

NBER WORKING PAPER SERIES

INSTITUTIONS FOR MONETARY
STABILITY

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Working Paper 5557

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 1996

We thank Laurence Ball, Jeffrey Frankel, Benjamin Friedman, Donald Kohn, Maurice Obstfeld, Dani Rodrik, Lars Svensson, and Carl Walsh for helpful comments, and the National Science Foundation for financial support. This paper is part of NBER's research program in Monetary Economics. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

This paper demonstrates that failures in monetary policy arise not just from dynamic inconsistency, but more importantly, from imperfect understanding of the economy and the effects of policy. Using recent and historic episodes from the United States and abroad, we show that limited knowledge on the part of economists, policymakers, elected leaders, and voters has been an important source of monetary policy mistakes. We then analyze what institutions of monetary policy could address the problems of both dynamic inconsistency and limited knowledge. Our analysis suggests that one set of institutions that could do this is a highly independent central bank with discretion about both the goals and the conduct of policy, combined with a two-level structure where elected leaders appoint a board of trustees for the central bank, which in turn selects the actual policymakers. We conclude by discussing recent and proposed reforms in monetary policy and institutions in industrialized countries in light of this analysis.

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I. INTRODUCTION

A generation ago, economists who believed that the performance of monetary policy could be improved focused their criticisms and proposals on the specifics of how policy was conducted. Friedman (1960) and other monetarists, for example, argued that monetary policy mistakes would be greatly reduced if the Federal Reserve adopted such policies as money targeting and one hundred percent reserve requirements.

Since that time, there has been growing empirical and theoretical evidence that the specifics of policy are highly dependent on institutional arrangements. On the empirical side, such characteristics of central banks as their legal independence, the average tenure of their governors, and the objectives enshrined in their charters have been found to have strong associations with average inflation rates (see, for example, Alesina, 1988; Grilli, Masciandaro, and Tabellini, 1991; and Cukierman, Webb, and Neyapti, 1992). On the theoretical side, it has been shown that policymakers' ability to commit to their actions, the government's ability to delegate control over policy, and contracts between the government and policymakers can affect average money growth and many other features of policy (see, for example, Kydland and Prescott, 1977; Rogoff, 1985; Walsh, 1995a; and Persson and Tabellini, 1993).

This evidence suggests that efforts to improve the performance of policy should focus not on the specifics of policy, but on institutions. This paper is therefore concerned with the design of institutions to produce desirable monetary policy. We seek to identify the governmental structures that would overcome the obstacles to good monetary policy both today and

in the future.

The first step in this analysis is to identify the sources of monetary policy mistakes in the past: only by knowing what the obstacles to good policy have been can we think sensibly about what institutions could make policy better. In Section II, we argue that dynamic inconsistency has been overemphasized as a source of monetary policy failures. While there surely is an incentive for policymakers to inflate once expectations are set, this is not the crucial obstacle to desirable policy that many have assumed.¹ Instead, we suggest that limited knowledge about how the economy operates and the effects of policy has been a much more pervasive obstacle to good policy. We use a series of examples of monetary policy failures in the United States and abroad to show that limited knowledge on the part of economists, monetary policymakers, and elected leaders and voters has been a frequent source of monetary policy mistakes.

Sections III and IV then consider the design of monetary institutions in light of this analysis. Section III considers what institutional features are likely to address the individual problems we identify. As one might expect, the solutions to one problem may exacerbate another. For example, a binding rule concerning the ultimate objectives of policy or the specifics of how policy is to be conducted is an obvious way to deal with the problem of dynamic inconsistency. But such a legislated rule may be highly undesirable if expert knowledge about how the economy operates is limited. Similarly, long terms for monetary policymakers may lessen the problems caused by uninformed politicians and voters, but they make it hard to remove

¹ Previous studies of the design of monetary institutions by Rogoff (1985), Lohmann (1992), Walsh (1995a), Persson and Tabellini (1993), and Debelle and Fischer (1994) all start from the presumption that the central problem that needs to be solved is inflationary bias arising from dynamic inconsistency.

policymakers who turn out to be incompetent.

In Section IV, we discuss one combination of institutions, selected from the menu of possibilities presented in Section III, that is likely to produce desirable outcomes in the face of the whole array of problems. Some components of this institutional arrangement are completely standard. For example, it includes a highly independent central bank as a way of both overcoming dynamic inconsistency and of allowing policy to be determined by specialists who are likely to be particularly well informed about monetary policy issues.² Other features of the arrangement, however, are less conventional. For example, it includes complete goal and instrument independence for the central bank so that advances in economic understanding can be incorporated rapidly into decision making. It also includes a two-tier system, where politicians choose a board of trustees for the central bank and the board of trustees chooses the actual policymakers. If the trustees have long terms of office, this system creates a delay in the government's control over the central bank that is likely to largely eliminate political pressure on policymakers. At the same time, this system makes it possible to have short terms of office for the actual policymakers, and thus allows incompetent policymakers to be removed quickly.

Section V discusses the recent monetary reforms in industrialized countries and the proposed design of the European Central Bank in light of our analysis of the causes and remedies for monetary policy mistakes. As we describe, most of these reforms consist of shifts within the existing institutions to policies that make price stability the central goal of policy. We argue that these changes do not address the underlying problems that

² Walsh (1995) and DeBelle and Fischer (1994) mention the potential value of having monetary policy conducted by specialists, but do not develop this idea.

gave rise to excessive inflation and other policy failures in the past, and that they therefore do little to reduce the likelihood of policy failures in the future. But we find that the reforms in New Zealand and in proposals for the European Central Bank do alter monetary institutions in ways that are likely to lead to substantial improvements in policy.

II. SOURCES OF MONETARY POLICY FAILURES

In order to determine what policy institutions are likely to produce desirable outcomes, it is important to understand the reasons that policy can go astray. This section therefore describes the most important potential sources of problems in monetary policy. We identify four major sources of problems.

Dynamic Inconsistency. The first, and best known, potential source of suboptimal monetary policy is the dynamic inconsistency of low-inflation policy. Dynamic inconsistency arises when expectations are forward-looking and the socially optimal level of output exceeds the equilibrium level. In this situation, the rate of money growth that is optimal after expectations are determined is greater than the rate that is optimal *ex ante*. As a result, rational policymakers who wish to maximize social welfare have an incentive to be overly expansionary.

Dynamic inconsistency may be an important source of high inflation. For example, the fact that inflation is lower in countries with more independent central banks is consistent with the view that dynamic inconsistency leads to excessive inflation. Similarly, Romer (1993) and Lane (1994) show that, because the real exchange depreciation that is caused by unanticipated monetary expansion is more harmful in more open economies, dynamic inconsistency theories predict that inflation should be lower in more

open economies. Both studies find that this prediction is confirmed by the data.

The Limits of Available Knowledge. Dynamic inconsistency, however, may not be the central source of imperfect monetary policy than many assume. A second potential source of problems is that expert knowledge at any time of the workings of the economy and the effects of policy is imperfect. The best that policymakers can do is to act on the basis of the evidence that is available when they make a decision. Subsequent improvements in knowledge may reveal, however, that different policies would have been preferable under the circumstances.

There are many important examples of problems in monetary policy that appear to have been caused at least partly by the limitations of the best available knowledge. Freedman (1993) and De Long (1996), for example, argue that such incomplete knowledge was an important source of the high inflation rates of the 1970s. The evidence available at the time suggested that there was (or at least that there might be) a permanent output-inflation tradeoff. In addition, the costs of moderate inflation appeared small. As a result, when policymakers were confronted with negative supply shocks, increases in the natural rate of unemployment, and the productivity growth slowdown, they rationally believed that the benefits of accommodating these shocks exceeded the costs. It seems unlikely that they would have made the same choices if they had known then, as we know today, that there is not a permanent tradeoff and that the costs of moderate inflation are in fact substantial. If this analysis correct, it implies that one important reason for the overly expansionary policies of the 1970s was not dynamic inconsistency, but limited expert knowledge.

Friedman and Schwartz's description of U.S. monetary policy after World War I provides a very different example of the effects of imperfect understanding. According to Friedman and Schwartz, little was known at

that time about the lags in the effects of monetary policy. As a result, when the Federal Reserve's initial shifts toward tighter policy in November 1919 did not have an immediate impact on the economy, policymakers responded with additional rounds of tightening in January and June 1920 (Friedman and Schwartz, 1963, pp. 229-239). The result was a major downturn in the economy that was largely unintended.

The issues of optimal inflation and the benefits of stabilization provide more timely examples of the potential importance of limited knowledge. There has not been any comprehensive quantitative analysis of the potential costs and benefits of alternative rates of inflation. For example, it is only very recently that the first thorough attempt has been made to quantify the impact of inflation on welfare through its impact on saving and the composition of the capital stock (Feldstein, 1996); there are only a handful of studies of the issue of whether moderate inflation improves microeconomic efficiency by permitting downward adjustments in real wages without nominal wage cuts (McLaughlin, 1994; Kahn, 1994; Card and Hyslop, 1996); and empirical work on the link between inflation and long-run growth has barely advanced beyond the examination of simple correlations (Fischer, 1991, 1993; Rudebusch and Wilcox, 1994; Barro, 1995).

As a result, policymakers have no choice but to operate on the basis of intuition and fragments of evidence. Estimates of the optimal inflation rate range from moderate deflation, to zero, to moderate inflation, and policymakers in different countries appear to have different estimates. It is likely that once we have a fuller understanding of the costs and benefits of inflation, we will be able to determine that some or all of these estimates were inaccurate, and we may find that in many cases there would have been large gains from aiming for different inflation rates.

Similarly, defensible views about the benefits of using policy to stabilize the economy range from the position that the benefits are trivial to

the view that they are enormous. If stabilization policy only reduces the variance of output around its mean, its likely benefits are small (Lucas, 1987; Atkeson and Phelan, 1994). But if the aggregate supply curve is significantly non-linear, then stabilization policy can fill in the troughs in output with only small offsetting reductions in the peaks, and can thus raise average output considerably (De Long and Summers, 1988). Likewise, if stability has an important effect on investment, then stabilization policy can have a substantial impact on long-run growth (Meltzer, 1988).

Since we have little clear evidence on non-linearities in aggregate supply or the importance of macroeconomic stability to investment, we do not know whether the benefits of stabilization are large or small. Thus again, policymakers must make their judgments on the basis of highly imperfect evidence, and again there is a substantial chance that advances in knowledge will eventually cause them to change those judgments.

Policymakers' Limited Knowledge. A third potential source of imperfect policy is incomplete understanding on the part of policymakers. Even if good information about the workings of the economy and the effects of policy is available, the individuals who determine policy may not have that information. There is no reason to expect knowledge of matters that are relevant to monetary policy to be instantly disseminated to everyone in the economy: since there are costs to acquiring even knowledge that is in the public domain, individuals' understanding of monetary policy issues is likely to be heterogeneous. For citizens whose only influence over monetary policy is through their voting, for example, the benefits of acquiring accurate information about policy are negligible. Thus it would be surprising if they had a state-of-the-art understanding of the relevant issues, and it would not be surprising if they were unaware of important pieces of knowledge. At the other extreme, individuals who specialize in conducting policy are likely to have strong incentives to acquire relevant information. Even among these

individuals, however, understanding is likely to vary: such factors as their experience, their intrinsic abilities, and the rewards that they face for conducting policy successfully are likely to influence their knowledge. Finally, since elected leaders are likely to have less control over monetary policy than those directly in charge of policy, and since they have less time to devote to monetary policy, their understanding of the relevant issues is likely to fall between that of voters and that of monetary policymakers.

U.S. monetary policy in the Great Depression provides the most famous example of a policy failure that may have been due to policymakers' lack of awareness of the best available evidence about the workings of the economy and the effects of policy. In Friedman and Schwartz's view, the failure of policy to respond to the banking panics and the depression was largely the result of the death of Benjamin Strong and the shift of power from the Federal Reserve Bank of New York to the Board of Governors in Washington. According to Friedman and Schwartz, the governors knew relatively little about the importance of monetary policy in stemming the panics and in combating the depression -- not because such knowledge was unavailable, but because they had little experience or expertise in such matters (Friedman and Schwartz, 1963, Chapter 7). It was this lack of knowledge on the part of policymakers that led the Federal Reserve to stand idly by as the U.S. economy collapsed in the early 1930s.

The modern experiences of less developed countries provide many examples of policy failures that appear to have been caused by policymakers' incomplete understanding of existing knowledge. Even among those who make monetary policy, knowledge of such basic matters as the importance of money growth to inflation is not universal. For example, Simonsen (1988) argues that the underlying source of the failure of Brazil's Cruzado plan in 1986 was that policymakers believed that Brazilian inflation was entirely inertial, and that it could therefore be eliminated by incomes policies alone.

As he puts it: "The big mistake of the government was to confound necessary with sufficient conditions and to diagnose inflation as a purely inertial problem. Demand inflation took its revenge" (Simonsen, 1988, p. 262). The necessity of lowering aggregate demand growth in order to reduce inflation is sufficiently well documented that it is unlikely that more knowledgeable policymakers would have made the same mistake. Nor is Simonsen's diagnosis controversial: Cardoso (1988, p. 288), Macedo (1988, p. 296), and Ortiz (1988, p. 300) all concur with his analysis.

Russian monetary policy under Viktor Gerashchenko in 1992-93 provides another example of a policy failure that appears to have been due to policymakers' lack of understanding of existing knowledge about the sources of inflation. As many observers have described, Gerashchenko believed that the underlying source of Russian inflation in this period was inadequate supply, and that low money balances were an important constraint on supply. He therefore believed that rapid expansion of the money stock through credits to former state enterprises would reduce inflation (see Sachs, 1994, for example). The result was massive inflation.

Elected Leaders' and Voters' Limited Knowledge. The final potential source of problems in monetary policy is that even if the individuals who set policy share the best available knowledge about the economy, they may answer to individuals who do not. This problem can take two general forms. The first is that elected leaders' understanding of the economy may be limited. De Long (1996), for example, argues that regardless of whether Federal Reserve officials understood the dangers of expansionary policies in the late 1960s and early 1970s, the Presidents and their political advisers did not. Thus an underlying source of the expansionary policies in that period, in his view, was elected leaders' imperfect understanding of the economy.

A more common example of the potential harms of elected leaders'

imperfect knowledge is the widespread tendency of newly elected leaders from liberal parties -- Carter and Clinton in the United States in 1977 and 1993, Mitterand in France in 1981, and many others -- to pressure monetary policymakers to pursue expansionary policies early in their terms. These policies are not plausibly explained as resulting from optimizing economic or political calculations: more often than not, the resulting inflation requires moves to tighter policies later in the leader's term, often with highly unfavorable political consequences. Instead, they appear to result from a desire to improve economic conditions (either for political benefit or out of genuine concern for social welfare), coupled with imperfect knowledge of the long-run consequences of expansionary policy.

The macroeconomic policies of "populist" Latin American leaders described by Dornbusch and Edwards (1990, 1991) are more extreme instances of this type of policy failure. Peru's economic policies under Alan Garcia from 1985 to 1990 provide the clearest example. Garcia and his advisers believed that inflation resulted from such factors as oligopoly, limited credit availability, and exchange rate depreciation. Indeed, they believed that expansion of aggregate demand, by allowing firms to exploit returns to scale, would reduce inflation. They therefore pursued policies of rapid monetary and fiscal expansion coupled with price controls (Dornbusch and Edwards, 1990; Lago, 1991). The results were disastrous.

The second, and possibly more important, way in which monetary policymakers may be influenced by incompletely informed individuals is that elected leaders must in turn answer to voters, whose understanding is likely to be quite limited. There are many different ways in which voters' imperfect understanding can cause problems in monetary policy. For example, like many politicians, voters are likely to understand the short-run benefits of monetary expansion, but may fail to realize the long-run inflationary consequences. As a result, voters generally favor expansionary

policy. Citizens, and the journalists from whom they receive most of their information, seem to view reductions in interest rates as obviously good and increases in interest rates as typically bad. This view leads to pressure on monetary policymakers for expansion.³

A related example of how imperfect knowledge on the part of voters may lead to poor monetary policy is the political business cycle. Since voters do not know precisely how the economy operates and have little incentive to find out, they may evaluate leaders on the basis of unemployment and inflation at the ends of their terms. This gives leaders an incentive to advocate monetary policies that produce recessions early in their terms (and hence lower inflation), and rapid growth as election day approaches. Nordhaus (1975) shows that this effect of voters' limited knowledge is indeed present to some extent in the United States and other industrial democracies.

Voters' imperfect information can also give rise to fiscal pressures on monetary policy. Persistent budget deficits, coupled with limits on the government's ability to borrow, are an important source of high inflation in many less-developed countries. One possible explanation of this reliance on money finance is that the public has only a limited understanding of the links between deficit spending and inflation. The harms of reduced deficits, such as higher taxes, reduced government employment, and higher prices of

³ The fact that limited knowledge on the part of politicians and voters leads to pressure for expansion may help explain the widespread acceptance of dynamic inconsistency as the crucial problem of monetary policy. Dynamic inconsistency provides an elegant explanation for the tendency toward over-expansion that we often observe. But it may not in fact be the main source of this tendency: the pressure for expansion typically comes from outside the central bank rather than from within, and the pressure appears to stem more from limited knowledge of the long-run consequences of expansionary policy than from optimizing calculations.

subsidized goods, are readily apparent and thus likely to be well understood. But, as Buchanan and Wagner (1977) argue, the benefit of reduced deficits - namely lower inflation -- is not as clearly linked to fiscal policy, and thus may be systematically underestimated.

III. POSSIBLE INSTITUTIONAL REMEDIES FOR POLICY FAILURES

Having described the most important sources of problems in monetary policy, we now turn to the issue of how to design the institutions of monetary policy to deal with these problems. Our argument proceeds in two steps. In this section, we investigate what institutional features can address each problem individually. Then, in Section IV, we discuss the question of what combination of institutions would be likely to produce desirable outcomes in the face of all of the problems.

Dynamic Inconsistency. The most straightforward solution to the problems created by the dynamic inconsistency of low-inflation policy is for policy to be made according to a binding rule. Under such a rule, policy cannot depart from what is announced *ex ante*. Thus there is no barrier to following a low-inflation policy.

Arrangements that make it costly but not impossible to deviate from an announced policy can also allow policymakers to achieve lower inflation than they can under complete discretion. The costs can take the form of monetary penalties, loss of prestige, or removal of policymakers from their positions. For example, there are generally believed to be costs to governments of breaking agreements to keep their exchange rates fixed. Such agreements can therefore help countries maintain low inflation. Similarly, directly penalizing policymakers for pursuing expansionary policies can also counteract the inflationary bias created by dynamic inconsistency

(Walsh, 1995a; Persson and Tabellini, 1993).

Empirically, we often observe countries achieving low inflation without any of these types of arrangements. And, as Taylor (1983) observes, many governments overcome dynamic inconsistency problems in other settings, such as patent law and capital taxation, without such measures. In the case of monetary policy, there are three leading explanations of these successes. The first is that they stem from the delegation of policy to individuals who place more weight on achieving low inflation than is warranted by its effect on social welfare (Rogoff, 1985). The second is that they arise from the fact that policymakers' horizons are longer than a single period. With longer horizons, policymakers have incentives to establish reputations as being anti-inflationary (for example, Barro and Gordon, 1983, and Backus and Driffill, 1985). The final possibility is that forward-looking expectations are relatively unimportant to the output-inflation tradeoff. For example, as we describe below, New Zealand took major steps in the late 1980s to make credible commitments to reducing inflation. But Debelle (1996) finds that these efforts had little impact on the output costs of the subsequent disinflation. In the extreme case where there is no forward-looking element to the behavior of inflation, low-inflation policy is not dynamically inconsistent, and thus no measures are needed to deal with dynamic inconsistency. In sum, if dynamic inconsistency is a problem at all, there appear to be several ways of overcoming it.

The Limits of Available Knowledge. The fact that the best available knowledge about the economy and policy is limited clearly cannot be fully solved. But there are at least two ways of allowing improvements in knowledge to be reflected as rapidly as possible in policy. The first, which we discuss below, is to put policy under the control of individuals with a state-of-the-art understanding of the relevant issues. Such experts are likely to incorporate advances in knowledge into monetary policymaking faster

than less-informed individuals.

The second way of dealing with limited knowledge is to give policymakers the ability to use their state-of-the-art understanding. That is, one important way of dealing with the fact that our knowledge is growing is the opposite of the first solution to the dynamic inconsistency problem: policy should be made according to discretion. If the best available evidence at a given time about policy is incorporated into a binding rule, the conduct of policy cannot reflect improvements in knowledge. If monetary policymakers had adopted a rule in the 1920s, for example, it might have been one of procyclical policy to provide an "elastic currency"; in the 1950s or 1960s, it might have been one of rapid feedback aimed at stabilization and at maintaining low unemployment; and in the 1970s, it might have been one of steady growth of M1 or M2. In light of what has been learned since those times, it seems likely that any one of those rules would have had large costs. And as we emphasize above, there is little reason to believe that we now have a firm understanding of the best policy rule.

Our imperfect knowledge concerns not just the specifics of how policy should be conducted to achieve a given set of objectives, but also what those objectives should be. For example, as described above, there have been major advances in recent decades in our understanding of the appropriateness of low unemployment as a goal for monetary policy, and there is still great uncertainty about such fundamental issues as the optimal rate of inflation and the benefits of stabilization. Thus, for discretion to address the problem of limited knowledge, the discretion must concern both the implementation and the objectives of policy. That is, our analysis implies that -- in contrast to the presumption of such authors as Fischer (1995) -- policymakers should have not only instrument independence, but goal independence as well.

Policymakers' Limited Knowledge. The natural solution to the

problem that policymakers' knowledge may not be at the frontier of our understanding is to delegate policymaking to experts. When knowledge is heterogeneous, policy should be made by well-informed individuals with the discretion to use their knowledge. The natural way to do this is to delegate control of policy to an independent central bank.

This argument for central bank independence is very different from the argument implied by dynamic inconsistency. In that case, the purpose of central bank independence is to delegate policy to individuals who do not share prevailing views about social welfare. Here, in contrast, the purpose is to delegate policy to individuals who are particularly adept at evaluating and maximizing social welfare.

In addition, concern about policymakers' knowledge and skills provides an argument for short terms of office for policymakers and for allowing for their reappointment. Policymakers' knowledge and skills are heterogeneous, and their conduct of policy is likely to reveal considerable information about them along these dimensions. If policymakers can be evaluated frequently and dismissed if they are not performing well, then it is possible to take advantage of this information. Thus it will be possible to raise policymakers' average skill level.

Elected Leaders' and Voters' Limited Knowledge. The problems created by the fact that policymakers must answer to elected officials, who must in turn answer to the public, may be the hardest to solve. Policymakers must ultimately be responsible to the public; if not, there would be nothing to prevent them from pursuing objectives completely unrelated to social welfare. Yet if elected leaders or voters have systematic misunderstandings of policy, it is hard to see how to prevent those misunderstandings from being reflected in policy.

The key to resolving this difficulty is that many important cases of imperfect understanding stem from the fact that the costs and benefits of

restrained money growth occur at different horizons. The costs of a recession to achieve price stability are immediate, but the benefits of the resulting increased capital formation and higher standards of living are spread over the indefinite future. The pain of eliminating a money-financed budget deficit through higher taxes, lower government employment, and higher prices of previously subsidized goods is felt quickly, while again the advantages of greater stability and growth accrue only slowly.

This discrepancy in the timing of the costs and benefits of low money growth suggests two institutional features that may help overcome the problems created by elected leaders' and the public's limited knowledge. The first is to make policymakers' terms relatively long. Specifically, their terms should be long enough that a substantial fraction of the benefits of any moves toward low money growth are apparent by the ends of their terms. Consider, for example, policymakers faced with high inflation. If their terms are short, they will know that if they embark on a policy of disinflation, the economy will probably be suffering through a recession when their terms end. If their terms are long, on the other hand, they will know that inflation may be low and unemployment normal by the time they are eligible for reappointment.

The second type of institution that can help address these problems are mechanisms that create delays in elected leaders' influence over policy. Specifically, if there are long enough lags that elected leaders cannot determine the policies that will be undertaken during their terms, they have no incentive to try to influence policy to exploit the public's misunderstandings. For example, leaders who cannot influence policy until after they are up for reelection have no way of catering to the public's desire for low interest rates during their terms, or of pursuing a traditional political business cycle policy.

Long terms of office for policymakers are one way to create delays

in elected leaders' control over policy: if policymakers' terms are considerably longer than elected leaders', then policy during a leader's term will be determined mainly by individuals appointed by his or her predecessors. Even with long terms of office, however, an elected leader who can appoint a policymaker has an immediate influence over policy. If, for example, the term of the head of the central bank ends shortly before an election, the elected leader may have an incentive to appoint someone who will pursue expansionary policy.

A more effective way to create delays in elected leaders' influence over policy is therefore through a two-level system where the leaders appoint members of a "board of trustees" of the central bank, which in turn selects the ultimate policymakers. If the trustees' terms are long enough that an elected leader cannot appoint a majority of members of the board during his or her term, then the elected leader has essentially no ability to bring about expansionary policy before he or she is up for reelection.

The appointment of the presidents of the regional Federal Reserve banks in the United States has elements of this type of two-level system: the appointment of the bank presidents must be approved by the Board of Governors, whose members are in turn appointed by the President and confirmed by Congress. Our analysis predicts that policymakers appointed indirectly will favor less expansionary policies than ones appointed directly. This prediction is confirmed by the behavior of the bank presidents and governors: the bank presidents have a systematic tendency to favor less expansionary policies than the governors (Belden, 1989).

IV. COMBINING THE POSSIBLE REMEDIES

The analysis in the previous section does not provide clear guidance

concerning what set of institutions is likely to produce desirable overall outcomes. Several of the institutional features we discuss, such as binding rules and long terms of office for policymakers, are helpful with regard to some problems but counterproductive with regard to others. This section therefore considers how the different features could be combined.

A Possible Combination. A possible combination of institutions that could substantially address all of the problems we have discussed is one with the following key features:

1. An independent central bank with discretion concerning both the ultimate goals and the specific operation of policy.
2. A two-level structure where policymakers are appointed by a board of trustees, who are in turn appointed by elected leaders.
3. Reasonably long terms of office for the trustees and reasonably short terms for the policymakers, with the policymakers but not the trustees eligible for reappointment.
4. Provision for the dismissal of policymakers before the ends of their terms by super-majority vote of the trustees.

Benefits. This package of institutions has several benefits. Most importantly, these institutions have features that would address the various problems that arise from misunderstandings of the operation of the economy and the effects of policy. By giving policymakers discretion, they allow advances in knowledge to be quickly incorporated into the conduct of policy. By delegating policy to an independent central bank, they provide for the conduct of policy by specialists. By allowing for the reappointment of policymakers, making their terms relatively short, and allowing the board of trustees to remove policymakers by super-majority vote, they allow the

trustees to retain high-skill policymakers and dismiss low-skill ones. And, as described in the previous section, both the two-level structure and the relatively long terms of office for the trustees help to overcome the problems created by the public's and elected leaders' imperfect understanding.⁴

In addition, these institutions allow the dynamic inconsistency problem to be overcome either through reputation or through the appointment of conservative trustees or policymakers. Specifically, the policymakers have an incentive to establish reputations for following low-inflation policies, and the trustees have an incentive to establish reputations for rewarding policymakers who follow such policies. Alternatively, elected leaders can appoint trustees who attach unusual importance to keeping inflation low, or the trustees can appoint such individuals as policymakers.

A further advantage of the two-level structure is that it places the choice of whether to select conservative individuals as policymakers in the hands of the trustees rather than of elected leaders. The optimal degree of conservatism for policymakers depends on such considerations as the relative importance of keeping inflation low and responding optimally to shocks (Rogoff, 1985), the costs and benefits of surprise inflation, and the extent to

⁴ Most of the independence of policy from the public and elected leaders under the two-level structure stems from the trustees' independence from elected leaders, rather from policymakers' independence from the trustees. A formal analysis of the optimal way to create independence would show that the optimal structure depends on the relative difficulties of finding individuals who are skilled at conducting policy and finding individuals who are skilled at evaluating policymakers. If, for example, it is difficult to evaluate policymakers but a good evaluator can confidently identify a large pool of skilled policymakers, then the optimal way to create independence is to make policymakers highly independent of the trustees and to allow for frequent reevaluation of the trustees. Our implicit assumption is that the reverse assumption holds -- that is, that it is easier to identify skilled evaluators than skilled policymakers.

which reputational forces overcome the dynamic inconsistency problem. The trustees are likely to have much more knowledge about these issues than are elected leaders.

Finally, the two-level structure provides for the delegation of policy to specialists, while keeping ultimate control over monetary policy in the hands of elected leaders (and thus of the public). In the current system in the United States, some of the ultimate control over policy is exercised by directors of the regional reserve banks, two-thirds of whom are appointed by the member banks in the districts. In addition to introducing the obvious problem of regulated firms helping to select their regulators, this feature of the current system appears anti-democratic; indeed, its constitutionality has been challenged. The two-level structure, in contrast, achieves independence and delegation to specialists without placing any of the underlying control over policy in the hands of anyone other than the public.

The Specifics of the Two-Tier System. The purpose of the two-level system is to provide policymakers with substantial independence from elected leaders while still allowing for their relatively rapid removal if they are not conducting policy well. To accomplish these goals, it is important that the system be structured so that the trustees do not take control of the day-to-day conduct of policy. This can be accomplished by limiting the frequency of the board's meetings and by giving it no powers other than the appointment, reappointment, and dismissal of the ultimate policymakers. For example, the members of the ultimate policymaking body could be appointed to staggered two-year terms. The board of trustees could then meet every six months, with its authority limited to the consideration of the reappointment of policymakers, the appointment of new policymakers, and (if need be) the early dismissal of policymakers whose terms have not expired.

Because the trustees' meetings would be infrequent, serving as a

trustee would be much less than a full-time job. There is a wide range of activities from which trustees could be drawn. Since the trustees would not determine the specifics of policy, there is no reason that the board could not include individuals who are involved in financial markets (as long as the policymaking body was not making regulatory decisions concerning their firms). Other types of individuals who could naturally serve as trustees include academics, members of think tanks, former members of the policymaking body, former members of the executive and legislative branches with expertise concerning monetary policy, and industrial and labor leaders. As in other arenas, having individuals from a variety of backgrounds would be a safeguard against the appointment of policymakers with extreme or idiosyncratic views. Finally, since the responsibilities of the ultimate policymakers under this proposal are similar to what they are under conventional systems of direct appointment, moving to a two-level system does not require any major changes in the types of individuals appointed as ultimate policymakers.

Alternative Structures. If a two-level structure for appointing policymakers is infeasible for some reason, then there would be large advantages to lengthening policymakers' terms. If policymakers' have short terms and are directly appointed by elected leaders, there would be substantial risk of inflationary bias arising from dynamic inconsistency, of elected leaders manipulating policy to exploit the public's misunderstandings, and of shifts to low-inflation policy being aborted before their benefits were apparent. Longer terms would reduce all of these problems. But having elected leaders directly appoint policymakers to long terms would eliminate the possibility of quickly removing policymakers whose skills prove to be low. It would also give elected leaders more control over policy during their terms, and it would leave the choice of the degree of conservatism of policymakers to elected leaders rather than to a board of trustees. For these

reasons, a two-level system is likely to produce more desirable outcomes than the direct appointment of policymakers to long terms.

A more fundamental alternative to the two-tier structure is one that makes policy follow a binding rule or that specifies the ultimate goals of policy. If the only source of problems in policy were dynamic inconsistency, such an arrangement might be preferable to the set of institutions we have been discussing. If it is possible to identify the optimal policy rule, for example, then committing to that rule is optimal.

As described above, such a rule is not necessary to overcoming dynamic inconsistency: countries often achieve low inflation without any arrangement along these lines. Moreover, the set of institutions we discuss allows reputation and delegation to overcome dynamic inconsistency. Thus the potential advantages of binding rules and pre-specified goals over the combination of an independent central bank and a two-tier structure are small.

More importantly, commitment to a binding rule is likely to be less successful in addressing problems other than dynamic inconsistency. We do not in fact know the optimal policy rule. The issue is not just that it is impossible to identify every possible type of shock in advance. The more fundamental problem is that, as described above, there is great uncertainty about such basic issues as the optimal inflation rate and the relative importance of keeping inflation on target versus smoothing fluctuations in output. Thus trying to specify a binding rule for policy, or even what policymakers' ultimate goals should be, may have large costs.

Finally, there are two features that can easily be added to the combination of institutions we have been discussing. First, one could penalize policymakers for deviating from low-inflation policies, as proposed by Walsh (1995a) and Persson and Tabellini (1993). But, just as determining the optimal degree of conservatism for policymakers is difficult,

so too is determining the optimal penalty for inflationary policies. The optimal penalty depends on such factors as the importance that policymakers attach to their own compensation or prestige relative to social welfare and the extent to which reputation already overcomes dynamic inconsistency. If reputational forces and the selection of conservative policymakers would already largely eliminate inflationary bias, then adding penalties for inflation could result in inefficiently low inflation.

Second, DeBelle and Fischer (1994) and others argue for the importance of increasing policymakers' accountability, for example by requiring them to periodically state the goals of policy, explain how the conduct of policy is designed to achieve those goals, and justify any departures from the previously announced path of policy. Again, it would be straightforward to add such requirements to the combination of institutions we have been discussing. The potential benefits of these requirements appear to be small, however. To the extent that they help policymakers build support for their policies, increase their credibility, and reduce uncertainty, then policymakers have an incentive to take these steps without a formal requirement. And policymaking is sufficiently complicated that such a requirement would not be a substantial impediment to policymakers who wanted to pursue goals other than maximizing social welfare, for example by overstimulating the economy just before an election.

V. RECENT AND PROPOSED MONETARY REFORMS

This section analyzes the most important recent monetary reforms in industrialized countries in light of the preceding discussion. We also analyze the proposed design of the European Central Bank.

Policy Changes. The most common type of recent monetary reform

in industrialized countries is a shift to a low-inflation policy within existing institutional arrangements. Changes to policies that made low inflation or price stability the primary or the sole objective of policy were made in New Zealand in 1984, Canada in 1988, the United Kingdom in 1992, and Sweden and Finland in 1993. In every case, the change was followed by a large reduction in inflation, and a large rise in unemployment.⁵

These policy shifts have two implications for our analysis. First, they provide clear evidence of the importance of advances in knowledge for the conduct of policy. Since these changes occurred without any changes in institutions, they cannot be due to changes in the incentives that policymakers face. Nor, since they occurred in so many countries, can they be attributed to such factors as random fluctuations in policymakers' tastes. Rather, the changes appear to be due to the growing evidence of the absence of a long-run output-inflation tradeoff, of the costs of moderate inflation, and of the limitations of stabilization policy.

Second, these shifts are further evidence that policy can avoid inflationary bias without binding rules or legislated goals. In all of these countries, policymakers reduced inflation substantially under existing institutional arrangements. This again suggests that dynamic inconsistency was not the source of these countries' high inflation rates. And since policymakers would have the ability to make low inflation their main objective under the institutional framework discussed in Section IV, this suggests that these arrangements would be sufficient to avoid excessive

⁵ Of course, policymakers in almost all countries have put more emphasis on low inflation over the past fifteen years. We focus on the clearest shifts in the goals of policy.

inflation.⁶

At the same time, our analysis has an important implication for these policy reforms. Policy was overly inflationary in these countries for extended periods. Given what we now know about the costs of expansionary policies, this particular mistake is unlikely to be repeated. And by making low inflation the central goal of policy, the reforms in these countries provide additional insurance against the reoccurrence of this mistake, and make a specific judgment about how much weight policy should put on keeping inflation low.

But these reforms do not address the underlying problems that led to the policy failures: they do nothing to give specialists greater control over policy, or to raise those specialists' average skill levels. As a result, although they reduce the likelihood of repetition of a particular failure of policy, they do nothing to reduce the likelihood of other failures. Suppose that evidence appears that a major change in policy is warranted -- evidence, for example, that there are substantial benefits of moderate deflation, or of trying to aggressively stabilize the economy while keeping average inflation low. The recent policy reforms do nothing that will cause such evidence to be reflected in the conduct of policy any more rapidly than was the evidence about the costs of inflation. Indeed, by emphasizing our current beliefs about desirable policy, the reforms could slow the response to evidence that

⁶ One could argue that the fact that these countries have been able to reduce inflation only through high unemployment indicates that their polices were not fully credible, and that binding low-inflation rules would produce a more favorable unemployment-inflation tradeoff. But since all of these shifts in the announced goals of policy were followed by large declines in actual inflation, the idea that the policies -- particularly the later ones -- did not have substantial credibility is implausible. Thus a more reasonable interpretation of the fact that the disinflations had substantial output costs is that inflation has an important inertial component, and thus that any use of monetary policy to disinflate requires a period of high unemployment.

changes in policy are warranted.

Institutional Reforms in New Zealand and France. The two industrialized countries that have significantly altered their monetary institutions in recent years are New Zealand and France. The Reserve Bank Act of 1989 altered New Zealand's monetary institutions in several ways (see Dawe, 1990; Lloyd, 1992; Fischer, 1993; Dowd and Baker, 1994; and Walsh, 1995b). First, it greatly increased the independence of the Reserve Bank and gave it much greater control over monetary policy. Second, it made price stability the sole objective of policy. Third, it provided for periodic Policy Targets Agreements between the bank and the government on a definition of price stability and a timetable for achieving it. The governor of the bank may be dismissed if the goals set out in the agreement are not met, unless the failure is due to changes in indirect taxes, terms-of-trade shocks, or a natural disaster. Fourth, the act requires the governor to issue a monetary policy statement at least every six months that discusses how policy is being conducted and how that conduct relates to the Policy Targets Agreement and the goal of price stability. Fifth, it clearly delineates the roles of the governor of the Reserve Bank and the bank's board of directors. The governor is solely responsible for the conduct of policy and for achieving the objectives in the Policy Targets Agreement; the board of directors has only a monitoring role.

Finally, the act changes the procedures for appointing the governor and the directors. The directors are appointed by the Minister of Finance to five-year terms, and can be reappointed. The governor, in contrast, is chosen by the Minister of Finance from a list of candidates submitted by the board of directors. Like the directors, he or she has a five-year term and can be reappointed.

These institutional reforms have much in common with the combination of institutions we discuss in Section IV. Policy is conducted by

a highly independent central bank with considerable discretion over the implementation of policy. The fact that the government must choose the governor of the Reserve Bank from a list drawn up by the directors sets up a two-level system. While not identical to the arrangement described in the previous section, the New Zealand two-tier system does mean that the government has only limited control in the short run over who is in charge of policy. Furthermore, it makes it possible to have the governor subject to dismissal without compromising the independence of the central bank. Because of these features, we would expect the reforms to produce desirable policy.

The one major feature of New Zealand's reforms that differs from the framework described in the previous section is the emphasis on price stability. As suggested above, this emphasis appears unnecessary: the institutional framework gives the governor enough independence and flexibility to pursue price stability if that is the most appropriate goal of policy, and does not have any features that would incline him or her not to do so in such situations. Indeed, Dowd and Baker (1994) find that the main shifts in monetary policy and expected inflation in New Zealand came in 1984, with a shift in the conduct of policy under the old institutions, rather than in 1989. In addition, as we have emphasized, the focus on price stability has a drawback: if evidence appears that this is not the best goal of policy, policymakers will be unable to respond rapidly.

France overhauled its monetary institutions in 1993 (Banque de France, 1993). As in New Zealand, the changes in France gave the central bank much more independence and control over policy, made price stability the central goal of policy, and required the bank to make periodic reports on its conduct of policy. The reforms gave authority over monetary policy to a monetary policy council consisting of a governor, two deputy governors, and six other members. The governor and deputy governors are appointed

by the government to six-year terms that can only be renewed once. The other members are appointed by the government to non-renewable nine-year terms.

The overwhelming advantage of these reforms is that they grant control over policy to an independent central bank. This will almost surely produce more desirable outcomes than having policy determined by the government. The reforms, however, do little beyond increasing the central bank's independence. The emphasis on price stability, as we have argued, is probably unnecessary and potentially counterproductive. And the reforms do not have any features that allow low-skill policymakers to be dismissed rapidly or that prevent the government from appointing individuals who would overstimulate the economy prior to elections. In short, the French reforms appear to be driven by a single-minded focus on central bank independence and price stability, and not by a thorough rethinking of the sources of problems in monetary policy and of the measures that would overcome them.

The European Central Bank. The proposed European Central Bank (ECB) provides another important example of radical changes in monetary institutions. As agreed to in the 1991 Maastricht Treaty, the ECB would largely eliminate the monetary policy functions of the various national central banks. As a result, the institutional features of the ECB are likely to be a crucial determinant of monetary stability in a united Europe.⁷

One important feature of the European Central Bank is that it is highly independent. The six-member Executive Board is chosen by "common accord" of the governments forming the monetary union, based on the recommendation of the European Council. The members of the board

⁷ Kenen (1992), Giovannini (1992), and Thygesen (1993) provide useful descriptions of the key features of the European Central Bank.

are appointed for non-renewable eight-year terms, and cannot be dismissed arbitrarily. Monetary policy is decided by the Governing Council, which consists of the heads of all the national central banks and the members of the Executive Board. To ensure the independence of the national central bank governors, all of their terms must be at least five years, though they can be renewable.

The independence of the Governing Council is ensured in other ways. First, because the ECB is set up by treaty, it is inherently very hard to change its institutional structure. This is in contrast to the Federal Reserve, whose independence can be changed at any time by a simple act of Congress. Second, independence is assured by a series of articles that prohibit both the Community and the national governments from trying to influence the Governing Council of the ECB, and that impose strict limits on the monetary financing of official entities.

While the independence of the European Central Bank is clearly consistent with the institutional arrangement we discuss in Section IV, its organizational structure differs in an important way from that framework. The political appointees to the Governing Council make monetary policy directly, rather than merely choosing the policymakers. As a consequence, the policymakers must have long, non-renewable terms to ensure their independence. This has the effect that policymakers who prove incompetent cannot be removed and those who prove adept cannot be reappointed.

Another important feature of the ECB is its degree of goal and instrument independence. The Statute of the European System of Central Banks (ESCB) states that the "primary objective" of the European Central Bank is to maintain price stability. Many other goals are also mentioned, such as balanced development, a high level of employment, and social cohesion. However, the Statute explicitly states that these goals may only be considered if they do not conflict with the goal of price stability.

As discussed above, explicit goals may be problematic because knowledge about the desirability of various objectives may improve over time. For this reason, the ECB's explicit goal may be less than ideal. On the other hand, it is not clear how binding this stated goal will actually be. The ESCB Statute contains no definition of price stability, no procedures for setting targets or transition plans, no punishments for failure to achieve price stability, and few requirements for explaining undesirable inflation outcomes. As a result, it is quite likely that the goal will not be binding. Indeed, Thygesen (1992, p. 18) suggests that many fear that the ECB will be more inflationary than the current system, which is dominated by the conservative Bundesbank. Therefore, it is possible that the ECB has a nearly ideal level of goal independence.

The European Central Bank also has essentially complete instrument independence. The Treaty delegates the implementation of monetary policy entirely to the Executive Board of the ECB. This institutional feature is consistent with the view that it is undesirable to tie the monetary authority to particular targets or instruments when knowledge is limited.

VI. CONCLUSION

The central argument of this paper is that in designing the institutions of monetary policy, it is not enough to consider the incentives that the institutions create for fully informed, optimizing individuals. It is also important to consider the limitations of knowledge. Specifically, it is important to account for the facts that knowledge is likely to continue growing, that policymakers' skills are heterogeneous, and that elected leaders' and voters' knowledge is likely to be especially limited.

These considerations suggest that in order to reduce monetary policy mistakes the institutions of monetary policy should be designed to give control over policy to specialists with discretion about both the ultimate goals of policy and the specifics of policy operations. They also suggest that the policy institutions should allow for frequent evaluation of policymakers' performance, while insulating them from political pressures. One way to do this is to make policymakers responsible to a board of trustees, and to give the trustees considerable independence from elected leaders and the public.

A natural question is whether limitations in knowledge are important to other policy issues. For example, it is widely believed that many countries' budget deficits are excessive. Efforts to explain a tendency toward excessive deficits on the basis of strategic considerations with fully informed individuals have had only limited success. For example, Persson and Svensson (1989) and Tabellini and Alesina (1990) find that strategic interactions between political parties with differing views lead to excessive deficits only when certain parties are in power, or only when preferences exhibit features that are not particularly natural. Given the limitations of these theories, and given the evidence we have presented about the sources of failures in monetary policy, the possibility that excessive deficits stem from limited knowledge deserves serious consideration.

More generally, our analysis suggests that the potential effects of limited knowledge should be an important consideration in the design of any policy institutions. We leave it to future research to determine what undesirable outcomes have arisen from limited knowledge in other policy settings and how other policy institutions could be designed to avoid those outcomes.

REFERENCES

- Alesina, Alberto. 1988. "Macroeconomics and Politics." NBER Macroeconomics Annual 3: 13-52.
- Atkeson, Andrew, and Christopher Phelan. 1994. "Reconsidering the Costs of Business Cycles with Incomplete Markets." NBER Macroeconomics Annual 9: 187-207.
- Backus, David, and John Driffill. 1985. "Inflation and Reputation." American Economic Review 75 (June): 530-538.
- Banque de France, 1993. Annual Report. Paris: Imprimerie Nationale.
- Barro, Robert J. 1995. "Inflation and Economic Growth." National Bureau of Economic Research Working Paper No. 5326 (October).
- Barro, Robert J., and David B. Gordon. 1983. "Rules, Discretion and Reputation in a Model of Monetary Policy." Journal of Monetary Economics 12 (July): 101-121.
- Belden, Susan. 1989. "Policy Preferences of FOMC Members as Revealed by Dissenting Votes." Journal of Money, Credit, and Banking 21 (November): 432-441.
- Buchanan, James M., and Richard E. Wagner. 1977. Democracy in Deficit: The Political Legacy of Lord Keynes. New York: Academic Press.
- Card, David, and Dean R. Hyslop. 1996. "Does Inflation 'Grease the Wheels of the Labor Market'?" This volume, Chapter 2.
- Cardoso, Eliana A. 1988. "Comment." In Michael Bruno, Guido Di Tella, Rudiger Dornbusch, and Stanley Fischer, eds., Inflation Stabilization: The Experience of Israel, Argentina, Brazil, Bolivia, and Mexico, 287-294. Cambridge: MIT Press.
- Cukierman, Alex, Steven B. Webb, and Bilin Neyapti. 1992. "Measuring the Independence of Central Banks and Its Effect on Policy Outcomes." World Bank Economic Review 6 (September): 353-398.

- Dawe, Stephen. 1990. "Reserve Bank of New Zealand Act 1989." *Reserve Bank of New Zealand Bulletin* 53 (March): 29-36.
- Debelle, Guy. 1996. "The Ends of Three Small Inflations: Australia, New Zealand, and Canada." *Canadian Public Policy* (March): 56-78.
- Debelle, Guy, and Stanley Fischer. 1994. "How Independent Should a Central Bank Be?" Unpublished paper, M.I.T. (March).
- De Long, J. Bradford. 1996. "America's Only Peacetime Inflation: The 1970s." This volume, Chapter 6.
- De Long, J. Bradford, and Lawrence H. Summers. 1988. "How Does Macroeconomic Policy Affect Output?" *Brookings Papers on Economic Activity*, no. 2, 433-480.
- Dornbusch, Rudiger, and Sebastian Edwards. 1990. "Macroeconomic Populism." *Journal of Development Economics* 32 (April): 247-277.
- Dornbusch, Rudiger, and Sebastian Edwards, eds. 1991. *The Macroeconomics of Populism in Latin America*. Chicago: University of Chicago Press.
- Dowd, Kevin, and Simon Baker, 1994. "The New Zealand Monetary Policy Experiment -- A Preliminary Assessment." *World Economy* 17 (November): 855-867.
- Feldstein, Martin. 1996. "The Costs and Benefits of Going from Low Inflation to Price Stability." This volume, Chapter 3.
- Fischer, Andreas M. 1993. "Inflation Targeting: The New Zealand and Canadian Cases." *Cato Journal* 13 (Spring/Summer): 1-27.
- Fischer, Stanley. 1995. "The Unending Search for Monetary Salvation." *NBER Macroeconomics Annual* 10: 275-286.
- _____. 1993. "The Role of Macroeconomic Factors in Growth." *Journal of Monetary Economics* 32 (December): 485-512.
- _____. 1991. "Growth, Macroeconomics, and Development." *NBER Macroeconomics Annual* 6: 329-364.

- Freedman, Charles. 1993. "Designing Institutions for Monetary Stability: A Comment." Carnegie-Rochester Conference Series on Public Policy 39 (December): 85-94.
- Friedman, Milton. 1960. A Program for Monetary Stability. New York: Fordham University Press.
- Friedman, Milton, and Anna J. Schwartz. 1963. A Monetary History of the United States, 1867-1960. Princeton: Princeton University Press.
- Giovannini, Alberto. 1992. "Central Banking in a Monetary Union: Reflections on the Proposed Statute of the European Central Bank." CEPR Occasional Paper No. 9.
- Grilli, Vittorio, Donato Masciandaro, and Guido Tabellini. 1991. "Political and Monetary Institutions and Public Financial Policies in the Industrial Countries." Economic Policy, no. 13 (October): 341-392.
- Kahn, Shulamit. 1994. "Evidence of Nominal Wage Stickiness from Microdata." Unpublished paper, Boston University School of Management.
- Kenen, Peter B. 1992. EMU After Maastricht. Washington, D.C.: Group of Thirty.
- Kydland, Finn E., and Edward C. Prescott. 1977. "Rules Rather Than Discretion: The Inconsistency of Optimal Plans." Journal of Political Economy 87 (June): 473-492.
- Lago, Ricardo. 1991. "The Illusion of Pursuing Redistribution through Macropolicy: Peru's Heterodox Experience, 1985-1990." In Rudiger Dornbusch and Sebastian Edwards, eds., The Macroeconomics of Populism in Latin America, 263-323. Chicago: University of Chicago Press.
- Lane, Philip R. 1994. "Openness, Inflation, an Exchange Rate Regimes." Unpublished paper, Harvard University (December).
- Lohmann, Suzanne. 1992. "Optimal Commitment in Monetary Policy: Credibility versus Flexibility." American Economic Review 82 (March): 273-286.

- Lloyd, Michele. 1992. "The New Zealand Approach to Central Bank Autonomy." Reserve Bank of New Zealand Bulletin 55 (September): 203-220.
- Lucas, Robert E., Jr. 1987. Models of Business Cycles. Oxford: Basil Blackwell.
- Macedo, Roberto. 1988. "Comment." In Michael Bruno, Guido Di Tella, Rudiger Dornbusch, and Stanley Fischer, eds., Inflation Stabilization: The Experience of Israel, Argentina, Brazil, Bolivia, and Mexico, 294-298. Cambridge: MIT Press.
- McLaughlin, Kenneth J. 1994. "Rigid Wages?" Journal of Monetary Economics 34 (December): 383-414
- Meltzer, Allan. 1988. Keynes's Monetary Theory: A Different Interpretation. Cambridge: Cambridge University Press.
- Nordhaus, William D. 1975. "The Political Business Cycle." Review of Economic Studies 42 (April): 169-190.
- Ortiz, Guillermo. 1988. "Comment." In Michael Bruno, Guido Di Tella, Rudiger Dornbusch, and Stanley Fischer, eds., Inflation Stabilization: The Experience of Israel, Argentina, Brazil, Bolivia, and Mexico, 298-302. Cambridge: MIT Press.
- Persson, Torsten, and Lars E. O. Svensson. 1989. "Why a Stubborn Conservative Would Run a Deficit: Policy with Time-Inconsistent Preferences." Quarterly Journal of Economics 104 (May): 325-345.
- Persson, Torsten, and Guido Tabellini. 1993. "Designing Institutions for Monetary Stability." Carnegie-Rochester Conference Series on Public Policy 39 (December): 53-84.
- Rogoff, Kenneth. 1985. "The Optimal Degree of Commitment to an Intermediate Monetary Target." Quarterly Journal of Economics 100 (November): 1169-1189.
- Romer, David. 1993. "Openness and Inflation: Theory and Evidence." Quarterly Journal of Economics 108 (November): 869-903.

- Rudebusch, Glenn D., and David W. Wilcox. 1994. "Productivity and Inflation: Evidence and Interpretations." Unpublished paper, Federal Reserve Board (May).
- Sachs, Jeffrey D. 1994. "Prospects for Monetary Stabilization in Russia." In A. Aslund, ed., Economic Transformation in Russia, 34-58. London: Pinter Publishers.
- Simonsen, Mario Henrique. 1988. "Price Stabilization and Incomes Policies: Theory and the Brazilian Case Study." In Michael Bruno, Guido Di Tella, Rudiger Dornbusch, and Stanley Fischer, eds., Inflation Stabilization: The Experience of Israel, Argentina, Brazil, Bolivia, and Mexico, 259-286. Cambridge: MIT Press.
- Tabellini, Guido, and Alberto Alesina. 1990. "Voting on the Budget Deficit." American Economic Review 80 (March): 37-49.
- Taylor, John B. "Comments." Journal of Monetary Economics 12 (July): 123-125.
- Thygesen, Niels. 1993. "EMU: A Solid Framework from Maastricht." In The Monetary Future of Europe. London: Centre for Economic Policy Research.
- Walsh, Carl E. 1995a. "Optimal Contracts for Central Bankers." American Economic Review 85 (March): 150-167.
- Walsh, Carl E. 1995b. "Is New Zealand's Reserve Bank Act of 1989 an Optimal Central Bank Contract?" Journal of Money, Credit, and Banking 27 (November): 1179-1191.