4

Stabilization Policy — Can we?

In this chapter we will outline the implications for stabilization policy if people form their expectations rationally. Stabilization policies are typically defined as policies aimed at reducing (usually the variance of) output or employment deviations from their full-employment ('natural' or 'equilibrium') levels. This is the definition we will use primarily, though we will occasionally widen it to policies designed to stabilise a wider menu of macro variables (such as inflation).

We will consider government use both of the budget (tax rates and spending- 'fiscal policy') and of the money supply ('monetary policy'). We will treat a monetary policy of interest rate setting as equivalent to some money supply policy (rather like in trade theory import quotas are treated as equivalent to tariffs which vary with market conditions).

As this point is important (given that central banks usually do use rules for setting interest rates) and not immediately obvious, let us consider two examples of this. In the first case, suppose the interest rate behaviour of the government or central bank (henceforth 'the government') is

$$R_t = \alpha(y_{t-1} - y^*) + \beta(m_t - m^*) + \eta_t \tag{1a}$$

Then we can rewrite it as a money supply rule:

$$m_t = m^* + \frac{1}{\beta}R_t - \frac{\alpha}{\beta}(y_{t-1} - y^*) - \frac{1}{\beta}\eta_t \tag{1b}$$

In the second case, assume that the interest rate behaviour does not directly include the money supply. Here we have to introduce other relationships in the model to determine the implied money supply behaviour. So let

$$R_t = \alpha(y_{t-1} - y^*) + \eta_t \tag{1c}$$

and suppose the demand for money is simply $m_t = -\beta R_t$

Then the implied money supply rule is

$$m_t = -\alpha\beta(y_{t-1} - y^*) - \beta\eta_t \tag{1d}$$

In other words we can rewrite any interest rate behaviour as an implied behaviour of the money supply, and regard the government as obeying that 'money supply rule'.

The vexed question now arises of what government policies are 'rules', which 'discretionary', and which 'fixed rules'. However from the viewpoint of rational expectations we can distinguish between that part of government behaviour which is a surprise (cannot be predicted from known past events) and that part which is a predictable response to past events; furthermore within the surprise element we will distinguish between that part which responds predictably to contemporaneous events and that part which is contributed by the government's own unpredictability. The description of the predictable part of the behaviour is the 'rule' governing its behaviour; the rest is the 'surprise' element in policy. Within the rule element, the government could respond to past events actively or it could refuse to respond at all; the former is often called a 'feedback' response, the latter a 'fixed target' rule. Perhaps the best-known example of this last is Milton Friedman's proposal that the government should adopt a policy of a fixed growth rate of the money supply (Friedman, 1968).

It is possible for feedback rules to be simple or complex, depending on exactly how governments set about stabilization. In the 1970s for example it was quite usual for governments to make detailed forecasts every so often of what would happen with different settings of policy instruments; and then to adjust the settings to obtain the most desirable forecast — 'optimal control policy'. This is sometimes referred to as 'discretion' or 'fine-tuning'.

The relationship between past events and policy reaction resulting from this process would be complex; but it could in principle be written down. More recently governments have lost faith in such forecasting procedures (for reasons we discuss in chapter 6) and have used simpler rules of policy reaction — to one or at most a few lagged variables. It is rules like these we shall focus on as typical of feedback response or 'flexible rules'. (Notice in passing that flexibility cannot, as some might think casually, consist in a government changing its mind every period on how it will react to past events; if it did, it would have entirely unpredictable behaviour — policy would be a pure surprise.)

We will also examine the government response to contemporaneous events. It is usual to suppose that governments can observe these no better than any private person (we will also consider the case where it has superior information below). However, there are ways policy can respond to events without the government directly observing them: we describe these as 'automatic' responses. For example taxes (and benefits) respond to incomes through the tax/benefit system, without the government doing anything (i.e. changing tax or benefit rates). Similarly, the money supply (or interest rates) may respond automatically and simultaneously to income under the particular rule in force, without a contemporaneous decision by the government. These policy responses may well be important stabilizers (or indeed destabilizers).

MODELS WITH THE SARGENT–WALLACE SUPPLY CURVE

An early result, due to Sargent and Wallace (1975), is that stabilization policy has no impact on either real output or unemployment in classical equilibrium models if they embody a supply function relating deviations of output to surprise movements in the price level, and further that both private and public agents (a) have identical information sets and (b) are able to act on these information sets. We discussed this result briefly in chapter 2 in the context of a simple monetary model, which we now extend somewhat.

Consider the following simple model:

$$y_t = -\alpha(R_t - E_{t-1}p_{t+1} + E_{t-1}p_t) + \mu_f(y_{t-1} - y^*) \tag{2}$$

$$y_t = y^* + \beta(p_t - E_{t-1}p_t) \tag{3}$$

$$m_t = p_t + y_t - cR_t + v_t \tag{4}$$

$$m_t = \overline{m} + \mu_m(y_{t-1} - y^*) + u_t \tag{5}$$

α, β, μ_f, μ_m, and c are constants (μ_f, μ_m would typically be negative in Keynesian policy rules), u_t and v_t are random errors, R_t is the nominal interest rate.

Equation (2) is the aggregate demand schedule. It includes a fiscal feedback response $\mu_f(y_{t-1}-y^*)$ representing government counter-cyclical variations in spending or tax rates.

Equation (3) is the Sargent and Wallace Phillips (or supply) curve. This is derived as in chapter 3. The only difference is that it assumes that people can obtain no useful information about the general price level from their current local prices; so there is no signal extraction in this case — hence the dating of expectations at $t-1$. The same assumption is used throughout the model. It turns out, as we shall see later, to be an important restriction.

Another way of looking at (3) is as an 'old' Keynesian expectations-augmented Phillips curve in which inflation equals expected inflation plus an effect of excess demand proxied by $y - y^*$: we can rewrite it as $\pi_t - E_{t-1}\pi_t[= p_t - p_{t-1} - (E_{t-1}p_t - p_{t-1})] = \frac{1}{\beta}(y_t - y^*)$. Sargent and Wallace stressed that their result could be viewed as an implication of orthodox Keynesian models, if rational expectations were substituted for adaptive expectations.

Equation (5) is a money supply rule with a feedback response

$$\mu_m(y_{t-1} - y^*)$$

On substituting (2) for R_t into (4) and equating (5) to the result, we obtain:

$$\overline{m} + \mu(y_{t-1} - y*) + w_t = p_t + (1 + \frac{c}{\alpha})y_t - c(E_{t-1}p_{t+1} - E_{t-1}p_t) \quad (6)$$

where $w_t = u_t - v_t$ and $\mu = [\mu_f(\frac{c}{\alpha}) + \mu_m]$. Substitution of (3) into (6) for y_t and y_{t-1} yields :

$$\overline{m} + \beta\mu(p_{t-1} - E_{t-2}p_{t-1}) + w_t = p_t + (1 + \frac{c}{\alpha})\beta(p_t - E_{t-1}p_t) - c(E_{t-1}p_{t+1} - E_{t-1}p_t) + (1 + \frac{c}{\alpha})y^* \quad (7)$$

To solve (7) for prices, we use the Muth solution method discussed in chapter 2, writing:

$$p_t = \overline{p} + \sum_{i=0}^{\infty} \pi_i w_{t-i} \quad (8)$$

We find that the identities yield:

$$\overline{p} = \overline{m} - (1 + \frac{c}{\alpha})y^* \quad (9)$$

$$\text{(terms in } w_t) \quad 1 = \pi_0[1 + \beta(1 + \frac{c}{\alpha})] \quad (10)$$

The identities in the other errors are irrelevant for our purposes here. Since

$$p_t - E_{t-1}p_t = \pi_0 w_t \quad (11)$$

substitution in (3) yields

$$y_t = y^* + \beta\pi_0 w_t \quad (12)$$

From (10) we see that π_0 does not depend on either $\mu_m$or μ_f and consequently we see from (12) that systematic monetary policy does not influence the variance of output in this model. Unanticipated monetary change is of course equal to $m_t - E_{t-1}m_t$.

Since $E_{t-1}m_t = \overline{m} + \mu m(y_{t-1} - y^*)$,

$$m_t - E_{t-1}m_t = u_t \tag{13}$$

which is a component of w_t. Consequently, unanticipated monetary policy does influence output in the Sargent-Wallace model but not anticipated monetary policy.

This result stems from the nature of the supply curve. Output is set by supply considerations (relative prices, technology, producers' preferences, etc.) and is only influenced by macroeconomic events if these cause surprise movements in absolute prices which in turn are partially (mis-) interpreted as relative price movements. Government by definition cannot plan surprises (if it tried to, the 'surprise' would be — under our assumptions here — part of available information at $t - 1$ and so would be fully anticipated, and no surprise at all); its feedback responses are planned variations in net spending or money supply.

A basic extension of the result occurs if there are adjustment costs in supply; allowance for these in a standard way (e.g. a quadratic cost function) adds a term $+j(y_{t-1} - y^*)$to (3) $(0 < j > 1)$. A shock to output now persists, and in principle the business cycle in output can be accounted for by the interaction of a variety of shocks with such a 'persistence mechanism' (various forms of it have been suggested by Lucas, 1975; Sargent, 1976; Fischer, 1980b; Barro, 1980).

Even though a macroeconomic shock now affects output for the indefinite future, it is still impossible for fiscal or monetary feedback rules to affect its variance because they can neither affect the impact of the shock itself, being a surprise, nor alter the adjustment parameter which determines the lagged effects, this parameter being fixed by technology, etc. We leave the demonstration of this — by substituting for y_t and y_{t-1} in (7) from the new supply curve in (3) — as an exercise for the reader.

DIFFERENT INFORMATION SETS

It is crucial for this neutrality proposition that, even in a model embodying a Sargent-Wallace supply curve, both private and public agents have the same information set.

If, for example, the government has an information superiority, then it can use this to modify the 'surprise' faced by the private sector. For suppose private agents have access only to last period's data in the current period, but the government knows the true price level (assume it collects price statistics over the period and waits before releasing them). Then it may in principle let its net spending or the money supply react to this information; its reactions will modify the price surprises to suppliers. Formally, add $-a_f(p_t - E_{t-1}p_t)$ into (2) and $-a_m(p_t - E_{t-1}p_t)$ into (5) where a_f, a_m (both positive) are fiscal and monetary responses respectively. To simplify matters set $\mu_f = \mu_m = 0$. Equation (7) now becomes

$$\overline{m} - (a_m + \frac{ca_f}{\alpha})(p_t - E_{t-1}p_t) + w_t = p_t + (1 + \frac{c}{\alpha})(p_t - E_{t-1}p_t) - c(E_{t-1}p_{t+1} - E_{t-1}p_t) + (1 + \frac{c}{\alpha})y^* \quad (14)$$

so that from the terms in w_t we have:

$$\pi_0 = \frac{1}{1 + (1 + \frac{c}{\alpha})\beta + a_m + \frac{ca_f}{\alpha}} \quad (15)$$

from which it is apparent that the higher a_m, a_f the smaller the price surprise and hence the output variance.

One may ask, however, why a government in possession of macro information should not release it rapidly as an alternative to implementing such (presumably costly) rules. If it did so, private agents would be able to make better informed judgements about current macroeconomic events, increasing the economy's stability. In the example here, if price data are released rapidly, then p_t will be effectively known in period t and the economy will be in continuous equilibrium — perfect stability!

A further information asymmetry, which may violate neutrality and has had some attention (Turnovsky, 1980; Weiss, 1980), is that where one group of private agents has superior information to that possessed by suppliers and by the government. To illustrate this possibility, modify the aggregate demand schedule (2) in the above model to

$$y_t = -\alpha(R_t - E_t p_{t+1} + p_t) \quad (16)$$

The interpretation of this aggregate demand schedule (16) is that investors have instantaneous access to current information on all relevant macro data while other agents, such as the government or suppliers of goods receive this information with a one-period lag.

In defence of this idea, it is argued that agents in regular contact with asset markets receive global information (such as interest rates and asset prices) almost instantaneously, by contrast with those in the labour market.

Substitution of (16) into our model in place of (2) yields the following reduced form:

$$\overline{m} + \mu\beta(p_{t-1} - E_{t-2}p_{t-1}) + w_t = (1+c)p_t + (1+\frac{c}{\alpha})(p_t - E_{t-1}p_t) - cE_t p_{t+1} + (1+\frac{c}{\alpha})y^* \quad (17)$$

where $\mu = (\mu_m + \mu_f c/\alpha)$ as before. Using the Muth solution the identities are given by:

$$\overline{p} = \overline{m} - (1+\frac{c}{\alpha})y^* \quad (18)$$

(terms in w_t)

$$1 = \pi_0(1 + c + \beta(1+\frac{c}{\alpha}) - c\pi_1 \quad (19)$$

(terms in w_{t-1})

$$\mu\beta\pi_0 = \pi_1(1+c) - c\pi_2 \quad (20)$$

(terms in $w_{t-i},\ i \geq 2$)

$$0 = \pi_i(1+c) - c\pi_{i+1} \quad (21)$$

Equation (21) defines an unstable process. Consequently applying the stability condition, we set $\pi_i = 0$ ($i \geq 2$). Therefore we can simultaneously solve (18) and (19) to obtain π_0 and π_1. The important point is that π_0, the coefficient on the current innovation, will depend on μ; consequently the variance of output depends on the feedback rules.

The basis of this result is that the agents in the goods market with superior information demand goods this period in reaction to expected future prices because these affect the real interest rate they expect to pay. Even though expected future output is invariant to the feedback rule, expected future prices are not in these models — clearly not, since the *demand* for output is affected by feedback and this in turn has to be equated with given output supply by prices and interest rates. So current demand for goods is affected by the feedback parameters via their effect on expected future prices, and the response of goods demand, and so of prices and so of output, to shocks is correspondingly modified. The government can thus exploit these agents' information without itself having access to it. This second asymmetry result is, however, subject to questioning of a similar type to the first: namely, the basis for the restriction of such macroeconomic information to one set of agents. The case for macroeconomic information on individual markets being so restricted seems more secure, although this is communicable through asset prices.

But macroeconomic information, once available, is a public good which, first, it is usual for the government to insist be made available at low cost; second, even if it is not so provided, it would pay the possessors to divulge it for a fee to other agents, since this maximizes the overall possibilities for its exploitation; third, asset prices themselves will communicate this information indirectly to other agents. The model just used furthermore makes the strong assumption that people operating in asset markets know *all* current macro data (this is implicit in taking expectations based on current period data), which is clearly implausible.

In short, the overall set-up here is generally implausible in both the asymmetry and the comprehensiveness of the group's information set.

PARTIAL INFORMATION

The result above can be refined to deal with the two objections under certain conditions. Suppose we let everyone in the economy have access to some partial current information, as discussed in chapter 3. When that information is micro, it turns out that flexible rules will affect the variance of output. The reason is the same as in the Turnovsky-Weiss case: people react to current shocks because they have incomplete information but the flexible policy rule affects expected future prices, which in turn condition those reactions. Of course, if people could disentangle from their current information exactly what the current money supply shock was, then they could protect their real wages, relative prices and real supplies and demands against mere monetary noise, and a flexible money supply rule would be ineffective; but they cannot, and so it is effective. As for a flexible fiscal rule, that too is effective provided people cannot disentangle the shocks well enough to predict the current price level exactly: in other words, they have less than full current information, which is guaranteed by assumption.

To illustrate policy effectiveness in the presence of micro partial information, take the model of chapter 3, equations (15) and (16), in which people know their local prices only (models of this sort with policy effectiveness were first set out in Marini (1985, 1986) and Minford, 1986). Let us modify the model equation (15) by the addition of a flexible money supply response to output, $-\mu(y_{t-1} - y*)$and a Cagan-style demand response to expected inflation. The model now becomes:

$$\overline{m} + \epsilon_t - \mu(y_{t-1} y*) = p_t + y_t - \alpha(E_t p_{t+1} - E_t p_t) \qquad (22)$$

$$y_t - y* = \frac{1-\phi}{\delta}(p_t - E[p_t \mid \Phi_{t-1}]) \qquad (23)$$

where as before $\phi = \frac{\pi_0^2\sigma_\epsilon^2}{\pi_0^2\sigma_\epsilon^2+\sigma_v^2}$. Using the Muth solution method and our previous results that $E_t\epsilon_t = \phi\epsilon_t$, we can substitute for y_t from (23) into (22) to obtain:

$$\overline{m} + \varepsilon_t - \mu\frac{(1-\phi)}{\delta}\pi_0\epsilon_{t-1}$$
$$= \sum_{t=0}^{\infty} \pi_i\epsilon_{t-1} + y* + \frac{(1-\phi)}{\delta}\pi_0\epsilon_t - \alpha(\pi_1\phi\epsilon_t - \pi_0\phi\epsilon_t)$$
$$+ \sum_{i=1}^{\infty}(\pi_{i+1} - \pi_i)\epsilon_{t-i} \quad (24)$$

$$\text{(terms in } \epsilon_t) \qquad 1 = \pi_0\frac{1}{\delta}(1-\phi)\pi_0 - \alpha(\pi_1\phi - \pi_0\phi) \quad (25)$$

$$\text{(terms in } \epsilon_{t-1}) \qquad -\frac{\mu}{\delta}(1-\phi)\pi_0 = \pi_1 - \alpha(\pi_2 - \pi_1) \quad (26)$$

$$\text{(terms in } \epsilon_{t-i},\ i \geq 2) \qquad 0 = (1+\alpha)\pi_{i-i} - \alpha\pi_{i+1} \quad (27)$$

Imposing the terminal condition $\pi_N = 0$ ($N > 2$) yields $\pi_i = 0$ ($i \geq 2$); $\pi_1 = -\mu(1-\phi)\pi_0/\delta$; and

$$\pi_0 = \frac{1}{1 + \frac{1-\phi}{\delta} + \alpha\phi + \frac{\alpha\mu\phi(1-\phi)}{\delta(1+\alpha)}} \quad (28)$$

It is clear from (28) that the parameter μ of the flexible rule affects π_0 and so output's response to the monetary shock, which is $\frac{(1-\phi)\pi_0}{\delta}$. It turns out, when ϕ is substituted out in terms of π_0, that (28) is a quintic in π_0. Computer solutions for a wide variety of possible parameter values indicate that π_0 has only one real root, which is reduced as μ rises: this yields the commonsense result that the more policy 'leans against' the recent business cycle, the more it stabilizes output. Suppose a monetary expansion, ϵ_t, raises output through a surprise rise in prices, this causes an expected money supply contraction through the flexible rule, implying expected future price deflation, which in turn raises the current demand for money, lowers that for goods and so partially counteracts the upward pressure on current prices exerted by the current monetary expansion.

The process is illustrated in figure 4.1. $A'D'$ shows the aggregate demand curve shift from ϵ_t alone. But next period's AD curve, A_1D_1, shifts leftwards generating an expected price fall to E_tp_{t+1}. This also shifts current aggregate demand to A_0D_0. The path of prices and output

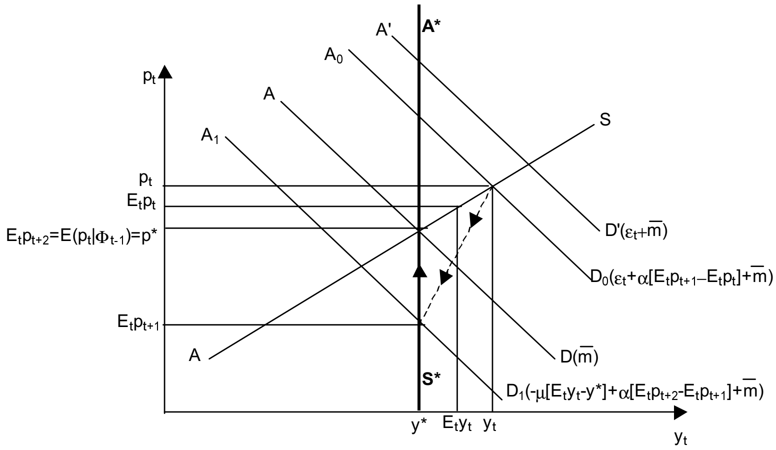


Figure 4.1: A monetary shock, ε_t, with a monetary feedback rule and local price information

is marked by the arrows. The point of the illustration is to show that y_t rises to less than it would reach without the rule.

When people have only partial macro information as in our second model in chapter 3, equations (17)–(20), this same effect does not in fact occur. Consider the effect of μ the flexible response of money to past events, in that model. While the solution for prices and interest rates reflects the response parameter, μ, that for output does not. The reason is that the current information on interest rates allows people to work out exactly what the effect of the feedback response is on expected future prices; since it can be worked out exactly, it is impounded into $E_t p_t$ and cannot affect output, which depends on producers being surprised by prices. In effect, in figure 3.4 whatever change in $E_t p_t$ is produced by feedback (affecting $E_t p_{t+1}$), it shifts both the AS and AD curves vertically by the same amount, leaving y_t and $E_t y_t$ the same.

However, when people have both micro information on local prices and macro information on interest rates, effectiveness is restored (see, for example, Barro, 1980; King, 1982). Let us take as a representative model this same model, equations (17)-(20) of chapter 3, and add local price information, so that $p_{it} = p_t + v_{it}$: this is essentially the model of Barro (1980). There are now two pieces of information, p_{it} and R_t. For simplicity, let $v_t = 0$ so that there are only two macro errors, e_t and u_t.

Plainly both p_{it} and R_t will be used to estimate e_t and u_t. In this case we would have

$$E_t u_t = \alpha_u p_{it} + \beta_u R_t \tag{29}$$

$$E_t e_t = \alpha_e p_{it} + \beta_e R_t \tag{30}$$

where the αs and βs would be derived from the regressions of u_t and e_t on p_{it} and R_t; $R_t = Au_t + De_t + Zm_{t-1}$and $p_{it} = q_0 u_t + \pi_0 e_t + v_{it} + \pi_m m_{t-1}$.

It turns out from the regression formulae that:

$$\alpha_u = \frac{DK}{\Delta} \tag{31}$$

$$\alpha_e = -\frac{AK}{\Delta} \tag{32}$$

$$\beta_e = \frac{q_0 K + D\sigma_v^2 \sigma_e^2}{\Delta} \tag{33}$$

$$\beta_u = \frac{-\pi_0 K + A\sigma_v^2 \sigma_u^2}{\Delta} \tag{34}$$

where $\Delta = (q_0 D - A\pi_0)^2 \sigma_u^2 \sigma_e^2 + \sigma_v^2 (A^2 \sigma_u^2 + D^2 \sigma_e^2)$ and $K = (q_0 D - A\pi_0)\sigma_u^2 \sigma_e^2$.

It follows that

$$A\alpha_u + D\alpha_e = 0 \tag{35}$$

and

$$D\beta_e + A\beta_u = 1 \tag{36}$$

Equation (24) holds as before so that here

$$ae_t + u_t = aE_t e_t + E_t u_t \tag{37}$$

Substituting from $E_t e_t$ and $E_t u_t$ gives:

$$ae_t + u_t = [(a\alpha_e + a_u)q_0 + (q\beta_e + \beta_u)A]\, u_t + [(a\alpha_e + \alpha_u)\pi_0 + (\alpha\beta_e + \beta_u)D]e_t \tag{38}$$

yielding two identities in u_t, e_t as

$$1 = q_0 a\alpha_e + \alpha_u q_0 + a\beta_e + A\beta_u \tag{39}$$

$$1 = \alpha_e \pi_0 + \frac{a_u \pi_0}{a} + D\beta_e + \beta_u \frac{D}{a} \tag{40}$$

Letting, from (35), $\alpha_u = -\frac{D}{A\alpha_e}$ and, from (36), $\beta_u = \frac{1}{A} - \frac{D\beta_e}{A}$, and substituting these into (39) and (40) implies that $\frac{D}{A} = a$.

Consequently the regression coefficients simplify to

$$\alpha_u = \frac{aK}{\Delta}; \alpha_e = -\frac{K}{\Delta}; \beta_e = \frac{q_0 K + a\sigma_v^2\sigma_e^2}{A\Delta}; \beta_u = \frac{-\pi_0 K + \sigma_v^2\sigma_u^2}{A\Delta}$$

where $K = (aq_0 - \pi_0)\sigma_u^2\sigma_e^2$ and $\Delta = (aq_0 - \pi_0)^2\sigma_u^2\sigma_e^2 + \sigma_v^2(\sigma_u^2 + a^2\sigma_e^2)$.

The solution is then worked out for R_t as before in chapter 3 yielding

$$A = -\frac{(1-\alpha)(1-aW)(1+c[1-\mu]) + \alpha(1+c)(1-\mu)W}{X};$$

$$D = \frac{-(1-\alpha)a(1+c[1-\mu])V + \alpha(1+c)(1-\mu)(1-V)}{X}$$

where $W = \frac{a\sigma_v^2\sigma_e^2}{\Delta}; V = \frac{\sigma_v^2\sigma_u^2}{\Delta}$ and $X = \alpha(1+c)(1+c[1-\mu])$.

Finally, using the expression for $p_t = \pi_0 e_t + q_0 u_t + m_{t-1}$, π_0, q_0 and π_m are found by the undetermined coefficients method.

We then find that

$$y_t = (1-aW)u_t + aVe_t \tag{41}$$

It turns out therefore that μ indeed enters the determination of $y_t = E_t u_t$ because it affects the weight of R_t and p_{it} in forming expectations of u_t and so also π_0, q_0, A, D.

AUTOMATIC STABILIZERS: AN ASIDE

Before going on to consider alternative assumptions about the supply curve we digress briefly to discuss the potential goal of 'automatic' stabilizers. By an automatic stabilizer we mean a mechanism in which a variable (for instance, tax liabilities) responds to current income levels, and therefore provides an automatic and immediate adjustment to current disturbances.

This is to be distinguished from policy actions in response to global information, such as we have been considering hitherto; 'automatic' implies that the response is effected at the microeconomic level, without recourse to macroeconomic information or to higher political authority. Tax liabilities, when tax rates are set, are of this sort: only the taxpayer, his income and the tax man are involved. In the monetary area, certain open market procedures — such as pegging central bank liabilities by Treasury bill sales — also fall into this category. The work of Poole (1970) on monetary policy in a closed economy and of Parkin (1978) on monetary and exchange rate intervention in an open economy can be regarded as dealing with these types of stabilizer.

McCallum and Whittaker (1979) considered the properties of automatic tax stabilizers and showed that they do influence the variance of output. Their point can most easily be demonstrated by writing the aggregate demand schedule as:

$$y_t = \alpha'(R_t - E_{t-1}p_{t+1} + p_t) - \sigma_t y_t \tag{42}$$

where t is the direct tax elasticity and σ is the elasticity of spending to temporary variations in tax liabilities. The tax elasticity,

$$t = \frac{\partial \ln(\text{tax receipts})}{\partial \ln(\text{output})} = \frac{(\frac{\partial \text{tax}}{\partial \text{output}})}{(\frac{\text{tax}}{\text{output}})}$$

is the marginal tax rate divided by the average tax rate.

If we define

$$\alpha = \frac{\alpha'}{1 + \sigma t} \tag{43}$$

then the solution of the model (42), (3), (4) and (5) is the same as (9) and (10), but where α is defined as here in (43). Consequently the solution for output is not independent of the automatic stabilizer, given this orthodox aggregate demand function;[5] a higher tax elasticity reduces the variance of output. However, although a high tax elasticity contributes to a reduction in output fluctuations, it does so at the cost of distortions to the operations of markets at the micro level: the highest tax elasticity of all is obtained when the marginal rate is 100 per cent!

The role of automatic stabilizers of this sort is quite distinct from that of feedback policy, although sometimes they are confused in popular discussion. It is, as we have seen, preserved within the Sargent and Wallace model considered above. However, there is one interesting set of conditions under which a particular monetary stabilizer is ineffective. This is where people have access to the same partial macro (or micro) information responded to by the monetary authorities.

Consider an 'automatic response' to the current interest rate, as discussed by Poole (1970), in the context of the macro model with partial macro information in chapter 3, equations (17)-(20). Suppose we rewrite the money supply function (19) as

$$m_t = \mu m_{t-1} + \eta R_t + e_t \tag{3.19$'$}$$

Assume first that the monetary authorities can respond at a micro level (e.g. in the treasury bill market) to a market interest rate, with the effect aggregated over the whole security market of ηR_t; assume also that no one observes the aggregate interest rate, R_t. Then the effect is to augment c, whenever it occurs in the solution, to $c' = c + \eta$ (flattening the LM curve). This will, as Poole suggested, dampen the effect of money and supply shocks, u_t and e_t, and augment that of demand shocks, v_t, as can be verified from the first line of table 3.1.

Now suppose R_t to be known to all as partial macro information; then the same policy (now no longer a response to micro data, but one to macroeconomic information) has no effect on output at all, as can be seen from the second line of table 3.1 where c does not enter.

We therefore have the result that interest rate stabilization is rendered ineffective (on output) in a Sargent -Wallace framework when the interest rate is universally observed. The reason is that any such response in impounded into $E_t p_t$ (because people can work out the money change due to ηR_t) and cannot affect the surprise element $p_t - E_t p_t$.

This would not be true of any variable to which the monetary authorities could respond at a micro level and which was not universally observed, as in the case above with R_t when unobserved. In this case people could not work out the money change to this response, and it could affect the surprise element, $p_t - E_t P_t$. However, plausible candidates for such a variable are hard to think of.

Nevertheless, the interesting possibility is introduced by macro information that the authorities can reduce the variance of output by raising the variance of the money supply shock, e_t, i.e. by deliberately making larger rather than smaller mistakes. Previously this was impossible; higher $vare$ necessarily implied higher $vary$ since e_t entered y_t additively. But now $vare$ affects the coefficients of the y expression via ϕ_u, ϕ_v, ϕ_e.

Consider the asymptotic variance of y, σ_y^2. Substituting for ϕ_u, ϕ_v, ϕ_ϵ from (32) in the y expression (table 3.1, line 3) we obtain:

$$\sigma_y^2 = \sigma_v^2 + [\frac{a^2\sigma_e^2 - a\sigma_u^2}{X'}]^2 + [\frac{\sigma_u^2 + (1+a)\sigma_v^2}{X'}]^2[\sigma_u^2 + a^2\sigma_e^2] \tag{44}$$

Now we find that as $\sigma_e^2 \to \infty$ and $\phi_e \to 1$, $\sigma_y^2 \to \sigma_v^2$ (the variance of the demand shock). In this case, the variance of output is dominated by the variance of demand shocks because suppliers become totally unresponsive to prices, believing them to reflect solely 'noise' in the money supply. It is clear that this may reduce the variance of output compared to the no-monetary-noise model; thus as $\sigma_e^2 \to 0$,

$$\sigma_y^2 \to \frac{a^2\sigma_v^2(\sigma_u^2)^2 + [\sigma_u^2 + (1+a)\sigma_v^2]^2\sigma_u^2}{[\sigma_u^2 + (1+a)^2\sigma_v^2]^2} \tag{45}$$

which, depending on σ_u^2 and a, can exceed σ_v^2.

Yet it can be shown that σ_y^2 is an inappropriate indicator of welfare and that the optimal policy is, commonsensically, to minimize σ_e^2 (that is, for the central bank cashiers to make as few and as small mistakes as possible).

Abstracting from the usual problems (public goods, externalities, incomplete markets, etc.) the Pareto-optimal situation under uncertainty is one of Walrasian equilibrium when all the shocks are known to all agents (this is discussed at greater length in chapter 5). In the context of our model output would in this situation be simply $y_t = u_t$, because $E_t p_t = p_t$and u_t, the supply shock, would shift our vertical supply curve fully along the quantity axis.

The optimal outcome under uncertainty, under normal assumptions for social welfare, is one which minimizes the variance of output from this outcome, as well as ensuring that this is the expected outcome: that is, such that $E_t y_t = E_t u_t$ and $\sigma_{yu}^2 = E(y-u)^2$ is a minimum. All rational expectations outcomes, whatever the information set, guarantee that $E_t y_t = E_t u_t$. The problem therefore reduces to choosing σ_e^2 to minimise σ_{yu}^2. However $\sigma_{yu}^2 = a^2 E(p_t - E_t p_t)^2$, so that the optimal policy is equivalently to minimise the variance of unanticipated price changes σ_{pe}^2.

Using our earlier expression for y_t (table 3.1, line 3), we find that

$$(p_t - E_t p_t) = \frac{y_t - u_t}{a} = \frac{\begin{array}{c} -[\phi_e + a(1-\phi_u)]u_t + ((1+a)\phi_u + \phi_v)ae_t \\ +[(1+a)\phi_\epsilon - a(1+a)\phi_v)]v_t \end{array}}{a(1+a)} \quad (46)$$

Hence

$$\sigma_{pe}^2 = \frac{\begin{array}{c} [\phi_e^2 + a^2(1-\phi_u)^2 + 2a\phi_\epsilon(1-\phi_u)]\sigma_u^2 + [(1+a)^2\phi_u^2 + \phi_v^2 \\ +2(1+a)\phi_u\phi_v]a^2\sigma_\epsilon^2 + [(1+a)^2\phi_e^2 + a^2(1+a)^2\phi_u^2 \\ -2a(1+a)^2\phi_e\phi_u]\sigma_v^2 \end{array}}{[a(1+a)]^2} \quad (47)$$

As $\sigma_e^2 \to 0$, we find that

$$\sigma_{pe}^2 \to \frac{\sigma_v^2 \sigma_u^2}{\sigma_u^2 + (1+a)^2\sigma_v^2} \quad (48)$$

and that as $\sigma_e^2 \to \infty$

$$\sigma_{pe}^2 \to \frac{\sigma_v^2 + \sigma_u^2}{a^2} \quad (49)$$

The ratio of (36) to (35), K, is given by

$$K = \frac{(\sigma_v^2 + \sigma_u^2)[\sigma_u^2 + (1+a)^2\sigma_v^2]}{a^2\sigma_v^2\sigma_u^2} > 1 \quad (50)$$

so that the low extreme dominates the high extreme.

We can also show that minimizing σ_e^2 minimizes σ_{pe}^2; for $\frac{\delta\sigma_{pe}^2}{\delta\sigma_e^2} > 0$ throughout the range of σ_ϵ^2.

Differentiating (47) yields:

$$\frac{\delta\sigma_{pe}^2}{\delta\sigma_\epsilon^2} = \frac{\begin{matrix}\phi_u^2\phi_e[1 + a^2 + 2a(\phi_e + \phi_v)] + 4a^2\phi_u^2\phi_v + \phi_v^2\phi_e \\ +4a\phi_e\phi_u\phi_v + (\phi_u + \phi_v)[(1 + a)\phi_u + \phi_v]^2\end{matrix}}{(1 + a)^2} > 0 \qquad (51)$$

Hence welfare is unambiguously maximised by minimising the variance of the money supply, as we would instinctively expect to be the case.

MODELS WITH LONG-TERM NON-CONTINGENT CONTRACTS: THE NEW KEYNESIAN PHILLIPS CURVE

One of the assumptions required for anticipated monetary policy to have no effect on output in the Sargent-Wallace model is that agents are able to act on their information sets. If we have a situation where, for instance, private agents cannot respond to new information by changing their consumption, wage-price decisions, etc., as quickly as the public sector can change any (at least one) of its controls, then scope once again emerges for systematic stabilization policy to have real effects. This insight was developed principally by Fischer (1977a, b) and Phelps and Taylor (1977) in the context of multi-period non-contingent wage or price contracts.

Suppose we have a situation where all wage contracts run for two periods and the contract drawn in period t specifies nominal wages for periods $t + 1$ and $t + 2$. At each period of time, half the labour force is covered by a pre-existing contract. As long as the contracts are not contingent on new information that accrues during the contract period, this creates the possibility of stabilization policy. Firms respond to changes in their environment (say, unpredictable changes in demand which were unanticipated at the time of the pre-existing contract) by altering output and employment at the pre-contracted wage; only contracts which are up for renewal can reflect prevailing information. If the monetary authorities can respond to new information that has accrued between the time the two-period contract is drawn up and the last period of the operation of the contract, then systematic stabilization policy is possible. In other words, while there are no information differences between public and private agents, the speed of response to the new information is different.

The essentials of this argument involve replacing the Sargent-Wallace supply equation (3) with one based on overlapping contracts. Suppose, following Fischer (1977 a, b), that wages are set for two periods so as to maintain expected real wages constant at a 'normal' level. Denote (the log of nominal) wages set in period $t-1$ for period t as ${}_{t-i}W_t$. Then

$$ {}_{t-i}W_t = E_{t-i}p_t \tag{52} $$

(where the log of normal real wages is set to zero) and current nominal wages are

$$ W_t = 0.5({}_{t-2}W_t +{}_{t-1} W_t) = 0.5(E_{t-2}p_t + E_{t-1}p_t) \tag{53} $$

Now let output supply be a declining function of the real wage (from firms maximizing profits subject to a production function with labour input and some fixed overheads):

$$ y_t = -q(W_t - p_t) + y^* \tag{54} $$

We derive from these the new supply equation:

$$ y_t = 0.5q[(p_t - E_{t-2}p_t) + (p_t - E_{t-1}p_t)] + y^* \tag{55} $$

This equation, the New Keynesian (NK) Phillips curve, and its derivation are illustrated in figure 4.2 (for $Y = \exp y$), which also contrasts it with the New Classical (NC) Phillips curve, in a diagram also taken from Parkin and Bade (1988). In figure 4.2, as p rises from its expected level p_0 to p_1, $MPL+p$ (the wage offer for labour where MPL is the log of labour's marginal product) shifts: under NC nominal wages are bid up along SS, under NK wages are fixed at the contract level W_0. Hence the NK Phillips curve, S_{NK}, is flatter than the NC Philips curve, S_{NC}.

Let us use (55) in place of (43), together with the rest of the model (2), (3) and (5); then it can conveniently be written in terms of the Muth solution as:

$$ y_t = q(\pi_0 w_t + 0.5\pi_1 w_{t-1}) + y^* \tag{56} $$

The model solution equation can now be written:

$$ \begin{aligned} \overline{m} + q\mu(\pi_0 w_{t-1} + 0.5\pi_1 w_{t-2}) + w_t = p_t + q(1+\frac{c}{\alpha})(\pi_0 w_t + 0.5\pi_1 w_{t-1}) \\ - c(E_{t-1}p_{t+1} - E_{t-1}p_t) + (1+\frac{c}{\alpha})y^* \end{aligned} \tag{57} $$

The identities in the w_{t-i} are now:

$$ \text{(terms in } w_t\text{)} \qquad 1 = \pi_0[1 + q(1+\frac{c}{\alpha})] \tag{58} $$

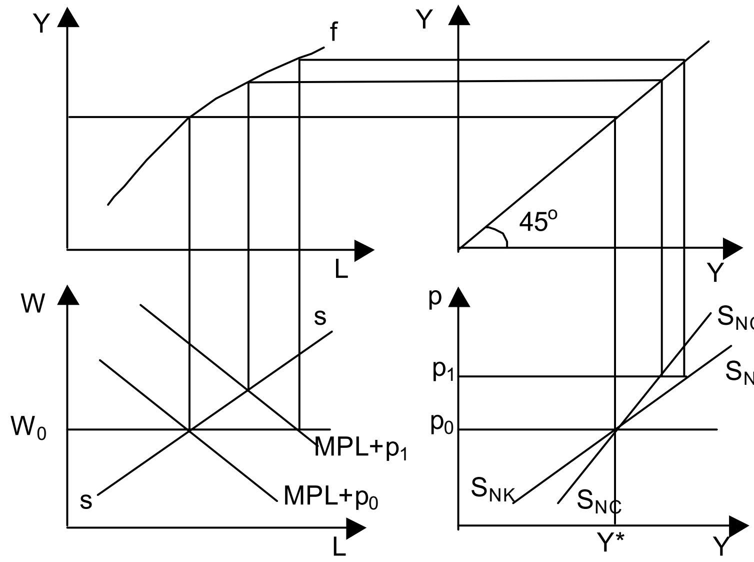


Figure 4.2: The New Keynesian Phillips curve (contrasted with the New Classical)

$$\text{(terms in } w_{t-1}\text{)} \qquad \mu q\pi_0 = \pi_1 + 0.5q(1+\frac{c}{\alpha})\pi_1 - c(\pi_2 - \pi_1) \quad (59)$$

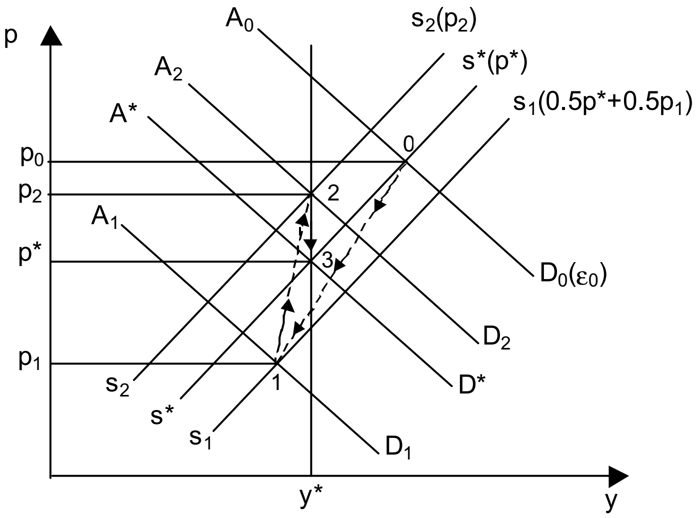
$$\text{(terms in } w_{t-2}\text{)} \qquad 0.5q\mu\pi_1 = \pi_2 - c(\pi_3 - \pi_2) \quad (60)$$

$$\text{(terms in } w_{t-i},\ i \geq 3\text{)} \qquad 0 = (1+c)\pi_i - c\pi_{i+1} \quad (61)$$

Equation (61) gives $\pi_i = 0$ $(i \geq 3)$ applying the stability condition, whence we can solve the other three equations for π_2, π_1, π_0. μ enters the solution for π_1 and π_2 and, since π_1 enters the output supply equation, μ therefore influences the variance of output. In fact in this particular example, it will raise the variance; minimum variance occurs where μ= 0, since this sets π_1=π_2=π_0.

The model is illustrated in figure 4.3. With feedback, $\mu \neq 0$, we obtain the path shown. Suppose there is a temporary aggregate demand shock in $t = 0$, shifting AD to A_0D_0. The supply curve, S^*S^*, whose position is fixed by $E_{t-2}p_t = E_{t-1}p_t = p*$, does not move; we reach point 0. Next period, aggregate demand is shifted by negative feedback on y_0 to A_1D_1. Half the workers have now renegotiated wages in $t = 0$ with $E_0p_1 = p_1$ (their expectations of p_1 in period 0), So the supply curve shifts to S_1S_1. Next period aggregate demand shifts to A_2D_2 as feedback now raises it in response to y_1. All workers have renegotiated wages, fully expecting $p_2 = E_0p_2$ (there is no further surprise in prices relative to wage negotiations); so $y_2 = y^*$. In period 3, finally, feedback stops so both aggregate demand and supply return to normal, that is A^*D^* and S^*S^*.

Of course, the diagram shows clearly that had the aggregate demand curve not reacted with feedback, then in period 1 it would have returned to A^*D^* and workers would not have needed to renegotiate wages, staying on S^*S^*. Thus the path would have been direct from point 0 to point 3, clearly more stable than the path with feedback.



The path with feedback is shown by numbers; the path without feedback is 0, 3, 3...

Figure 4.3: The effectiveness of feedback response in the New Keynesian model

This example illustrates the obvious point that the case for stabilization policy does not rest with showing effectiveness; it is also necessary to show optimality. Nevertheless, it is easy to construct examples where $\mu \neq 0$ minimizes output variance; the reader should investigate one such as an exercise, namely when an adjustment term $+j(y_{t-1} - y*)$ is added to (55). The reader should find that, while π_o is unaltered, the expression for π_1 becomes:

$$\pi_1 = \frac{q\mu\pi_0 + j(\pi_0 - 1)}{1 + c(1 - j)} + 0.5q(1 + \frac{c}{\alpha} - \frac{c\mu}{1 + c})] \tag{62}$$

Since $j(\pi_0 - 1) < 0$, the optimal value of μ found by minimising the variance of $y - y^*$, sets $E_0(y_{t+1} - y*) = 0$ after a shock in $t = 0$, implying that $\pi_0 j + \pi_1 = 0$. It turns out that the optimal value of $\mu = \frac{-j(1+c)}{0.5q}$ is negative, representing the normal 'leaning into the wind' response.

Models with overlapping contracting have been developed by Taylor (1979a, b, 1980) in a series of papers in order to show that important features of the business cycle can be captured by integrating this type of supply curve into standard macroeconomic analysis, and to analyse optimal policy design in such an economy.

Three points of weakness remain in this approach. First, the theoretical basis of non-contingent contracts, in which the nominal wage or price is fixed and quantity is set by demand, has not been established to universal satisfaction. One approach is to assume that in incomplete markets nominal wage contracts offer insurance against real shocks. Another approach is to assume 'menu costs', that is transactions costs in fixing, negotiating and changing prices which are reduced by periodic contracts: this approach (assumed by earlier authors such as Barro (1972), Mussa (1981) and Canzoneri (1980)) has been explored theoretically by, for example, Rotemberg (1983) and Parkin (1986). What is harder to establish is how large these menu costs are and why, given that non-contingent contracts risk losses in the face of shocks, the contracts do not build in contingency clauses (which may be less expensive to write in than the potential losses they avoid). The humdrum answer may be that people are approximately risk neutral for small risks and so reduce menu costs by writing non-contingent contracts that expose them totally to these risks: they only bother with contingency clauses (or other insurance) for the large risks. This tallies with other insurance practices, such as excess clauses and no claims bonuses, which effectively exclude the small risks.

If this is so, then the appearance of non-contingent contracts may be deceptive, the second weakness in this approach. They may be truly non-contingent for only rather trivial shocks. Indeed, closer inspection reveals that actual contracts are exceedingly complex once implicit elements are taken into account. For example, they will typically include bonus, discount and lay-off elements for quantity variation, and indexation (whether formal or informal via shop-floor renegotiation) is frequently found.

The third and related weakness is that, if the authorities were systematically to exploit these contracts in a way not envisaged at the time the contracts were set, then this would presumably lead to differences in the way contracts were written (contract length and indexation clauses are clearly endogenous). In the limit, if the government systematically exploited them in a way that altered agents' outcomes excessively from what they wished, then long-run contracts would be written in such a way that they were equivalent to a succession of single-period contracts so that the scope for stabilization policy would disappear.

For all these reasons (we revert to these issues in chapter 6) there remains considerable doubt as to whether non-contingent contracts can be regarded as a firm basis for modelling and policy formulation. Nevertheless, in practice they are widely used in macroeconomic modelling, since they both appear to be widely used and do pick up usefully the short-term nominal rigidity observed in wages: clearly this implies that we must treat analysis based on such models with caution — but then what is new about that?

One final point: the 'New Keynesian' and 'New Classical' supply curves are often presented as a contrast between 'disequilibrium' and 'market clearing' approaches. This can be misleading. The fact that people may sign non-contingent contracts does not imply either that they are in disequilibrium or that markets do not clear when shocks occur later on during the contract period. Obviously they were aware this could happen (hence no 'disequilibrium') and planned not to vary their price in response to changed demand (hence their supply is elastic, 'clearing' the market). We are dealing with a different (non-auction) market structure entered into voluntarily by rational agents: this implies different properties in response to shocks, that is all. It is quite different from the Keynesian or old Phillips curve assumptions set out in chapter 1.

NEW CLASSICAL MODELS WITH INTERTEMPORAL SUBSTITUTION

The last group of models we wish to examine for feedback effectiveness is New Classical models with intertemporal substitution fully operative. The earlier New Classical models of this chapter suppressed one mechanism, the role of real interest rates in varying labour supply; empirically, this mechanism itself is of doubtful significance but in the open economy movements in real interest rates are associated with movements in the real exchange rate, and these are found to have powerful effects on labour supply, as is discussed in chapter 8. We can think of this closed economy mechanism as a proxy for that powerful open economy mechanism. It has some interesting theoretical implications for policy effectiveness.

As explained in chapter 3, the New Classical supply function is derived from workers or consumers maximizing expected utility subject to a life-time budget constraint (a nicely tractable set-up, which has been explored by Sargent (e.g. 1979a, chapter 16), is the quadratic utility function with quadratic adjustment costs). From such a framework one can obtain a formal supply of labour equation of the form:

$$n_t = f(w_t^e, w_{t+1}^e - w_t - r_t, n_{t-1}) \tag{63}$$

where w is the real wage, n is labour supply (both in logarithms) and r is the real interest rate, which we now treat as a variable. The e superscript denotes expected at time t. The information set assumed in this is last period's macroeconomic information and each worker also observes at the micro level his or her current nominal wages; but we assume that no micro information is usable for signal extraction about macro data. So $w_t^e = W_t - E_{t-1}p_t = w_t + p_t - E_{t-1}p_t$ where W_t is nominal wages (in logs). The first term in (4.63) represents the long-term effect of rising wages on supply, while the second represents intertemporal substitution with a single-period 'future' for simplicity; the third represents costs of adjustment. w_{t+1}^e is standing in for the whole future path of real wages and it will be helpful for our purpose here to treat it as a constant, 'the future normal real wage'.

Let us write the equation in (log) linear form as:

$$n_t = \sigma_0 + \sigma_1(w_t + p_t - E_{t-1}p_t) + \sigma_2 r_t + j n_{t-1} (0 < j < 1) \tag{64}$$

Now juxtapose this with a demand for labour function (65) derived from a simple Cobb-Douglas production function, $y_t = \delta k_t + (1-\delta)n_t$, with a fixed overhead element k_t

$$n_t = y_t - w_t \tag{65}$$

from (65) and the production function we have

$$n_t = k_t - \frac{1}{\delta} w_t \tag{66}$$

or

$$w_t = -\delta n_t + \delta k_t \tag{67}$$

Substituting for w_t from this into (64) gives

$$n_t = \frac{1}{1+a} \frac{a k_t + \sigma_0 + \sigma_2 r_t + \sigma_1(p_t - E_{t-1}p_t)}{1 - qL} \tag{68}$$

where $q = \frac{j}{1+a}$; $a = \delta\sigma_1$.

Using (66) gives us:

$$y_t = (1 - qL)\delta k_t + \frac{1-\delta}{1+a}[ak_t + \sigma_0 + \sigma_2 r_t + \sigma_1(p_t - E_{t-1}p_t)] + qy_{t-1} \tag{69}$$

The steady state values of r_t and y_t (r^*, y^*) will depend on the whole model while k_t we assume to be held constant here; for simplicity we will normalize them all at zero in what follows.

Now write the full model as:

$$y_t = -\alpha r_t + \mu_f(y_{t-1}) \tag{70}$$

$$y_t = dr_t + \beta(p_t - E_{t-1}p_t) + qy_{t-1} \tag{71}$$

$$m_t = p_t + y_t - cR_t + v_t \tag{72}$$

$$m_t = \overline{m} + \mu_m y_{t-1} + u_t \tag{73}$$

$$R_t = r_t + E_{t-1}p_{t+1} - E_{t-1}p_t \tag{74}$$

Equation (70) is the IS curve with the fiscal feedback parameter μ_f. (71) is the supply curve with d, β, q taken from (69) (e.g. $d = \frac{1-\delta}{1+a}\sigma_2$). (72) is money demand, (73) is money supply with feedback parameter, μ_m. (74) is the Fisher identity.

We can immediately establish by (70) and (71) that fiscal feedback is effective, but monetary feedback is not. We obtain

$$r_t = -\frac{\beta(1-\mu_f L)}{(a+d)(1 - \frac{q\alpha + \mu_f d}{a+d}L)}(p_t - E_{t-1}p_t) \tag{75}$$

This expression for r_t then can be substituted into (70) to obtain y_t: clearly the reaction of y_t to unanticipated prices depends importantly on μ_f but not on μ_m. As for $p_t - E_{t-1}p_t$, this is quickly found as:

$$p_t - E_{t-1}p_t = \frac{a+d}{a+d+\beta(\alpha+c)}(u_t - v_t) \tag{76}$$

The intuition behind this result is that fiscal policy is causing *intertemporal substitution* of supply, in order to offset the 'cyclical' effects of shocks. Incidentally, this effect of fiscal feedback is quite independent of whether government bonds are net wealth (discussed in chapter 7). For example, even if private consumption depends only on permanent income and not on transitory income, the government expenditure pattern over time could be altered without affecting the present value of the tax stream, so altering the pattern of total demand over time. Of course, if private consumption depends also on transitory income, then alteration of the temporal pattern of taxes, holding the present value of the tax stream constant, would also have this effect. Such alteration of the patterns of aggregate demand over time then sets off the movement in real interest rates which creates intertemporal substitution in supply.

These points are illustrated in figure 4.4, where it is assumed that $q \approx 0.5$ and $\mu_f \approx -1$; the diagram is in $(r,\ y)$ space instead of the more usual $(p,\ y)$ space, to focus on real interest rate movements. Initially, we assume some money supply shock drives prices up, unexpectedly shifting the SS New Classical Supply curve rightwards; real interest rates drop to point 0 along the original IS curve. Now, if there were no fiscal feedback, $\mu_f = 0$, the SS curve would shift back to S^*S^* at the rate of 50 per cent of $(y_{t-1} - y^*)$ per period. The path would be traced by the arrows along the I^*S^* curve. With fiscal feedback, the IS shifts leftwards to I_1S_1 reaching point 1, where output is at y^*; hence in period 2 we return to to I^*S^* (plainly faster in this example than that with no feedback). The path of output is seen to be fully determined by this diagram; monetary feedback policy enters neither curve, so is ineffective. Only the shock to the money supply enters through $p_t - E_{t-1}p_t$.

The ineffectiveness of monetary feedback policy is negated by the introduction of wealth effects into the IS curve (or the supply curve). Assume that consumers hold long maturity bonds with fixed coupons denominated in money terms: these must be government bonds in this closed economy, since any private sector bonds would net out in a consolidated private sector balance sheet. If we treat these government bonds as net wealth (chapter 7), then variations in the price level brought about by monetary policy, future government expenditure constant, will alter the real value of these and so net wealth and spending.

The point can be seen by adding the term $f(\bar{b} - p_t)$ into (70)[1]. We set $\mu_f = 0$ since fiscal policy will remain effective as before; and to simplify the algebra here we set $q = 0 = \bar{b}$. Using (70) and (71) we now obtain:

$$r_t = -f'p_t - \beta'(p_t - E_{t-1}p_t)(77) \tag{77}$$

where $f' = \frac{f'}{\alpha+d}$, $\beta' = \frac{\beta}{\alpha+d}$. Equating (72) and (73) and substituting into the result (77) for r_t and (71) for y_t we obtain the following equation

[1] $\bar{b}$, the example here, would be the log of a perpetuity bond issue at £100 face value which promises to pay £$100xR_t$ (R_t being the perpetuity rate of interest) for all future periods; its present value will always be £100. The point made here goes through for all types of nominal bonds; only if bonds are indexed will it not do so, for the obvious reason that the path of prices becomes irrelevant to the value of net wealth.

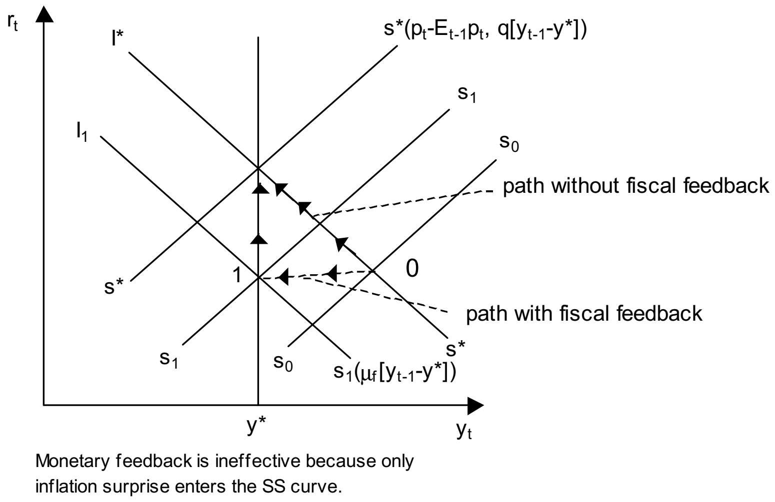


Figure 4.4: The effectiveness of fiscal policy with intertemporal substitution of supply

in p_t:

$$(1-f'd+f'c)p_t + f'\mu_m dp_{t-1} - cE_{t-1}p_{t+1} + cE_{t-1}p_t + (\beta-\beta'd+\beta'c)(p_t-E_{t-1}p_t) - \mu_m(\beta-\beta'd)(p_{t-1}-E_{t-1}p_{t-1}) = \overline{m} + u_t - v_t \quad (78)$$

If $p_t = \sum_{i=0}^{\infty} \pi_i w_{t-i} + \overline{p}$ where $w_t = u_t - v_t$ then the identities in the w_{t-i} are:

$$(w_t) \qquad [(1-f'd+f'c)+(\beta-\beta'd+\beta'c)]\pi_0 = 1 \quad (79)$$

$$(w_{t-1}) \quad (1-f'd+f'c)\pi_1 + f'\mu_m\pi_0 - c\pi_2 + c\pi_1 - \mu m(\beta-\beta'd)\pi_0 = 0 \quad (80)$$

$$(w_{t-i},\ i \geq 2) \qquad \pi_{i+1} - (\frac{1-f'd}{c} + 1 + f')\pi_i - \frac{f'\mu_m d}{c}\pi_{i-1} = 0 \quad (81)$$

Suppose (81) has a unique stable root δ: then $\pi_2 = \delta\pi_1$ where δ depends on μ_m. π_1 also depends on μ_m from (80). Now output is given by (71) using (77), as:

$$y_t = -df'p_t + \alpha\beta'(p_t - E_{t-1}p_t) \quad (82)$$

from which it is apparent that μ_m enters the solution for output too. Wealth effects make monetary feedback policy effective.

The full classical model of labour supply therefore yields two interesting propositions. First, without wealth effects fiscal feedback is effective but monetary feedback is not (this is noted by Sargent, 1979a, chapter 16). Secondly, with wealth effects both are effective. Again, this by no means establishes that feedback rules are beneficial. Sargent (1979a), for example, shows that if welfare is measured by the sum of identical consumers' expected utility, then with no wealth effects zero fiscal feedback is optimal in the case of quadratic utility and production functions. That issue we defer. As for the existence of wealth effects, on which the effectiveness of monetary policy turns, that too is an issue requiring separate discussion; theoretically and empirically it is at this point an open question (chapter 7). Nevertheless, as a minimum it is of some interest that, even without signal extraction from local prices, new classical models in general give scope for fiscal feedback and across a potentially broad class also give scope for monetary feedback. This is contrary to the impression given (no doubt unintentionally) by much of the early literature, although subsequently corrected by Lucas and Sargent (1978).

CONCLUSIONS

We have shown in the context of equilibrium linear models that there is one main set of assumptions under which neither monetary nor fiscal feedback policies have an impact on the variance of output: these are a New Classical (or old Keynesian with rational expectations) Phillips curve of the sort assumed by Sargent and Wallace, without signal extraction from local prices, without intertemporal substitution in supply induced by real interest rates, and without information asymmetries. It would be turgid and counter-productive to list here again all the conditions under which effectiveness of either fiscal or monetary feedback policy is or is not preserved.

The general proposition in this chapter is that rational expectations as such do not rule out counter-cyclical policy, but rather they alter its impact[2], leaving it as an empirical matter whether they do or do not re-

[2] This viewpoint is in principle reinforced by work (e.g. Dickinson et al., 1982) which has taken up a suggestion of Shiller (1978) and shown that if a non-linear version of the Sargent-Wallace supply function replaced their original linear version then even retaining all other assumptions, stabilization policy is feasible. Clearly non-linearity will be a typical feature of models of national economies; neverthe-

duce the variance of relevant macroeconomic variables, and as a further issue whether they do or do not improve welfare. We also considered automatic stabilizers briefly and showed that their distinct role was not nullified by rational expectations, except in the specific New Classical case where people have current access to the same information that triggers the stabilizing mechanism; in this case output will be invariant because people will incorporate the response into their price expectations. Once it is appreciated that stabilization policy is in general not ruled out by rational expectations models, whether New Classical or not, the issue of whether the economy is subject to 'disequilibrium' (a misnomer for non-contingent contracts) ceases to be of special significance: it is just one of a number of questions that have to be confronted in the detailed specification of a rational expectations model. It is the rationality of expectations itself that carries the really powerful implications for the nature of the impact of stabilization policy.

less, it seems doubtful that this source of stabilization leverage is of much practical importance.