7

Monetary Policy under Financial Innovation and Deregulation

Robert E. Hall

I. Introduction

No monetary policy is immune from the destabilizing effect of financial change. In this paper, I look first at a simple model of an open economy, subject to the three types of shocks that are relevant for stabilization: financial shocks, spending shocks, and price shocks. I argue that, of the three, the financial shocks are by far the largest concern for monetary policy. The basis of the argument is the proposition that controlling the growth of nominal GNP is a sensible compromise between the goals of price stability and output stability. Spending and price shocks are shown to have little impact upon nominal GNP, even though they have important effects separately on real GNP and the price level.

Although financial shocks are the predominant source of fluctuations in nominal GNP and therefore the source of the most trouble in monetary policy, it is less clear that monetary policy should actively try to offset financial shocks. I show that the shocks are relatively difficult to predict. Over the past two decades of U.S. history, most of the shocks have occurred during financial panics, most often preceding recessions. The most important exception was a large stimulative shock that occurred the year after the most significant financial deregulation.

The paper concludes by pointing out a further move toward financial liberalization that could have significant effect in reducing the magnitude of financial shocks. If the central bank paid near-market interest rates on reserves, and expanded the stock of reserves to meet the resulting increased demand, the incidence of destabilizing panics would fall. With an economy saturated in reserves, a policy of constant growth of the monetary base could be expected to provide a reasonably smooth evolution of nominal GNP.

2. A Model of the Impacts of Financial, Spending, and Price Shocks

In this section I will work out a model of an open economy with gradually adjusting prices, subject to random shocks in financial markets, in aggregate spending, and in the price level. The model combines the IS-LM model of income determination in the short run with a price adjustment equation. The latter takes account of both aggregate demand effects on prices and the effects of changes in the exchange rate.

I will characterize the financial side of the economy in terms of the LM curve:

$$y = \mu r + m - p + \varepsilon \tag{2.1}$$

Here y is the log of real GNP, r is the interest rate, m is the log of the monetary base, p is the log of the price level, and ε is a random disturbance. The LM curve describes the combinations of output, interest rates, and prices that equate the supply and demand for the monetary base. In this and the subsequent equations, the variables are expressed as deviations from trend. Moreover, the economy is viewed as starting in the immediately preceding year on the trend path of all variables. That is, the LM curve shows the combinations of the changes in real GNP, interest rates, and price levels that equate the demand for the monetary base to the trend increase in the supply. The random shift in the LM curve, ε, will have a major role in the ensuing discussion. Both changes in financial regulations and shifts in consumer preferences among monetary assets will be reflected in ε.

The model characterizes the spending side of the economy in terms of the IS curve:

$$y = -\alpha r + \eta \tag{2.2}$$

The IS curve describes the combinations of real GNP and the interest rate that equate the demand and supply of goods and services. Spending is perturbed by a random shift, η. Again, y stands for the growth of real GNP and r for the change in the interest rate. Although spending is presumably controlled by the real interest rate, I will assume that no important changes occur in expected inflation from one year to the next.

The third equation describes the process of price adjustment:

$$p = \phi y - \delta r + \nu \tag{2.3}$$

The rate of increase, p, of the price level is positively related to real GNP, y, negatively related to the interest rate, r, and is perturbed by a

shock, ν. The first term is the standard Phillips curve relation of inflation to the excess demand for goods and services. The second term is the reduced form of the relationship described by Rudiger Dornbusch (1976) for an economy with a floating exchange rate and gradually adjusting prices: an event which raises the interest rate also causes appreciation of the currency, which lowers the price of tradable goods and so lowers the overall price level. The disturbance, ν, incorporates all sources of variation in the price level apart from the excess demand and tradables effects captured by the other terms. It includes both spontaneous domestic inflation shocks, such as bursts of trade union militance, and influences from the world economy not related to changes in the domestic interest rate, such as oil price increases and jumps in the exchange rate.

Let me start the discussion of the properties of the model by considering the case of unresponsive prices: $\phi = \delta = 0$. In this case, the price level next year is determined just by the random price shift, ν. The solution of the model is

$$y = \theta m + \theta \varepsilon + (1 - \theta)\eta - \theta \nu \tag{2.4}$$

$$p = \nu \tag{2.5}$$

The sum of these two equations is the equation for the change in nominal GNP (since the variables are logs):

$$y + p = \theta m + \theta \varepsilon + (1 - \theta)(\eta + \nu) \tag{2.6}$$

All of the relevant properties of the economy are described by the parameter θ. In terms of the original parameters, it is

$$\theta = \frac{1}{1 + \mu/\alpha} \tag{2.7}$$

If money demand is fairly unresponsive to the interest rate (μ is small) or spending is fairly sensitive to the interest rate (α is large), then θ is close to one. In this case, the spending disturbance, η, is relatively unimportant for real GNP. The financial disturbance, ε, and the price disturbance, ν, affect real GNP with nearly unit elasitcity. However, because the price disturbance, ν, affects real GNP with elasticity -1, and affects the price level with elasticity of $+1$, that disturbance has little effect on nominal GNP. The only disturbance that is important for nominal GNP is the financial disturbance, ε. To the extent that monetary policy is concerned with keeping nominal GNP growth on target, the only important issue is the financial disturbance. The spending disturbance has little impact on real or nominal GNP. The price dis-

turbance has a strong effect on real GNP and prices, but in opposite directions.

A modern open economy with financial deregulation has a θ close to one, I will argue. First, money demand is relatively inelastic with respect to the interest rate. Banks are free to pay close to market rates on all deposits. Non-interest-bearing currency is a relatively small part of the total money stock. When interest rates rise, the public does not substitute away from money vigorously because their earnings on money rise more or less in parallel with interest rates. Second, spending is sensitive to interest rates. In addition to the response of total investment to the interest rate, the division of spending between domestic and foreign sources is effectively highly sensitive to the interest rate. A small increase in the domestic interest rate brings appreciation in the currency and a less competitive position in tradables. In other words, in an open economy without trade barriers or capital controls, fluctuations in domestic spending cause corresponding fluctuations in the current account rather than in GNP.

The fixed-price analysis is too simple for two reasons. First, changes in the domestic economy bring changes in the exchange rate, with consequent changes in the price of tradables and thus in the overall price level. Second, wage rates and prices of nontradables are somewhat responsive to the degree of excess demand or supply. The solution to the model with these two factors, captured by the coefficients ϕ and δ respectively, is

$$y = \theta\gamma\left(m + \varepsilon + \frac{\delta + \mu}{\alpha}\eta - \nu\right) \tag{2.8}$$

$$p = \theta(1 - \gamma)(m + \varepsilon)$$
$$+ \left[\theta(1 - \gamma)\frac{\delta + \mu}{\alpha} - \frac{\delta}{\alpha}\right]\eta + [1 - \theta(1 - \gamma)]\nu \tag{2.9}$$

Here θ is a derived parameter that describes the overall effect of a disturbance:

$$\theta = \frac{1 + \phi + \delta/\alpha}{1 + \phi + \mu/\alpha + \delta/\alpha} \tag{2.10}$$

As in the case of fixed prices, θ is close to one if money demand is insensitive to the interest rate (μ close to zero) or if spending is highly sensitive to the interest rate [α large]. But θ will also be close to one if prices are highly flexible, either because ϕ is large or because δ is large.

The derived parameter γ controls the distribution of effects of shocks

between real GNP and the price level. It is

$$\gamma = \frac{1}{1 + \phi + \delta/\alpha} \tag{2.11}$$

Note that γ is one when the price level is unresponsive [ϕ and δ are zero) and approaches zero when either or both of those coefficients become large.

The positive impact of a financial disturbance, ε, on real GNP depends on the product of θ and γ. That product is at its highest level of 1 in an economy with rigid prices and either interest-inelastic money demand or highly interest-elastic aggregate demand. The impact of ε on the price level is at its highest level, also 1, in the same economy with completely flexible prices. The influence of the spending shock, η, on real GNP is described by $\theta\gamma(\delta/\alpha + \mu/\alpha)$. If spending is highly interest-elastic (α is large), spending shocks have little effect on real GNP-they are dissipated in modest changes in the interest rate. However, unlike the earlier case of price rigidity, with flexible prices, it is not sufficient that money demand be interest-inelastic ($\mu = 0$) in order that the spending shock not affect real GNP. If δ/α is not too small, that is, if the decline in prices associated with the higher interest rate from a positive spending disturbance is reasonably large, then real GNP will respond through a different channel: A shock raises the interest rate, appreciates the currency, lowers the price level, and shifts the LM curve to the right. Again, this mechanism is important only if the interest-elasticity of spending, described by α, is not too high. In particular, if the higher value of the currency brings a large increase in the current account deficit, then α is high and the effect through this channel is small.

The negative effect of a price shock, ν, on real GNP is controlled by the same coefficient, $\theta\gamma$, as in the case of a financial shock. Again, an economy with a rigid price level and a horizontal IS curve or a vertical LM curve will be most sensitive to this type of shock.

With regard to the price level, a financial disturbance, ε, affects the price level over the first year according to $\theta(1 - \gamma)$. This expression has its maximum value of one in the case of an economy with perfectly flexible prices and horizontal IS or vertical LM curves. For the spending shock, η, there are two conflicting effects. First, to the extent that the shock raises output, aggregate demand rises and the price adjustment process raises the price level. The elasticity for this effect is $\theta(1 - \gamma)$ ($\delta/\alpha + \mu/\alpha$). Second, the interest-rate response appreciates the currency and depresses the price level; the elasticity governing this relation is $-\delta/\alpha$. In an economy with weak price adjustment for non-

tradables (low ϕ) or interest-inelastic money demand (low μ), together with some degree of sensitivity of prices to the interest rate through the exchange rate (δ positive), the relationship will be negative. A spending shock will depress the price level.

The impact of a price shock, ν, on the price level is described by the expression $1 - \vartheta(1 - \gamma)$. The impact is always positive, but is smaller in an economy where price shocks have large real effects (high θ) and where prices are flexible (low γ).

If monetary policymakers are specifically concerned with nominal GNP, they will need to make use of the sum of the earlier expressions for y and p:

$$y + p = \theta m + \theta \varepsilon + [\theta(\delta/\alpha + \mu/\alpha) - \delta/\alpha]\eta + (1 - \theta)\nu \qquad (2.12)$$

Note that the price-flexibility coefficient, γ, does not appear in this expression. It controls the division of the effects of the disturbances between real GNP and the price level, and is irrelevant when the two variables are added together. The impact of a financial shock, ε, on nominal GNP is described by θ. In an economy with either interest-inelastic money demand (μ close to zero) or highly interest-elastic spending (α high), θ will be close to one and the impact of ε on nominal GNP will be almost unit-elastic.

The effect of a spending shock, η, on nominal GNP is described by the coefficient $\vartheta(\delta/\alpha + \mu/\alpha) - \delta/\alpha$. Recall that the spending shock unambiguously raises real GNP but may decrease the price level. If the negative effect on the price level is strong enough, nominal GNP may fall in the face of a positive spending shock. This will happen if δ exceeds α, that is, if the negative effect on the price level (in percentage points) of an increase in the interest rate exceeds the negative effect (also in percentage points) on real GNP in the IS curve of an increase in the interest rate. As this appears to be an unlikely case, I will assume that the effect of a spending shock on nominal GNP is at least slightly positive. The effect of a price shock, ν, on nominal GNP is controlled by the simple expression $1 - \theta$. In a high-θ economy with a flat IS curve and a steep LM curve, price shocks will have little effect on nominal GNP. Although a price shock has an adverse effect on the economy by lowering real GNP with an elasticity $\theta\gamma$, the elasticity of the price level with respect to the shock is $1 - \theta(1 - \gamma)$, so the net effect is an elasticity of $1 - \theta$. Note that the degree of price flexibility has relatively little role in determining the effect of a price shock on nominal GNP, even though it is very important in distributing the effect of the shock between real GNP and the price level.

3. *Implications of Innovation and Deregulation*

Changing financial markets and institutions have two roles in the model I have just presented. First, individual steps in the process of financial change appear as individual financial shocks, ε. For example, if deregulation permits the sudden growth of transaction accounts with low reserve requirements, a positive ε will occur. For a given interest rate, a higher level of real GNP will be consistent with the equality of supply and demand for the monetary base. As I indicated at the beginning of the last section, I am assuming at this stage that the central bank does not adjust the base to try to offset the change in the demand schedule for the base.

The second important influence of financial liberalization is in changing the slopes of the crucial schedules. There are good reasons to believe that recent changes in many countries have tended to raise the value of θ in each of them. Let me repeat the definition of θ and the coefficients that go into it:

$$\theta = \frac{1 + \phi + \delta/\alpha}{1 + \phi + \delta/\alpha + \mu/\alpha} \tag{3.1}$$

ϕ: response of price level to demand (elasticity)
δ: response of price level to interest rate (semi-elasticity)
α: response of spending to interest rate (semi-elasticity)
μ: response of base demand to interest rate (semi-elasticity)

Payment of interest on demand deposits and the lowering of reserve requirements diminishes μ and raises θ closer to 1. The demand for the monetary base arises in part from the demand for reserves, and that demand derives in turn from the demand for those monetary instruments subject to reserve requirements. With low reserve requirements and competitive interest rates on reservable accounts, the demand for reserves is not very responsive to market rates. Account holders have little incentive to shift into other forms of wealth when interest rates rise. However, as long as reserves do not pay market rates themselves, rates paid by banks on reservable accounts will not vary exactly with market interest rates and μ must be a little bit positive. Further, no major nation, so far as I know, has pushed liberalization to the point of allowing private, interest-bearing currency that might displace the non-interest-bearing government currency. In theory, μ should also be somewhat positive because the public should substitute away from currency in times of higher interest rates. Empirical evidence on this last point is weak.

Where liberalization has increased the openness of the economy, the critical parameter θ has increased on that account as well. An open economy has a higher α than a closed one because a higher interest rate attracts resources from trading partners. The IS curve of a highly open economy is flat. A large decline in production, y, can occur when the interest rate rises only slightly because investors and consumers will satisfy their wants with imported products and domestic producers will export less. Capital and import controls thwart this process; as they are dismantled, the value of α rises. To a certain extent, the same liberalization will raise δ and make the domestic price level more sensitive to the interest rate. However, the net effect of increases in α and δ is almost certainly to raise θ.

At the end point of liberalization, the LM curve will be vertical and μ will be zero. In such an economy, θ will be one and the expression for the relation between the shocks on the economy and nominal GNP is very simple:

$$y + p = m + \varepsilon \tag{3.2}$$

That is, the only disturbance that influences nominal GNP is the financial disturbance. Spending shifts and price shocks do not affect nominal GNP even though they both affect real GNP and the price level. Let me emphasize this point in a

> *Proposition.* In a fully deregulated economy where monetary policy is concerned with nominal GNP, the *only* types of disturbances that need be considered are financial. Spending and price shocks are irrelevant.

4. The Logic of Nominal GNP Targeting

I have written elsewhere at length on nominal GNP targeting and its generalizations (Hall 1984). Let me quickly summarize the case here. Consider the rather general problem of conducting stabilization policy in an economy subject to the disturbances considered in Section 2 of this paper: financial, spending, and price shocks. The goal of policy is to minimize a weighted average of the variances of the departures of output and inflation from their target values. The general solution can be characterized as choosing a policy that stabilizes $Ay + p$. A is a coefficient that depends on the relative social cost of output as against inflation fluctuations. A very strict policy that kept inflation close to zero at all times would have a small A; a policy that aimed mainly for full employment would have a large A. Nominal GNP targeting cor-

responds to the value $A = 1$; it is intermediate between a hawkish anti-inflation policy and a dovish full-employment policy.

5. Conducting Monetary Policy

Next I will consider the problems of conducting monetary policy in the face of financial and other shocks. I will assume that monetary actions taken in one year have little effect until the next year, so that the problem of this year's policy is to set in motion a policy that will achieve a desired effect under next year's conditions. I further assume that the goals of policy can be expressed as achieving a predetermined level of nominal GNP next year.

I will write the solution to the model as

$$(y + p = \theta m + \theta \varepsilon + \psi \eta + (1 - \theta)\nu \tag{5.1}$$

Recall that the monetary base enters with the same coefficient, θ, as does the financial shock, ε. In a modern economy, I would expect θ to be close to one, so the monetary base is a powerful determinant of nominal GNP one year hence. I have also substituted the new coefficient, ψ, for the more complicated expression governing the response of nominal GNP to the spending shock, η. I would expect ψ to be close to zero. As before, the price shock, ν, has a coefficient of $1 - \theta$, which would also be close to zero under the conditions I have in mind.

If the target of monetary policy is to achieve a level of nominal GNP, g, and if policymakers could anticipate the shocks perfectly, then the appropriate level of the monetary base is:

$$m = -\varepsilon + \frac{1}{\theta}[g - \psi \eta - (1 - \theta)\nu] \tag{5.2}$$

Independent of any parameters, monetary policy should fully offset the financial shock, ε. The other shocks should be offset by coefficients ψ/θ and $[1 - \theta)/\theta$, which will be small.

Of course, policymakers will not know the values of the forthcoming shocks and will not be able to achieve the nominal GNP target exactly. Instead, they will make use of forecasts of the shocks. Because spending and price shocks are not easy to forecast a year in advance, and because those shocks receive little weight in the policy formula anyway, it is probably appropriate to drop them from the formula. The simpler formula is

$$m = -\varepsilon + \frac{1}{\theta}g \tag{5.3}$$

Now ε is interpreted as the best available forecast for the financial shift over the forthcoming year. The monetary policy rule is, in words, *expand the monetary base by the desired growth in nominal GNP, adjusted for the elasticity of nominal GNP with respect to the base, less the expected financial shift.*

In the steady state, the desired growth of nominal GNP is likely to be the same from year to year—it will be the natural growth rate of real output. The rule recommends that the growth of the monetary base be equal to that constant, natural rate plus an adjustment for expected financial shifts. The rule recommended by monetarists is the same except that they propose to ignore the financial shifts. How different are the two recommendations?

The answer rests on a single issue, the predictability of the financial shifts. Figure 1 shows a measure of the shifts that have occurred in the United States since 1962. It plots the GNP velocity of the monetary base, that is, the ratio of nominal GNP to the monetary base (as adjusted by the Federal Reserve Board for changes in reserve requirements). Velocity has risen along a steady trend, as the public has gradually substituted away from currency and reservable deposits as methods for carrying out transactions. The upward trend is interrupted occasionally by declines in velocity, usually associated with recessions or financial crises. The first one in the figure occurred in 1966. Similar declines in velocity occurred in 1970, 1974, and 1980, each coinciding with a recession. Then velocity jumped upward in a completely unprecedented way in 1981, largely as a result of major regulatory changes enacted in 1980. The recession of 1982, which brought the economy to a lower level of real output, compared to potential, than in any recession since the great depression, was accompanied by a dramatic decline in velocity.

The experience summarized in Figure 7.1 makes it plain that the most recurrent pattern of financial shocks are those that precede recessions or coincide with periods of financial stress. When panic hits the financial system, the public tries to shed less liquid assets and move into currency and reservable accounts. Base velocity declines as a result. But the single biggest shock to velocity was the upward spurt following deregulation in 1980.

Macroeconomic forecasters have not been notably successful in predicting the financial crises that periodically grip the U.S. and other economies. However, the velocity shifts of Figure 7.1 are somewhat predictable. For example, a regression with the annual change in velocity as the dependent variable and the lagged change in velocity and the lagged 6-month Treasury bill interest rate as predictors explains about
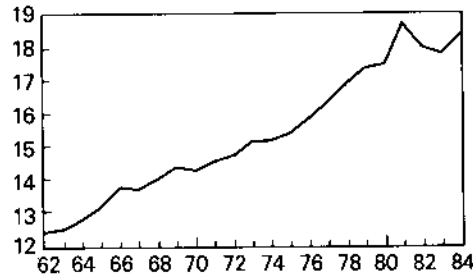
Figure 7.1
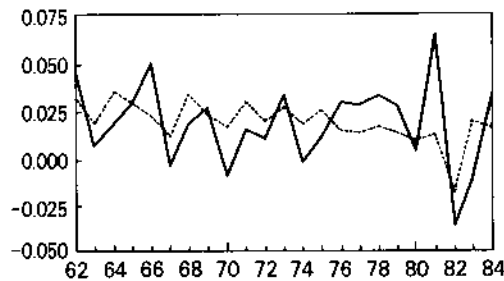Velocity of the U.S. Monetary Base, 1962–84

Figure 7.2
Actual Change in Base Velocity (Solid Line) and Predicted Change (Dotted Line), United States, 1962–84

25 percent of the variance in the dependent variable. Figure 7.2 shows the explanatory success of the simple regression.

The regression does not incorporate any information available a year in advance about financial deregulation. In 1980, observers were aware that important financial change was in the works, but it is not clear that they could have predicted that a sharp jump in base velocity was about to occur.

As a general matter, it is far from clear that the financial shocks, ε, that are much the most important consideration in the theory of monetary stabilization, are sufficiently forecastable as to make the activist policy of equation 5.3 materially different from the monetarist policy of ignoring ε and simply raising the base by a constant percent each year. However, it is abundantly clear that εs have been an important influence on the U.S. economy in past decades, especially in the early 1980s.

6. Financial Change to Reduce the Incidence of Shocks

Although important changes have occurred in the U.S. and other financial systems in recent years, the basic vulnerability of the systems to panics which cause velocity to fall has remained unchanged. In percentage terms, the contraction of velocity in 1982 was the worst of the two-decade span of the figures in the previous section. Panics are times when the public tries to shift into currency and reserves. When the central bank does not accommodate the shift, recession follows, through the mechanism outlined in Section 2 of this paper. In the United States, precisely this observation led to the creation of the Federal Reserve, whose instructions were to expand the base as necessary to head off panics. However, the Federal Reserve, just as central banks in many other countries, has to be cautious in accommodation. History shows it is all too easy for a series of accommodations to turn into a policy of chronic inflation.

Elsewhere (Hall, 1983), I have described a program of monetary change that would avoid the conflict between accommodation and inflation. The essence of the idea is to pay interest on reserves at close to market rates. Paying interest on reserves has long been recommended by economists on microeconomic efficiency grounds. Holders of reserves needlessly economize on their balances when interest rates are high. At the optimum, the opportunity cost of holding reserves as against other financial instruments would be essentially zero. Milton Friedman (1969) advocated a policy of chronic deflation in which nominal interest rates would be close to zero as one way to attain the optimum where the economy is saturated in reserves. But paying the market rate on reserves is an alternative route to the same end without the inconvenience of continuing change in the price level.

The macroeconomic case for interest-bearing reserves is less familiar. Obviously, the demand for reserves would be far higher than it is today if they bore interest. If the central bank pays interest on reserves, it has to provide a much higher volume of reserves. Just paying interest without expansion of the quantity would be a significantly deflationary move. In the United States, if the Federal Reserve began a policy of paying interest on reserves at the three-month Treasury bill rate less 20 basis points, it might find it necessary to expand reserves from $40 billion to $300 billion.

Were a significant fraction of the outstanding national debt in the form of interest-bearing reserves, it stands to reason that the incidence of financial shocks would be reduced. Today, a panic in the United States causes investors to question the safety of trillions of dollars of

financial instruments other than base money, and to try to move into only about $200 billion in the monetary base. If the base were close to $500 billion instead, the financial shift in percentage terms would be far smaller. Saturation in reserves would bring increased financial stability as well as microeconomic efficiency.

A switch to near market rates of interest on reserves together with a large increase in the volume of reserves would not change the central bank's basic responsibility for stabilization. But it would make it far easier, because the ε shocks would be much smaller. A policy of constant growth of the monetary base would give better price and output stability under reserve saturation than under a restricted monetary base.

References

Dornbusch. Rudiger 1976. Expectations and Exchange Rate Dynamics, *Journal of Political Economy*, vol. 84, December, pp. 1161–1176.

Friedman Milton. 1969. The Optimum Quantity of Money, Chapter 1 in *The Optimum Quantity of Money and Other Essays*. Chicago: Aldine, 1969, pp. 1–68.

Hall Robert E. 1984. Monetary Strategy with an Elastic Price Standard, in *Price Stability and Public Policy*, Federal Reserve Bank of Kansas City.

———. 1983. Optimal Fiduciary Monetary Systems, *Journal of Monetary Economics*, vol. 12, pp. 33–50, July.