# Chapter 21
# Stabilization Policy with Backward-Looking Expectations

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Are economic recessions and depressions a social evil which economic policy makers should try to prevent, or do they reflect the economy's optimal response to exogenous shocks? During the 1980s and early 1990s several economists actually defended the latter view. This school of thought - known as Real Business Cycle theorists - claimed that shocks to productivity are the main driver of business cycles, and that the economy is reasonably well described by the general equilibrium model of a perfectly competitive economy. In such an economy Pareto-optimality always prevails, so even though policy makers may regret that economic activity falls in response to a negative productivity shock, there is nothing they can do to improve the situation, given that the economy always makes efficient use of the available resources and technologies.

Although this view of the business cycle still has its advocates, most economists nowadays believe that the competitive real business cycle model is an implausible theory of short-run business fluctuations. The dominant view is that business cycles reflect market failures and that social welfare could be raised if business fluctuations could be dampened. A fundamental issue for macroeconomics is whether policy makers can indeed smooth the business cycle through macroeconomic *stabilization policy*?

Stabilization policy involves the use of monetary and fiscal policy to dampen fluctuations in output and inflation. In this chapter we offer an introduction to the problems of macroeconomic stabilization policy. The first part of the chapter discusses the *goals* of stabilization policy, asking why business fluctuations cause welfare losses, and how the goals of stabilisation policy should be defined. In the second part of the chapter we use our stochastic AS-AD model from Chapter 20 to characterise the *optimal monetary stabilization policy* under alternative assumptions regarding the goals of policy makers and the type of shocks hitting the economy. Part 3 then analyses the *optimal fiscal stabilization policy*.

The formal analysis in this chapter maintains our previous assumption that expectations are *backward-looking*, i.e., that the expected future rate of inflation is determined solely by the actual rates of inflation observed in the past. In chapters 22 and 23 we shall analyse the scope for stabilization policy when expectations are *forward-looking* in the sense that agents try to form the best possible estimate of future inflation, utilizing all the relevant information available to them at the time expectations are formed.

The present chapter also assumes that policy makers can observe and react to the current output gap and to the current deviations of inflation from its target rate. The complications arising when policy can only react to movements in output and inflation with a *lag* will be discussed in Chapter 23. Furthermore, this chapter abstracts from *imperfections in the political process*, assuming that stabilization policy is conducted with the objective of maximising the welfare of the general public. In Chapter 23 we shall consider cases where political imperfections imply that monetary and fiscal policy will not necessarily be conducted with a view to stabilizing the macro economy.

# 1 The goals of stabilization policy

The case for stabilization policy rests on the hypothesis that policy makers - and ultimately their constituency, the general public - are averse to fluctuations in output, employment and inflation. Given that employment and output tend to move together, this supposed aversion to fluctuations is sometimes formalized in the "social loss function"

$$SL = \sigma_y^2 + \kappa \sigma_\pi^2, \qquad \kappa > 0 \tag{1}$$

$$\sigma_y^2 \equiv E\left[(y_t - y^*)^2\right], \qquad \sigma_\pi^2 \equiv E\left[(\pi_t - \pi^*)^2\right]$$

where $E[X]$ indicates the mean value of $X$. Equation (1) postulates that society's welfare loss from macroeconomic instability $(SL)$ increases with the variance $\sigma_y^2$ of the deviations of output from its target level $y^*$ and with the variance $\sigma_\pi^2$ of the inflation rate around its target level $\pi^*$. The parameter $\kappa$ measures the degree to which society values stable inflation relative to output stability.

This social loss function raises a host of issues. First of all, why should society be concerned about the *variability* and not just the *average* values of output and inflation? Second, what are the appropriate target values $y^*$ and $\pi^*$ for output and inflation? Third, will a macroeconomic policy which reduces the variance of output also reduce the variance of inflation, or could there be a trade-off between output stability and inflation stability? Fourth, what are the properties of the optimal stabilization policy rules if policy makers wish to minimize the social loss function (1)? In particular, should stabilization policy be *countercyclical*, implying a loosening of monetary and fiscal policy when output falls, and vice versa? And is the Taylor rule embodied in our AS-AD model an optimal monetary policy rule?

In the following sections we shall consider these issues.

**The case for stable inflation**

Why do fluctuations in the rate of inflation imply a social welfare loss, as postulated in (1)? The answer may seem straightforward: In our AS-AD model a fluctuating rate of inflation means that people generally fail to anticipate the rate of inflation correctly. When households and firms underestimate or overestimate inflation, they end up with different real rates of return to their labour and capital than they expected. Due to these miscalculations, they will regret some of the economic decisions they made and will suffer a corresponding welfare loss. Moreover, unanticipated inflation (an unexpectedly low real rate of interest) implies an arbitrary redistribution of wealth from creditors to debtors, while an unexpectedly low rate of inflation generates a similarly arbritrary redistribution in the opposite direction. Such unintended redistribution may threaten the stability of society if it occurs on a large scale. This may be one reason why large fluctuations in inflation create a disproportionately greater welfare loss than small fluctuations, as we implicitly assume by including the *variance* (rather than, say, the standard deviation) of inflation in the social loss function (1).

Still, one could argue that these problems of unanticipated inflation could be avoided if all nominal contracts were systematically *indexed* to inflation. For example, labour contracts could state that nominal wage rates should rise in line with the general consumer price index over the contract period, and debt contracts could stipulate that the principal amount of debt be indexed to consumer prices. With such systematic indexation, the welfare costs of unanticipated inflation would basically disappear, and there would be no reason why policy makers should worry about fluctuations in inflation.

However, despite its apparant advantages, indexation occurs only on a limited scale. Presumably this is because the two parties to a contract often worry about different prices. For example, in a highly open economy the prices of imported consumer goods enter with a heavy weight in the general consumer price index. If the prices of importables go up, workers would want to be compensated via a cost-of-living indexation clause in their contracts. But since the prices of domestic goods do not automatically follow the prices of imports when the two types of goods are imperfect substitutes, domestic employers would not want to fully compensate workers for the higher price of imports, since this would cut into domestic profit margins. Thus employers focus on the evolution of the prices of *domestically produced goods* relative to nominal wage rates, whereas workers focus on a weighted *average of the prices of domestic and imported goods* relative to their nominal wage. Hence the two parties would find it difficult to agree on the definition of the relevant price index, even if they agreed in principle on the desirability of indexation. In a similar way, an individual employer may be reluctant to offer full indexation of his employees' wages to some general price index if he fears that he will not always be able to raise his own price in line with the general index. Whatever the cause of the lack of widespread indexation may be, it seems legitimate for policy makers to worry about fluctuations in the rate of inflation as long as we have so little indexation.

**The case for output stability**

Consider next why instability of output may be a problem. This has already been illustrated within the framework of the traditional Keynesian AS-AD model in Chapter 3. In that model we measured the welfare loss from unemployment by the wedge between the marginal product of labour and the marginal disutility of work. This wedge falls when employment goes up during a boom, but it also increases disproportionately when employment goes down due to a recession. As we illustrated in Figure 3.10, this means that average economic welfare would be higher if employment (and hence output) could be stabilised around its natural rate. Intuitively, the marginal value of leisure is far below labour's marginal productivity in a recession when unemployed workers are forced to take a lot more leisure than they would prefer. By contrast, the marginal value of leisure may be fairly close to labour's marginal product in a boom where unemployment is low. Hence the welfare loss from falling employment during recession times outweighs the welfare gain from rising employment during boom times, so it would be better to avoid employment fluctuations altogether.

This rationale for stabilising output and employment rests on the assumption that rising employment implies rising marginal disutility of work and falling marginal productivity of labour. For simplicity, our model of the labour market in Chapter 18 assumed constant labour productivity and abstracted from variations in the marginal disutility of work. But even if the wedge between the marginal productivity of labour and the marginal value of leisure were to stay constant, business cycles would still cause welfare losses, because fluctuations in real output generate fluctuations in real income and consumption. Since the marginal utility of consumption declines with increasing consumption, consumers put more value on avoiding low levels of consumption than on attaining very high consumption levels. Hence they prefer a smooth path of consumption to an unstable path, so if stabilisation policy can even out the time path of consumption by smoothing fluctuations in output, a consumer welfare gain will result.

One objection to this reasoning might be that consumers can use the private capital market to smooth consumption over time, as we saw in Chapter 17. However, as we mentioned in Chapter 17 and in Exercise 17.1, capital markets are hardly perfect, so some consumers may be subject to credit constraints. In particular, during a serious recession the market values of many assets may fall considerably and destroy much of the collateral that consumers normally use to obtain credit.

One might argue that in addition to borrowing in the capital market, people can insure themselves against temporary income losses by taking out insurance in the private market, say, insurance against unemployment. But here again we run into problems with the functioning of markets. A person who is fully insured against any income loss from unemployment has little incentive to avoid joblessness. If he values leisure more than the social interaction obtained via his job, he may therefore choose to stay out of work for long periods of time. Because of this so-called *moral hazard problem* it is inoptimal for private insurance companies (as well as for the government) to offer full insurance against income losses from unemployment.

On top of this, the demand for unemployment insurance is likely to come mainly from those who face the highest risks of unemployment. If the premium for unemployment insurance is set to cover the *average* income loss from unemployment across a large group of insured workers, individuals in very risky jobs have a strong incentive to buy insurance, because the present value of their expected unemployment benefits will exceed the present value of the insurance premium. But workers facing a relatively low risk of losing their jobs may find that the premium is too high relative to their expected unemployment benefits. Therefore they may decide to drop out of the insurance scheme. Due to this so-called *adverse selection problem*, private insurance companies may fear that those who want to take out insurance are only the highest risks, and companies may therefore decide that offering insurance will not be profitable. Hence the adverse selection problem may cause too little unemployment insurance to be supplied by the market.

Thus the problems of moral hazard and adverse selection limit the scope for consumption smoothing via private credit and insurance markets. The moral hazard problem also makes it inoptimal for the government to offer full insurance against private income losses through the system of public transfer payments. A successful stabilisation policy may therefore raise consumer welfare by evening out the time path of real income. We may say that effective stabilisation policy provides a type of *income insurance* which cannot be delivered via the private market or via the public transfer system.

Economists differ in their perceptions of the severity of the market imperfections mentioned here, so it is not surprising that they also differ in their perceptions of the potential gain from stabilisation policy. Some economists like Robert Lucas have argued that the quantitative gains from consumption smoothing are very small for realistic values of the intertemporal elasticity of substitution in consumption[1]. Others have argued that Lucas underestimates the degree of consumer risk aversion and hence the value that people attach to consumption stability. In support of their argument, these economists point out that the big difference between the market rates of return on stocks and bonds (the equity premium) observed historically is very hard to explain unless consumers are highly risk averse. It has also been argued that the fluctuations in hours of work generated by output fluctuations cause significant welfare losses, because people's desired labour supply is quite inelastic (this argument assumes that people are forced off their desired labour supply curves during business cycles, as in the Keynesian AS-AD model).

As this discussion indicates, it is still an open issue how much society could potentially gain from successful stabilisation policy. Perhaps one of the best reasons why policy makers should worry about output instability is that the income losses caused by recessions are very unevenly distributed. Economic research has documented that manual workers - and in particular low-paid unskilled workers and young workers - tend to suffer a much larger decline in consumption than other people during recession time[2]. For these groups who already earn low incomes while they are employed, recurring recessions and the associated spells of unemployment can imply a serious welfare loss. Hence a society concerned about inequality should also be concerned about instability of output and employment.

**Choosing the inflation target**

Given that policy makers want a stable rate of inflation, what is the appropriate target rate $\pi^*$ at which the inflation rate should be stabilised? It is tempting to answer that the target inflation rate should be zero, since inflation generates social costs even if it is stable

[1] See Robert E. Lucas, Jr., *Models of Business Cycles*. Oxford: Basil Blackwell, 1987.

[2] See Clark, Leslie and Symons, 'The Cost of Recessions', *Economic Journal* (1994), vol. 104, pp. 10-37.

and fully anticipated. These costs may be summarized as follows:

*'Shoeleather costs'.* A higher inflation rate implies a higher nominal interest rate which induces households and firms to economize on their money balances. When people hold a lower average stock of real money balances, they have to make more frequent trips to the bank to withdraw money needed for transactions purposes. The resulting 'shoeleather costs' (which include the value of the time spent on trips to the bank as well as other costs of exchanging non-liquid assets for money) are part of the costs of inflation.

*'Menu costs'.* If the rate of inflation goes up, firms have to change their nominal prices more frequently to avoid an erosion of their real prices and profits. Price changes involve resource costs which include the costs of printing new price lists and catalogues (or menu cards, in case of a restaurant) plus any other costs of communicating the new prices to the market.

*Relative price distortions.* Prices of individual products are only changed at discrete time intervals, and the price changes of individual firms are not synchronized. At any point in time some firms have recently adjusted their prices, whereas others are still stuck with prices that were set some time ago. The fact that different firms have not caught up with inflation to the same degree means that consumer choices are distorted: Even firms with the same level of marginal costs may charge different prices on any given day, simply because they do not adjust their prices at the same time. This relative price distortion will tend to be more severe, the higher the rate of inflation.

*Distortions due to an unindexed tax system.* A positive rate of inflation drives a wedge between the nominal and the real rates of return on saving and investment. The income tax is typically levied on the entire nominal interest rate, including that part which the investor must set aside to preserve the real value of his nominal asset. As a result, inflation may cause the return to nominal assets to be overtaxed relative to real assets such as land and buildings. This will tend to distort savings and investment decisions.

Although many economists believe that all of these costs of anticipated inflation are relatively small, the fact that they are positive nevertheless suggests that the target inflation rate should be zero. However, a zero inflation rate may impair the central bank's ability to stabilise the economy. With zero inflation, the short-term nominal interest rate will typically be rather low. In that situation the central bank will not be able to counter a severe recession by a large cut in the interest rate, since the nominal interest rate cannot fall below zero. If policy makers want interest rate policy to be an effective tool of stabilisation policy, they may therefore have to accept a positive average rate of inflation to preserve room for substantial interest rate cuts in times of recession[3].

The inability to cut the nominal interest rate at very low rates of inflation is not just a theoretical possibility. In Japan, which has experienced economic stagnation and genuine *deflation* in recent years, the short-term nominal interest rate has in fact been driven almost all the way to zero without putting an end to the economic malaise, as illustrated in Figure 21.1. At a time when a boost to aggregate demand is badly needed, the central bank of Japan has thus lost its ability to stimulate demand via its interest rate policy.

[3]This point is elaborated in Lawrence Summers, 'How Should Long Term Monetary Policy Be Determined?' *Journal of Money, Credit and Banking*, vol. 23, August 1991, pp. 625-31.

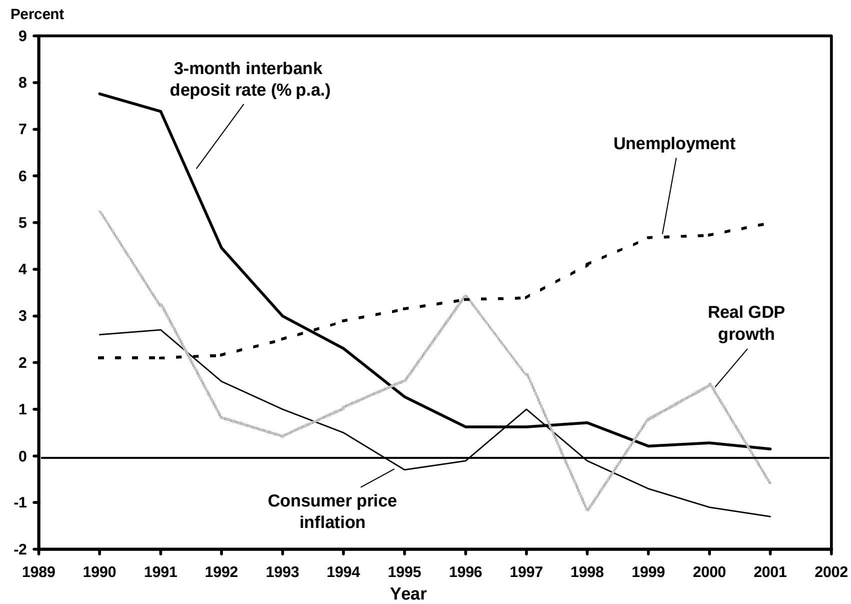


**Figure 21.1: Economic stagnation in Japan**

Source: OECD Economic Outlook, OECD Main Economic Indicators and ECB Monthly Bulletins.

As a further argument against a zero inflation target, several economists have pointed out that nominal wage rates tend to be particularly sticky in the downward direction. If the economy is hit by a negative shock which calls for a fall in real wages, this adjustment is therefore easier to achieve through price inflation than through a fall in nominal wages. This is one additional reason why it may be easier to stabilise the real economy if policy makers are willing to accept a moderate positive rate of inflation.

Finally, official price indices tend to overestimate the true rate of inflation since they cannot fully account for the fact that some price increases reflect improvements in product quality rather than genuine inflation.

For these reasons countries with explicit official inflation targets such as Australia, Canada, New Zealand, Norway, Sweden, Switzerland and the UK, have typically accepted a positive target inflation rate of 2-2.5 percent per annum. The European Central Bank also accepts an inflation rate of up to 2 percent as being consistent with its goal of price stability.

**Choosing the output target**

Choosing the output target $y^*$ in the social loss function (1) is a difficult issue, since at least three different candidates for this target suggest themselves. These are: 1) The 'efficient' level of output, $y^e$, defined as the output level which would prevail in a perfectly competitive economy without any market distortions, 2) The 'natural' rate of output $\overline{y}$ corresponding to the natural rate of unemployment, and 3) the trend level of output $\overline{y}_o$ corresponding to the smooth underlying growth trend of the economy. Recall that $\overline{y}_t = \overline{y}_o + s_t$, so natural output will fluctuate around trend output, since the supply shock variable $s_t$ fluctuates around a mean value of zero.

By definition, the efficient output level reflects a Pareto-optimal allocation of resources and therefore seems the most natural candidate for the output target. If there is perfect competition, the natural rate of output coincides with the efficient rate. However, with *imperfect* competition in product and labour markets, natural output $\overline{y}$ and trend output $\overline{y}_o$ will both be *lower* than the efficient output $y^e$, because prices will be driven above marginal costs and because some workers will be involuntarily unemployed even in equilibrium. The fact that efficient output tends to exceed natural output and trend output raises a potential credibility problem for any stabilisation policy choosing $y^e$ as the output target. To see this, recall from the previous chapters that the short-run aggregate supply curve may be written as

$$\pi_t = \pi_{t-1} + \gamma \left(y_t - \overline{y}_o\right) - \gamma s_t = \pi_{t-1} + \gamma \left(y_t - \overline{y}_t\right) \tag{2}$$

When $y^e_t$ is systematically greater than $\overline{y}_o$ and $\overline{y}_t$, it follows from (2) that a policy which succeeded in keeping actual output $y_t$ at the efficient level $y^e_t$ would tend to generate ever-accelerating inflation ($\pi_t > \pi_{t-1}$). If policy makers announce the output target $y^e_t$, it may therefore be difficult for them to convince the markets and the public that they are firmly committed to a low inflation target.[4]

Therefore it is usually argued that stabilisation policy should aim at stabilising output around its natural rate or around its trend level, since this is consistent with maintaining a stable long-run rate of inflation. The government should then use *structural policies* such as labour market policies, tax policies and competition policies to influence the structure of labour and product markets to increase $\overline{y}_o$ and $\overline{y}_t$, thereby pushing these variables closer to the efficient output level. Another pragmatic argument is that the hypothetical construct of the 'efficient' output level is very hard to estimate and hence cannot be used as an operational target for stabilisation policy.

If we accept these arguments, the question remains whether policy makers should choose natural output or trend output as their output target. Since $\overline{y}_t = \overline{y}_o + s_t$, the natural rate of output will fluctuate with the supply shocks $s_t$. Whether target output should be $\overline{y}_o$ or $\overline{y}_t$ therefore depends on whether it is optimal to allow actual output to fluctuate with $s_t$. This in turn hinges on two factors: 1) whether fluctuations in $s_t$ reflect *genuine* productivity shocks, and 2) whether the capital market functions well, offering good opportunities for consumption smoothing. Let us briefly explain this.

If productivity is unusually high in a given year ($s_t > 0$), additional income can be earned without any additional effort. It seems natural for society to take advantage of such extraordinary opportunities by actually producing more in that year. If there is a well-functioning capital market, the bulk of the extra income earned during the year could be invested in additional capital to secure that the consumption benefits from the temporary productivity gain are spread out over time. In a similar way, it makes sense to accept a lower level of output in years where productivity is unusually low ($s_t < 0$) if the capital market allows consumers with temporarily low incomes to borrow so as to avoid a sharp

[4] We will discuss this credibility problem in more detail in Chapter 23.

temporary drop in consumption. Hence, if supply shocks reflect true productivity shocks and capital markets are close to perfect, actual output and income should be allowed to fluctuate in line with natural output.

However, in an *imperfectly* competitive economy fluctuations in $s_t$ may also reflect shocks which have nothing to do with changes in the technological opportunities available to society. For example, a temporary fall in $s_t$ may be caused by a temporary rise in mark-ups reflecting reduced competition in product or labour markets, or it may be due to more aggressive union wage claims[5]. Since such temporary shocks reflect monopolistic behaviour rather than a worsening of society's technical production possibilities, there is no reason why they should lead to a less ambitious output target.

Moreover, *imperfect credit markets* may hamper the ability of consumers to smooth their stream of consumption relative to a fluctuating stream of income. In particular, credit constraints may prevent some consumers from borrowing if they suffer income losses due to negative supply shocks. If temporary supply shocks are caused mainly by changes in market structure and monopolistic practices rather than by changes in technological opportunities, or if credit markets only allow limited opportunities for consumption smoothing, it may therefore be better to choose the trend level of output $\overline{y}_o$ rather than natural output $\overline{y}_t$ as the output target, since $\overline{y}_o$ is unaffected by supply shocks and therefore evolves more smoothly.

Unfortunately little is known about the degree to which supply shocks are caused by 'genuine' productivity shocks. It is also hard to measure the degree to which real world credit markets deviate from the ideal of perfect capital markets. But the upshot of the preceding discussion is that if market imperfections are believed to be important, there may be a good case for stabilising output around trend rather than around its 'natural'

[5] This would correspond to a rise in our parameter $m$ and a rise in our parameter $\omega$, respectively. See our discussion of supply shocks in Chapter 20.

rate.

There is one additional argument for choosing $\overline{y}_o$ rather than $\overline{y}_t$ as the output target. In practice it is quite difficult to estimate the current level of natural output because current supply shocks may be very hard to identify. The observed deviations of output from trend are caused by a mixture of demand and supply shocks, and nobody knows for sure how much of the deviation that can be traced to supply shocks. It may therefore be difficult to keep policy makers *accountable* if they declare that they are targeting natural output. If the natural level of output cannot be estimated with a reasonable degree of accuracy, it is very hard to evaluate the success of a stabilisation policy which claims to target the natural rate. By contrast, the normal procedures for estimating the trend level of output are more straightforward and transparent, as we have seen in Chapter 15. Hence it will be easier to keep policy makers accountable for their actions if $\overline{y}_o$ is chosen as the output target.

Because of market imperfections and the difficulties of estimating the fluctuating natural rate of output, in practice stabilisation policy normally focuses on stabilising output around its trend level, except if there are clear indications that a significant genuine productivity shock has occurred. In the rest of this chapter we will therefore assume that $y^* = \overline{y}_o$. However, since the case for any particular output target is not entirely clear-cut, exercise 21.1 will invite you to analyse the implications for stabilisation policy of choosing the natural rate as the output target ($y^* = \overline{y}_t$).

**Rules versus discretion**

Apart from choosing their targets for output and inflation, policy makers must also decide whether they wish to follow a fixed *policy rule*, or whether they prefer to be left with *discretion* in their policy choices.

Under the rules approach stabilisation policy is essentially automatic, since the policy rule prescribes how the policy instruments should be set in any given situation. The Taylor rule discussed in Chapter 19 is an example of a fixed monetary policy rule specifying how the central bank interest rate should be set, given the observed state of the economy. The Friedman rule prescribing a constant growth rate of the nominal money supply is another example of a fixed monetary policy rule. In an open economy a fixed exchange rate regime can also be seen as a monetary policy rule which requires the central bank interest rate to be set so as to stabilise the foreign exchange rate.

By contrast, under discretion policy makers are free to conduct monetary and fiscal policy in any way that they believe will help advance the objectives of stabilisation policy in any given situation. The idea is that policy makers should use all the available information, including advice from economic experts, and take account of any special circumstances which might prevail.

Note that the distinction between rules and discretion is not equivalent to the distinction between *passive* and *active* macroeconomic policy. For example, while the Friedman rule requires monetary policy to be passive by sticking to a constant monetary growth rate regardless of the state of the economy, the Taylor rule implies that the central bank actively reacts to changes in inflation and the output gap.

It might seem that discretion should be preferred to rules, since reliance on a simple fixed policy rule reduces the ability of policy makers to react to all relevant information. Many economists nevertheless believe that stabilisation policy should be based on simple rules. They argue that rules can help policy makers to establish *credibility* which will help them realise the goals of stabilisation policy. For example, if the natural unemployment rate is rather high, the public may suspect that policy makers have an incentive to drive down the actual unemployment rate by creating surprise inflation (remember that $u_t < \overline{u}_t$ when $\pi_t > \pi_t^e$). In these circumstances it may be difficult for policy makers to convince the private sector that they are committed to securing a low and stable rate of inflation. The fear of inflation will then keep the expected and actual inflation rate at an uncomfortably high level which can only be reduced by generating a serious recession. However, suppose policy makers put their reputation at stake by publicly announcing that they are bound by a policy rule requiring them to respond strongly to any increase in inflation. It may then be easier to convince the markets that inflation will indeed be kept low. In this way a policy rule may serve as an anchor for (low) inflation expectations (we shall elaborate on this argument in the Chapter 23). Similarly, if policy makers announce a rule which implies that policy is automatically tightened when output goes up and automatically eased if output goes down, this may help to stabilise the growth expectations of the private sector which in turn will help to stabilise aggregate demand.

Of course, policy makers can only 'buy' credibility by announcing a fixed policy rule if they can convince the public that they are really bound by the rule. This will be easier if the rule is written into the law or into the mandate or statutes of the central bank, and if policy makers face some kind of sanction if they break the rule. For example, the law regulating the central bank could specify that the central bank governor will be fired if he consistently misses the bank's inflation target. For a rule to be credible, it must also be reasonably simple so the public can easily understand the rule and check that policy makers actually stick to it.[6]

The advocates of discretion argue that fixed policy rules can only establish credibility if they are overly simple and rigidly adhered to. Hence credibility can only be bought at the price of *flexibility*: By sticking to a simple policy rule no matter what the situation is, policy makers lose the ability to account for whatever special circumstances might prevail. For instance, suppose that because of some unexpected event the stock market suddenly takes an exceptional plunge which provides good reason to believe that the economy is

[6] In Chapter 23 we will analyse the issue of rules versus discretion and the case for central bank independence in greater detail.

headed for a deep recession. In that situation, should the central bank really keep the interest rate unchanged just because stock prices do not enter into the policy reaction function which it has announced?

Many adherents of rules acknowledge that complete loss of flexibility would be a problem. Thus John Taylor has not argued that central banks should slavishly follow his rule. Rather, they should use it as a *guideline* to be followed under normal circumstances, but deviations from the rule would be acceptable when exceptional circumstances prevail[7].

In practice central banks do not announce a fixed quantified interest rate reaction function, presumably because they wish to preserve some amount of policy flexibility. Nevertheless, as we saw in Chapter 19, the interest rate policies of the most important central banks seem to be fairly well described by the Taylor rule. In the following we will therefore assume that stabilization policy is in fact based on rules.

# 2 Monetary stabilization policy

Having discussed the *goals* of stabilization policy, we will now study *how* such policy should be conducted, given that policy makers have chosen targets for output and inflation, and given that policy follows a rule. In the present part of the chapter we will focus on monetary stabilization policy, postponing the investigation of fiscal policy until Part 3.

**The theoretical framework**

Our analysis will be based on the AS-AD model developed in chapters 19 and 20. In this model the supply side is described by the

$$\text{SRAS curve:} \qquad \pi = \pi_{-1} + \gamma\left(y - \overline{y}_o\right) - \gamma s, \tag{3}$$

while the aggregate demand side is summarized in the equation

[7] See the reference given in footnote 11 in Chapter 19.

$$y - \overline{y}_o = \alpha (\pi^* - \pi) + z \quad \Longleftrightarrow \quad \pi = \pi^* - (1/\alpha)(y - \overline{y}_o) + (1/\alpha) z. \tag{4}$$

Using the expressions for $\alpha$ and $z$ given in equation (38) in Chapter 19, and assuming for the moment that public spending stays on trend ($g = \overline{g}$), we can rewrite the aggregate demand curve in (4) as

$$\text{AD curve:} \qquad \pi = \pi^* - \left(\frac{1 + \alpha_2 b}{\alpha_2 h}\right)(y - \overline{y}_o) + \frac{v}{\alpha_2 h}, \tag{5}$$

where we recall that the variable $v$ captures shocks to private demand such as shifts in private sector confidence (shifts in expected future income growth). Underlying the AD curve (5) is the assumption that interest rate policy follows the Taylor rule so that

$$i_t = \overline{r} + \pi_t + h(\pi_t - \pi^*) + b(y_t - \overline{y}_o). \tag{6}$$

In a later section we will discuss whether it is actually optimal for the central bank to follow some form of Taylor rule. For the moment, we will just describe the optimal monetary policy *given* that the central bank has committed itself to a Taylor rule.

We should emphasize that this framework for analysing stabilisation policy rests on two strong simplifications. The first one is that *expectations are entirely backward-looking*, in the sense that expected inflation depends solely on the actual inflation rate observed in the past ($\pi_t^e = \pi_{t-1}$). As we shall see in the next chapter, stabilisation policy becomes more challenging if private agents rationally anticipate the effects of policy changes on current inflation. Our second simplification is the assumption embodied in (6) that the central bank can immediately observe and react to changes in current output and inflation without any delay. In Chapter 23 we will discuss the difficulties arising when policy makers can only react with a lag to changes in the state of the economy. Nevertheless, despite its simplicity the AS-AD model above serves as a useful starting point for a discussion of the problems of stabilisation policy.

Suppose that policy makers wish to minimize a social loss function like (1), and suppose that they have chosen *trend* output as their output target along with an inflation target $\pi^*$. We may then investigate how the central bank's choice of the monetary policy parameters $h$ and $b$ will affect the variances of output and inflation around their target levels ($\sigma_y^2$ and $\sigma_\pi^2$). How should $h$ and $b$ be chosen if monetary policy makers wish to minimize fluctuations in output and inflation? Is it possible to minimize both types of fluctuations at the same time, or does society face a trade-off between output variability and inflation variability? In analysing these questions, let us start by considering the case where the shocks to the economy originate from the aggregate demand side.

**The monetary policy reaction to demand shocks**

Figure 21.2 illustrates the case where the economy is hit by a negative demand shock. In the initial period 0 the economy is in long run equilibrium at point $\overline{E}_o$ where output and inflation are both at their target levels[8]. However, in period 1 a negative demand shock occurs due, say, to more pessimistic private sector expectations. According to (5) such a drop in $v$ will shift the AD curve downwards, causing output as well as inflation to drop below their targets.

Now consider how the economy's reaction to the negative demand shock is affected by the monetary policy parameter $b$. According to (5) the numerical slope of the AD curve is given by the expression $(1 + \alpha_2 b) / \alpha_2 h$. Since $\alpha_2$ and $h$ are positive, this expression shows that the AD curve will be *steeper* when $b > 0$ than when $b = 0$. As illustrated in Figure 21.2, a steeper AD curve implies that the fall in output as well as inflation will be smaller (notice from (5) that the vertical downward shift of the AD curve will be the same regardless of the value of $b$, as shown in the figure). In other words, by pursuing a *countercyclical* monetary

[8] In a long run equilibrium $y = \overline{y}_o$ and $v = 0$. It then follows from (5) that $\pi = \pi^*$.

policy ($b > 0$) involving a cut in the interest rate when output falls below trend (and vice versa), the central bank can cushion the economy against demand shocks and reduce the variability of output and inflation. Of course the reason is that a lower interest rate tends to stimulate private spending, thereby offsetting the negative shock to aggregate demand.

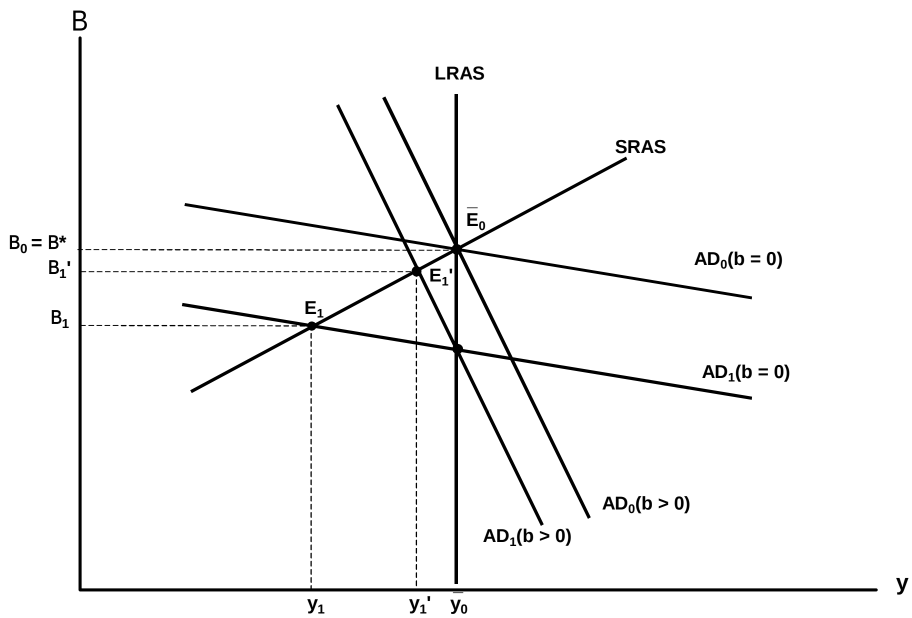


**Figure 21.2: The short run effects of a negative demand shock: The importance of countercyclical monetary policy**

It is easy to see from Figure 21.2 that the steeper the AD curve, that is, the higher the value of $b$, the smaller will be the change in output and inflation when the economy is hit by a demand shock. From this observation it might be tempting to conclude that $b$ should be set at a very high level (in principle, that it should be infinitely high) to minimize the impact of demand shocks. However, such a prescription ignores the constraint that the nominal interest rate cannot fall below zero. If $b$ were very high, a shock which reduces the rate of inflation might require that the nominal interest rate be driven down below zero. But since this is impossible, there is a limit to how high $b$ can be. If the shock variables $v$

and $s$ have a high variance, causing substantial fluctuations in output and inflation, there may be a fairly narrow limit to how high $b$ can be, given that the non-negativity constraint for the nominal interest rate must be respected in each period. Thus the implication of the graphical analysis in Figure 21.2 is that $b$ should be as high as allowed by the non-negativity constraint $i_t \geq 0$.

Consider next how interest rate policy should react to *inflation* when the economy is hit by a demand shock. The central bank's response to a change in the rate of inflation is captured by the policy parameter $h$ in the Taylor rule (6). From equation (5) we see that a higher value of $h$ will have two effects on the aggregate demand curve: On the one hand it will reduce the numerical slope $(1 + \alpha_2 b) / \alpha_2 h$ of the AD curve. As we saw in Figure 21.2, a flatter AD curve will tend to *amplify* the change in inflation and output for any *given* vertical shift of the curve. On the other hand, it follows from (5) that whenever $v$ falls by some amount $\Delta v$, a higher value of $h$ will *reduce* the distance $(\Delta v / \alpha_2 h)$ by which the AD curve shifts down. Clearly this effect of a higher $h$ will tend to *dampen* the fall in output and inflation induced by a negative demand shock. To check which of these two offsetting effects of a higher $h$ will dominate, we insert (3) into (5) and solve for the output gap to find

$$y - \overline{y}_o = \frac{v}{1 + \alpha_2 (b + \gamma h)} + \left( \frac{\alpha_2 h}{1 + \alpha_2 (b + \gamma h)} \right) (\pi^* - \pi_{-1} + \gamma s) \,. \tag{7}$$

Since the economy is in long run equilibrium in period 0 and the economy is hit by the shock in period 1, we have $\pi_{-1} = \pi_o = \pi^*$. Moreover, since we are focusing on demand shocks at the moment, the supply shock variable $s = 0$. Equation (7) then reduces to

$$y - \overline{y}_o = \frac{v}{1 + \alpha_2 (b + \gamma h)} \tag{8}$$

This equation shows that a higher value of $h$ will in fact dampen the fall in output generated by a fall in private sector confidence $v$. In other words, the greater the interest rate cut in response to a drop in inflation, the milder is the recession induced by a negative demand shock. From the AS curve (3) we see that a smaller drop in output $y$ also implies a smaller drop in inflation relative to its initial target rate $\pi_{-1} = \pi_o = \pi^*$.

A similar reasoning implies that a higher value of $h$ will help to dampen the *increase* of $y$ and $\pi$ *above* their target values whenever the demand shock is positive ($\Delta v > 0$). Thus we may conclude that, when the economy is hit by demand shocks, a strong central bank reaction to changes in inflation (a high value of $h$) will help to stabilise the economy. Indeed, when demand shocks are the only disturbances to the economy, our simple model implies that the magnitude of $h$ should be as high as possible, subject only to the constraint that the nominal interest rate cannot turn negative in response to a negative demand shock.

A basic insight from this analysis is that there is *no trade-off between output instability and inflation instability when business fluctuations are driven by demand shocks*: A strongly countercyclical monetary policy (a large value of $b$) and a strong interest rate response to changes in inflation (a high value of $h$) will simultaneously reduce the variance of output as well as inflation. In this way an active monetary policy will unambiguously serve to reduce the social welfare loss from shocks to aggregate demand. Unfortunately things are not that simple when the economy is hit by supply shocks, as we shall see below.

**The monetary policy reaction to supply shocks**

In Figure 21.3 we consider a situation where the economy's initial long run equilibrium $\overline{E}_o$ is disturbed by a negative supply shock hitting the economy in period 1. In such a case where the supply shock variable $s$ goes down, equation (3) implies that the short run aggregate supply curve will shift upwards.

Now suppose that monetary policy makers are primarily concerned about stabilising the rate of inflation. It then follows from (5) that the central bank should choose a low value of $b$ (indeed a *negative* $b$) and a high value of $h$ in order to make the AD curve as flat as possible. As shown in Figure 21.3, this would tend to minimise the rise in inflation generated by a negative supply shock. At the same time it is clear from the figure that such a policy would imply strong fluctuations in output in response to supply shocks.

By contrast, if the central bank focuses only on stabilising the level of output, it should choose a high value of $b$ and a low value of $h$ in order to make the AD curve as steep as possible. In these circumstances we see from Figure 21.3 that the supply shock will have very little impact on output. Instead, the shock will be almost fully absorbed by a rise in inflation.

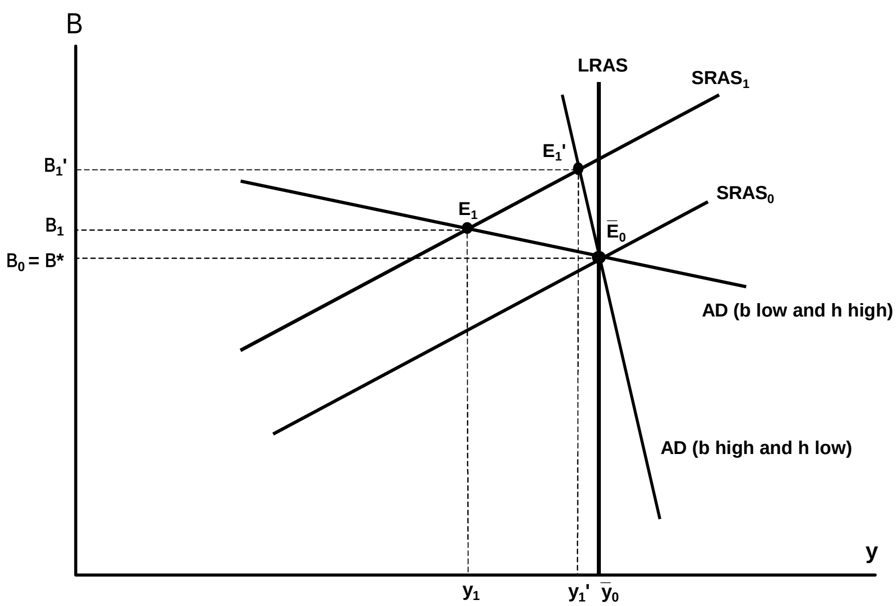


**Figure 21.3: The short run effects of a negative supply shock: The importance of the monetary policy response**

While concern about output stability calls for a low value of $h$ when shocks originate from the supply side, the value of $h$ should nevertheless stay (slightly) positive. In other words, the nominal interest rate should always rise by more than one percentage point when the inflation rate goes up by one percentage point, and vice versa. To see why, recall from equation (16) in Chapter 20 that our AS-AD model can be reduced to the difference equation

$$y_{t+1} - \overline{y}_o = \beta(y_t - \overline{y}_o) + \beta(z_{t+1} - z_t) + \alpha\gamma\beta s_{t+1}, \qquad \beta \equiv \frac{1}{1+\alpha\gamma}, \qquad \alpha \equiv \frac{\alpha_2 h}{1+\alpha_2 b} \quad (9)$$

If $h$ turns negative, we see from (9) that $\beta$ becomes greater than one so that output will tend to move further and further away from its trend value once the long run equilibrium has been disturbed by a shock. In mathematical terms, the difference equation (9) will be *unstable* when $\beta > 1$. To ensure long run stability $(|\beta < 1|)$, we need $h > 0$.

This point is illustrated by recent American business cycle history. Figure 21.4 shows the estimated reaction of the short term interest rate to the rate of inflation in the U.S. for the two periods 1960-1979 and 1987-1997. The slopes of the two solid straight lines reflect the estimates of the coefficient $1 + h$ in the Taylor rule (6) in the two periods. We see that $1 + h < 1$ in 1960-1979, implying a negative value of $h$ in this period.

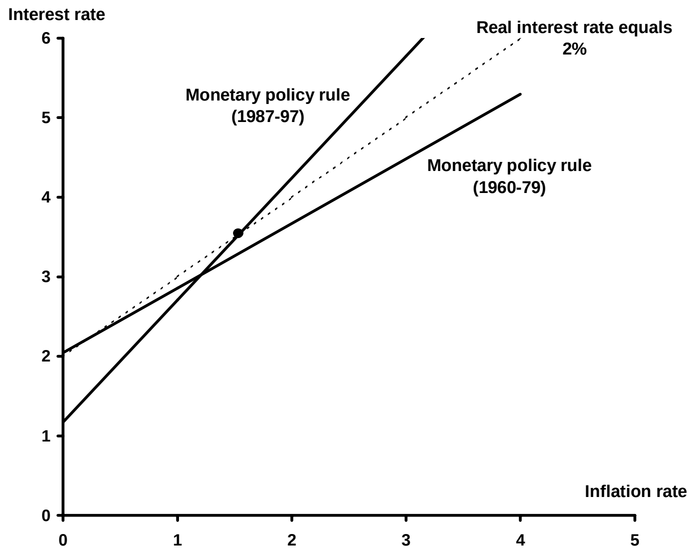


**Figure 21.4: Estimated monetary policy rules in the United States: 1960-79 versus 1987-97**

Source: John B. Taylor, 'A Historical Analysis of Monetary Policy Rules', Chapter 7 in John B. Taylor (editor), Monetary Policy Rules, NBER Business Cycles Series, Volume 31, The University og Chicago Press, 1999.

From the difference equation (9) we would then expect the variance of output around trend to have been greater during 1960-79 than during 1987-97 where $h$ is seen to be positive. In Figure 21.5 the horizontal lines indicate the average output fluctuations implied by the estimated standard deviations of the cyclical components of real U.S. GDP in the two periods. We see that output instability was indeed greater during 1960-79 when higher inflation was allowed to reduce the real rate of interest.

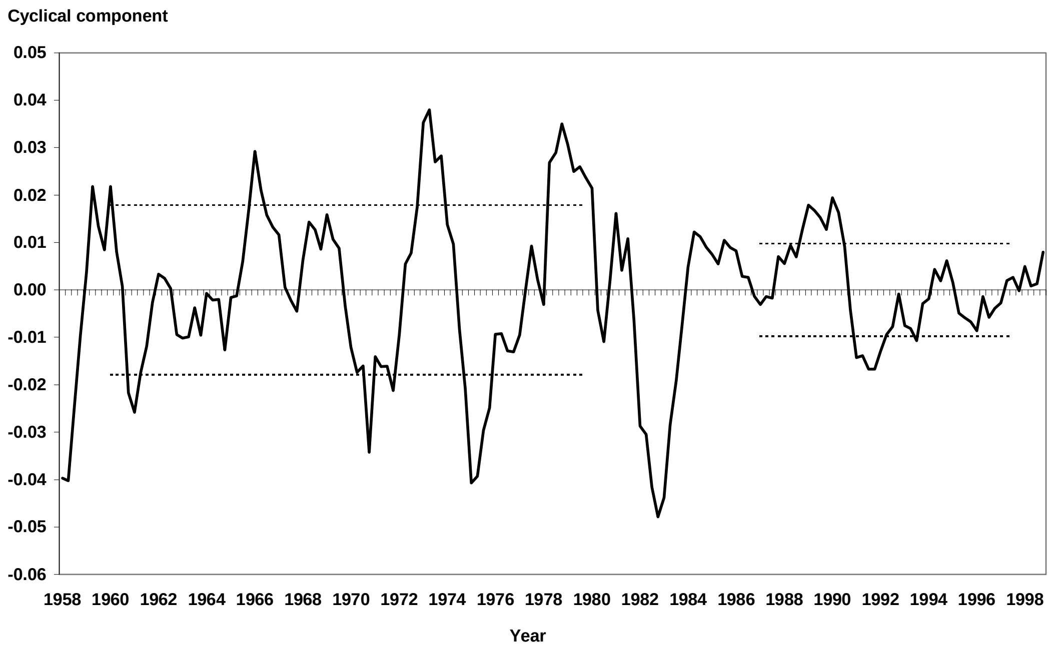


**Figure 21.5: The volatility of real GDP in the United States, 1958-1998**

Source: Bureau of Economic Analysis. The time series for real GDP is has been detrended by HP-filtering.

The failure of the U.S. Federal Reserve Bank to raise the nominal interest rate sufficiently when faced with rising inflation in the late 1960s and the 1970s is nowadays seen as a serious policy mistake by many observers. The following quote from a speech given in 1977 by Federal Reserve Chairman Arthur Burns indicates why monetary policy makers did not respond aggressively to rising inflation:

"We well know - as do many others - that if the Federal Reserve stopped creating new money, or if this activity were slowed drastically, inflation would soon either come to an end or be substantially checked. Unfortunately, knowing that truth is not as helpful as one might suppose. The catch is that nowadays there are tremendous nonmonetary pressures in our economy that are tending to drive costs and prices higher ..... If the Federal Reserve then sought to create a monetary environment that seriously fell short of accommodating the nonmonetary pressures that have become characteristic of our times, severe stresses could be quickly produced in our economy. The inflation rate would probably fall in the process but so, too, would production, jobs, and profits. The tactics and strategy of the Federal Reserve System - as of any central bank - must be attuned to these realities."[9]

Arthur Burns' reference to 'tremendous nonmonetary pressures in our economy that are tending to drive costs and prices higher' strongly suggests that he considered cost-increasing supply shocks to be the main shocks hitting the U.S. economy at the time. The quote also suggests that Burns was more concerned about instability of output than about fluctuations in the rate of inflation. As we saw in Figure 21.3, in such circumstances it is indeed optimal for monetary policy to choose a very low value of the parameter $h$, that is, to avoid raising the real interest rate significantly in response to higher inflation. However, our analysis has also shown that even if securing output stability in the face of supply shocks is the main concern, it cannot be optimal to choose a *negative* value of $h$, as U.S. monetary policy makers seemed to do in the 1960s and 70s.[10]

In our previous study of demand shocks we found that the central bank will never face a trade-off between output stability and inflation stability: A monetary policy which reduces output stability will also imply a more stable inflation rate. However, when the economy is hit by *supply* shocks, it follows from Figure 21.3 that monetary policy makers face an inescapable trade-off between output stability and inflation stability. If they choose the policy parameters $h$ and $b$ so as to reduce the fluctuations in output, they will have to accept a greater variability of inflation, and vice versa. We shall now show that rational policy makers will also face such a trade-off in the more general case where the economy

[9] Quoted from Arthur F. Burns, *Reflections of an Economic Policy Maker: Speeches and Congressional Statements: 1969-1978.* American Enterprise Institute for Public Policy Research, Washington, D.C., 1978.

[10] In Chapter 23 we shall see that the failure of U.S. monetary policy makers to raise the real interest rate in response to inflation in the 1960s and 1970s was apparently due to the fact that they overestimated the economy's potential output during those years. Thus they were not really exceptionally "soft"on inflation; instead they seem to have been victims of serious macroeconomic measurement errors. Chapter 23 will analyze the implications of measurement errors for the optimal stabilization policy.

is hit by demand shocks as well as supply shocks.

**The trade-off between output volatility and inflation volatility**

Via its choice of the policy parameter $h$, the central bank can control the variance of the demand shift variable $\widehat{z} \equiv v/\alpha_2 h$ in the aggregate demand curve (5). If the variance of the confidence variable $v$ is $\sigma_v^2$, the variance of $\widehat{z}$ will be $\sigma_{\widehat{z}}^2 = \sigma_v^2/\left(\alpha_2 h\right)^2$ which may be reduced by choosing a higher value of $h$. In addition to controlling $\sigma_{\widehat{z}}^2$, the central bank can control the numerical slope $1/\alpha$ of the AD curve, since $\alpha$ depends on $b$ as well as on $h$. Through its impact on $\sigma_{\widehat{z}}^2$ and $\alpha$, the central bank can thus influence the variance of output ($\sigma_y^2$) and the variance of inflation ($\sigma_\pi^2$) entering the social loss function (1). A rational central bank acting in the interest of society will therefore manipulate $\sigma_{\widehat{z}}^2$ and $\alpha$ so as to minimize the social loss $SL$. The first-order conditions for minimization of (1) with respect to $\alpha$ and $\sigma_{\widehat{z}}^2$ are

$$\frac{\partial SL}{\partial \alpha} = 0 \qquad \Longrightarrow \qquad \frac{\partial \sigma_y^2}{\partial \alpha} + \kappa \frac{\partial \sigma_\pi^2}{\partial \alpha} = 0 \tag{9}$$

$$\frac{\partial SL}{\partial \sigma_{\widehat{z}}^2} = 0 \qquad \Longrightarrow \qquad \frac{\partial \sigma_y^2}{\partial \sigma_{\widehat{z}}^2} + \kappa \frac{\partial \sigma_\pi^2}{\partial \sigma_{\widehat{z}}^2} = 0 \tag{10}$$

Since the parameter $\kappa$ is positive, equations (9) and (10) imply that any change in $\alpha$ or $\sigma_{\widehat{z}}^2$ which reduces the variance of inflation will increase the variance of output, and vice versa. Therefore, if the policy parameters $h$ and $b$ are chosen appropriately so as to minimize the social loss from economic instability, policy makers will inevitably face a trade-off between output instability and inflation instability. The specific choice between the two types of instability will depend on the magnitude of the parameter $\kappa$ which measures the policy makers' aversion to fluctuations in inflation relative to output volatility.

**Summing up: Optimal monetary policy under the Taylor rule**

Table 21.1 summarizes our findings regarding the proper monetary stabilization policy when target output equals trend output and the central bank sets the interest rate in accordance with a simple Taylor rule of the form (6). The table distinguishes between the case where demand shocks are the dominant source of fluctuations, and the situation where business cycles are mainly driven by supply shocks.

One important conclusion from Table 21.1 is that the real interest rate should generally be raised when the rate of inflation goes up, that is, $h$ should generally be positive. The only modification to this famous 'Taylor principle' is the case where supply shocks are all-dominant and policy makers care only about minimising the variance of output. In that special scenario the optimal value of $h$ approaches zero, since policy makers will then want the AD curve to be almost vertical, as we have seen above.

A second conclusion from Table 21.1 is that interest rate policy should generally be countercyclical ($b > 0$) except when supply shocks are dominant and policy makers care mainly about stabilizing inflation.

| Policy preference for | Dominant shocks | |
|---|---|---|
| | Demand shocks | Supply shocks |
| Output stability | $h > 0$<br>$b > 0$ | $h \to 0$<br>$b > 0$ |
| Inflation stability | $h > 0$<br>$b > 0$ | $h > 0$<br>$b < 0$ |

**Table 21.1: Optimal monetary policy under the Taylor rule**

**Is the Taylor rule optimal?**

We have so far assumed that monetary policy follows a Taylor rule of the form (6). As we explained in Chapter 19, there is evidence that the monetary policy of the major OECD economies can indeed be described quite well by such an interest rate reaction function.

But is there any reason to believe that it is actually *optimal* for the central bank to follow a Taylor rule like (6)? Or could the central bank secure a higher level of social welfare by following some other and possibly more complex monetary policy rule?

This issue has recently been addressed by economists Julio Rotemberg and Michael Woodford[11]. They have developed an empirical AS-AD type model for the United States in which the representative consumer's lifetime utility loss from economic instability may be approximated by a function of the same form as our social loss function (1). Their model implies that the central bank can minimize the consumer's welfare loss by setting the interest rate as a function of all observed past values of the output gap $\widehat{y}_t = y_t - \overline{y}_o$, all past values of the inflation gap $\widehat{\pi}_t = \pi_t - \pi^*$, and all past values of the interest rate, with declining coefficients on past variables observed further back in history. However, they also find that if the central bank follows a simple interest rate rule of the form

$$i_t = \overline{r} + \pi_t + h \cdot \widehat{\pi}_t + b \cdot \widehat{y}_t + c \cdot i_{t-1} \qquad (11)$$

with appropriately chosen positive values of the parameters $h$, $b$ and $c$, it can ensure almost the same level of consumer welfare as the welfare level attainable under the optimal policy rule.

In other words, a modified Taylor rule which includes the lagged interest rate on the right-hand side comes close to being optimal, according to Rotemberg and Woodford. To understand why it is desirable to include the lagged short-term interest rate $i_{t-1}$ in the interest rate reaction function, recall from Chapter 19 that the *long-term* interest rate is an average of the current and *expected future* short rates. If market participants understand that monetary policy follows the rule (11) with $c > 0$, they will realize that an increase in the current short rate $i_t$ will also lead to higher short-term rates in the future, ceteris

[11] Julio J. Rotemberg and Michael Woodford, 'Interest Rate Rules in an Estimated Sticky Price Model', chapter 2 in John B. Taylor (editor), *Monetary Policy Rules*, NBER Business Cycle Series, Volume 31, University of Chicago Press, 1999.

paribus. Compared to the standard Taylor rule where $c = 0$, a change in the short term interest rate will therefore have a *stronger* impact on long term interest rates, and hence a *stronger* impact on aggregate demand. In this way the central bank's interest rate policy, operating through the short term interest rate, becomes a more effective instrument for managing aggregate demand. In particular, when interest rate policy has a stronger impact on demand, it is less likely that the non-negativity constraint on the short-term nominal interest rate becomes binding for monetary policy: If even a small cut in the short term interest rate has a substantial positive impact on aggregate demand, the central bank would rarely end up in a situation where it would want the nominal interest rate to be negative.

The issue of the optimal monetary policy rule is still subject to much research and debate among monetary economists, but the findings of Rotemberg and Woodford suggest that following a relatively simple modified Taylor rule may be a good strategy for monetary stabilization policy.[12]

# 3 Fiscal stabilization policy

Since we wanted to focus on monetary policy, the previous analysis assumed that public expenditure was kept at its trend level $(g_t - \overline{g})$, reflecting a passive fiscal policy. Let us now consider whether *active* fiscal policy can help to stabilise the economy. As a starting point, we go back to equation (19) in Chapter 19 where we wrote the equilibrium condition for the goods market in the form

$$y - \overline{y}_o = \alpha_1 (g - \overline{g}) - \alpha_2 (r - \overline{r}) + v \tag{12}$$

[12] Empirical studies of central bank interest rate reaction functions also indicate that a modified Taylor rule of the form (11) with a positive value of $c$ provides a better description of interest rate policy than the simple Taylor Rule with $c = 0$. So central banks seem to act in accordance with the prescriptions of monetary theory!

Suppose that fiscal policy can react to the same information on the inflation gap and the output gap as monetary policy and that public expenditure is adjusted in accordance with the following *fiscal policy rule:*

$$g - \overline{g} = c_\pi (\pi^* - \pi) - c_y (y - \overline{y}_o) \tag{13}$$

We may then ask what the sign and the magnitude of the fiscal policy parameters $c_\pi$ and $c_y$ should be if fiscal policy makers wish to assist monetary policy makers in minimizing the social loss function (1)? For example, should fiscal policy be *countercyclical*, reacting with an increase in public spending when output falls below trend ($c_y > 0$)? To investigate this, recall that the real interest rate is $r \approx i - \pi$ under static inflation expectations, so the Taylor rule (6) implies that

$$r = \overline{r} + h (\pi - \pi^*) + b (y - \overline{y}_o) \tag{14}$$

Inserting (13) and (14) in (12) and rearranging, we get the

AD curve with active fiscal policy:

$$\pi = \pi^* - \left( \frac{1 + \alpha_1 c_y + \alpha_2 b}{\alpha_1 c_\pi + \alpha_2 h} \right) (y - \overline{y}_o) + \frac{v}{\alpha_1 c_\pi + \alpha_2 h} \tag{15}$$

Equation (15) has exactly the same qualitative form as the AD curve (5) in our AS-AD model with passive fiscal policy. The only modification is that the slope of the AD curve is now affected by the fiscal policy parameters $c_\pi$ and $c_y$, and that the impact of the demand shift variable $v$ now depends on fiscal policy (via $c_\pi$). However, these parameters enter in a way which is quite symmetric with the impact of the corresponding monetary policy parameters $h$ and $b$. For example, if fiscal policy makers decide to cut public spending more sharply in response to rising inflation, the resulting increase in $c_\pi$ will affect the slope of the

AD curve and the variance of the demand shift term $v/(\alpha_1 c_\pi + \alpha_2 h)$ in the same way as when monetary policy makers decide to raise the interest rate more aggressively in reaction to higher inflation. Furthermore, we see from (15) that a more active countercyclical fiscal policy will have the same qualitative impact as a more activist countercyclical monetary policy, since $c_y$ and $b$ affect the slope of the AD curve in the same manner.

We may draw two important conclusions from these observations. First, the factors determining the optimal sign and magnitude of the fiscal policy parameters $c_\pi$ and $c_y$ are the same as those determining the optimal monetary policy. Hence our previous analysis of optimal monetary stabilization policy also fully characterizes the optimal fiscal stabilization policy. In particular, the results summarized in Table 21.1 carry over to fiscal policy if $h$ is replaced by $c_\pi$ and $c_y$ is substituted for $b$. Second, *if there are no constraints* on the policy parameters $h$, $b$, $c_\pi$ and $c_y$, fiscal stabilization policy can achieve nothing in terms of reducing the variability of output and inflation which could not have been achieved through monetary policy, and vice versa.

The explanation for these results is that fiscal as well as monetary policy work via the economy's demand side, by affecting the slope of the AD curve and the variance of the shifts in this curve.[13] From this one might be tempted to conclude that either fiscal stabilization policy or monetary stabilization policy is redundant: If one of these instruments is available, we do not need the other one. Yet such a conclusion would be unwarranted, since the policy parameters $h$, $b$, $c_\pi$ and $c_y$ *are* in fact constrained. As you remember, the choice of the monetary policy parameters $h$ and $b$ is constrained by the fact that the nominal interest rate cannot fall below zero. Hence there is a limit to the feasible cut in the interest rate when a large negative demand shock drives output and inflation

[13]In a more complete and realistic model one should allow for the fact that changes in fiscal policy instruments (e.g., tax rates) may also affect the economy's supply side by affecting the economic incentives of households and firms. For simplicity we leave out such incentive effects which are the subject of Public Finance theory.

far below their target levels. In such a gloomy scenario where a large negative output gap persists despite a short-term nominal interest rate close to zero, as many countries experienced during the Great Depression of the 1930s, and as the world's second largest economy (Japan) has experienced in recent years, monetary policy may become impotent, and active fiscal policy may be the only means by which the economy can be dragged out of recession. Indeed, the view that fiscal policy is an important potential tool of stabilization policy was born out of the experience of the Great Depression.

On the other hand there are important constraints on the ability of fiscal policy makers to implement immediate and large changes in taxation and public spending in reaction to changes in the business cycle. The level and structure of taxation and public expenditure has important effects on resource allocation and income distribution, so large and abrupt changes in these variables may have considerable negative effects on the welfare of (some) citizens, even if they help to stabilize the macro economy. Moreover, in practice it may take time before a change in taxes or public spending can be implemented, as we shall discuss in Chapter 23. For these reasons there are limits on the values of the fiscal stabilization policy parameters $c_\pi$ and $c_y$ which are feasible in a short-term business cycle perspective. Hence there is a clear potential for monetary policy to help stabilizing the economy.

**The relative importance of demand and supply shocks**

As we have seen, the proper fiscal and monetary policy depends on the relative importance of demand and supply shocks. Estimating the extent to which business cycles are driven by demand shocks rather than supply schocks is a difficult matter, because the shocks must be identified from data on output and inflation by making assumptions on the way the economy reacts to different types of disturbances. Prevailing estimation methods rely on the facts that demand shocks generate a positive correlation between output and inflation and have no permanent effect on output, whereas supply shocks imply a negative correlation between production and prices and will affect output even in the long run if they are permanent.

| | Demand shocks | | |
|---|---|---|---|
| Country | Nominal shocks | Real shocks | Supply shocks |
| Canada | 31-59 | - | 40-69 |
| France | 0-6 | 55-79 | 19-41 |
| Germany | 95-99 | 0-2 | - |
| Italy | 25-45 | - | 55-75 |
| United Kingdom | 37-77 | 23-63 | - |
| United States | 16-60 | 29-79 | 4-17 |
| All countries | 23-55 | 38-61 | 0-27 |

**Table 21.2: Percentage of variance of industrial production explained by demand and supply shocks, 1973-1995**[1]

[1] 68%confidence intervals.

Source: Table 2 of Fabio Ganova and Gianni de Nicolo: "On the source of business cycles in the G-7". Forthcoming in Journal of International Economics.

Table 21.2 shows the results of a recent attempt to estimate the relative importance of demand and supply shocks for fluctuations in industrial output in the most important Western economies. Demand shocks are divided into nominal shocks and real shocks. Nominal shocks are disturbances originating in the monetary sector of the economy. These shocks may reflect shifts in private sector demand for money and other financial assets[14]. They may also be caused by unsystematic changes in monetary policy, for example, a shift in the interest rate reaction function of the central bank. Real demand shocks reflect shifts in real consumption or investment with a direct impact on the demand for goods and services. Such shocks may originate in the public as well as the private sector. Both nom-

[14] Recall from equation (28) in Chapter 19 that if the central bank follows a constant money growth rule, trying to secure a stable growth rate of the nominal money supply, an oberserved shift in the parameters of the money demand function will change the way the central bank interest rate reacts to output and inflation, and this in turn will affect aggregate demand.

inal and real demand shocks affect output and inflation by shifting the aggregate demand curve. By contrast, supply shocks are all those types of shocks which shift the aggregate supply curve.

The figures in Table 21.2 report 68 percent confidence intervals. For example, in Canada there is a 68 percent probability that between 31 and 59 percent of the total variance of industrial output can be explained by nominal demand shocks. When the data for all the countries are pooled, we see from the bottom row of the table that most of the variability of output appears to stem from demand shocks, although supply shocks seem quite important in Canada and Italy.

It is important to note that the estimated demand shocks include the effects of *unsystematic* changes in fiscal and monetary policy, that is, erratic policy changes which do not follow a stable policy reaction function such as equations (13) and (14). Hence it is difficult to conclude from Table 21.2 that demand shocks emanating from the *private* sector have been inherently more important for business cycles than supply shocks.

In Chapter 23 we shall consider why monetary and fiscal policy may sometimes be unsystematic and destabilizing in practice.

# 4 Exercises

**Exercise 21.1. Targeting the natural rate of output**

In the main text of this chapter we assumed that monetary policy makers wanted to stabilize actual output around trend output. You are now asked to analyse the optimal monetary stabilization policy in the alternative case where monetary policy makers are targeting the *natural rate* of output so that $y^* = \overline{y} = \overline{y}_o + s$, where you recall that $s$ captures supply shocks. In other words, we now assume that policy makers wish to minimize the social loss function

$$SL = \sigma_y^2 + \kappa\sigma_\pi^2, \qquad \sigma_y^2 \equiv E\left[(y_t - \overline{y})^2\right], \qquad \sigma_\pi^2 \equiv E\left[(\pi_t - \pi^*)^2\right] \tag{1}$$

We will maintain the assumption that interest rate policy follows the Taylor rule (6). This means that the aggregate demand curve is still given by equation (5). Thus, even though the central bank targets the *natural* rate of output, the interest rate still responds to the deviation of output from its *trend* level $(y - \overline{y}_o)$. The reason might be that the central bank cannot immediately observe the supply shocks occurring in the current period, and hence it cannot observe the current natural output level (whereas it can estimate trend output $\overline{y}_o$ on the basis of historical data).

*Question 1:* Discuss under which circumstances it would be appropriate for policy makers to choose natural output rather than trend output as the output target? Does the choice of output target matter much if the economy is mainly exposed to demand shocks?

*Question 2:* Suppose that $y^* = \overline{y} = \overline{y}_o + s$ and that the economy is mainly exposed to supply shocks. Use a graphical analysis as a basis for discussing how the central bank interest rate should respond to changes in the inflation rate. Should the value of the policy parameter $h$ in the Taylor rule be positive or negative? Should the value of $h$ be large or small? Try to provide an intuitive explanation for your finding.

*Question 3:* Suppose again that $y^* = \overline{y} = \overline{y}_o + s$ and that supply shocks are the dominant source of disturbances. Use a graphical analysis as a basis for discussing how the interest rate should respond to changes in the output gap $y - \overline{y}_o$. Should monetary policy be countercyclical or procyclical? Should the value of $b$ be large or small? Give an intuitive explanation for your result.

*Question 4:* Is there a trade-off between output variability and inflation variability when policy makers are targeting natural output and supply shocks are much more important than demand shocks?

**Exercise 21.2. Principles and problems of stabilization policy**

In this exercise you are invited to restate and discuss some of the main results and arguments presented in this chapter.

*The goals of stabilization policy*

The case for macroeconomic stabilization policy rests on the assumption that it is desirable to stabilise the rates of output and inflation around some target values. This raises a number of questions:

*Question 1:* Discuss why it is socially desirable to stabilize the rate of inflation around some constant target value. What are the costs of a fluctuating rate of inflation?

*Question 2:* What are the arguments for avoiding fluctuations in real output? What factors determine the magnitude of the welfare costs of output instability?

*Question 3:* Explain why even a constant rate of inflation generates welfare costs. Do you consider these costs to be large or small? Discuss the factors which policy makers should take into account when they choose the target inflation rate. Is zero inflation an optimal inflation target?

*Question 4:* Discuss the factors which should be considered when policy makers choose the target level of output $y^*$. Should they choose the 'efficient' level of output, the natural rate of output, or the trend level of output. Discuss the arguments for and against the different output targets.

*Question 5:* Should macroeconomic stabilization policy follow fixed rules, or should policy makers be left with discretion to make whatever macroeconomic policy choice they consider appropriate in any given situation? What are the arguments in favour of rules, and what is the case for discretion?

*Optimal stabilization policy*

*Question 6:* Try to restate the arguments underlying the results on optimal monetary stabilization policy summarised in Table 20.1 (which assumes that target output is equal to trend output). In doing so, you may want to use an AS-AD diagram to illustrate how demand and supply shocks affect the inflation gap and the deviation of actual output from trend output. Explain the constraints on the choice of the policy parameters $h$ and $b$ in the Taylor rule.

*Question 7:* Explain why it may be desirable for the central bank to let the current interest rate vary positively with last period's interest rate.

*Question 8*: Explain why Table 20.1 also characterizes the optimal fiscal stabilization policy, given that fiscal policy reacts to inflation and the output gap. Discuss wheter it is useful for policy makers to be able to use fiscal as well as monetary stabilization policy?