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THE MACROECONOMIC IMPLICATIONS OF FINANCIAL DEREGULATION

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ABSTRACT

The Macroeconomic Implications of Financial Deregulation*

This paper explores the possible macroeconomic consequences of financial deregulation in an institutional environment where deregulation raises risks in banking. The central bank is assumed to maximize an objective function an argument of which is the probability of bank failure. It is then shown that the usual trade-offs between policy objectives imply that financial deregulation will affect optimal monetary policy: deregulation will lead to more interest rate smoothing than would otherwise be the case. Because of restricted entry into banking, deregulation will also call for some inflation, despite the fact that the central bank prefers no inflation. The framework for the discussion is a Poole model with a Lucas supply function and imperfect wage indexation. The analysis deals separately with the stationary equilibrium and the movement from regulation to deregulation. The transition towards deregulation raises special problems, which are likely to require a more gradual approach towards the stationary equilibrium.

JEL classification: 310

Keywords: financial deregulation, optimal monetary policy, probability of bank failure, the Poole model, interest rate smoothing, emergency lending, inflation

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NON-TECHNICAL SUMMARY

Concern has been voiced recently over the possible macroeconomic implications of the current wave of financial deregulation in the West and the associated increase in the vulnerability of banks. Henry Kaufman and Benjamin Friedman argue that the problem of bank failure could lead to more expansionary monetary policy in the US. The rise in the vulnerability of banks is not open to question: it is reflected in rises in bad debts, reductions in credit ratings, and increases in bank failures. However, the connection of financial deregulation to these recent developments in banking is not as obvious. Ambiguities result from differing situations in various countries. Thus, in the United States the change in the operating procedures of the Federal Reserve in 1979 contributed to the riskiness of banking without bearing any relationship to deregulation. The rise in FDIC insurance in 1980 probably exerted a similar impact on bank risks, again having little to do with deregulation. More generally, the complex patchwork of freedom and regulation in finance in the US makes it difficult to say how much deregulation has really happened there and whether the main impact of any particular deregulatory action is not primarily the result of remaining regulatory features (as when the removal of a legal ceiling on interest rates makes a geographical restriction more binding). The same ambiguities about the impact of deregulation on bank risks are not necessarily present everywhere. In France, for example, the authorities ceased to fix the interest rate on the money market at the opening of every session on one specific day, December 1, 1986. Since then, interest rate volatility on the money market has risen by every conceivable measure, and bank security has never been the same. Most countries probably fall in between the complex US example and the crystal-clear French one. But it can probably be said that in circumstances where extensive financial deregulation is envisaged, a rise in the riskiness of banking is usually contemplated. All of the members of the European Community with highly regulated financial markets – Spain, Portugal, Greece, Ireland and, to lesser degrees, Italy and Denmark – who expect much higher capital market integration in January 1993, if not earlier, seem to consider the change as a basic risk for their banks. In any effort to deal with financial deregulation on a theoretical plane, some choice of assumptions about the institutional context is necessary. In this paper, our choice is to view financial deregulation as implying more risks in banking.

We analyse whether these fears of the macroeconomic implications of financial deregulation can be given a general theoretical foundation. By macroeconomic implications we mean ones which bear on macroeconomic aggregates or macroeconomic stability or both. This is not necessarily the same question as the more familiar one of whether financial regulation is required for monetary control and therefore for effective monetary policy. To this last question a negative answer is usually given, on the grounds that anything the central bank can do with bank regulation it also can do without it, provided that it retains control

over its own balance sheet. But the macroeconomic implications of financial deregulation can be understood as relating to *optimal* policy. The answer to the question whether deregulation *ought* to change policy depends critically on the issue whether bank failure is a legitimate concern of the central bank. If it is, macroeconomic implications do follow.

There is a liberal wing of the profession that contests the legitimacy of any central bank concern with individual bank failure, and therefore questions the case for official aid to banks in difficulty. But the argument of this wing is simply the sceptical one that the legitimacy of such aid has never been adequately demonstrated. The partisans of this view have shown that it is possible to construct business cycle models in which the central bank cannot improve welfare through any sort of intervention. They have done so using models in which all of the shocks are real. Yet what are the productivity shocks that can explain the past history of bank crises since the nineteenth century? The answer is not clear. In addition, those on the opposite side have exhibited the vital role of bank failures and private debt in the Great Depression, and they have pointed to various arguments for the essential role of the central bank as lender of last resort based on the possible contagion of individual bank failure elsewhere in the financial environment, and the external effects of bank failure on non-financial firms and households. The issue therefore is open. Perhaps the most widely shared position, among Keynesians and liberals alike, is to agree that the central bank should act as lender of last resort but to insist that macroeconomic policy nonetheless should not be affected. Yet this last position, we maintain, will not hold. If central bank concern with bank failure is appropriate, then in any sensible economic model the usual trade-offs between different objectives will argue against any such strict separation between optimal banking and optimal macroeconomic policy.

For the purposes of the analysis, we take a very schematic view of financial deregulation. Deregulation is supposed to mean, above all, that the banks can charge whatever they want for their services and can offer whatever they want to attract deposits. In addition, they can also hold any type of financial asset and they can issue any liability except currency. Within this framework, many sorts of regulations are possible, including legal reserve requirements, required capital-asset ratios, mandatory deposit insurance, and rules of access to discount-desk facilities at the central bank. The central bank may also act as a lender of last resort in a certain predictable fashion. Evidently therefore deregulation is not interpreted to mean the absence of prudential rules and a certain safety net. We take the system of rules and the safety net for granted. Whether both of them are optimal is not our problem, though very important. Two other features of the environment are basic. First, the government has a monopoly over the issue of currency. Second, there are barriers to entry into banking. The first feature avoids problems of indeterminancy which have been recently stressed. The second feature means the absence of perfect competition in banking. Unfettered entry into banking has few advocates in practice and is not generally part of the deregulatory agenda.

On this view of deregulation, we draw a sharp distinction between the stationary deregulatory environment and the transition from regulation to deregulation, and we deal with the stationary deregulatory environment first. To do so we employ a Poole-like model where shocks are buffeting the economy while the monetary authorities try to affect the variance as well as the level of prices in order to avoid unwanted repercussions on the level and the distribution of output. The authorities are also concerned with the probability of bank failure. The model further includes a Lucas supply function and imperfect wage indexation. Under these conditions, it is shown that the usual trade-offs between policy objectives imply that financial deregulation will require extra smoothing of interest rates. It is further shown that because of the barriers to entry into banking, permanent inflation will benefit the banks. Hence some inflation will be optimal. To explain, expected inflation raises the differential between the interest rate the banks receive on assets and the one they pay on liabilities. If entry is restricted in banking, the resulting profits – nominal and real – are not returned entirely to customers through lower service charges and are not fully eroded through off-balance-sheet transactions but will be partly retained by the banks. As a result, inflation will reduce the probability of bank failure. By inflating, the authorities can therefore benefit the banks while avoiding some extra smoothing of interest rates. This is why some inflation will prove warranted.

The problems of the transition from regulation to deregulation result largely from expectations. Interest rate variance hurts the banks, but the damage is worse if the variance is unexpected. Thus if the banks expect less interest rate variance than they get, the transition to higher interest rate variance will be harsher in the deregulatory phase. A strategic problem ensues. For the banks know that the central bank is concerned with their survival, and therefore may be able to infer from the official welfare function that even if the authorities threaten to make a once-and-for-all move to the new equilibrium, they will not do what they say. In the event, the optimal smoothing of the transition may depend partly on the pressure that the banks are able to impose on the central bank not to raise interest rate variance above the level that they expect. The central bank must nonetheless be prepared to cause some unexpected interest rate variance, or otherwise the march towards the optimum stationary equilibrium could stall entirely. Another factor requiring some smoothing of the adjustment path, quite independently, is parameter uncertainty. The optimal path toward the stationary optimum, consequently, is a very complex affair.

I. Introduction

A lot of concern has been voiced recently about the possibility that the current wave of financial deregulation in the West and the associated increase in the vulnerability of banks may have some macroeconomic implications (see BIS (1984)). Kaufman (1986) and Friedman (1986) expressly argue that the problem of bank failure could lead to more expansionary monetary policy in the U.S. The rise in the vulnerability of banks is not open to question: it is reflected in rises in bad debts, reductions in credit ratings, and increases in bank failures ((Seidman (1986), and BIS (1986) (the Cross Report)). However, the connection of financial deregulation to these recent developments in banking is not as obvious. Ambiguities result from differing situations in various countries. Thus, in the United States the change in the operating procedures of the Federal Reserve in 1979 contributed to the riskiness of banking without bearing any relationship to deregulation. The rise in FDIC insurance in 1980 exerted a similar impact on bank risks in this country, again having little to do with deregulation (see Hall (1984) and Benston (1986)). More generally, the complex patchwork of freedom and regulation in finance in the U.S. makes it difficult to say how much deregulation has really happened there, and whether the main impact of any particular deregulatory action is not largely the creature of remaining regulatory features (see especially Eisenbeis (1986)).(1) The same ambiguities about the impact of deregulation on bank risks are not necessarily present everywhere. In France, for example, the authorities ceased to fix the interest rate on the money market at the opening of every session on one specific day, December 1, 1986. Since then, interest rate volatility on the money market has risen by every conceivable measure (Lévy-Lang and Henrot (1987) and Lunel-Jurgensen (1987)), and bank security has never been the same. Most countries probably fall in between the complex U.S. example and the crystal-clear French one. But it can probably be said that in places where a lot of financial deregulation is envisaged, a rise in the riskiness of banking is usually contemplated. All of the members of the European Community with highly regulated financial markets – Spain, Portugal, Greece, Ireland, and to lesser degrees, Italy and Denmark – who expect much higher capital market integration in January 1993, if not earlier, seem to consider the change as a certain risk for their banks. In any effort to deal with financial deregulation on a theoretical plane, some choice of assumptions about the institutional context is necessary, and ours will be to view financial deregulation as implying more risks in banking.

The question we propose to treat, on this basis, is whether the fears to which we alluded at the start can be given a general theoretical foundation: that is, whether financial deregulation has any consequences for monetary policy, and through this channel, may have some macroeconomic implications. By macroeconomic implications we mean ones which bear on macroeconomic aggregates or macroeconomic stability or both. This question can be given either a narrow or a broad interpretation. On the narrow one, the question is whether financial deregulation may interfere with monetary control. The answer in this case is pretty clear. While there may be some interference with monetary control during a deregulatory transition, it has been shown time and again that as long as the money multiplier remains determinate, then in the new steady state, there is no reason why deregulation should impede monetary control. If only the authorities can retain control over their own balance sheet and therefore over the monetary base, monetary control is still possible (see Baltensperger and Dermine (1987) and Goodfriend and King (1988)). The question we have in mind is a broader one, concerning *optimal* policy, which is whether optimal monetary policy remains the same under financial deregulation. The answer to this next query, we shall argue, is not necessarily positive. It depends on whether bank failure is a legitimate concern of the central bank. If it is, macroeconomic implications do follow.

This raises a new set of issues. There is a liberal wing of the profession that contests the legitimacy of any central bank concern with individual bank failure, and therefore questions the case for official aid to banks in difficulty. But the argument of this wing is mostly the skeptical one that the legitimacy of such aid has never been adequately demonstrated. Williamson (1988) carries the argument further by showing that it is possible construct a business cycle model in which bank failure is essential, and yet the central bank cannot improve welfare through any sort of intervention. The reason for this result is that all of the basic shocks in Williamson's model are real. Yet arguments also exist on the opposite side. No one has ever isolated the productivity shocks that can explain the past history of bank crises since the nineteenth century. In addition, the vital role of bank failures and private debt in the Great Depression has been shown (Bernanke (1983)), and well-known arguments exist for the essential role of the central bank as lender of last resort based on the possible contagion of individual bank failure elsewhere in the financial environment, and the external effects of bank failure on non-financial firms and households (for a general perspective, see Gertler (1988), Gertler and Hubbard (1988), and Guttentag and Herring (1987)). The issue therefore is open. Perhaps the most typical position, among Keynesians and liberals alike, is to agree that the central bank should act as lender of last resort, but to insist that macroeconomic policy nonetheless should not be affected (see Kareken (1984), Tobin (1984), Goodfriend (1988) and Goodfriend and King (1988)). This is to say that any central bank assistance to individual banks should not be allowed to affect aggregates but should be immediately sterilised. Yet this last position, we maintain, will not hold. If central bank concern with bank failure is fitting, then in any sensible economic model, the usual tradeoffs between different objectives will argue against any such strict separation between optimal banking and optimal macroeconomic policy.

For the purposes of the analysis, we shall take a very schematic view of financial deregulation. A sharp distinction between the stationary deregulatory environment and the transition from regulation to deregulation will also be made. We shall first develop our view of deregulation (section II), and next present our basic argument about the stationary deregulatory environment. This will be done prior to any formalisation (section III). In the fourth section, we will formalise the argument about deregulation in the stationary environment. The next two sections will discuss the path from regulation to deregulation. The transition period brings into play new aspects of the problem, involving the interaction between the banks and the central bank. The concluding section will underline a few main points.

II. The deregulatory environment

Deregulation will take a very simplified form in this paper. We shall consider there to be only one type of financial firm in the deregulatory environment, a sort of universal bank. Consequently, anything the individual financial firm can do, all of them can. In other words, such divisions in finance as those provided by the Glass-Steagall Act in the U.S., and such restraints on competition as those that existed in brokerage prior to Big-Bang in the U.K., are a thing of the past.[2] Yet deregulation will also not be interpreted to mean no regulation at all. The key feature of the deregulation will be the ability of banks to charge whatever they like for their services and to offer whatever they like to attract deposits. The banks will also be free to hold any type of financial asset and to issue any liability except currency. Within this framework, various sorts of regulations are still possible, including legal reserve requirements, required capital-asset ratios, mandatory deposit insurance, and rules of access to discount-desk facilities at the central bank. The central bank may also act as a lender of last resort in a certain predictable fashion. Evidently therefore deregulation is not understood to mean the absence of prudential rules and a certain safety net. We shall take the system of rules and the safety net for granted. Whether both of them are optimal is a problem that we shall not entertain, though it is very important.(3) Two other features of the environment are basic. First, as presaged, the government has a monopoly over the issue of currency. This avoids problems of indeterminancy which have been recently stressed by Wallace (1983). Second, there are obstacles to entry into banking. These obstacles may involve charter requirements, but could simply mean the refusal of automatic lender-of-last-resort protection to new entrants by the central bank. This last refusal is the only remaining barrier to entry in banking in the U.K. today, but it is basic. The lack of free entry, and the resulting absence of perfect competition in banking, will play a major role below. Unfettered entry into banking, it should be added, has few advocates in practice and is not generally part of the deregulatory agenda.

The only other feature of the deregulatory environment to be mentioned at once concerns the risks in banking, especially the interest risks. The banks bear three kinds of risks: credit risks, deposit risks, and interest risks. These risks also translate into costs. Therefore they affect bank behavior even if the banks are not risk averse, but simply maximise expected value. The credit risks give rise to costs by requiring provisions for losses on defaults and efforts to monitor debtors (Townsend (1979), Diamond (1984), and Williamson (1987a, 1987b)). The deposit risks also imply costs by imposing the need to hold some non-interest-bearing reserves and low-interest-bearing assets. The interest rate risks and the related costs are those that demand the most discussion since they are the critical ones in our analysis.(4) We should begin perhaps by emphasizing the empirical significance of these risks. The Cross Report (BIS (1986)) documents the way in which the rise in the variance of interest rates in the West since 1980 has contributed to major changes in bank portfolios and financial innovation, including a turn toward more brokerage activity in banking. Aharony, Saunders, and Swary (1986) also offer evidence of the effect of interest rate variance in limiting bank profitability for the U.S.

The role of interest rate risks can be explained as follows. Banks issue long-dated assets in return for short-dated liabilities, including many liabilities that are available on demand. Consequently, the banks must frequently finance net reserve outflows over short intervals. The greater their liquidity, the lower the cost of the adjustments. This harks back to the deposit risks, but it sets the stage for the central argument. Liquid assets are those that can be converted quickly without penalty. Some liquid assets, like reserves, have a fixed nominal price, but others vary in price with interest rates. Upward fluctuations in interest rates, therefore, lower the total value of liquid assets held by the banks and downward fluctuations do the opposite. As a result, interest rate variance requires the banks to rely more on sales of illiquid assets to meet their engagements, and do so at the very times when the market value of these assets is below average. The greater the interest rate variance, thus, the greater the bank losses through induced sales of illiquid assets. Similar reasoning applies to bank customers. Interest rate variance affects their liquidity, with repercussions on banks that are only amplified by the concomitant change in the value of collateral on bank loans. More exactly, it is when customer liquidity is low because of high interest rates, and therefore when bad debts are higher, that the value of collateral on bank loans is low.(5)

The interest rate risks, of course, could be perfectly hedged by holding a balanced maturity position in assets and liabilities. Bank profits would then be limited to "brokerage" charges. But since the perfect hedging position would mean lower average returns, even the risk-averse bank would not hold it, much less the expected-value maximising one. Consequently, either kind of bank will hedge only to a limited degree. How much will depend on a number of things: the adverse effect of interest rate variability on bank profits, the scale of this variability, and the current interest rate differential in favor of risk exposure. However, all banks will choose what can be termed, in the language of the banking literature, a certain balance of "asset-maturity transformation" ("duration mismatching") and "brokerage" activity.(6)

The link to monetary policy can be seen. The central bank affects interest rate variability by deciding how much to smoothen interest rates on the bond market. Thereby it also affects bank profits, and if we assume a certain density function for the distribution of profits over individual banks, further affects the probability of bank failure. Because bank closure causes liquidity problems to spread from one bank to another and to nonbank firms and households, and because liquidity problems can cause solvent firms and households to default, the central bank attaches separate weight to the probability of bank failure in its objective function. We have already indicated our decision to limit our argument to the case where this view holds, and we have also referred to the literature on the causal chain from bank failure to aggregate economic activity. Bernanke and Gertler (1988), Greenwald and Stiglitz (1988), and (for a Minsky-style construction) Taylor and O'Connell (1985) may be cited as specific examples of the sort of models we have in mind. Henceforth, legitimate central bank concern with bank failure will be simply taken for granted.

IV. The basic argument

We can now set forward the basic lines of our argument prior to any formalisation. Let us place ourselves in the familiar context of the Poole model (1970). Shocks are buffeting the economy while the monetary authorities try to affect the variance as well as the level of some macroeconomic aggregate like output. Of course, if wage-earners properly indexed their wages, the authorities would have no reason to worry about the variance of the relevant aggregate, as Canzoneri, Henderson, and Rogoff (1983) have shown. But since a lot of money wages are not indexed at all to the cost of living, while optimal indexation would even require wage indexation to interest rates, we can regard Poole's original treatment as retaining all of its relevance.(7) The result in the model is an optimal "combination policy," as Poole termed it, calling for the monetary authorities to interfere with interest rate variance, but only so much.

Figure 1 illustrates the matter. V on the vertical axis represents the variance of output (or whatever other variable the authorities are concerned with), and the coefficient k regards the extent of their interference with interest rate variance in order to control V. The interest rate variance (not shown) diminishes with k. A coefficient k of zero would mean no interference with interest rate variance, a k of infinity would mean keeping the interest rate variance nil. The value k^* illustrates Poole's solution to the problem of optimal monetary policy: k^* minimises V.

Things change, however, once a separate central bank concern with the probability of bank failure is allowed to enter in. By raising k above k^*, the authorities can lower interest rate variance, V_r, though thereby also raising the variance V. From the previous discussion, the fall in V_r would lower interest rate risk, and as an offshoot, would lower credit risk, while the rise in V would raise credit risk. The evidence would indicate that the preponderant effect on the banks would come from the fall in interest rate risk. Central bank concern with the probability of bank failure therefore will lead the authorities to a separate emphasis on V_r. The optimal k hence becomes a compromise between V and V_r, and is larger than k^*. It may be illustrated by $\hat{k}$ in the figure.

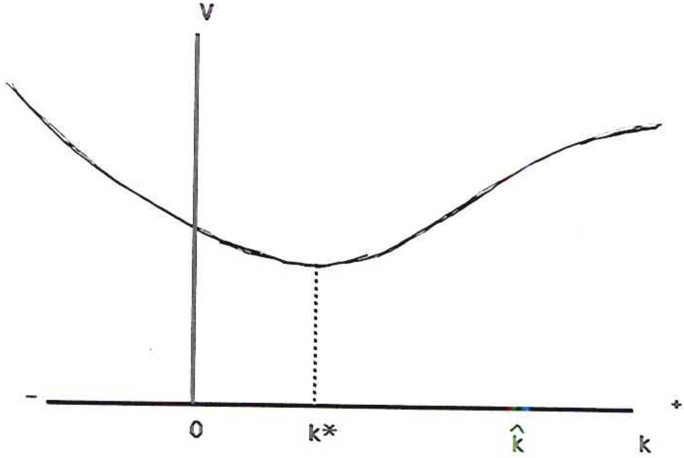

Figure 1

So far there is no basis in the reasoning for any effect on aggregates, only on macroeconomic stability. Interest rate smoothing, as such, could leave the aggregates on average the same.(8) But a simple extension will show why we can expect differently. Another way to help reduce the probability of bank failure, besides smoothing the interest rate, is to allow the aggregate stock of money to grow. To the extent that this raises anticipated inflation, it increases the nominal interest rate, and the banks benefit.

In the early literature on the inflation tax, this view was taken for granted. In case of an inflation tax, it was thought, banks would collect revenue because of their issue of zero-interest-bearing (or low-interest-bearing) deposits. The seminal paper on the welfare cost of inflationary finance, by Bailey (1956), asserts as a matter of course that "the government's share in the total 'tax' on cash balances is only the share of currency in the total money supply" (Arrow and Scitovsky, eds., p. 447). The same view is prominent in Deaver's contribution to Meiselman (1970) concerning the Chilean inflationary experience. Subsequently, this perspective on inflation as a benefit to banks disappeared, as the focus shifted narrowly on the government revenue from the inflation tax through the demand for base money, as such (see, for example, Fischer (1982)). The reason has never been adequately spelled out, to our knowledge. One possible explanation is the idea that banks pay interest on checking accounts through foregone service charges, thereby limiting their profits from higher nominal interest rates. Another is that bank revenue from inflation is simply a redistribution of private wealth and as such deserves no more attention than other forms of redistribution of wealth through nominal contracts. Be that as it may, the fact remains that so far as entry is not free into banking, even though the benefits of inflation to the banks may be partly returned to their customers through reduced service charges, and though some of the rest of the benefits may also flow out through off-balance-sheet engagements, these benefits will not disappear, but some of them will be retained by the banks.

The issue struck as sufficiently important to warrant some empirical work. The supposed mechanism through which banks benefit from anticipated inflation, is a rise in the nominal interest rate, leading to a rise in the equilibrium return on bank assets relative to the equilibrium interest the banks pay out on their deposits. Together with Daniel Goyeau and Alain Sauviat, we tested this channel of influence using pooled OECD data for banks for the largest possible number of OECD countries over 1979-86. Both the effect of the nominal bond rate on the yield differential in banking and the effect of this differential on bank profits at constant prices emerge as extremely significant statistically.(9) The only major reservation we have about this test is that the result may depend partly on interferences with bank pricing during the study period. But restricted entry into banking would have contributed to the result as well, and would still be a factor under deregulation. We suppose this last effect to be the critical one, though we did nothing to separate the two. With this one reservation in mind, we interpret the results as confirming the conclusion that the monetary authorities can promote bank solvency through expansionary monetary policy.

It should be emphasized that the benefits to the banks in our argument come from the rise in the nominal interest rate, not directly from the concomitant rise in anticipated inflation as such. This is particularly important in interpreting recent experience, since the rise in nominal interest rates that took place in the early eighties was associated with decelerating inflation, observed and anticipated. This recent experience therefore would not necessarily be inconsistent with our argument in case of a negative association between bank profits and anticipated inflation at the time.(10) Further, the effect of inflation and that of the variance of inflation should be kept strictly apart (just as the separate effects of the level and variance of the interest rate should be). Though anticipated inflation helps the banks by raising the nominal interest rate, the variance of inflation does them no good. According to the previous reasoning, the influence of interest rate variance on banks completely dominates that of inflation variance. But the latter influence is indubitably a problem.

IV. A model

We may now model the previous results. Consider the following relationships:

$$Y = Y^* + a\,(P - P^e) + w \qquad (1)$$

$$Y = -b\,(R - P^e + 1) + c\,(\overline{M} - P + 1) + u \qquad (2)$$

$$M - P + 1 = Y - R + v \qquad (3)$$

where w, u, and v are serially uncorrelated disturbances of zero mean with variances $\sigma_w{}^2$, $\sigma_u{}^2$, and $\sigma_v{}^2$ and no covariances. Y^* is normal output, P^e is the expected price, $\overline{M}$ is the average money balance in the period, Y and M are stated in logarithms, and last period's P is one, inflation thus being $P - 1$.

The supply of output (equation (1)) sets output Y, the demand for output (equation (2)) sets price P (via the real balance term $\overline{M} - P + 1$ which says that the goods demand depends on the real value of average cash balances), and the demand for money (equation (3)) sets the nominal interest rate R.

The probability of bank failure, F_1, is written:

$$F_1 = F_0 + h\,(R/\overline{R})\,\sigma_r\,(\sigma_r/\sigma_r{}^e) - j\,\overline{R}$$

$$\text{for } \sigma_r/\sigma_r{}^e > 1$$

and (4)

$$F_1 = F_0 + h\,(R/\overline{R})\,\sigma_r - j\,\overline{R}$$

$$\text{for } \sigma_r/\sigma_r{}^e \leq 1$$

$$F = F_1 - F_0$$

where $\overline{R}$ is the average interest rate, or the level that would prevail independently of the disturbances, and σ_r^e is the standard deviation of the interest rate ($V_r^{0.5}$) as expected by the banks. The prudential rules condition all of the parameters of the equation. The specification captures the fundamental aspects of the previous discussion. Positive shocks on interest rates $(R/\overline{R})$ hurt banks as does high interest rate variance, σ_r, while a high average interest rate $(\overline{R})$ benefits them.

The $(R/\overline{R})\ \sigma_r\ [\sigma_r/\sigma_r^e]$ term may seem unnecessarily complicated. All of the subsequent results would be the same if it were written more simply as either $(R/\overline{R})$ $[\sigma_r/\sigma_r^e]$ or $\sigma_r\ [\sigma_r/\sigma_r^e]$. But in the former case we would fail to recognize that even if the most recent observations of R happen to equal $\overline{R}$, a high variance of R raises the average probability of bank failure, while in the latter we would ignore the effect of recent observations on this last probability. That is, in the latter case we would pretend that a singularly bad outcome, like a 40% interest rate, does not raise the probability of bank failure as long as σ_r is the same. Another economical way to take current outcomes into account, of course, would be to write equation (4) as a random walk. But while getting us closer to the facts, this would complicate matters, since the model would become non-stationary, the mathematics would be encumbered and issues of statistical drift would come to the forefront. Perhaps issues of drift and irreversibilities belong in an analysis of financial crises and bank failure: this is likely. But we aim to show that the analysis can go far independently.(11)

The way that expectations enter the equation also requires comment. The specification says that deviations between the actual and the expected average interest rate do not affect the probability of bank failure, whereas deviations between the actual and the expected variance of the interest rate do. The underlying idea is that the influence of the interest rate level operates through banks' real profits, thus does not make itself felt quickly, and can be corrected in time, while the influence of interest rate variance operates through liquidity, therefore makes itself felt very soon, and will not be corrected in time. Accordingly, if the banks underestimate the variance of the interest rate ($\sigma_r/\sigma_r^e > 1$), the underestimate causes both the interest variance and any sharp interest rate hike to raise their probability of failure more than it would otherwise, as they overexpose themselves to interest risk. On the other hand, overestimating the interest rate variance does not lower their probability of failure, even though, in this case, the banks underexpose themselves. So doing has an offsetting, adverse effect on their profitability, which translates itself into lower cash (reserve) inflows, and we suppose, thereby neutralises the earlier beneficial effect on their safety. The assumption is perhaps a bit strong; but it helps us to avoid the idea that any sort of bank error can systematically help the banks to survive. The constant term F_o comprises all of the influences on the probability of bank failure that the authorities are unable to affect. Therefore it reflects all the forces acting on credit risks and reserve risks independently of interest rate risks.

The authorities wish to minimise the objective function L:

$$L = \sum_{j=0}^{\infty} \frac{\beta_j}{2} [AV_p + BF^2 + C(\overline{P}-1)^2] \qquad (5)$$

where V_p is the variance of inflation (P−1), β is the rate of actualisation of the future, F (or F_1 minus F_o) is the part of the probability of bank failure which the authorities can affect, and $\overline{P}$ is the average price, or the price that would prevail independently of the disturbances.

The choice of inflation as the variable whose variance the authorities are concerned with deserves a special word. The authorities are supposed to be interested in this variance as a reflection of their concern with the distribution as well as the level of output. Price variance affects output variance through equation (1) (because of sticky factor prices). In addition, there are non-indexed contracts, and as Greenwald, Stiglitz, and Weiss (1984), and Greenwald and Stiglitz (1988) stress, managers make financing decisions causing the incomes of lenders to be much less sensitive to price shocks than those of owners. Hence price variance redistributes income both between debtors and creditors, and between manager/owners and lenders. Including V_p in the objective function is simply a shorthand way of reflecting both influences and both concerns.

In order to minimise the preceding loss function, the authorities adopt a certain feedback rule

$$M = \overline{M} + k (R - \overline{R}) \qquad (6)$$

where $\overline{M}$ is the average value of M and $\overline{R}$ that of R, and systematic deviations between M and $\overline{M}$ and R and $\overline{R}$ occur in accordance with a coefficient k. The authorities therefore must solve for the optimal values of $\overline{M}$ and k, or equivalently $\overline{R}$ and k.

Suppose we simplify at first by setting B in the welfare function equal to zero and only later recognize the influence of official concern with bank failure. This leads to Poole's results if we further ignore the possibility of an official temptation to create surprise inflation (or to raise P on average relative to P^e).(12) On this further condition ($\overline{P} = P^e$), then optimisation in every period is completely independent of the future, as in Poole, and the policy problem is equivalent to one of current optimisation. Furthermore, the choice of the optimal average level of M and R is completely divorced from that of the optimal feedback coefficient k.

In case of a "pure money" policy, which means fixing $M = \overline{M}$ and $k = 0$, R is endogenous and therefore we have for P:

$$P = \frac{(b+a+ab)\,P^e + c + u - (1+b)\,(Y^* + w) + (b+c)\,\overline{M} - bv}{a + c + b\,(1+a)} \qquad (7)$$

Hence

$$V_p = \frac{\sigma_u^2 + (1+b)^2\,\sigma_w^2 + b^2\,\sigma_v^2}{[a + c + b\,(1+a)\,]^2} \qquad (8)$$

In case of a "pure interest rate" policy and $R = \overline{R}$, $k = \alpha$, M is endogenous, and we have instead:

$$P = \frac{(a+b)\,P^e - b\,(R+1) + u - w - Y^* + c\,(\overline{M}+1)}{a + c} \qquad (9)$$

and

$$V_p = \frac{\sigma_u^2 + \sigma_w^2}{(a + c)^2} \qquad (10)$$

We easily check that interest rate as opposed to monetary control (thus, equation (10) instead of (8)) amplifies the influence of σ_u^2 (demand-for-goods variance), but completely avoids the influence of σ_v^2 (money-demand variance). It also reduces the impact of supply-of-goods variance, σ_w^2, on the condition $c < 1$.

Of course, generally, a "combination policy," which means setting k optimally rather than arbitrarily adopting either one of the preceding values, will yield better results. To find the optimal k, we must turn to equation (6). First we solve for $R - \overline{R}$. From

$$R = Y^{*} + a\,(P - P^{e}) + w + v + P - M - 1 \tag{11}$$

and

$$\overline{R} = Y^{*} + \overline{P} - \overline{M} - 1, \tag{12}$$

if also $\overline{P} = P^{e}$, we get

$$R - \overline{R} = w + v + (1+a)\,(P-\overline{P}) - (M-\overline{M}) \tag{13}$$

Based on equation (6) and the definitions $r = R - \overline{R}$, and $p = P - \overline{P}$, this last equation says:

$$r = \frac{w + v + (1+a)\,p}{1 + k} \tag{14}$$

Next we must solve for V_p. After setting $P^{e} = \overline{P}$ in equation (9) for P, this equation yields:

$$\overline{P} = \frac{(a+b)\,\overline{P} - b\,(\overline{R}+1) - Y^{*} + c\,(\overline{M}+1)}{a + c} \tag{15}$$

From (9) and (15) combined, we get

$$p = \frac{u - w - b\,r}{a + c} \tag{16}$$

Once we substitute for r in this next equation, using (14), we find:[13]

$$V_p = \frac{(1+k)^2\,\sigma_u 2 + (1+k+b)^2\,\sigma_w{}^2 + b^2\sigma_v{}^2}{\{\,(a+c)\,(1+k) + (1+a)\,b\,\}^2} \tag{17}$$

and if we minimise (17) with respect to k, we obtain:

$$k^{*} = \frac{b(a+c)\,\sigma_v^2 - (1+a)\,\sigma_u^2 - (1-c)(1+b)\,\sigma_w^2}{(1+a)\,\sigma_u^2 + (1-c)\,\sigma_w^2} \qquad (18)$$

where the k^{*} notation serves to remind us that the value corresponds exactly to k^{*} in figure 1. Evidently, money-demand instability, σ_v^2, pulls toward greater interest rate stability, and goods market instability, σ_u^2 and σ_w^2, pulls the opposite way. Further, k^{*} could be negative: it could minimise V_p to amplify V_r rather than the contrary. (The same follows in Poole, as we can see readily by letting σ_v^2 go toward zero while keeping σ_u^2 the same in his model).

Getting inflation down to zero is simply a matter of picking the right $\overline{M}$ and does not compromise optimal stabilisation in any way. If we solve for $\overline{P}$ in terms of $\overline{M}$, and set $\overline{P} = 1$, we get the right value of $\overline{M}$. Using equation (7) for P and letting $P^e = \overline{P}$, we have:

$$\overline{P} = \frac{(b+c)\,\overline{M} - (1+b)\,Y^{*} + c}{c} \qquad (19)$$

and therefore, for $\overline{P}$ equal one (the optimal value),

$$\overline{M} - \frac{(1+b)\,Y^{*}}{b+c} \qquad (20)$$

Now we are prepared to introduce central bank concern with probability of bank failure F (or B > 0), and thereby bring equation (4) for F into the picture. Suppose $\sigma_r = \sigma_r^e$ in this equation. Then time separability remains, and minimising L is still simply a matter of current optimisation. However, r, V_r (that is σ_r^2) and $\overline{R}$ now affect welfare by moving F. We can, once more, proceed in stages, first allowing the coefficient of $\overline{R}$ in the F equation to be nil. Then in the first stage, optimal monetary policy will clearly continue to mean keeping inflation zero. Therefore inflation will be unaffected. Only the feedback coefficient k will change. The effect on k, of course, will be to raise it. A compromise hence ensues between minimising V_p and minimising V_r. We already know the solution for minimum V_p from equation (18). Minimising V_r alone would clearly pull toward $k = \alpha$ (see equation (14)). The new equilibrium k, $\hat{k}$ (figure 1), is therefore somewhere in between: at some value above the one in equation (18) but still finite. This value will depend heavily on the relative weight Bh^2/A, which pulls k up higher.

The impact of $\overline{R}$ on F, in the next (and last) stage of analysis, complicates matters still. It introduces a further compromise between inflation and the other two macroeconomic objectives. By raising $\overline{R}$, the authorities can keep V_r higher and yet avoid raising F. Thus they can simultaneously lower F and V_p. The way to raise $\overline{R}$ derives from equation (12) showing $\overline{R}$ in terms of $\overline{M}$ and $\overline{P}$. After substituting for $\overline{P}$ in this equation, using equation (19), we find

$$\overline{R} = \frac{(c-b-1)\, Y^* + b\, \overline{M}}{c} \qquad (21)$$

Hence raising $\overline{M}$, thus causing some inflation, is the way to raise $\overline{R}$ and to reduce the probability of bank failure. The optimum course of action will be to pursue some positive inflation, some rise in k above the level shown in the Poole-like formula (18), but still, a lower k, $\hat{k}$, than would obtain in the absence of the possible use of inflationary policy to protect banks against the effects of interest rate variability.(14) This argument for expansionary monetary as a means of helping banks, unlike some of the rest that can be found, cannot be criticised as neglecting associated effects on inflation and price variability (e.g., see Meltzer (1984)).(15) But the argument does suppose simultaneous control of the mean and the variance of money.

V. The adjustment path

The discussion thus far has omitted any consideration of the adjustment path to equilibrium. The crucial step in so doing was to set all expected values equal to the equilibrium ones. Most important in this respect was the omission of any possible mistake in bank anticipations of the variance of interest rates. The basic point we wish to develop in this regard is that if the banks underestimate the variance of interest rates, optimal monetary policy can differ. Thus a problem of finding the right path toward equilibrium arises.

Suppose the banks underestimate the variance of interest rates. That is, they overestimate the policy variable k. Should the central bank pay no notice? If it did so, of course, bank expectations would still adjust and the economy would still ultimately attain the same position. However, the adjustment path would differ. The positive unanticipated variance in interest would increase the probability of bank failure. By increasing k toward the expected value during the transition, the authorities can reduce this probability, thus ease the transition. However, if they meet bank expectations all the way, they may keep the economy glued at a position with an excessive k along the path. The authorities thus must not go too far in smoothing the transition. The problem of choosing an optimum adjustment path emerges clearly.

The factors in deciding how much to smooth the transition should banks underestimate interest rate variance may be analysed as follows. Again assume at first that the average money rate of interest is not a factor in bank failure. Consider also σ_r^e as given for the moment, and the adjustment of σ_r^e to the actual value as given as well. (The factors in determining σ_r^e will be discussed later). For any σ_r^e value lower than the actual, the expected loss attributable to not giving in to the banks and keeping k the same is:

$$\sum_{j=0}^{t} \frac{\beta_j}{2} B \{ h \, \sigma_r \, [\sigma_r / \sigma_{r,j}^e - 1] \}^2 \qquad (22)$$

where t is the period of adjustment of σ_r^e to σ_r. The expected gain of this unwillingness to comply with the banks' expectations is

$$\sum_{j=0}^{\infty} \frac{\beta_j}{2} A \, [V_{p,j}^e - V_p] \qquad (23)$$

where V_p^e is the price variance associated with the expected value σ_r^e and V_p is that associated with σ_r. In other words, $V_{p,j}^e - V_p$ is the extra price variance that is avoided by sticking to one's guns and failing to fulfill the banks' expectations in period j (a gain which is positive for $k > k^*$).(16) If the expected loss attributable to holding

k the same exceeds the expected gain of doing so for the new stationary equilibrium value $\hat{k}$, it is clear that the authorities should smoothen the adjustment process. That is, they should raise k. As can be seen from this reasoning, they should only raise k until the preceding cost and gain are equated. (Both of these values go toward zero as k rises above $\hat{k}$, thus as σ_r approaches $\sigma_r{}^e$, but since F falls and V_p rises in the process, the quadratic nature of the utility function means that the loss attributable to holding k the same will fall more quickly than the gain.) The factors favoring a smoothing of the adjustment – or those that raise expression (22) relative to (23) – therefore can be easily identified as being: namely, high initial underestimates of σ_r; a long period of adjustment t; a high relative cost of bank fragility relative to price variance B/A; a strong effect of interest rate variance on the probability of bank failure h; and a low actualisation rate of the future β.

Once we admit the effect of $\overline{R}$ on F in the analysis, of course, we find that expansionary monetary policy may also have a role in the transition. By raising inflation relative to the stable equilibrium value, the authorities can avoid some extra smoothing of interest rates along the way, and thereby ease the transition while nonetheless shortening it if, as seems reasonable, the length of the transition, for any given underestimate of σ_r, is strictly a function of k relative to $\hat{k}$.

VI. The implications of deregulation

We come at last to the implications of deregulation as such. By deregulation we mean the removal of all barriers to what we described before as the deregulated environment. In order to proceed, it is obviously necessary to make some hypotheses about the initial condition, or the regulated environment. We will specify only two features of this environment, both of which we will define relative to the sequel. First, as part and parcel of the initial situation of regulated prices, we will assume that the interest rate variance was lower prior to the reform – lower than it is to become at any time thereafter. Second, we will assume that all of the influences on the probability of bank failure bore lower coefficients earlier too. The rise in the probability of bank failure, at the time of deregulation, might have been muted by attendant changes in the prudential rules. This does not matter.

At the dawn of deregulation, it is evident that the banks hold portfolios that become ill-suited to the new environment. They must adapt themselves to higher interest rate variance. This means doing less intermediation, more brokerage, and moving toward less interest rate exposure in general. Let us see why the problem of the optimal transition path may loom large.

Consider the possibility of an announcement by the central bank that it will raise interest rate variance immediately to the new stationary equilibrium value. Apart from problems of factor adjustment in banking – or adjustments of labor, capital, and technology – the proposal has some merit since if the banks were to believe the announcement, the problem of a transition would be completely avoided. But the difficulty is that the banks may have no reason to believe it. Within a certain range of values of σ_r^e between the current value of σ_r and the new stationary equilibrium one, the banks may be able to infer from the official loss function that the authorities would not do what they say, but would intervene to help them. In this case, the central bank announcement is incredible. It is all the more incredible since the banks would like not to believe it as, quite apart from the foregoing problems of factor adjustment from which we abstract, a smoother transition would raise their profits as well as their security along the way. The optimal transition path hence is not necessarily the one obtained by threatening to move as fast as possible. On the other hand, it goes without saying that a timid central bank policy of assuring the banks satisfaction of their expectations would be wrong as well, since it would block adjustment mid-way.

In fact, the optimal transition path is by no means evident under the conditions. This path can be defined if we take bank expectations as given independently of the government strategy, as we did in the previous section simply in order to illustrate the problem of optimal dynamic control and the central forces acting on the solution. Such bank expectations are unreasonable, however, since the banks ought to see that monetary policy is a fundamental factor in their best decision. The path can be defined as well if we assume collective bank action, since in this case the central bank could base its strategy on the best expectations the banks could form in accordance with their collective interests taking into account their own influence on policy, and a game-theoretical solution might obtain. This next solution, it should be observed, could involve continuous satisfaction of bank expectations, yet continuous movement toward the new equilibrium. If we suppose, however, both decentralised bank behavior and bank efforts to guess central bank intentions – probably the most reasonable assumptions under the circumstances – the result is up in the air, even though a solution might be especially designed to fit. The best central bank policy hence might be some precommitment in order to provide an anchor for bank expectations, basing the precommitment on the best of the credible alternatives, if there is a single best one.

The change in the equation for the probability of bank failure is further significant in the situation. Because of it, we must assume that the new equation for the probability of bank failure is uncertain when deregulation begins. Brainard (1967) showed long ago that parameter uncertainty leads to less energetic exercise of the policy instruments. In the current context of high initial government intervention, this means larger intervention coefficients and lower interest rate variance. On this ground alone, a smoothing of the transition is necessary. With learning, optimal policy will call for a progressive increase in interest rate variability. Moreover, in the case of parameter uncertainty, the next year is always cloudier than the next week, and this is conducive to a lower actualisation rate of the future. Based on the previous analysis, a diminished accent on the future means still more smoothing of the path toward the stationary equilibrium. Obviously the danger of too much smoothing – or excessive accommodation – lurks in the background as well.

The analysis would say that deregulation is also conducive to some inflation. The fundamental factor here is the persistence of barriers to entry in banking. Because of these barriers, anticipated inflation, therefore a higher nominal interest rate, promotes bank profits and bank solvency, thereby opening up a beneficial tradeoff between inflation and interest rate variability, and further permitting the authorities to allow more interest rate uncertainty without hurting the banks. As a result, the authorities can get greater macroeconomic stability by inflating – that is, lower values of V_p and F. In developing the argument, we have assumed perfect monetary control. This is questionable, especially for the transition. More specifically, it can be argued that the same factors leading to uncertainty of the probability of bank failure during the deregulatory phase will bring about some uncertainty of other financial parameters, thereby reducing monetary control (Akhtar (1983), Santomero and Siegel (1986), and Baltensperger and Dermine (l987)).(17) If so, the authorities might lean even further toward expansionary monetary policy, since in their incertitude, they may prefer inflationary surprises over deflationary ones.

Finally, discount desk activities of the U.S. variety may appear in a specially favorable light in the context of our discussion. Increasing the money stock through such discount desk activities may mean getting the most reduction in the probability of bank failure out of any planned expansion in money. When reserves are provided at a U.S.-type discount desk, the rise in reserves aims the support particularly toward the least fortunate banks.(18) Two factors limit this reasoning, however. One is moral hazard. If discount-desk facilities offer banks some limited insurance against bad outcomes, the banks clearly may respond by accepting extra risk, with little net effect on their safety. Second, borrowed reserves cannot be perfectly controlled, and therefore must be sterilised partly. This further complicates the task of monetary control.

VII. Conclusion

Fundamentally, we have developed the implications of admitting that the central bank should be concerned with the safety of the individual bank. The pivotal parts of the argument are those that would explain why the central bank will behave differently as a result of this concern. Seen in this way, there are two pivotal factors in the analysis. The first is the greater significance of interest risks than credit risks in banking, implying that interest rate smoothing is unusually good for banks. The second is that banks benefit from anticipated inflation. We provided some empirical support for this last view, which we related to the presence of imperfect competition in banking. If a linkage between financial reform and bank safety is also accepted, it follows, further, that questions of financial reform and macroeconomic policy are interconnected.

In answer to similar assertions that the central bank is liable to expand the money supply in order to head off financial problems, like those of Friedman and Kaufman to which we referred at the start, the usual response is to say that, of course, there is a danger that the central bank will overreact in a myopic fashion to a big financial shock such as the fall of a major bank. Implicit in this response is the idea that the central bank should not do so. However, if we are right, the truth is different. How much different, of course, is an empirical question. We suspect the distinction between tranquil and turbulent times to be relevant in this regard. Much of what we say may matter little in tranquil times, while our message might be significant in turbulent times. The issue of the transition path is important, it follows, since financial deregulation, as such, can be a source of turbulence.

FOOTNOTES

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1. Relatedly, see Hess (1987) and Gorton and Haubrich (1987).

2. For Big-Bang in the United Kingdom, see Bank of England (1985) and (1987).

3. The discussion of this matter has largely centered on the issue of the optimal pricing of bank deposit insurance, and features prominently the view that the proper pricing of this insurance – including possibly the total deregulation of this price – would reduce the problems of interest rate risk and bank failure. See, for example, Kareken (1984), Gorton and Haubrich (1987), and Goodfriend and King (1988). But there has also been much consideration of capital-asset ratios more recently, especially since the Cooke report (see Koehn and Santomero (1980), Furlong and Keeley (1987), and Kim and Santomero (1988)). We skirt these issues entirely.

4. For an early emphasis on interest rate risk in banking, see Samuelson (1945). Santomero (1984) offers a very useful review of the literature on general risks in banking (apart from foreign exchange risks, which we neglect too).

5. The problem in connection with bank customers can be exposed more fully as follows. Let bad debts on the average be L, the (linear) percentage change in bad debts caused by a small deviation from the average interest rate be a, and the corresponding (linear) percentage change in the value of collateral be ab. Let y also be the value of collateral as a percentage of debt when the interest rate is at the average. With a rise in the interest rate, total losses on bad debts become

$$\lfloor (1+a)\, L \rfloor \quad \lfloor 1 - y\,(1-ab) \rfloor$$

and with a fall in interest rate, they become

$[(1-a)L]\ [1 - y(1+ab)]$

The losses associated with a rise in a are therefore $L\ [1 - y + by\ (1+2a)]$, while the gains associated with a fall are only $L\ [1 - y + by\ (1-2a)]$.

6. Santomero (1982) develops the argument more fully. See also Niehans (1978, ch. 9), and Deshmukh, Greenbaum, and Kanatas (1983). Deshmukh et al. propose special conditions where banks suffer from drops as well as hikes in interest rates. We have not followed them in this respect.

7. King (1982), (1983) advocates an argument for macroeconomic stabilisation which does not depend on imperfect indexation, but differential information across individual agents. His argument would require more sophisticated modeling than ours.

8. In an important, related paper, Goodfriend (1987) shows that an interest smoothing objective can induce some drift in the money supply by requiring the monetary authorities not to correct entirely for past departures from a money-growth target. His result, though, depends on growth-rate targeting, and would not follow if the authorities engaged in continuous optimisation, since in this case the authorities could disregard the past entirely, as no lagged influences are present in his model. The result does not follow here, since we suppose continuous optimisation in similar conditions of no lags.

9. The test results, covering 17 countries and based on two-stage least-squares, are:

$$ID = \underset{(2.39)}{0.49} + \underset{(4.75)}{0.07}\ IB + \underset{(5.26)}{0.16}\ NW/A + \underset{(4.25)}{0.06}\ R/D \qquad \bar{R}^2 = 0.53 \quad s.e.e. = 0.66 \quad \text{mean } ID = 2.35$$

$$P^*/A = \underset{(0.54)}{-0.17} + \underset{(4.53)}{1.06}\ ID + \underset{(3.78)}{0.19}\ NW/A - \underset{(5.14)}{0.14}\ R/D \qquad \bar{R}^2 = 0.61 \quad s.e.e. = 0.72 \quad \text{mean } P^*/A = 2.60$$

where ID is the weighted-average interest rate on bank assets minus the weighted-average interest rate on bank liabilities, IB is the nominal interest rate on long term bonds, NW/A is the ratio of net worth to assets, R/D is the ratio of reserves to deposits, and P*/A is the ratio of real profits to assets (real profits are adjusted for changes in the CPI). t statistics are in parentheses. (The DW statistic would be meaningless for these cross-country results). We interpret the R/D and NW/A variables as reflecting legislation, hence as exogenous. All the signs are correct. A higher legal reserve requirement should induce banks to offer a lower interest rate to their depositors in relation to the one they can charge on their assets. But it should diminish their profits nevertheless. A higher capital-asset requirement should also have a positive effect on the interest differential ID, but is very likely to raise the profit-asset ratio (despite a negative effect on profits per unit of capital) by limiting the proportion of bank assets against which interest claims can be held. The critical t statistics, of course, are those relating to the coefficients of IB and ID. The results for the Group of Seven alone, rather than all of the 17 countries in the sample, conform: the general fits are better and the coefficient estimates a bit less precise. For description of the series, see Revell (1985) and OECD (1987).

10. The point might have some bearing on the evidence reported by Santini (1986) of an adverse effect of inflation on a sample of U.S. banks.

11. Compare note 8. Goodfriend (1987) sheds light on the complexities we are avoiding. The later sections on the adjustment path will shed some more.

12. This possibility is obviously not our problem here. For a treatment of the issue, see Barro and Gordon (1983a), (1983b).

13. In the intermediary step, we have:

$$p = \frac{(1+k)\,u - (1+k+b)\,w - b\,v}{(a+c)\,(1+k) + (1+a)\,b}$$

14. The general solution would be that to the problem:

Maximise

$$L = A\,V_p + B.F^2 + C\,(\overline{P}-1)^2$$

for $F^2 = (h\,(R/\overline{R})\,\sigma_r - j\,\overline{R})^2$

$$V_p = \frac{(1+k)^2 \sigma_u^2 + (1+k-b)^2 \sigma_w^2 + b^2 \sigma_v^2}{\{ (a+c)(1+k) + (1+a)b \}^2} \quad \text{(from eq. (17))}$$

and (from (19) and (21))

$$(\overline{P}-1)^2 = \left(\frac{c(c+b)\overline{R} + (1-c) Y^*}{b} \right)^2$$

with respect to $\overline{R}$ and k.

15. Admittedly, price variability has been subsumed under inflation variability in the analysis. However, at least in case of moderate inflation, say, under 20 percent, the evidence shows that the impact of inflation on relative price movement comes essentially from unanticipated inflation. See Fröchen and Maarek (1978) and Parks (1978). If so, there is little distortion involved here. A steady rate of inflation has indeed no important implications for price variability, and the variance of the price level can serve as an indicator of the impact of monetary policy on price variability.

16. The structural similarity to Barro and Gordon's (1983b) treatment of a reputational equilibrium is important and will not evade the reader. We will have more to say on this matter later.

17. The British example of Competition and Credit Control in 1971 should always serve to remind us that the monetary authorities may well lose monetary control during a deregulatory transition.

18. In continental Europe, discount desk activities are essentially a regular channel of central bank financing of private activities through the commercial banks.

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