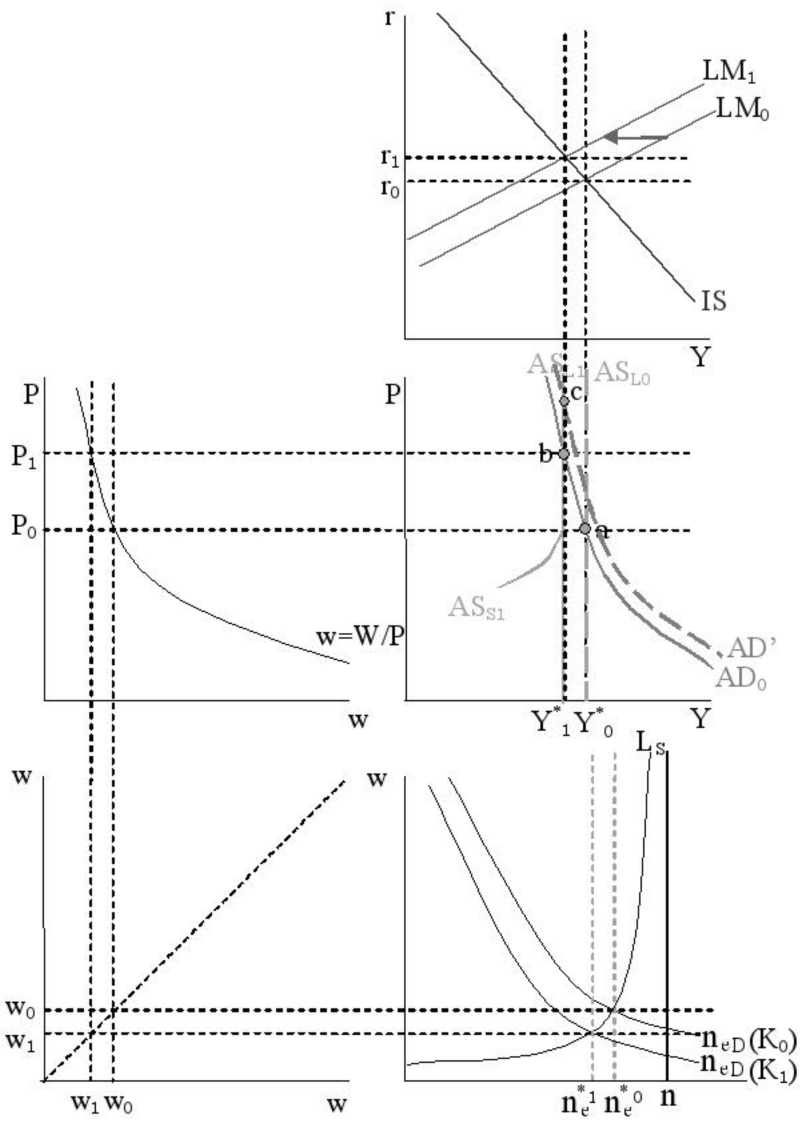


Figure 6.6: Supply side shock

sticky nominal wages is that they cannot be used to generate output above the equilibrium level, because if nominal wages are driven below the equilibrium level workers will work less than at the equilibrium level and there will be excess demand for labour. The advantage of money illusion is that it can explain output fluctuations in a simple symmetric way. It takes workers time to realize that the domestic price level has changed. This means at any time there can be a discrepancy between the workers' perceived/expected domestic price level P_e and the actual price level P. We assume that firms know the actual price level correctly. Labour demand is assumed to be described by a perfectly competitive market. If firms have a Cobb-Douglas production function $F = K^{\alpha}L^{1-\alpha}$, their profit function will be given by:

$$PK^{\alpha}L^{1-\alpha} - WL$$

Maximizing this function gives the first order condition: $\frac{W}{P} = (1-\alpha)(\frac{K}{L})^{\alpha}$ (this condition says that the real wage w is equal to the marginal product of labour). We can clearly see from this that the labour demand curve is downward sloping and convex, and goes to infinity as L goes to 0 and 0 as L goes to infinity.

We can think of L as the number of workers who are working, and assume for simplicity that they each work a standard week. The labour supply curve will be derived from the reservation wage required to get each worker to enter the labour market. If there are unemployment benefits we would expect that there would need to be a certain positive level of real wages before any workers will choose to work. Different workers will have different reservation wages because they have different preferences, different situations etc. If we let $\hat{L}$ be the total number of workers in the labour force, the labour demand curve must climb to infinity before it reaches this line because no level of the real wage can induce more workers to work than actually exist. We are now in a position to derive the aggregate supply curve (short run and long run) from the labour market model. To do this, we assume that the workers' expected/perceived nominal price level is fixed at P_{e0}. The fact that the nominal price level can deviate away from this means that workers can be "driven away" from their labour supply curve. Because firms know the actual price level, and the market is assumed always to clear, firms must always be on their labour demand curve.

Output can be driven above the potential level Y_0 if labour supply is driven above L_0 (i.e. if unemployment is driven below the natural rate). This can happen if prices rise to P_1 and nominal wages to W_1. Although the real wage has in fact dropped from $\frac{W_0}{P_0}$ to $\frac{W_1}{P_1}$, workers do not realize that the price level has increased and believe that the real wage level is $\frac{W_1}{P_{e0}}$. They therefore supply L_1 labour. They are in fact off of their labour supply curve, but they are on their perceived labour supply curve, the dashed green line lying below the actual labour supply curve. (A similar story applies if the price level drops below the expected price level, except that here the workers perceived labour supply curve lies above the actual labour supply curve this is shown in blue.) Once workers realize that the price level has increased, the SRAS curve will shift upwards from $SRAS_0$ to $SRAS_1$ to cross the LRAS curve at the new perceived price level. The labour market can only be in long run equilibrium when the workers' perceived price level is the actual price level. Clearly this point will lie on the intersection of the LRAS and SRAS curves. (Note: if workers have rational expectations they always correctly perceive the price level and so we are always on the LRAS curve.)

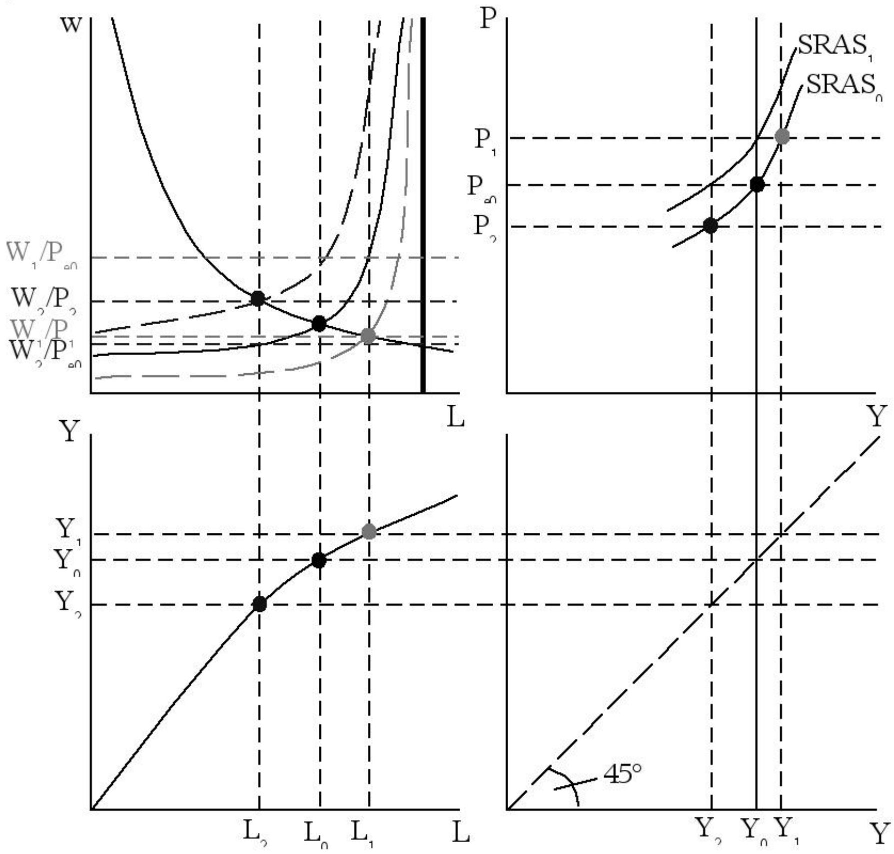


Figure 6.7: SRAS with worker price misperception

Chapter 7

The Phillips Curve and the AS curve

7.1 Inflation control

> There is no unemployment-inflation trade-off. Therefore: (a) Central Bank policy should focus on controlling inflation only. (b) Lower unemployment can only be achieved by improving work incentives.

There is a consensus among the economics profession that the above statement will hold in the long run. Once all nominal prices (including, most importantly, wages) have had time to adjust to one another, the optimizing behaviour of economic agents will lead to the same real equilibrium in the economy. This means that just as the amount of potatoes produced in the long run depends on the real supply and demand functions for potatoes, the amount of labour employed will depend on the real supply and demand functions for labour. To put it another way, in the long run, the economy is money neutral; money plays the role solely of frictionlessly oiling the transactions in the economy. In the short run, however, many economists believe that changes in the money supply (and therefore, changes in the rate of inflation) do have an effect on the real variables in the economy.

The negative relationship between inflation and unemployment was famously observed in the Phillips curve. This is the converse of the positive relationship between output and inflation observed in the aggregate supply curve. The original Phillips curve, however, did not take into account the role of expectations. The higher the expected inflation rate, the higher must be actual inflation in order to support the same level of output. This is because there is persistence in the expectations of economic agents. If a high inflation rate is expected, then workers and firms will push for higher nominal wages and prices in order to achieve their target real wages and prices.

As we have seen in previous chapters, fluctuations away from potential output and employment can be due to misperception by economic agents (either workers or firms) of the real price level when prices change unexpectedly or imperfections in the labour market which prevent it from clearing immediately (often due to the presence of trade unions and collective wage bargaining). The controversy is over how long the short run is relative to the long run. The neoclassical school of macroeconomics has operated on the assumption that the short run is a matter of days or weeks, and sought for explanations of economic fluctuations which rely on the real structure of the economy. Keynesianism, on the other hand, has seen the short run as lasting for years, so that monetary policy is very important in stabilizing the economy in order to increase economic welfare through preventing unnecessary unemployment. However, before the rise of monetarism, Keynesianism did not properly recognize the long run neutrality of money. Modern neo-Keynesianism, on the other hand, sees the interest rate purely as a short run stabilization tool, and recognizes that inflation should be kept at a low and stable rate in the long run.

Most models of the macroeconomy start from the assumption that there is a vertical long run supply curve (we will consider a criticism of this view later on). This output level Y^*, represents the total amount that can be produced when the labour market clears. The structure of the labour market within this model, however, can be quite different from a true classical model where workers compete on an individual basis for jobs. The labour supply curve can incorporate the role of trade unions, or the need for efficiency wages (a model based an asymmetric information where firms pay workers higher than the market clearing rate so that the threat of being sacked induces workers to exert greater effort). It is best to think of Y^*, simply as the level of output compatible with no change in the inflation rate. A common formulation of the connection between the output level and the inflation rate is $\Delta\pi = \alpha(Y - Y^*)$. When output is above the equilibrium rate, there will be inflationary pressure as nominal wages catch up with the changes in other nominal variables (particularly the money supply). It is the rate of inflation which changes, because previous increases or decreases in inflation are built into the expectations of agents. This model is therefore based on adaptive expectations. The model provides a more satisfying definition of the short run aggregate supply curves than one where the position of the SRAS curve depends on the current price level. The position on the SRAS curve depends instead on the current inflation rate. We therefore need to put inflation π on the y-axis rather than the price level P. The LRAS curve remains vertical and the SRAS curve remains upward-sloping, and crosses the LRAS curve where the expected price level equals the actual price level.

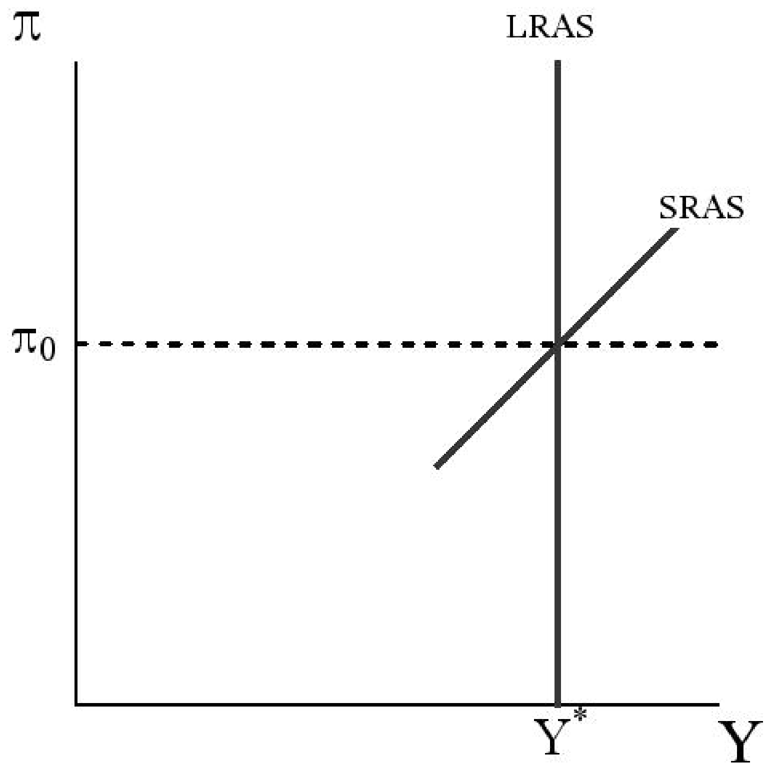


Figure 7.1: AS curves in an economy with inflation

If the expected inflation rate π_0 is also the target rate, then there is no incompatibility between stabilizing the employment rate at the equilibrium level of employment and keeping the inflation rate on target. The active use of monetary policy in order to keep inflation on target in response to aggregate demand shocks is thus, in a neo-Keynesian world, part and parcel of fulfilling part (a) of the title statement. Essentially, modern central bank policy aims to shift the AD curve, via changes in the interest rate, to ensure that it always passes through the intersection of the SRAS and LRAS curves in the diagram above. This begs the question what the optimal target inflation rate will be, from the point of view of overall economic welfare. There are a number of good reasons why the optimal inflation rate should be small but positive. Firstly, and obviously, high rates of inflation are damaging due to their impairment of the efficiency of the price mechanism and the likelihood that an economy which allows a high rate of inflation will also allow that rate to vary more, thus making agents expectations more likely to be wrong, and therefore causing greater fluctuations. Secondly, deflation is even more damaging than inflation, because when the price level is expected to fall, investment collapses because people prefer to hold money rather than real assets, causing a large and persistent recession which can be difficult to recover from. Having a positive rate of inflation gives a margin for error in avoiding deflation. Thirdly, if taxes must be raised by the government, then it is better for the tax burden to be spread over many commodities rather than just on a few. Since inflation is essentially a tax on the liquidity services offered by money, it may well make microeconomic sense for money to bear a small part of the overall tax burden by having a positive rate of inflation.

The description of neo-Keynesian monetary policy above is essentially consistent with monetarism, the idea that the nominal money supply should be allowed to grow only in line with target inflation. Leaving aside the issues of velocity and the money multiplier (i.e. assuming these are constant over time) monetary policy which aims to maintain the target rate of inflation in the short run will, in the long run, automatically allow the nominal money supply to grow at a rate equal to the growth rate of the economy plus the inflation rate. The neoclassical school, on the other hand, does not see the need for short run stabilization via monetary policy because the private economy is seen as having automatic mechanisms to ensure this adjustment. One way to achieve this result is to substitute adaptive expectations for rational expectations. If agents can fully anticipate the future results of any alterations in the money supply, there will be no period while private sector wages and prices catch up with these changes. This will mean that monetary policy will have no effect on output, only on inflation. In this kind of world, the best the government can do is to keep the fluctuations to the money supply down to a minimum. Active monetary policy could, in this situation, actually increase the instability of the economy.

Neo-Keynesian theory has essentially become the modern paradigm for macroeconomics. It combines the best features of monetarism, Keynesianism, and recent developments in microeconomics such as imperfect information and game theory. There is, however, controversy within this framework about the validity of part (b) of the title statement. In the long run, if the vertical LRAS model is correct, the level of employment will return to the equilibrium level whatever the government does in the short run in terms of monetary policy. This implies that if the government tries to use monetary policy in the short run to consistently raise the level of output above the equilibrium rate (i.e. by systematically setting the interest rate too low) all it will do is to cause a rising rate of inflation. This is where mainstream neo-Keynesianism differs from traditional Keynesian theory, which ignored the supply side of the economy and saw aggregate demand management as the complete solution to the problem of achieving low unemployment. The ineffectiveness of aggregate demand management policy to lower the rate of unemployment in the long run does not, of course, imply that government policy has no effect on the unemployment rate. On the contrary, modern macroeconomics sees supply side policy as the key is improving the efficiency of the operation of the economy in terms of employment, inflation and output. Essentially, what is required are changes in government policy which will shift either the labour supply or the labour demand curves advantageously so that the equilibrium rate of unemployment is lower. There are many policy instruments available to the government that will clearly affect this: Rates and incidence of taxation, the size and duration of unemployment benefits, the levels of education and vocational training, infrastructure, healthcare; in fact virtually every area of government policy can have an effect on the equilibrium employment and output level.

7.2 The challenge of hysteresis

The consideration of the many factors which affect the position of the LRAS curve brings into focus, however, the possible serious criticism of the simple model we have so far examined. This concerns the concept of **hysteresis**, the idea that the long run equilibrium of the economy is path-dependent. If the long run output capacity of the economy depends on investment in all kinds of real variables, and short run fluctuations affect employment and output, it would seem unavoidable that the conclusion must be that negative short run fluctuations do have a negative impact on the long run performance of the economy. This threatens to make a nonsense of the distinction between the short run and the long run. In the specific context of the unemployment performance of the macroeconomy, one of the most important forms of hysteresis is the particularly damaging effect of long run unemployment. There is plenty of empirical evidence to show that it becomes much harder for workers to find new jobs once they have been unemployed for a lengthy period of time. This will imply that failure to achieve the target inflation rate (assuming that the target rate is also the expected rate) will result in the LRAS curve and the equilibrium unemployment rate changing over time (i.e. temporary unemployment today can increase the equilibrium level of unemployment). This means that using monetary policy in an inflationary manner (i.e. raising Y above Y*) could actually reduce the equilibrium unemployment rate and bring long run benefits.

If defence of the neo-Keynesian approach to the short run management of the economy, however, a number of things should be pointed out. Firstly, the effect of hysteresis is likely to be small and take a long time to build up. This means that the distinction between the long run and the short run is still valid. Secondly, there are likely to be better ways to solve the problem of hysteresis (e.g. retraining of the unemployed and other active labour market programmes) than simply causing excess inflation. To conclude, modern macroeconomic theory, primarily in the form of neo-Keynesianism, shows us that in the short run, controlling inflation and preventing unemployment are, in terms of short run aggregate demand management, two sides of the same coin of keeping the inflation rate on target. Despite the issue of hysteresis, however, in the long run monetary policy is not the answer to the policy problem of reducing the equilibrium rate of unemployment. In this sense, neo-Keynesianism has taken on board the best ideas of neoclassical macroeconomics concerning the importance of supply side policy in ensuring good long run economic performance.

7.3 Gradualism vs. "Cold Turkey"

Additional issues arise when the policy problem is that of *reducing* inflation from a level that has been inherited from the past and is judged to be too high. In a neo-Keynesian world, in order to get inflation to come down, it is necessary to cause temporary unemployment. By tightening monetary policy, the government could shift the AD curve to AD', as shown in the diagram below. Next period, workers will build in the new reduced inflation rate of π_2 into their expectations, thus causing the SRAS curve to shift downwards to $SRAS_2$. Over a sequence of periods, the inflation rate will drop to the new target rate of π_t (provided that the government has correctly placed the AD curve). The potential problem with this "cold turkey" approach is that the social cost of the sudden jump in unemployment may be deemed too high. An alternative would be a "gradualist" approach involving less unemployment but over a longer period of time. This would require a gradual "easing" of the AD curve to the left, rather than a sudden abrupt shift. Eventually, this also could get the inflation rate down to π_t. Which option is preferable will depend both on the slope of the SRAS curve (the steeper it is, the less costly and more rapid is the cold turkey approach) but also on the policy-maker's preferences (i.e. how much they dislike unemployment relative to inflation).

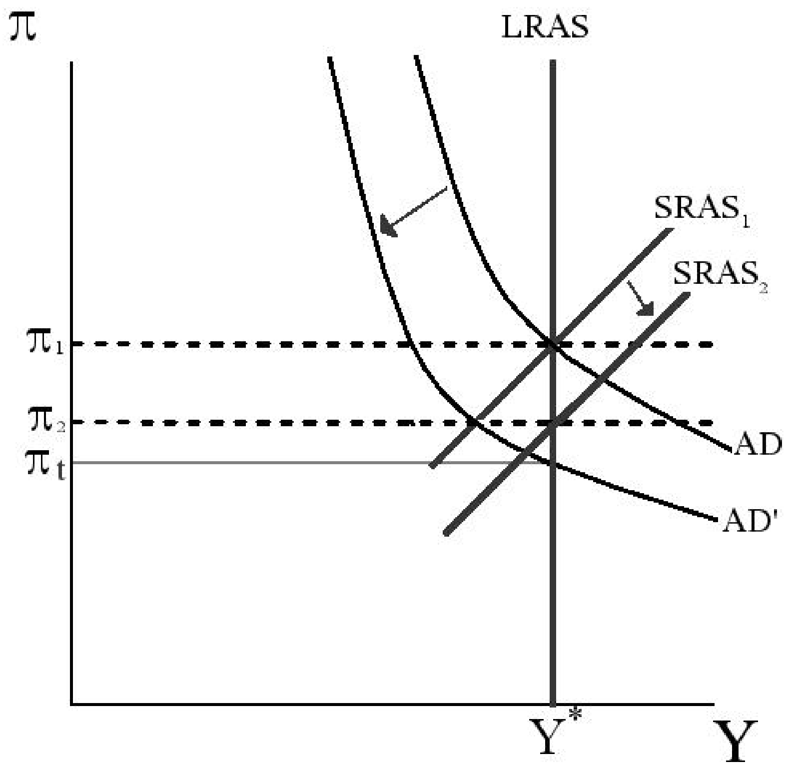


Figure 7.2: "Cold turkey" inflation reduction

Part IV

The Open Economy

Chapter 8

The Mundell-Fleming IS-LM Model

8.1 Open economy concepts

Fixed and floating exchange rate regimes form two extreme poles on a continuum of possibilities. In a pure floating regime, the Central Bank does not buy or sell any foreign currency. The Central Bank plays essentially the same role as in the closed economy, fixing the supply of high powered money in accordance with its desired monetary policy. The exchange rate is therefore determined entirely by the equilibration of private sector supply and demand. The convention is to define the **nominal exchange rate** E as the price of foreign currency in terms of domestic currency. So, the exchange rate of the dollar against the pound (i.e. the U.K. is the domestic economy and the U.S. the foreign economy) is the price of a dollar in terms of pounds. So, an **nominal appreciation** of the domestic currency is a decrease in E. The nominal value of the pound will have increased relative to the dollar. A **nominal depreciation** of the domestic currency is an increase in E; the nominal value of the pound will have decreased relative to the dollar.

The **competitiveness** of the domestic economy depends both upon the nominal exchange rate and the domestic price level relative to the foreign price level. It can be measured using the **real exchange rate** $e = E\frac{P_f}{P}$. A higher nominal exchange rate or higher level of foreign prices makes domestic exports more attractive relative to the alternative goods produced in other countries, thus increasing aggregate demand. A higher domestic price level makes domestic exports less attractive, thus reducing aggregate demand. It is thus the real exchange rate e that enters into the open economy Keynesian multiplier model and thus affects the position of the open economy IS curve. A **real appreciation** is a decrease in competitiveness and therefore a decrease in e. A **real depreciation** is an increase in competitiveness and therefore an increase in e. In the Keynesian short run, we assume that both the domestic price level and the foreign price level are fixed, and so changes in the nominal exchange rate feed through directly into changes in the real exchange rate. In the long run, when prices can change, this simple relationship will no longer hold, and the distinction between the real and nominal exchange rate becomes significant.

The demand and supply of foreign currency will be affected by a number of factors. Firstly, domestic currency will need to be exchanged for foreign currency in order to purchase imports from abroad, and profits from export sales will need to be turned from foreign currency into domestic currency in order to be repatriated. A second source of supply and demand will be generated from the trade in international assets. If domestic bonds become more attractive relative to foreign bonds, the demand for domestic currency and the supply of foreign currency will increase as people seek domestic currency in exchange for foreign currency in order to switch from foreign to domestic bonds. This will lead the private sector institutions which buy and sell currency to decrease the price of the dollar, i.e. to decrease E. The pound will therefore appreciate against the dollar. A third determinant of supply and demand is generated by the speculative motive for holding money. If speculators believe that the pound is likely to appreciate in the near future, they will buy pounds in order to sell them at a profit once the pound has appreciated. However, the increase in demand for pounds resulting from the beliefs of speculators can cause a self-fulfilling prophecy.

The problem of currency speculation becomes much more serious when the Central Bank attempts to fix nominal exchange rates. This is because the discontinuity in the price adjustment means that currency crises build up until the Central Bank is forced to alter the exchange rate peg. However, even with floating exchange rates there is a great degree of variability in the nominal exchange rate which it is hard to explain only using changes in real interest rates or other real variables. This suggests that the speculative motive may also be important in the theoretical analysis of floating exchange rates. It is a matter of debate whether floating exchange rates increase or decrease instability of the real exchange rate.

8.1.1 Fixed exchange rates

In order to fix the price of any good without using rationing, an institution such as the government must be willing either to soak up the excess supply at the artificially high price or satisfy the excess demand at the artificially low price. The same applies to foreign currency. In a fixed exchange rate regime, the Central Bank must be willing to buy and sell any amount of foreign currency at the fixed price. This will mean that no private sector agency can sell foreign currency at a price greater than the fixed nominal exchange rate E, or buy it at a price less than the fixed nominal exchange rate E. This also implies that the Central Bank loses direct control over the domestic high-powered money supply; it must provide the amount of domestic currency demanded at the fixed exchange rate. This last statement is a slight simplification; even if the nominal exchange rate is fixed, there are still other policy tools which the Central Bank can attempt to use to affect the domestic high-powered money supply.

One possibility is sterilization. If the amount of high powered money is being increased or decreased due to the buying or selling of foreign currency at the fixed exchange rate by the Central Bank, the Central Bank could in principle sell or buy government debt bonds of equal value so that the total amount of high powered money in circulation remains the same. There are, however, a number of problems with this. Firstly, the Central Bank is only able to do this as long as it has bonds left to sell, so the Central Bank's control over the money supply is certainly no longer unlimited, as it is in the case of a floating exchange rate regime. Secondly, the effect that the sterilization has on further demand for domestic currency at the fixed exchange rate depends on the model we use for the equilibrium in world capital markets. In the Mundell-Fleming model, as we shall shortly see, sterilization is completely ineffective except in the very short run. In more realistic models, sterilization can have an effect, but the key point is that even with sterilization, the Central Bank is essentially limited by the international financial and monetary system in its control over the high powered money supply once it has committed to fixing the nominal exchange rate.

There were a number of attractions to a fixed exchange rate for many nations after WWII. The first was a reduction in uncertainty about exchange rate fluctuations, and thus hopefully an increase in international trade in goods and services. The second was inflation control; a traditionally high inflation nation could, by pegging its currency to a low inflation currency like the Deutschmark, provide a nominal anchor to keep inflation under control. However, the expansion of the international financial system, alongside increased international trade eventually made fixed exchange rates increasingly impractical. There were attempts in many European countries in the late 1970s and early 1980s to use capital controls to prevent speculative pressures, but by the time of the ERM crises in the early 1990s, it had become clear that the cost of achieving fixed exchange rates outweighed the benefits. This provided some of the impetus in Europe to irrevocably fixing exchange rates via a single currency, but the fluctuation bands of the ERM were greatly loosened in order to reduce the pain required in the intervening period during the 1990s.

One of the most serious problems with a fixed exchange rate occurs due to speculative pressures. When speculators believe that there is a chance the Central Bank will alter the fixed exchange rate, they will start to buy or sell in currency in large quantities. If it is believed that the exchange rate will be revalued (i.e. that E will be decreased), this is not too much of a problem as people will want to hold domestic currency, and so they will sell foreign currency to the Central Bank in return for domestic currency at the fixed exchange rate. The Central Bank will see its foreign exchange reserves rise and the domestic high powered money supply increase. The problem emerges if a devaluation is expected in the near future. People holding domestic currency reserves will want to sell them in exchange for foreign currency before the deviation takes place, in order to avoid making a loss. This will result in a rapid depletion of the Central Bank's foreign currency reserves as it tries to hold the exchange rate fixed. The usual result in that sooner or later the Central Bank is forced to devalue. Here again we have the self-fulfilling prophecy. However, it can be argued that currency crises only emerge when there are underlying reasons in the real economy why a devaluation is likely (e.g. a recession or trade deficit). We discuss this further later in regard to the UK and the ERM crisis.

8.1.2 The balance of payments

The balance of payments is the sum of the current account and the capital account. The current account consists of the net trade in goods and services plus net transfer payments to domestic residents from abroad. If it is in surplus, the domestic economy is on average earning foreign currency. This foreign currency could either be accumulated by the Central Bank or used to make investments abroad. The capital account measures the value of net domestic investment from abroad. So, if all of the current account surplus were invested abroad, the capital account would be equal to the negative value of the current account surplus. In any exchange rate regime, therefore, the following identity must hold: $CA + CU = \Delta R \Longrightarrow BOP = \Delta R$ (Where BOP is the balance of payments, CA is the capital account, CU is the current account[1] and R is the Central Bank's foreign exchange reserves.) In a pure floating exchange rate regime, the Central Bank does not buy or sell any reserves, and so $BOP = \Delta R = 0$. In a fixed exchange rate regime, ΔR is determined by the requirement for keeping the nominal exchange rate fixed. In most countries which officially having a floating regime, however, it is rarely the case that $\Delta R = 0$. Many countries therefore engage in what is often described as **dirty floating**; the Central Bank intervenes in a discretionary way to keep the floating exchange rate within desirable limits. The balance of payments therefore tends to fluctuate around the zero mark, provided the Central Bank is not deliberately building up foreign currency reserves (as many Asian central banks have been doing recently with the U.S. dollar).

8.2 The Mundell-Fleming Model

The classic Mundell-Fleming model uses the assumption of perfect international capital mobility to draw some strong conclusions about the efficacy of monetary and fiscal policy in an open economy. Perfect international capital mobility implies (ignoring risk, or assuming risk neutral investors, so that there is no risk premium on different countries bonds) that in equilibrium the real interest rate must be the same on government bonds in all countries. Another assumption is that the domestic economy is small relative to the world market so that the world interest rate is effectively fixed from a domestic point of view. Effectively, there is a third horizontal line in the IS-LM diagram at the world interest rate which represents the condition for

[1]The current account is equal to the trade balance plus net transfers from abroad (e.g. gifts, money earned abroad by domestic citizens and repatriated, dividends on foreign equities owned domestically). For the remainder of this chapter, however, we will assume that net transfers are zero and use the terms current account, net exports and trade surplus interchangeably.

equilibrium in the international bond market. The IS-LM equilibrium in the open economy must lie on this horizontal line. However, the manner in which the economy gets to this equilibrium depends on whether there is a floating or a fixed exchange rate.

The Mundell-Fleming model should be thought of as a short run model. This is because, like the standard IS-LM model, it ignores the supply side of the economy. It is slightly more general than the standard IS-LM model in that, since the domestic real interest rate is now fixed by the world real interest rate, it can be applied provided the domestic and foreign inflation rates are identical. Provided this condition holds, the nominal exchange rate can be treated as the real exchange rate in the function for net exports, because relative nominal prices do not change. However, it is clear that in reality, in the medium run changes in the domestic output level will alter the domestic inflation rate relative to the world inflation rate. This means that the simple Mundell-Fleming model is not adequate for an analysis of the medium run when the inflation rate is no longer fixed.

If there is a floating exchange rate regime, the adjustment to the short run equilibrium occurs through endogenous shifts in the IS curve. The LM curve is fixed because the Central Bank maintains control of the domestic money supply. If the domestic real interest rate falls below the world interest rate, there will be a massive capital outflow and therefore a depreciation of the domestic currency as investors switch to foreign bonds. This causes an outward shift in the IS curve, because it increases autonomous exports (autonomous in the sense of being independent of domestic income Y). Similarly, if the domestic real interest rate rises above the world interest rate, there will be a massive capital inflow and an appreciation. This causes an inward shift in the IS curve. These shift will continue until the IS curve meets the LM curve at the world interest rate.

With fixed exchange rates, the adjustment to ensure international capital market equilibrium in the short run equilibrium occurs via endogenous shifts in the LM curve. This is because, assuming that domestic and foreign inflation rates are equal, the fixed nominal exchange rate leads to a fixed real exchange rate, a fixed level of autonomous exports, and therefore a fixed IS curve. In contrast, as we discussed earlier, the domestic money supply is now out of the control of the Central Bank because foreign currency must be bought and sold by the Central Bank at the fixed nominal exchange rate. Sterilization will not work due to the assumption that large capital inflows or outflows will continue until the domestic real interest rate is equalized with the world real interest rate. If the Central Bank were to use the sale of bonds to sterilize the expansion of the money supply brought about by a domestic interest rate higher than the world interest rate, the expansion of the money supply and the increase in foreign exchange reserves would continue until the Central Bank runs out of bonds to sell. At this point, the entire assets of the Central Bank would have been converted into foreign currency. However, it would then no longer be able to sterilize, and would be forced to allow the money supply to expand. The final result would be as if it had never attempted sterilization in the first place (so sterilization would at best prevent the money supply from expanding in the very short run, before the short run equilibrium in reached).

Suppose, on the other hand ,that the Central Bank were to buy bonds in order to sterilize the effect of a reduction in the domestic money supply (note that the domestic money supply includes holdings of domestic currency by foreigners) due to the domestic interest rate being below the world interest rate. This would eventually result in an exhaustion of the Central Bank's foreign currency reserves, at which point it would no longer be possible to keep the nominal exchange rate fixed. The entire assets of the Central Bank would have been converted into bonds. In reality, a devaluation would be forced long before this point is reached. Sterilization is therefore even less of an option here because it rapidly undermines the basis of a fixed exchange rate regime; a stock of foreign currency to cushion the Central Bank against shifts in demand for domestic and foreign currency. The Mundell-Fleming model therefore assumes that sterilization cannot be undertaken, and so the money supply expands or contracts until the LM curve meets the IS curve at the world real interest rate in the short run equilibrium.

A number of features of the simple perfect capital mobility Mundell-Fleming model are worth noting. Firstly, since in equilibrium the domestic real interest rate must be equal to the foreign interest rate, domestic real investment demand cannot be affected by either monetary and fiscal policy. This means that in an open economy with a floating exchange rate it is net exports which increase or decrease to equilibrate the goods and money markets. In other words, according to the simple Mundell-Fleming model, it is net exports which fluctuate around the trade cycle (although a more realistic model would of course have investment respond to fluctuation via changes in confidence). This is a major difference from the closed economy model, where investment bears the brunt of fluctuations in output. Secondly, the Mundell-Fleming model ignores the supply side of the economy; it does not deal with inflation. It is therefore, as previously argued, only appropriate under the assumption that foreign and domestic prices are fixed, or at least that the foreign and domestic inflation rates are fixed.

8.2.1 A fiscal expansion

Suppose that we are initially at IS-LM equilibrium at the fixed world interest rate r_w with output Y_0. A fiscal expansion then shifts the IS curve outwards. What happens next depends on whether we have a floating or a fixed exchange rate regime. With floating exchange rates, the increase in the domestic interest rate to r' causes an appreciation of the exchange rate which causes a decrease in autonomous export demand, shifting the IS curve back to the original position. The appreciation of the domestic currency means that domestic consumers are better off, because they are able to afford more foreign goods with their income. As a consequence, the current account will worsen because there will be lower export earnings and greater imports. This begs the question of how this current account deficit is financed. The answer in the context of this simple model is that the capital account automatically offsets any current account deficit. Perfect capital mobility means that infinitesimal difference in domestic and foreign interest rates can cause capital outflows or inflows to offset any current account deficit or surplus. The government deficit is reflected entirely in the current account deficit at the new equilibrium (this is assuming that consumption and investment do not respond to the exchange rate). Output is again Y_0 and the domestic interest rate will be r_w.

Suppose instead that there is a fixed exchange rate regime. The increase in the domestic interest rate above the world interest rate now causes an expansion in the money supply which shifts the LM curve outwards until it meets the new IS curve at the world interest rate. This results in an increase in output from Y_0 to Y_1. The final resultant increase in output is equal to the increase in government expenditure multiplied by the Keynesian multiplier. So, fiscal policy is more effective in the short run under a fixed exchange rate than in a closed economy, because there is no crowding out of investment due to the automatic expansion of the money supply. At the new equilibrium, Y, C and G will all have increased. The government budget deficit will have

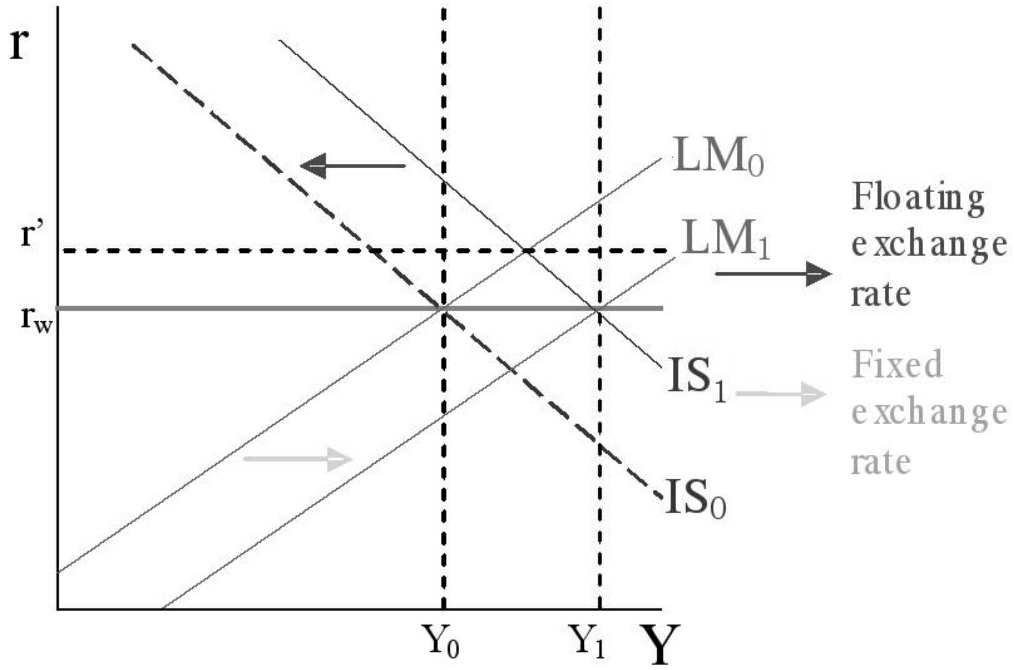


Figure 8.1: Fiscal expansion in Mundell-Fleming model

increased, but not by as much as the increase in G. I will be unchanged. The trade balance will have worsened because imports will be positively related to consumption and exports will not change because the real and nominal exchange rates are fixed.[2]

8.2.2 A monetary expansion

A monetary expansion under a fixed exchange rate regime will result in the domestic interest going below the world interest rate, and so in order to keep the exchange rate fixed, the Central Bank will be forced to sell foreign currency in exchange for domestic currency. This will cause a contraction in the money supply until, at the new short run equilibrium, the inward shift of the LM curve has brought the economy back to its original point (Y_0, r_w). If the initial monetary expansion was brought about buy buying bonds from the public in an open market operation, then the result of the monetary expansion will simply be that the Central Bank has run down its foreign exchange reserves by exactly the same amount as its bond holdings have

[2]See section 8.3 for further details on the open economy Keynesian multiplier model.

increased. In a floating rate regime, on the other hand, the dropping of the domestic interest rate below the world interest rate will cause a depreciation which will shift the IS curve outwards, so that the new short run equilibrium is at (Y_1, r_w). So, under floating exchange rates, a monetary expansion is even more effective that in the closed economy. At the new equilibrium, the increase in net exports caused by the gain in competitiveness will have fed through the multiplier to increase Y and C. G and I will be unchanged, and the government budget deficit will have been reduced because output has increased, thus raising tax revenue.[3]

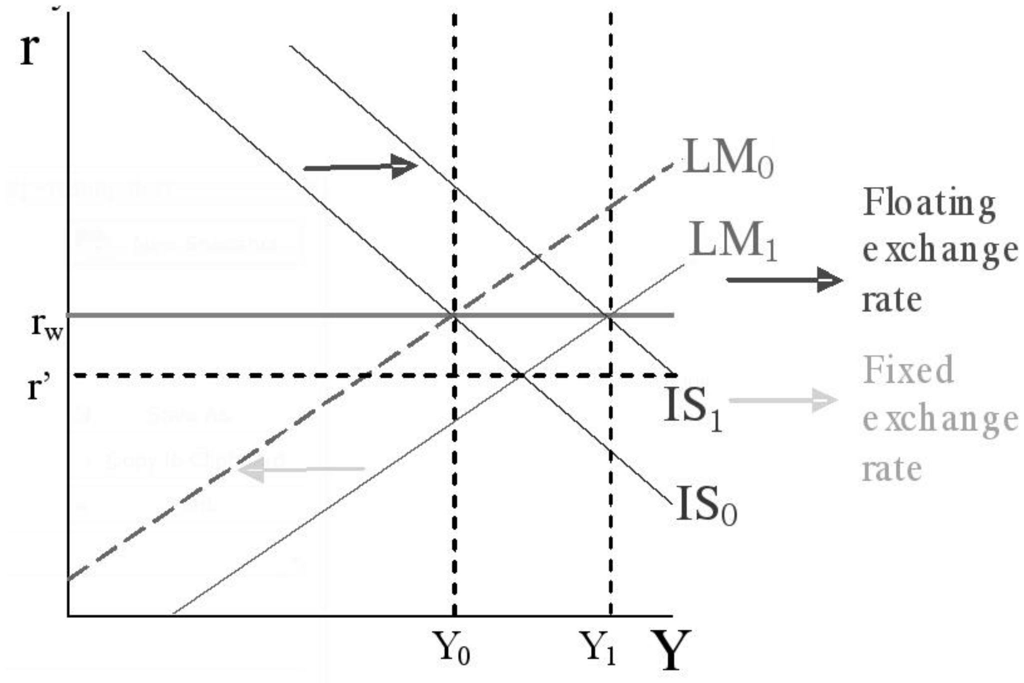


Figure 8.2: Monetary expansion in Mundell-Fleming model

8.2.3 An increase in the world interest rate

An increase in the world interest rate will, under a fixed exchange rate, cause a monetary contraction as people sell domestic currency to the cen-

[3]Note here we see the important point that in the Mundell-Fleming model it is net exports that respond to a monetary expansion rather than investment demand, as in the closed economy. (Although, since there is not perfect international capital mobility in the real world, investment does in reality also respond to monetary policy, as also does consumption for various reasons such as consumer mortgage debt.)

tral bank in return for foreign currency. The result will, in the short run, therefore, be a recession. In a floating exchange rate, on the other hand, the result of an increase in the world interest rate will be a depreciation of the currency and a short run economic boom. Note that even if recessions are more undesirable than inflationary booms, this analysis still does not count in favour of either type of regime because if the rise in world interest rates were instead a drop in real interest rates, the results from the two regimes would be reversed.

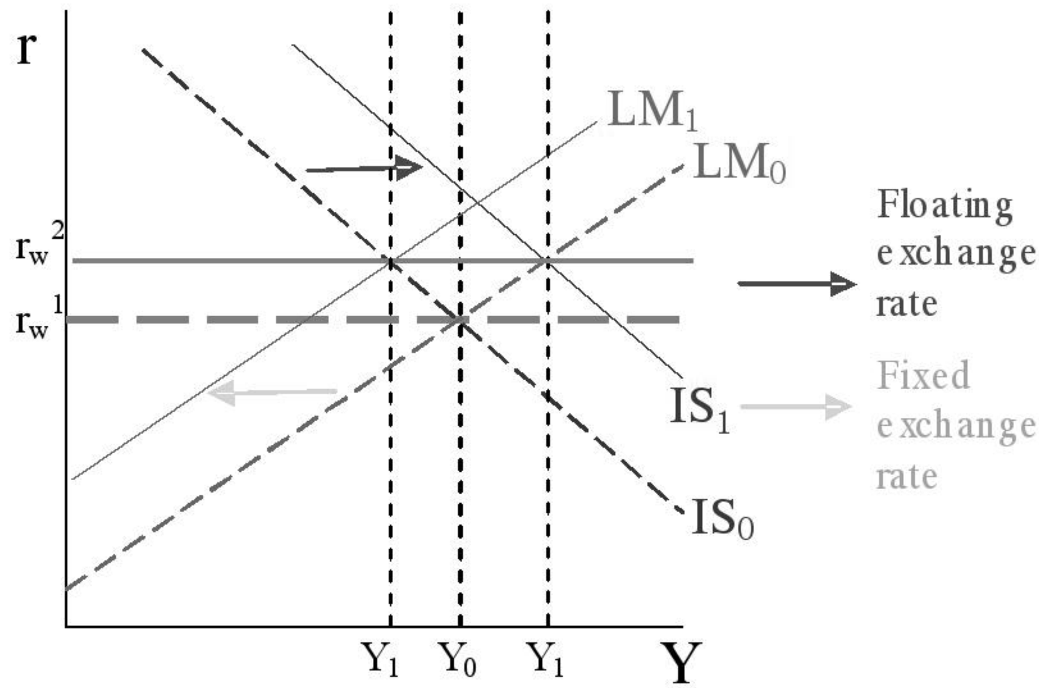


Figure 8.3: Increase in world interest rate in Mundell-Fleming model

Since the Mundell-Fleming model only makes sense if the domestic and foreign inflation rates are equal, there is no need to distinguish between nominal and real exchange rates. Note also that since it is the real interest rate on the Y-axis, this simple model is able to deal with a positive rate of inflation provided there is no inflation differential between the domestic and foreign economies.

8.3 Derivation of the aggregate demand curve

We define the components of aggregate demand as the following:

$$C = C_0 + c_1(1 - t_1)Y$$
$$I = I_0 - \delta r_w$$
$$G = G_0$$
$$NX = X_0 + \gamma e - c_1 m_1(1 - t_1)Y$$

Y is output, c_1 is the marginal propensity to consume out of post-tax income, t_1 is the proportional income tax rate, m_1 is the marginal propensity to import out of consumption, C_0, I_0, G_0 and X_0 are autonomous consumption, investment, government spending and exports respectively, r is the real interest rate. The real exchange rate is $e = E(P_f/P)$. E is the nominal exchange rate; this is given as the price of foreign currency in terms of domestic currency. The real exchange rate is therefore the real price of foreign goods in terms of domestic goods (P_f is the foreign price level, P is the domestic price level). An increase in e is an increase in competitiveness because when foreign goods become relatively more expensive, domestic and foreign demand shifts to the domestic economy. Using the condition for goods market equilibrium $Y = Y^e$ we can rearrange this model to give the equation for the IS curve:

$$Y = \frac{1}{1 - c_1(1 - m_1)(1 - t_1)}(C_0 + I_0 + G_0 + X_0 - \delta r_w + \gamma e) = \kappa(A_0 - \delta r_w + \gamma e)$$

From this condition, it is clear that the IS curve has the following properties (under the assumptions of this model, which are of course simplifications):

It is linear and downward sloping. Increases in r reduce output, with the size of the output reduction depending on the Keynesian multiplier κ, and the sensitivity of investment to the real interest rate, given by the coefficient δ. Increases in any of the autonomous components cause parallel outward shifts with the size of the output increase being equal to the change in the autonomous component multiplied by the Keynesian multiplier κ. Increases in competitiveness (i.e. e) cause parallel outward shifts, with the size of the shift depending on both the Keynesian multiplier and the sensitivity of net exports to the exchange rate, represented by the coefficient γ. Note also that if there is perfect international capital mobility and the economy is small relative to the world then the δr_w part is also effectively constant.

We derive the LM curve from the equations for real money supply and real money demand. We let M_S represent the nominal money supply, which is assumed to be fixed by the authorities:

$$m_S = \frac{M_S}{P}$$

$$m_D = m_{D0} + \alpha Y - \beta \iota$$

Where $\iota = r + \pi^e$ (i.e. the nominal interest rate on bonds must be equal to the real interest rate plus the expected inflation rate). Since we have defined money demand as a linear function of output and the nominal interest rate, the LM curve will be found by setting $m_S = m_D$.

Therefore:

$$Y = \frac{1}{\alpha}\left(\frac{M_S}{P} - m_{D0} + \beta(r + \pi^e)\right)$$

It can therefore be seen that the LM curve has the following properties:

- It is upward sloping.
- Increases in the nominal money supply cause parallel outward shifts.
- Increases in the expected inflation rate cause parallel outward shifts.
- Increases in the price level cause parallel inward shifts.

The way in which we derive the IS-LM equilibrium in a small open economy with perfect capital mobility depends upon whether that economy has a floating or a fixed exchange rate regime. Let us first take the case of a floating exchange rate regime. Here, the government can fully control the position of the LM curve (because it controls the nominal money supply, it can offset any shock to inflation or prices by altering the nominal money supply appropriately). However, because the nominal exchange rate is freely floating, it is determined in markets beyond the control of the government. Whenever the domestic interest rate is below the world interest rate r_w, huge outflows of capital will be causing the exchange rate to depreciate and domestic competitiveness to improve (e goes up). This shifts the IS curve outward. Whenever the domestic interest rate is above the world level, massive capital inflows cause an appreciation (e goes down) which shifts the IS curve inwards. Essentially, therefore, it is the intersection of the LM curve with the world interest rate that determines the short run output level. This means that investment is always equal to $I_0 - \delta r_w$. It is the competitiveness level e that changes when monetary policy changes. For example, when the domestic nominal price level P decreases, this causes a rightward shift in the LM curve. This is turn leads to a depreciation which shifts the IS curve, magnifying the effect of the monetary expansion. So, in a fully open economy with a floating exchange rate under the assumptions made here, net exports and consumption (via the Keynesian multiplier) respond to monetary expansions and contractions whilst investment and government spending remain constant.

If we now think about the derivation of the aggregate demand curve, it is clear that a drop in the price level, with all other variables such as the nominal money supply, fiscal policy, world interest rate etc. staying constant, causes an outward shift of the LM curve and therefore an increase in output. As we saw above, this increase in output is shared between net exports and domestic consumption, with investment and government spending remaining constant. It is also clear that an expansion of the nominal money supply will shift the AD curve to the right (by shifting the LM curve to the right for any given nominal price level), as will an increase in the expected inflation rate.

Unlike in a closed economy, however, in a small open economy with a floating exchange rate, fiscal policy, and changes in autonomous consumption, investment or exports do not shift the AD curve (assuming that monetary policy is left unchanged, i.e. there is no accommodating expansion). This is because any increase in G_0, C_0, I_0 or X_0 will cause an immediate appreciation of the domestic currency (decrease in e) in order to shift the IS curve back to meet where the LM curve meets the world interest rate line. This is not to say that these policy tools are not still useful, it is just that they cannot be used for aggregate demand management in the same way as monetary policy can. For example, if a country wanted to reduce its trade deficit, a cut in G_0, C_0 or I_0 would immediately lead to a depreciation of the currency leading net exports to "take up the slack" but with total output remaining unchanged. An increase in X_0 (autonomous exports,

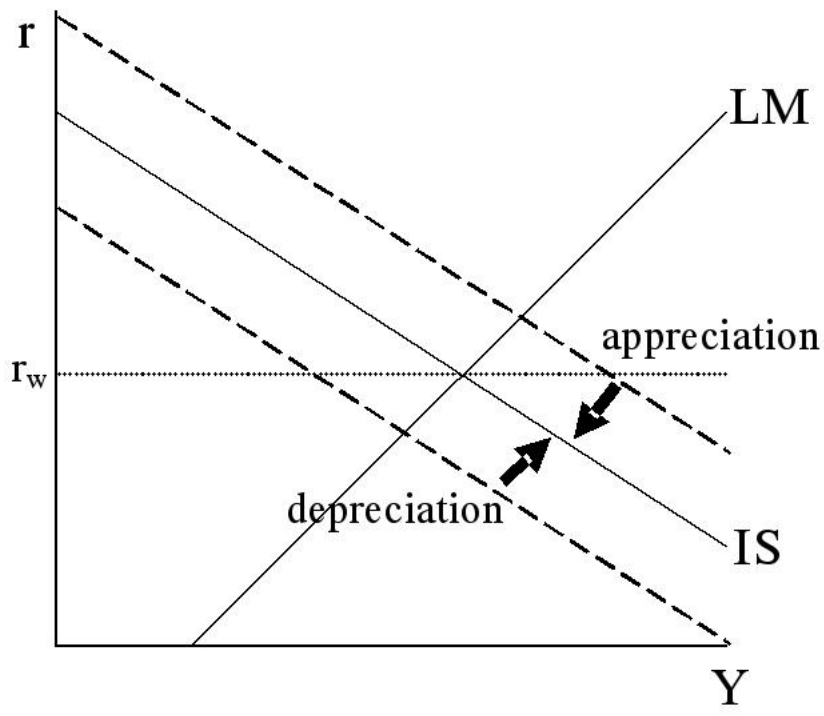


Figure 8.4: Mundell-Fleming with floating exchange rates

a measure of the desirability of the country's exports regardless of the real exchange rate) on the other hand, will cause an immediate appreciation of the currency. Since output must remain unchanged once the IS curve has shifted back to equilibrium position, we know that increased imports (caused by the decrease in e) must fully offset the extra injection into domestic demand from the autonomous exports. Although output and the trade balance would remain unchanged in the new short run Mundell-Fleming equilibrium, the country would be better off because it would now be importing more (its citizens must be better off because their currency has appreciated). So, the adjustment mechanism of the IS curve would here automatically be translating the increased demand for the country's exports into additional imports for its consumers.

Let us now take the case of a fixed exchange rate regime. Here the government fixes the value of the nominal exchange rate E. It can only do this by committing to buy and sell foreign exchange at any quantity supplied or demanded at the fixed rate. This means that the government can no

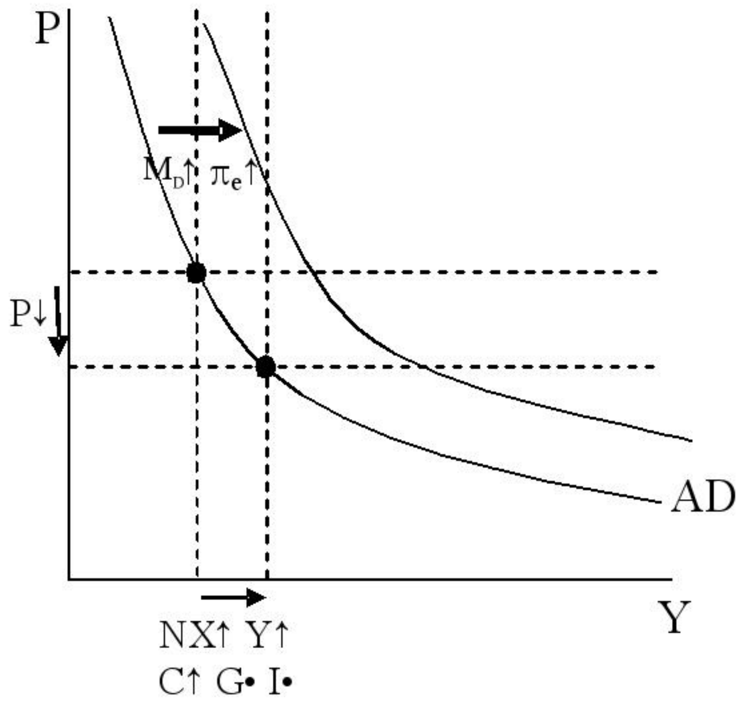


Figure 8.5: AD curve with floating exchange rate in Mundell-Fleming model

longer control the domestic money supply. The position of the LM curve is no longer under the control of the government. However, the government can now fully control the position of the IS curve (it can offset any shock to private investment or consumption by appropriately altering G_0 or by altering E, such as by devaluing - increasing E in order to boost domestic demand). The LM curve will always shift to meet the intersection of the IS curve and the world interest rate line. This is because whenever the domestic interest rate is below the world one, massive capital outflows cause a huge excess demand for foreign currency (excess supply of domestic currency), which the Central Bank must sell in exchange for domestic currency, thus causing a contraction of the domestic money supply. On the other hand, whenever the domestic interest rate is above the world interest rate, there is huge excess demand for domestic currency (excess supply of foreign currency) which the Central Bank must provide, thus causing a monetary expansion.

How is the aggregate demand schedule derived for a fixed exchange rate? The key to this is that it is the nominal exchange rate E that is fixed. The real exchange rate e depends on the domestic and foreign price levels. We can

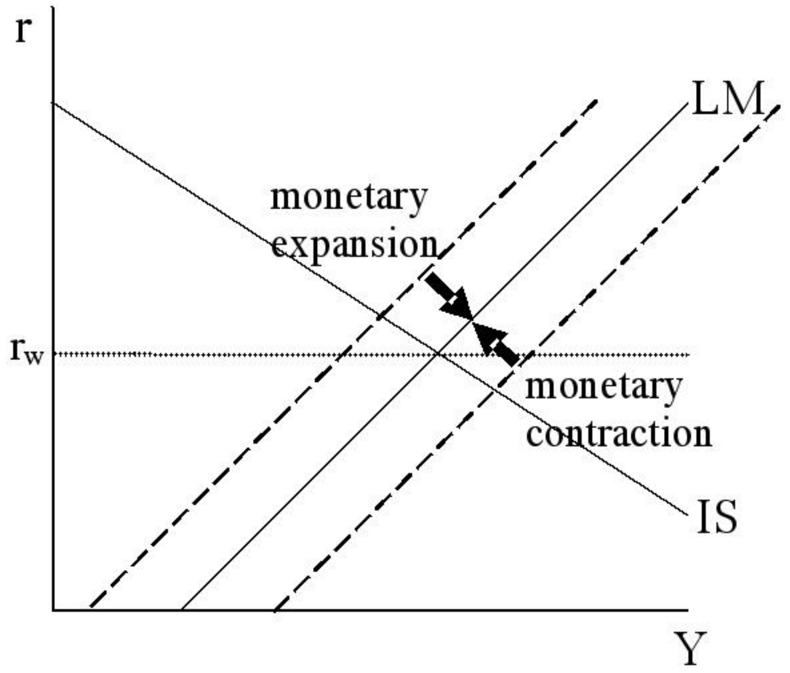


Figure 8.6: Mundell-Fleming with fixed exchange rates

assume P_f to be fixed. However, P alters along the aggregate demand schedule. When P decreases, this improves domestic competitiveness (e goes up). This adds to domestic net export demand and, via the Keynesian multiplier, to output and to consumption demand:

Although the effect of a drop in the price level is similar in terms of its effects on components of domestic demand, the mechanism by which this occurs is, as we have seen, different in the cases of fixed and floating exchange rate regimes. The factors under the control of the government which shift the AD curve are now also different to the floating exchange rate regime case. It is now fiscal policy tools and shocks to domestic autonomous demand components which cause an outward shift in the AD curve. Also, importantly, the level at which the nominal exchange rate is fixed determines the position of the AD curve. A devaluation (E goes up), by increasing domestic export demand at any given domestic price level, causes an outward expansion of the aggregate demand curve.

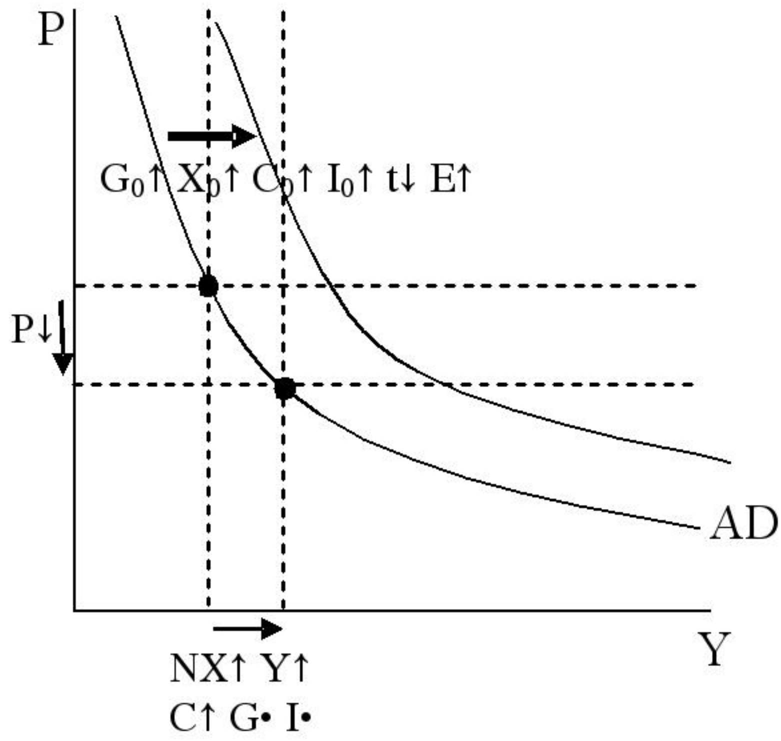


Figure 8.7: AD curve with fixed exchange rate in Mundell-Fleming model

Part V

Macroeconomic Policy Issues

Chapter 9

Macroeconomic Policy Issues

9.1 Fiscal policy and budget deficits

9.1.1 Overview

We have already seen that fiscal policy acts as an automatic stabilizer in the Keynesian multiplier model. We have also seen that active fiscal policy could, in principle, be used as an aggregate demand management tool if the automatic stabilizers do not act strongly enough in a particular situation.[1] However, the Keynesian multiplier model has week microeconomic foundations, and to build an adequate theoretical rationale for the role of fiscal policy in stimulating output and consumption, the Ricardian equivalence theorem must be considered. Only once we have established the extent to which the assumptions underlying this result are fulfilled, can we move on from the question of the efficacy of using fiscal policy (and thus a government budget deficit) to the desirability of so doing.

9.1.2 Ricardian equivalence

The Ricardian equivalence theorem states that, under certain strong assumptions, changes in government taxation levels (e.g. tax cuts to stimulate the economy, tax rises to reduce inflation) will have no effect on aggregate consumer expenditure. The intuition is that if taxes are lowered in the present, the government budget position will worsen, and this will result in greater government debts, which will require higher taxation in the future.

[1] The notable exception to this being an economy with a floating exchange rate regime and perfect international capital mobility, as discussed at the end of the previous chapter.

The private sector is rational and can predict this. If the government borrows at the same interest rate as the private sector, then the effect of any change in tax rates on the present discounted value of the representative consumer's lifetime tax bill will be zero. This means that the representative consumer's optimal consumption plan will remain unchanged. We will first demonstrate an extremely strong version of the Ricardian equivalence theorem using the perfect complements model introduced in section 3.3.

Adapting our expression for lifetime wealth to introduce taxation and government expenditure, we now have $\sum_{i=1}^{N}[(\frac{1}{1+r})^{i-1}M_i]-\sum_{i=1}^{N}[(\frac{1}{1+r})^{i-1}T_i]+W=\sum_{i=1}^{N}[(\frac{1}{1+r})^{i-1}C_i]$ and $U=min\{(C_0+G_0),(C_1+G_1),,(C_n+G_n)\}$. We require that the government fulfils its budget constraint over the lifetime of the representative consumer so that $\sum_{i=1}^{N}[(\frac{1}{1+r})^{i-1}T_i]=\sum_{i=1}^{N}[(\frac{1}{1+r})^{i-1}G_i]+D$.[2] This means that although the government can run a deficit or surplus in any single period, it must balance its budget over the entire lifetime of the representative consumer. If any government debts are run up, they must be fully paid off by period N.

By substituting the government budget constraint into the formula for the lifetime wealth of the representative consumer, we get: $\sum_{i=1}^{N}[(\frac{1}{1+r})^{i-1}M_i]+W-B=\sum_{i=1}^{N}[(\frac{1}{1+r})^{i-1}(C_i+G_i)]$. Since we know from the perfect complements utility function that (C_i+G_i) will be the same in all periods at the optimal chosen consumption plan (because C_i can be freely varied in every period by consumers able to borrow and lend however much they want), we can see that any change in any T_i will have no effect on current expenditure and that any change in any G_i will be fully offset by a corresponding change in C_i, again resulting in no effect on overall expenditure. Consequently, the government cannot use fiscal policy to alter aggregate expenditure.[3] This result occurs due to a number of assumptions in the model:

1. The government budget constraint must be fulfilled over the lifetime of the representative consumer. This represents the idea that a greater budget deficit run up by the current generation of tax payers will have

[2] M_i is income in period i, G_i is government spending, T_i is the tax revenue and C_i is private consumption.W is the initial wealth of the private sector and D is the government's initial debt to the private sector.

[3] Note also that once the government budget constraint is substituted into the private sector budget constraint, D ends up being subtracted from W. This is because any domestic government bonds held by the private sector are not real wealth, because they will eventually be paid off via taxes on private sector income.

to be paid off by higher taxes within their lifetime. Suppose that this assumption does not hold, and the current generation of tax payers can build up a debt that will have to be paid off by the next generation. This will cause Ricardian equivalence to break down, because taxing less today then raises the lifetime wealth of the representative consumer.

2. Consumers can borrow at the same interest rate, r, as the government. Suppose this were not the case, and the government could borrow at a lower interest rate than the private sector. This would mean that by borrowing today, the government can increase the present discounted value of lifetime wealth for the representative consumer, because the future taxes to pay back the government debt in the future are worth less to the private sector than the equivalent taxes today. This is another plausible explanation why Ricardian equivalence does not hold fully in practice.

3. Consumers are able to freely save and borrow at the market interest rate (i.e. they are not credit constrained). Suppose this does not hold. If there are consumers who would like to borrow in order to boost their current expenditure but are unable to do so (probably because they have no collateral to back up the loan) then by cutting tax, the government can alleviate the credit constraints and allow these consumers to spend more.

4. Private consumption and government expenditure must be "worth the same" in the representative consumer's utility function. Strictly speaking, this is not part of the standard Ricardian equivalence theorem, but the result of the utility function used in the above example. However, this assumption has an important intuitive basis. It represents the idea that government expenditure will fully crowd out the equivalent private expenditure. For example, suppose the government introduces a new government health service. As a first approximation, we would expect private expenditure on healthcare to reduce by the same amount, since the government is now providing the service that was previously being paid for privately. Again, however, we would not expect this assumption to hold fully because it is likely that private expenditure would not have been as high if it were not for government intervention in that sector (this could be because government is inefficient or because there

are public goods problems with private provision).

Even if its standard assumptions hold fully, which is unlikely, the Ricardian equivalence theorem on its own does not rule out active fiscal policy because although changes in current taxation do not alter current consumption expenditure, changes in government spending will not necessarily be fully crowded out by reduced consumption spending. However, if crowding out does not occur, it is difficult to avoid the conclusion that the government spending introduced is inefficient from the point of view of maximizing consumer welfare, since it is hard to see how the need for government expenditure in the representative consumers utility function would change in line with the economic cycle. It is the microeconomic inefficiency of altering government expenditure through the economic cycle (as well as its clumsiness as a policy instrument) which counts against using government spending as an active stabilization tool. It would seem to be more sensible to set government expenditure in line with microeconomic needs, and to use monetary policy as the main stabilization tool so that investment is stimulated as a way out of recession. The existence of some crowding out will also mean that more microeconomic distortion is required to get the same stimulatory effect (e.g. if the government were to try to stimulate the economy by spending more on healthcare or education, there would be to some degree a reduction in private expenditure on these things, which would work against the government).

Suppose now that the government is able to borrow at a lower interest rate than the private sector, and that some of the debt will be transferred to future generations. This is likely to be a more realistic reflection of reality because government bonds are generally less risky than private investments and so require a lower interest rate. The Ricardian equivalence theorem will no longer fully hold. It is however, likely that changes in current taxation will have a fairly small effect on current consumption expenditure for the same reasons that Ricardian equivalence holds in the extreme case (i.e. that people will take into account the fact that taxes are likely to rise later when they respond to a temporary tax cut, or to put it another way, that changes in current post-tax income only have small effects on permanent post-tax income). So, Ricardian equivalence does provide another argument against using discretionary tax rate changes in an active fiscal policy framework (on top of its clumsiness as a policy tool and the dangers of creating a structural government budget deficit). However, this assessment is not fully conclusive;

there is still the potential for tax cuts to the used as part of an active fiscal policy in a more realistic world where Ricardian equivalence does not hold fully.

9.1.3 The desirability of government budget deficits

Assuming that for any of the above reasons Ricardian equivalence does not fully hold, forcing a government to balance its budget during a recession will increase the size of the recession by preventing the automatic stabilizers from operating. This can be seen from the fact that the government budget deficit $B = G_0 - t_1 Y$ will increase in Y decreases whilst G_0 and t_1 do not change. This provides a strong economic argument for not forcing a balanced budget at all times. However, it is possible to define the **structural budget deficit** B_S as the budget deficit that would pertain *if* output were at its potential level Y^*. So, $B_S = G_0 - t_1 Y^*$. If the government is running a structural deficit then, if fiscal policy continues then, on average, the government will be saddling future governments with debt.

Whether or not structural budget deficits should also necessarily be avoided is also controversial, for a number of reasons:

1. If the economy is getting richer, then future taxpayers can afford to deal with the debt left over from current fiscal decisions. It may well be welfare improving to impose a small cost on the future in order to alleviate the effects of a recession which is causing suffering today.

2. Some government spending is a form of investment, and will augment the future productivity of the economy, and thus benefit future individuals.

3. It is tricky to work out what Y^* is in a growing economy (it requires using statistical techniques to "strip out" fluctuations from the growth data) and so the concept would be difficult to operationalize as a rigid policy rule.

Despite these considerations, the position of the structural budget deficit is at least a useful indicator of the degree to which the current government is leaving a detrimental fiscal legacy. Certainly, it is a far more useful indicator than the actual budget deficit.

9.2 Fixed vs. floating exchange rates

Which type of exchange rate regime is preferable depends on a number of factors:-

1. The ease with which fiscal policy can be used in macroeconomic demand management Since monetary policy is essentially ineffective under fixed exchange rates, the standard criticisms against using fiscal policy as a short run policy tool count against fixed exchange rates. A floating rate regime is more likely to be able to stabilize the economy in the short run. One possible criticism is that a floating rate regime relies on net exports bearing the brunt of the short run adjustment process. This may prove highly damaging for the export sector of an open economy with a floating rate. However, once we have a more realistic model of the economy with imperfect capital mobility, consumption and investment will also respond to interest rate changes.

2. The degree of openness of the economy There is more to gain in terms of efficiency of international trade if the economy is more open. Also, the more open is the economy, the more rapidly will any competitiveness gain from depreciation/devaluation be eliminated by inflation, because a depreciation will cause such a large drop in real wages that inflationary pressures will quickly accelerate. So, a very open economy is generally better off with a fixed exchange rate with its main trading partners, ceteris paribus - a monetary union probably being the best option.

3. The degree to which irrational speculation occurs - If speculation is indeed irrational from the point of view of economic efficiency and purely leads to bubbles and self-fulfilling prophecies then this is a problem both for fixed and floating exchange rates. However, it probably counts more severely against fixed exchange rates because it results in highly expensive and damaging currency crises even when economies are fundamentally sound, whereas in the case of floating exchange rates it simply results in an undesirably large variability of the exchange rate. However, if exchange rates are irrevocably fixed in a monetary union, this completely solves the problem because then speculation cannot occur at all. If irrational speculation is not a problem, on the other

hand, the increased short run flexibility of an economy with floating exchange rates arguably gives a floating exchange rate the upper hand. Empirical evidence suggests that irrational speculation is a problem, so overall this point counts in favour of monetary union.

The conclusion would seem to be that the essential choice is between either a dirty floating regime or a monetary union; fixed exchange rates simply create too many damaging speculative pressures whereas dirty floating has all the flexibility advantages of clean floating plus giving the Central Bank some latitude in order to reduce exchange rate instability. However, the decision between these two is rather subtle. Generally speaking, the greater a proportion of a country's output that is traded abroad, the greater benefits there are from having a single currency with its main trading partners, due to the greater price transparency for efficient international trade and the issues surrounding inflation and wage adjustment to competitiveness changes. Also, the greater the flexibility of a country's labour market, the more quickly prices can adjust during a recession to return the economy back to equilibrium output, and so the less need there is for aggregate demand policy. Thirdly, the more quickly and effectively fiscal policy can be used to stabilize the economy (either through large automatic stabilizers or rapid and accurate discretionary fiscal policy) the less cost there is to having fixed exchange rates.

Taking the U.S. as an example, it is fairly closed (about 9% of G.D.P. is traded), has a cumbersome fiscal policy making mechanism and trades with a wide variety of different countries. It is therefore undoubtedly better off with a floating exchange rate with the rest of the world. Take Belgium on the other hand. About 85% of its G.D.P. is traded and more than 70% of this is with its E.U. neighbours. There can be little doubt that Belgium is better off adopting the European single currency (although whether it is the best thing for larger countries like Germany or France is more debatable). The UK lies somewhere in between these extremes (just under 30% of GDP is traded with about 50%-60% of this with other E.U. countries), and so there is a legitimate debate over entry (which includes political considerations as well as economic ones, of course).

The Mundell-Fleming model suggests that a monetary expansion in a floating exchange rate regime will cause a depreciation of the domestic currency which will then stimulate domestic aggregate demand in the short run.

In a fixed exchange rate regime, a similar result could be achieved by devaluation. If a country with its own currency were to join a currency union, it would no longer have either of these options open to it. One can question whether this is important. In the medium run, the economy must have stable inflation. Supposing the economy started off at full employment, a monetary expansion or devaluation would clearly result in higher inflation in the medium run, until the price level domestically had risen so as to offset the depreciation of the nominal exchange rate so that the real exchange rate was back where it originally started. Only then could domestic inflation once again be stable (and it would have to have returned to the world inflation rate if the nominal exchange rate is once again unchanging, although this would depend on domestic monetary policy, i.e. upon the domestic inflation target being the same as the world inflation rate). The output gain from the devaluation/depreciation therefore only occurs in the short run. This would suggest that joining a currency union would not require giving up much latitude.

Suppose, however, that the economy is initially in recession below the equilibrium output level. In the economy were in a currency union, it would have to wait for domestic nominal prices and wages to drop in order to restore competitiveness and get the economy back to its original output level. On the other hand, if the economy were able to devalue or expand its own money supply and cause a depreciation, it would be able to get back to the original equilibrium immediately. In this case, if there is nominal wage rigidity in the economy, devaluation could work as a way of getting the economy out of a recession. Clearly, the degree to which this is a serious issue depends on the time it takes to get from the short to the medium run, which in turn depends on the degree of nominal wage flexibility in the economy.

There is another potential problem with using depreciation or devaluation as a macroeconomic demand management tool. This is the fact that whilst devaluation/depreciation increases domestic demand, it does so at the expense of demand in foreign economies. If all countries are in recession and attempt to use monetary expansion or devaluation to stimulate demand than this would result in a worldwide monetary expansion, which would have a desirable effect. The problem emerges if countries are worried about their current account deficit. For example, the U.S. currently has a current account deficit whilst the Euro area is running a surplus. Suppose the U.S. wants to close the deficit whilst keeping output at its current level. The

Mundell-Fleming model suggests that by tightening fiscal policy (i.e. reducing government expenditure), it will induce a depreciation which will expand net exports to fill in the gap. This would improve the U.S. current account deficit. However, suppose that the Euro area does not want its current account surplus to be reduced. It may follow suit by cutting its government expenditure. In the Mundell-Fleming model, since the world interest rate is fixed, the result will be a recession on both sides of the Atlantic and no improvement in the U.S. current account. This is an example of depreciation operating as a beggar thy neighbour policy. A similar result would occur if there was a fixed exchange rate and the U.S. combined a devaluation with fiscal consolidation. If the Euro area tried to prevent its current account surplus from being reduced, the result would be a recession. It should be pointed out, however, that these potential conflicts are not as serious as may seem at first, because a country whose currency appreciates becomes better off because foreign imports become cheaper. A country running a persistent current account surplus is basically failing to enjoy the wealth it has accumulated, so it should not really have too much of a problem if another country wants to devalue against it, which is essentially the way it will pay back what it owes to the first country.

The existence of the Euro area as opposed previously to an assortment of currencies over the English channel probably does reduce the flexibility benefits that having a floating exchange rate gives to the UK. because the U.K. will probably find it more difficult to control the value of its currency against such a large block. The U.K. also has fairly flexible labour markets. Just under 30% of U.K. G.D.P. is traded, and between 50%-60% of this is with the other E.U. countries. So, the U.K. lies somewhere between the examples of the U.S. and Belgium. There are potentially large gains to be made from greater currency stability. However, being able to devalue against the Euro could still be a useful short run demand management tool, and joining the Euro area would reduce the U.K.s exchange rate flexibility relative to the other 40% of its trade which is outside the Euro area. The UK has also historically experienced quite large and arguably damaging swings in its exchange rate, for example in the early 1980s when the overvaluation of the pound helped to decimate British manufacturing industries.

However, powerful ammunition for the argument against joining is that the E.R.M. debacle in the early 1990s demonstrates that fixing the exchange rate irrevocably could be disastrous. Although it was speculative pressures which forced the devaluation of the pound in 1992, the underlying reason for the crisis was the recession, and the belief that the government would not be able sustain a policy of keeping high unemployment as the cost of a fixed exchange rate. Essentially, German interest rates after reunification were too high for the U.K. The reverse situation exists today. The U.K. economy is currently booming whilst a large part of the rest of the E.U. is stagnant. Euro area interest rates are well below those in the U.K. If the U.K. were to join now, the result would probably be a period of inflation followed by a collapse in consumer demand as it is realized that the boom is not sustainable. A period of high unemployment would then be required to restore competitiveness. This is the primary reason why the current government has demanded that 5 economic convergence tests be fulfilled. Another point worth making is that if the U.K. had joined, then Euro area interest rates would have needed to be higher to accommodate the U.K. This would have meant that Germany would have suffered even more because its economy needed low interest rates in order to avoid deflation.

9.3 Central bank independence

Another key feature of modern capitalist economies, alongside floating exchange rates[4] and governments which play a significant role in the economy and both borrow and tax from the private sector, are independent cental banks such as the Bank of England in the UK, the Federal Reserve in the US and the European Central Bank. Allowing central banks this level of independence was politically unpopular in many countries during the third quarter of the twentieth century for reasons we discuss below. However, since the late 1980s, this institutional arrangement has been becoming increasingly popular.

One potential criticism of independent central banks is that they will place a lower priority on keeping unemployment low than will the people and their representatives in the elected government, and thus be more likely to adopt too severe a "cold turkey" approach to inflation reduction.[5] This

[4]Even in the case of the Euro area, it is a significant fact that its exchange rate floats against the US and Japan, unlike the pre WWI Gold standard or the post WWII Bretton-Woods agreement, so it is still true to say that the *worldwide* system currently is essentially one of floating exchange rates.

[5]See section 7.3.

may hold some weight in an economy with high inflation which needs to be brought down. However, once inflationary expectations have become low and stable, this is less likely to be a concern, because there will not need to be large increases in unemployment to keep inflation under control. However, a future period of high inflation in which it becomes politically impossible to continue to delegate monetary policy to an independent authority cushioned from democratic accountability cannot be ruled out.

The main argument for having a monetary policy instution which is independent of the elected government is what is known as the **time inconsistency problem**. Elected governments will always be tempted to allow inflation to increase in order to reduce unemployment and cause an output boom. However, for a variety of reasons, this will not be an optimal decision in retrospect. Firstly, if it is a subsequent government that deals with the increased inflation rate, then the current government will not fully internalize the cost of their actions for the future. Secondly, the pressure of an election may cause an inefficient expansion of the money supply as parties compete for re-election by "buying off" the current generation of voters. Thirdly, the government may be myopic in the sense that when it gets to next period, it no longer prefers the fact that it has allowed inflation to increase from the previous period, even though that resulted in higher employment and output in the previous period. There are game-theoretic models which show how it can be welfare improving for a government to "tie its hands" and allow the central bank discretion in achieving the inflation target, rather than maintaining day to day control of monetary policy.

9.4 Conclusion

This chapter has taken a whistle-stop tour of the impact that developments in macroeconomic theory have had on macroeconomic policy. The impact also goes the other way. For example, New Keynesian economics was given an impetus both by the success of Monetarist and New Classical models, but also the poltical success of monetarism. The institutions we see in today's world are the result both of practical policy-making experience and the implementation of macroeconomic theory. The IS-LM AD-AS model we have used throughout this book has survived these changes in the consensus among economic theorists, and remains a useful framework for beginning to get to grips with modern macroeconomic theory and policy analysis.