Central Bank Independence and Inflation Targeting: Monetary Policy Paradigms for the Next Millennium?

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An expanding body of literature typified by Stanley Fischer (1996) holds two truths about monetary policy to be self-evident: Effective central banks must be independent from undue political interference, and they would do well to target the rate of inflation directly. This article evaluates the progression of economic thought that led to these conclusions and examines the empirical evidence to support them.

The genesis of this literature may be found in the concern about the effective use of the significant power wielded by central banks around the world, and in the response to a pivotal and turbulent period in economic history. The central bank in the United States, as in many other countries, is arguably the most powerful economic institution, with the ability to influence the direction of the economy with some alacrity in response to changing economic conditions. This concentration of power naturally leads many to focus attention on the appropriate behavior of the Federal Reserve. This power and its appropriate use occupied center stage during the 1970s, when the marked rise in the level and variability of inflation following the oil price surges of the 1970s led many to question the Fed's and other central banks' commitment to a low and stable inflation rate.[1] Economists considered the possibility that central banks around the world faced incentives that would inherently lead to an "inflationary bias," and that this bias had manifested itself in the high inflation period of the 1970s.

In essence, the economic upheaval caused by the extraordinary inflation of the period demanded an explanation, and the "inflationary bias" theory struck many academics and policymakers as plausible. As a result, a solution to the problem was actively sought. The acceptance of the inflationary bias as the source of the great inflation and the resulting focus on proposed solutions to the bias, which ranged from the establishment of central bank independence to the adherence to monetary policy "rules" and inflation targets, have propelled the economics liter-

ature and many practitioners' discussions of monetary policy from the late 1970s to the present.

This article will take a critical look at the theory of inherent inflationary bias and the proposed solutions to the bias, focusing particularly on mechanisms for ensuring central bank independence and on inflation targeting. It will then examine the robustness of the empirical results that are often used to support the validity of the solutions.

Time Inconsistency, the Inflationary Bias, and Credible Monetary Policy

The notion that the central bank might be subject to an inflationary bias has its roots in the literature on "time inconsistency," which was developed in a widely cited paper by Finn Kydland and Edward Prescott (1977). Because so much of the current discussion of the proper design of central banks around the world has stemmed from this time inconsistency/inflationary bias theory, it is important to understand the theory as clearly as possible.

The gist of the argument may be seen clearly in a classic example from local public finance. A town wants companies to locate within its boundaries in order to create jobs for its citizens and increase commerce for existing businesses. It would prefer not to lose tax revenue, but in order to entice a company to locate in the town, it offers the firm a low tax rate. The firm likes the deal, builds its plant in the town, and hires local workers. However, recognizing the (at least partial) irreversibility of the firm's decision, the town now sees that it can, ex post, raise the tax rate on the firm. In fact, doing so will be optimal, because the decision of the firm has already been made, so the town will retain the increase in employment *and* gain an increase in tax revenues. The town's tax policy is clearly not consistent over time—hence the label "time inconsistency"—but, given its incentives, its tax policy is optimal.

The paradigm of time inconsistency was applied to the problem of monetary policy by Robert Barro and David Gordon (1983) in order to demonstrate the potential for an inflationary bias. In the simplest version of their model, monetary policymakers like high employment and dislike low employment; they dislike any deviations of inflation about its ultimate target.[2] In addition, the model describes the policymaker as able to act with "discretion": that is, the policymaker can change policy from one time period to the next. The long-run intention of the monetary authority is to keep inflation low, but its desire to keep employment high coupled with the ability to act with discretion yields a tension between its employment and inflation goals. As a consequence, the monetary authority tends to forgive inherited increases in inflation (they are water over the dam) and to allow the public to enjoy the additional employment that often comes with inflation, rather than cause a reduction in employment in order to reverse the trend in inflation. As the monetary authority errs on the side of more employment and thus more inflation, it imparts an inflationary bias to the economy. The situation is analogous to the lenient parent who, observing that the misbehaving child's misdeed is done and cannot be undone, decides not to punish the child. The result might be that the child misbehaves more often than the parent would like.

A literal rendering of Barro and Gordon's theory may be less revealing than a broader interpretation.[3] The thrust of Barro and Gordon's argument is that a central bank that is unduly influenced by political pressures may achieve a higher inflation outcome, with no better employment outcome, than one that is insulated from such pressures.

The definition of what constitutes "undue" political pressure is critical in discussions of optimal design of monetary policy institutions. Guy Debelle and Fischer (1994) and Geoffrey Tootell (1996) tackle this issue from different viewpoints. In essence, a central bank cannot and should not maintain long-term independence from political pressure if it consistently acts contrary to the will of the electorate. How long the long term is, and to what extent (if any) the bank's shorter-term goals should deviate from the public's, are the subject of considerable debate.

[1] Some argue that this questioning began even before the oil shocks, during the "Vietnam inflation" of the 1960s.

[2] N. Gregory Mankiw (1988) outlines the simple analytics of this basic time-inconsistency model.

[3] In the original model of Barro and Gordon (and in the simplified Mankiw 1988 version), the objective function of the monetary authority is slanted towards imparting an inflationary bias. In the original model, the monetary authority tries to achieve an unemployment rate that is below the equilibrium rate (roughly speaking, the NAIRU). In the simplified version, the authority simply gains utility from employment above full employment, and disutility from employment below full employment. A more standard objective function would make deviations of employment on *both* sides of *equilibrium* employment distasteful to the monetary authority. Absent a wedge between equilibrium employment and the monetary authority's target for employment, or an asymmetry in the objective function, the models generally deliver no inflationary bias, even with discretionary policy.

An important corollary to the theoretical presence of an inflationary bias is that a central bank that attempts to pursue stable inflation through discretionary policy will not be *credible*. The other participants in the economy, knowing that the central bank's incentives are to allow more inflation in the economy than is optimal, will not find the bank's (presumably low) inflation target credible. Some writers have suggested that the reason that it has been costly for a central bank to lower the inflation rate in an economy is that the bank's announcements of its intention to disinflate will not be judged credible if it uses discretionary policy to do so. Skeptical firms do not lower the rate of increase in their prices upon the announcement of the bank's intention to disinflate. If firms did believe the intent to disinflate, the central bank could in theory obtain a costless disinflation. Instead, firms only gradually adjust their prices as they see actions by the central bank that are consistent with disinflation (that is, higher interest rates and a recession). In this scenario, inflation falls not because of the recession's effect on the degree of slack in labor and product markets, but because the bank has demonstrated its commitment to the disinflation by raising interest rates, building credibility, and convincing firms that they should lower their prices. According to this theory, if the central bank were truly credible, it would simply announce its intentions and inflation would fall, requiring no rise in interest rates.[4]

Solutions to the Inflationary Bias

The first solution proposed for the time inconsistency problem is to bind the monetary authority to a rule. If the policymaker were constrained to follow a rule that stipulates a counterinflationary response to every inflation shock, then the inflationary bias would never occur. It is the ability of the policymaker to exercise discretion and forgive the inflation that has already occurred that leads it into trouble. This is the genesis of the "rules versus discretion" debate, which will be discussed at greater length below. The rule most often put forward in current policy discussions is an explicit inflation-targeting rule. If the central bank announces and binds itself to such a rule, then the public will know the bank's ultimate goals, and it will find its intentions to pursue those goals credible. The theoretical claim is that when the rule-bound central bank wishes to disinflate, it will be able to do so with significantly less disruption to the real economy than the discretionary central bank.

A central bank cannot and should not maintain long-term independence from political pressure if it consistently acts contrary to the will of the electorate.

Bennett McCallum (1995) has recently pointed out what he considers a flaw in the time inconsistency argument and its implication that rules are necessary to remove the bias. The monetary policymaker, aware of the argument just made and seeing its implications for inflation, can simply "do the right thing" and respond to the inflation shock so as to deliver the desired inflation outcome, not allowing the bias to creep in. Nothing constrains the policymaker from doing so, and in this way circumventing the time inconsistency problem. Thus, rules are not *required* for proper policy behavior; a sufficiently strong will to "do the right thing" is all that is necessary.

Kenneth Rogoff (1985) proposes another solution to the inflationary bias problem. If a central banker with the same preferences as the public (the same distaste for inflation and unemployment) may give rise to an inflationary bias, Rogoff suggests that countries appoint central bankers who have a markedly greater distaste for inflation than the public. The "hawkish" central banker will offset the inherent inflationary bias by responding more vigorously to inflation shocks than a central banker with the public's preferences would in the same circumstances. Some have suggested that the appointment of Paul Volcker represented just such a strategy in the United States.

Carl Walsh (1995) suggests that the "hawkish"

[4] The costless disinflation arises only under certain assumptions about the economy. One important assumption is that only firms' expectations (in particular, their expectation about the future commitment of monetary policy to a disinflationary effort) get in the way of immediate price adjustments. That is, prices could be completely flexible if firms' expectations were also flexible. This strong assumption ignores important features of the way firms typically set wages and prices, especially the tendency to engage in wage or price contracts (implicit or explicit) for a period of a year or more. When firms' prices are fixed for reasons other than expectations, a fully credible disinflation announcement will generally not give rise to a costless disinflation.

central banker in the Rogoff solution may push the economy into a recession too often for the general public's taste, in order to attain low inflation. As an alternative, Walsh proposes incentive-compatible contracts for central bankers that explicitly tie compensation to inflation performance. He shows that relatively simple compensation arrangements—tying pay to deviations of the inflation rate from the agreed-upon target, for example—are sufficient to make the central banker behave so as to avoid an inflationary bias.

McCallum points out that Walsh's contractual arrangement simply pushes the incentives that lead to an inflationary bias one level up, from the monetary policymaker to the central government that is charged with enforcement of the contract. All of the logic that applied to the central bank now applies to the government, so the incentive for the government to *enforce* the contract could lead to lax enforcement in the presence of employment-augmenting inflationary shocks, and once again yield an inflationary bias.

Central Bank Independence and the Inflationary Bias

The most general interpretation of the inflationary bias problem—that a central bank that is subject to undue political pressure may err on the side of "too much" inflation—suggests that the independence of the central bank must be a key ingredient in any solution to the bias problem. The legislation that defines the country's central bank must ensure that the conduct of monetary policy remains independent of political pressure.

It is important to note that many countries could solve the inflationary bias problem (and some may have) without an independent central bank, by pegging their currency to that of a country with a highly independent central bank committed to price stability. This saves them the trouble of legally restructuring their own bank, effectively allowing them to import the stable prices of the dominant trading partner. It also essentially hands the monetary policy role over to a foreign nation. The issue of currency pegging will be of some importance in the discussion of measures of central bank independence below.[5]

[5] Michael Bleaney (1996) emphasizes this point, and develops a measure of "attachment" to the Bundesbank by EMU countries in the 1980s. Note that a similar point can be made for countries that peg their currency to the dollar (for example, Argentina). However, no similar measure of attachment for these countries exists in the literature.

Debelle and Fischer (1994) clarify the definition of central bank independence, making a distinction between *goal* independence and *instrument* independence. The former allows the central bank to set its own ultimate goals (price stability, stable employment, and so on). The latter allows it to determine the appropriate setting for its instrument (the federal funds rate, bank reserves) in order to achieve ultimate goals. The prevailing view among proponents of central bank independence today is that a central bank should have instrument but not goal independence (see, for example, Fischer 1996). This dichotomy squares well with the prescriptions of Rogoff and Walsh. The conservative central banker is appointed because he has the right goals, but he is allowed to pursue those goals in the way that he sees fit. The contract envisioned by Walsh sets the incentives for the policymaker to achieve specific goals, but also allows the policymaker to decide how best to achieve those goals.

Goal independence allows the central bank to set its own ultimate goals (price stability, stable employment, and so on) and instrument independence allows the central bank to decide how best to achieve those goals.

The strict interpretation of a monetary policy rule—a formula that specifies the precise movements of the instrument of monetary policy under various conditions—gives the central bank neither goal nor instrument independence. It may well avoid the inflationary bias, *if* the rule is properly designed, but it does so simply by taking away the power of the bank to act according to its own judgment, which could also be consistent with avoiding the bias. It is by now a commonplace that the design of such a rule would be extremely difficult. In order to prescribe monetary policy behavior under all possible conditions, the rule would have to be complicated and would likely be altered repeatedly as new and unexpected circumstances arose. Thus, no countries in the world literally tie their central bank to a rule.

Recent Proposals for Central Bank Reform

A number of central banks around the world have begun to rewrite their charters in response to the arguments that emphasize the importance of an inflationary bias. The charters generally agree with the logic behind the inflationary bias and make practical adjustments to the monetary and political institutions that will help avoid such a bias. The exact arrangements differ significantly from country to country; a few key examples are summarized here. Most charters include language to ensure the independence of the central bank, to commit it primarily (and in some cases, exclusively) to price stability, and in some cases to make it responsible for inflation performance relative to a publicly announced target path for inflation.

The most common component of new central bank charters is an explicit statement of the primacy of price stability in the central bank's mission. The exact wording of this commitment to price stability varies, but a representative sample comes from the European Central Bank's charter:

> The primary objective of the European System of Central Banks is to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Community . . . [*Treaty on European Union* (1992), Title II, Chapter 2, Article 105.1],

where the "general economic policies" include "a harmonious and balanced development of economic activities," "a high level of employment and of social protection," and "the raising of the standard of living and quality of life" [*Treaty on European Union* (1992), Title II, Article 2].

It is important to be clear about what most central banks mean by price stability. In almost all cases, they do not mean literally stabilizing the general level of prices. Rather, they usually mean achieving and maintaining a low and stable rate of inflation. The distinction is quite important in practice. A bank could (1) literally target a constant price level, or (2) target a zero rate of inflation, which in no way limits the path of the price level, or (3) target a path for the price level that increased at a constant rate, or (4) target a low but nonzero rate of inflation. The implications of each of these policies for price and employment stabilization can be quite different.

To show graphically the qualitative differences in these policies, Figures 1a and 1b display simulations of a simple model under the different policy responses for a positive shock to the general level of prices. A policy that targets inflation only requires the policymaker to bring the level of inflation back down to its desired level after a price shock, as in the solid lines in Figures 1a and 1b. The path of prices is permanently altered from its initial path under inflation targeting. A policy that targets the price level, however, must bring the inflation rate *below* its desired level after a price shock in order to return the price level to its desired path, as shown in the dashed lines in the bottom panels of Figures 1a and 1b. The price shock does not have a permanent effect on the path of prices in this case. However, the figures suggest that the output loss required to stabilize inflation *and* the price level will be higher than that required to stabilize inflation alone; the corresponding benefit is the lower variability of the price level. Most central banks seem to have settled on a policy that achieves a low and stable inflation rate, accepting the increased uncertainty in the price level that such a policy implies.

The reasons cited for making price stability the primary or sole long-run goal of monetary policy are as follows: (1) if the central bank has only one monetary instrument (for example, the federal funds rate) it should have only one goal; (2) monetary policy has no sustainable or long-run real effects, and so it should only attempt to influence something nominal in the long run; (3) a central bank that attempts to stabilize both employment and inflation with a single instrument will not be credible; that is, people will not believe in its commitment to stabilizing inflation (or employment).

A few comments on these justifications are in order. First, the proposition that a policy institution with one instrument should have only one goal is faulty. No logic binds the central bank from pursuing both employment and price stabilization, for example. The bank can "lean against the wind," partially offsetting deviations of both employment and inflation from desired levels. In doing so, it will sometimes face a trade-off between more success in one regard and less in another. If economic conditions force both employment and inflation above their desired levels (a "demand shock"), then the central bank can bring both back in line with restrictive monetary policy. If conditions push inflation up and employment down (a "supply shock"), then the bank can move its single instrument in weighted response to both variables.[6] In

[6] The widely-cited Taylor rule (1993) incorporates just such a weighted response. In John Taylor's rule, equal weight is placed on inflation and output deviations. More generally, the weights that determine the response to inflation and employment deviations will reflect the central bank's relative distaste for deviations of each of the objectives from their desired levels.

Figure 1a

Inflation versus Price Level Targeting

Zero Steady State Inflation with a 1 Percent Inflation Shock

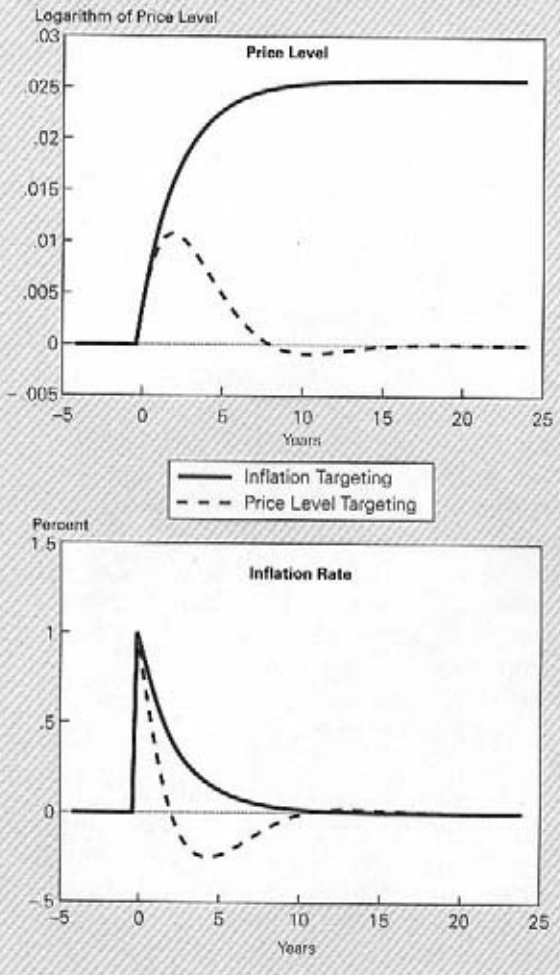
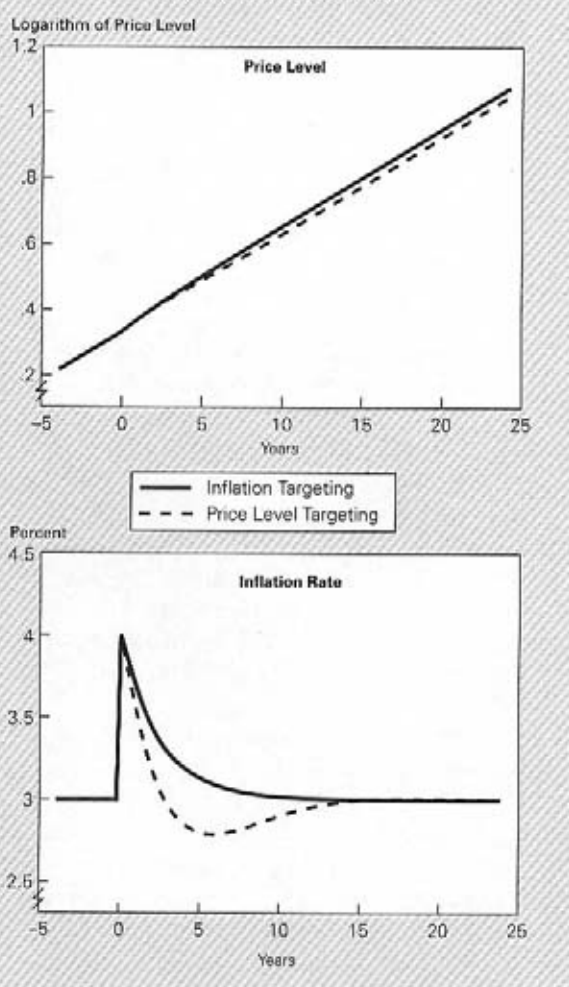


Figure 1b

Inflation versus Price Level Targeting

3 Percent Steady State Inflation with a 1 Percent Inflation Shock



the end, inflation will return to the level desired by the bank, and employment will return to its normal level, which is beyond the bank's control.

Second, the presumption (a strong one, but a presumption nonetheless) that the central bank cannot influence employment or real growth in the long run does not imply that it should not stabilize employment in the short run, or that it can ignore the employment effects of price stabilization. In fact, the more the central bank attempts to stabilize inflation, the more it will destabilize employment in the short run. The reason is straightforward: The central bank influences inflation primarily through its influence on employment and real activity.[7] In order to completely stabilize inflation, it would have to move employment around tremendously so as to completely offset any destabilizing influence on inflation. This would, of course, impart tremendous instability to employment,

[7] This channel of influence on inflation is not universally agreed upon by economists, but it is a widely used description of the way in which monetary policy affects prices.

even in the long run.[8] Central bankers can reasonably disagree on the distaste that they attach to departures of inflation from its goal relative to departures of employment from its goal, but they cannot abdicate responsibility for the fluctuations that they cause in either inflation or employment through the normal conduct of policy.[9]

The final reason for pursuing price stability as the primary or sole goal is the assertion that pursuing multiple goals will engender a loss of credibility. How can the central bank be credible in fighting inflation when it sometimes also responds to employment or real output growth? This objection does not seem to follow even the logic of the time inconsistency/rules versus discretion literature. The solution to time inconsistency, which is to bind the bank to a rule, in no way precludes binding the bank to a rule that responds to both inflation and employment. Such a rule would stabilize both inflation and employment, and it would eliminate any inflationary bias; rational agents would find it fully credible.

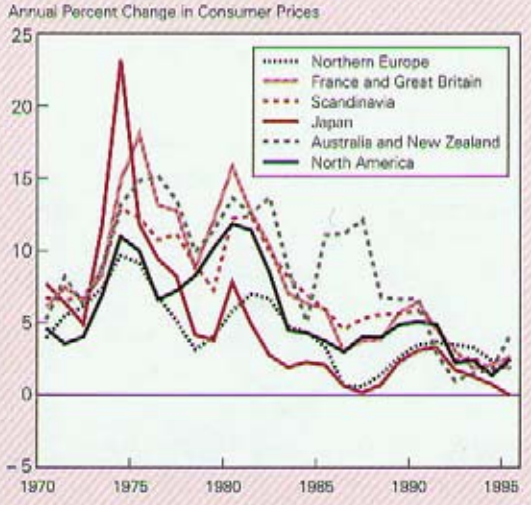
Finally, the European Central Bank's statement would appear to approach the problem backwards: The promotion of full employment and growth or, more generally, the highest possible living standards for all citizens, is the primary goal of government policy. Price stability should be pursued because it aids in the attainment of these primary policy goals. If under certain conditions the pursuit of price stability interferes with achievement of the highest standards of living for a country's residents, then price stability should be made subordinate to the primary goals. While this may seem to be a matter of semantics, it seems important to state as clearly as possible the underlying goals that will guide the European Central Bank and other central banks.

Was/Is There An Inflationary Bias?

At about the time that the now-famous Barro-Gordon paper (1983) was published, dozens of developed countries around the world were embarking on a massive disinflationary effort that Taylor (1992) has dubbed "The Great Disinflation." Figure 2 shows the average annual rates of inflation for a wide array of

Figure 2

Inflation Histories for the OECD Countries



Northern Europe: Benelux, Austria, Switzerland, and Germany
Scandinavia: Sweden, Finland, Denmark, and Norway
North America: Canada and the United States
Source: International Monetary Fund, *International Financial Statistics*.

countries from 1970 to the present. As the figure indicates, most countries suffered high rates of inflation following the two oil price increases of the 1970s, but most countries also significantly reduced their inflation rates in the early 1980s. It is worthy of note that the two countries that never quite disinflated in the early 1980s and consequently experienced persistent double-digit inflation into the mid 1980s—Australia and New Zealand—are two that have recently embarked upon central bank reforms aimed at lowering inflation.

How were these disinflations accomplished? First, it is worth noting that the overall disinflation in these economies is in some sense less than the sum of the parts; as a number of "leader" countries disinflate, they export their disinflation to trading partners, who will be more or less influenced in proportion to their degree of openness. Still, the figure is impressive. While the disinflation in the United States began after a change in operating procedures,[10] it was not accompanied by any formal commitment by the Federal

[8] Note that this long-run instability could itself impart a long-run influence of monetary policy on real variables.

[9] The presence of this trade-off between inflation variability and output or employment variability and its implications for monetary policy is the subject of work by Taylor (1994) and Fuhrer (1994).

[10] The Fed moved to a nonborrowed reserves operating target from October 1979 to November 1982.

Reserve to a reduction in inflation, nor by a change in the political independence of the Fed, a constraint requiring the Fed to follow a policy rule, or an announcement of an explicit inflation goal. The same can be said of the United Kingdom, Germany, France, and most of the other developed countries in the sample.

Thus, it would appear that, as Robert Hall (1994) suggested, "central banks have not played out their inevitable role as inflators." The inflationary bias explanation for the 1970s inflation received a sharp blow just at the time that it was being proposed and accepted. Institutional changes and the lashing of monetary authorities to the mast of rules were not required to disinflate; the will of monetary policymakers, perhaps coupled with the backing of the general public, was sufficient to accomplish the task.[11]

What Is Credibility and Where Can I Get Me Some?

An important element in the discussions above is the notion of a "credibility bonus." The bonus is the reduction in the real cost to lowering inflation that might redound to a central bank that has credibility. But what is credibility, and how does a central bank build it? And do central banks that are viewed as credible enjoy a credibility bonus?

The answers to these questions are difficult and the subject of much debate. Here are ventured both a definition and a means of acquiring credibility. The definition is this: A central bank is credible if businesses and consumers have come to believe that the bank will act systematically to attain a reasonably small set of ultimate objectives. In a limited sense, a central bank with credibility may be interpreted as one that in large measure behaves as if it were following a "rule." This is not to say that the central bank literally follows a rule, but that its behavior is systematic enough that outsiders can look at it and convince themselves that it moves its instrument as if it were, for example, trying to maintain a low and stable inflation rate with full employment.

How does a central bank obtain credibility? By *behaving* systematically over a long span of time in pursuit of widely recognized goals. By way of contrast, a bank that has *not* behaved systematically over a fairly long span is unlikely to attain immediate credibility by announcing a new set of inflation targets and institutional arrangements. Such announcements are relatively easy to make and relatively hard to follow through on. When tough decisions need to be made, inflation measures can be redefined, target bands can be broadened, and extenuating circumstances can be cited. A central bank becomes credible through its actions, not its words. By these definitions, the central banks of Germany and the United States have pursued policies that have allowed them to gain credibility over the past decade and a half (or more).

Do central banks that attain high credibility pay less for disinflations? The experience of several countries provides evidence bearing on this claim. Debelle and Fischer (1994) cite the experience of Germany in the 1980s as evidence contrary to the proposition. They find that the output forgone in Germany during disinflationary episodes is no smaller than that forgone in the United States. Where, then, is the credibility bonus for the (arguably) most credible central bank in the world? Probably it is asking too much of slippery estimates of forgone output to distinguish between two credible central banks.

As for the possibility that announcements and institutional arrangements alone might yield such a bonus, the experience of New Zealand, Australia, and Canada suggests otherwise. Debelle (1996) finds little evidence that Canada, New Zealand, and Australia have benefited to date in smaller disinflationary output losses from their announcements of specific inflation targets and paths.

What Do the Data Say about the Relationship between Central Bank Independence and Inflation?

With the proposition that central bank independence might be a key ingredient to monetary policy success, a number of authors (Alberto Alesina and Lawrence Summers 1993, Robert Bade and Michael Parkin 1982, Alex Cukierman 1992) developed quantitative measures for countries over time. (A description of the Cukierman index and its construction appears in the Box.) In general, they attempt to quantify the terms and conditions of appointment of the central bank "CEO" that bear on independence; the degree of independence with which the bank formu-

[11] It is interesting to note that public opinion data for the United States on the fraction of the public that found inflation to be an important problem rose to its highest point in the late 1970s, suggesting public support for the move to disinflate in the early 1980s. Today, the same data suggest that almost no one sees current levels of inflation as problematic. See Tootell (1996) and Fischer (1996) for further discussion of the importance of public opinion data in regard to the monetary policy process.

Construction of the Cukierman Index of Legal Central Bank Independence

Research by Alesina and Summers (1993) and Cukierman (1992) has focused on legal aspects of central bank independence. Legal CBI is measured by differences across countries in the laws that affect the conduct of monetary policy.* Cukierman (1992) attempts to measure several aspects of legal CBI by examining the charters and associated legislation governing central banks in 70 countries. He categorizes the differences between central banks using 16 variables, grouped into four major areas, as shown in the table. The first category contains measures relating to the chief executive officer's appointment and tenure. Cukierman judges a central bank to be more independent if the CEO holds a long term of office, cannot be easily dismissed, and is appointed by the central bank. The second category relates to the policy-making process; a bank which has final authority over monetary-policy formulation and implementation is considered more independent than one which shares responsibility with the government. The third category measures the primacy of price stability as a goal for the central bank. Cukierman considers a central bank whose charter includes goals besides price stability to be less independent. The fourth category develops measures of lending limitations on the central bank. In this category, more limitations indicate more independence.

Cukierman arrays each variable on a scale from zero to one according to subjective assessments about the degree of independence represented. Each variable is measured for 70 countries across four decades (1950s to 1980s) where the data are available. He generates combined indexes which are weighted averages of the components of legal CBI. In practice, the combined indexes range from 0.1 to 0.7, with no country being either completely independent or completely subservient in Cukierman's judgement. This article uses the weighted index "LVAW," the construction of which is described in more detail by Cukierman (1992).

Components of the Cukierman Index of Legal Central Bank Independence

Major Components	Specific Variables
Chief Executive Officer (CEO)	Term of office of CEO Who appoints the CEO? Provisions for dismissal of CEO Is CEO allowed to hold another office?
Policy Formulation	Who formulates policy? (central bank alone, central bank with government) Who has final authority for policy? Central bank active in formulating government budget?
Central Bank Objectives	Price stability alone, or others?
Limitations on Lending	Limitations on advances to government Limitations on securitized lending Who controls terms of lending? How wide is circle of borrowers from central bank? Type of lending limit, if it exists (absolute, relative to government revenue) Maturity of loans Restrictions on interest rates Prohibition on lending in primary market

* Of course, legal CBI could be very different from "actual" CBI in countries where the practice of monetary policy deviates from the letter of the law. Measures of legal CBI should thus be viewed as (possibly noisy) indicators of underlying CBI.

lates monetary policy; how explicitly (and appropriately) the bank's objectives are stated in its charter; and to what degree the bank's primary mission might be compromised by the requirement to lend to the government.[12]

The natural question to ask is whether constructed measures of central bank independence (henceforth CBI) are well correlated with monetary

[12] What constitute appropriate goals for monetary policy is, of course, the subject of some debate. One component of the Cukierman index, for example, gives the highest ranking to a central bank that has "price stability mentioned as the only or major goal" in its charter. The Federal Reserve, whose defining legislation mentions both stable employment and stable prices, consequently receives a ranking of 0.4 on a scale of 0 to 1, where 1 denotes greater independence.

policy success. A few simple empirical relationships have been explored, the first whether countries with higher degrees of CBI attain lower average levels of inflation. The upper panel of Figure 3a shows a scatterplot of CBI against the average level of inflation from 1950 to 1989, using the countries in the Alesina-Summers paper and the Alesina-Summers measure. The correlation is negative, large, and significant. This simple correlation has been cited as supporting the claim that a high degree of CBI helps eliminate the inflationary bias in monetary policy.

The correlation appears somewhat sensitive to the CBI index and the sample of countries used, however. The lower panel of Figure 3a plots the same inflation data against Cukierman's (1992) CBI index. Here, the correlation is weaker and less significant. Area subsamples are displayed in Figure 3b; each panel uses Cukierman's CBI index. For the OECD countries, shown in the top left panel, the correlation is lower and less significant. For other country groups around the world—Latin America, Asia, and Sub-Saharan Africa—the correlation is insignificant, although in two cases the point estimate is positive.

The natural question to ask is whether constructed measures of central bank independence are well correlated with monetary policy success.

One question that the data might also appear to answer is: At what cost does CBI yield lower inflation? Do countries with high CBI and low inflation pay for it with high unemployment, slower growth, and higher variability of growth? Figure 4 displays scatter plots and simple correlations between the Cukierman CBI index, real growth, and unemployment rates (where available) for the Alesina-Summers sample of countries. As the figure shows, these simple correlations suggest that countries with high CBI do not pay a penalty in terms of slower output growth, higher output variability, or higher unemployment rates. This observation gave rise to a number of papers on the supposed "free lunch": lower inflation from CBI with no obvious costs.

The next figure compares Cukierman's overall CBI index with Laurence Ball's (1994) estimates of the sacrifice ratio—the percentage point-years of forgone output paid for each percentage point decrease in inflation—for a variety of countries over a variety of time periods. As this figure indicates, the correlation between the sacrifice ratio and CBI is significantly

Figure 3a

Inflation and Central Bank Independence

Alesina-Summers Subsample of Countries

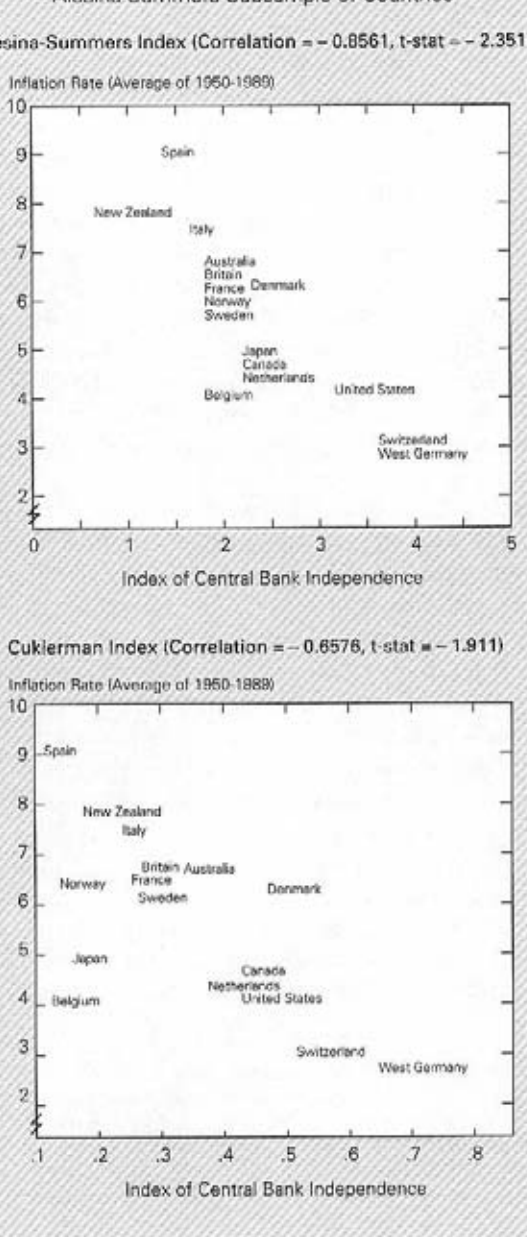
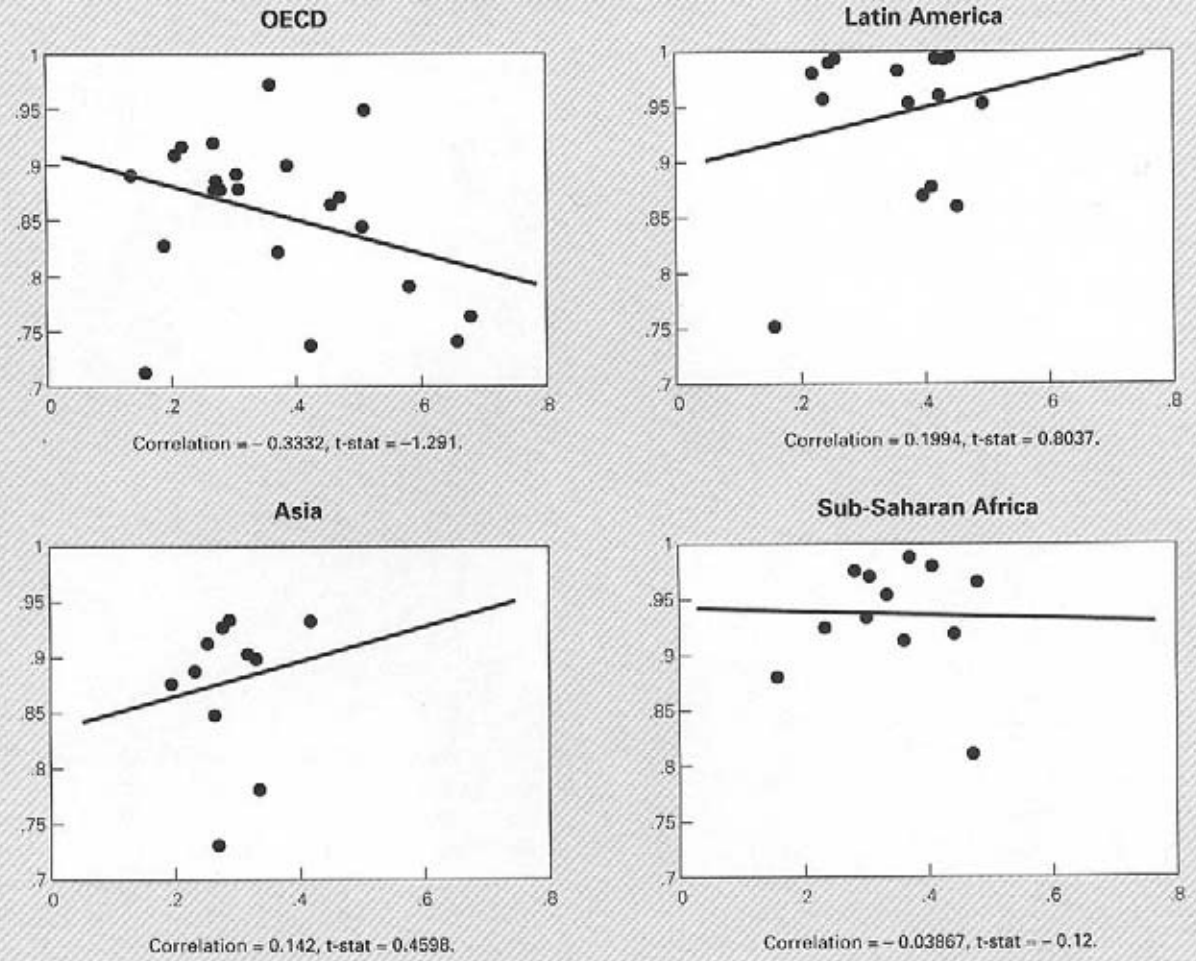


Figure 3b

Depreciation of Money and Central Bank Independence

Various Subsamples



X-axis: Cukierman's CBI Index; Y-axis: Depreciation rate of money.
Note:The depreciation rate of money is defined as 1+1/(1-x), where x is the inflation rate.
This re-scaling is necessary in order to include low, moderate, and hyper inflations in the same sample.

positive, largely owing to the values for the United States and West Germany. Excluding these two countries, the correlation is less positive and less significant. Still, these two notable central banks seem to contradict the notion of a "credibility bonus" that might otherwise attach to a very independent (and thus credible) central bank.

An important question for these scatter diagrams is the degree to which they reflect an underlying correlation between another variable not shown in the two-dimensional scatters and the two variables displayed. In order to control for such effects, a panel data set was constructed for a variety of countries that includes annual data for inflation, real growth, unemployment, short-term (central-bank-controlled) interest rates, ratios of fiscal deficit to GDP, and 10-year averages of CBI indexes from Cukierman (1992). In addition, a variable derived by Bleaney (1996) is

Figure 4

Real Variables and Central Bank Independence

Alesina-Summers Subsample of Countries

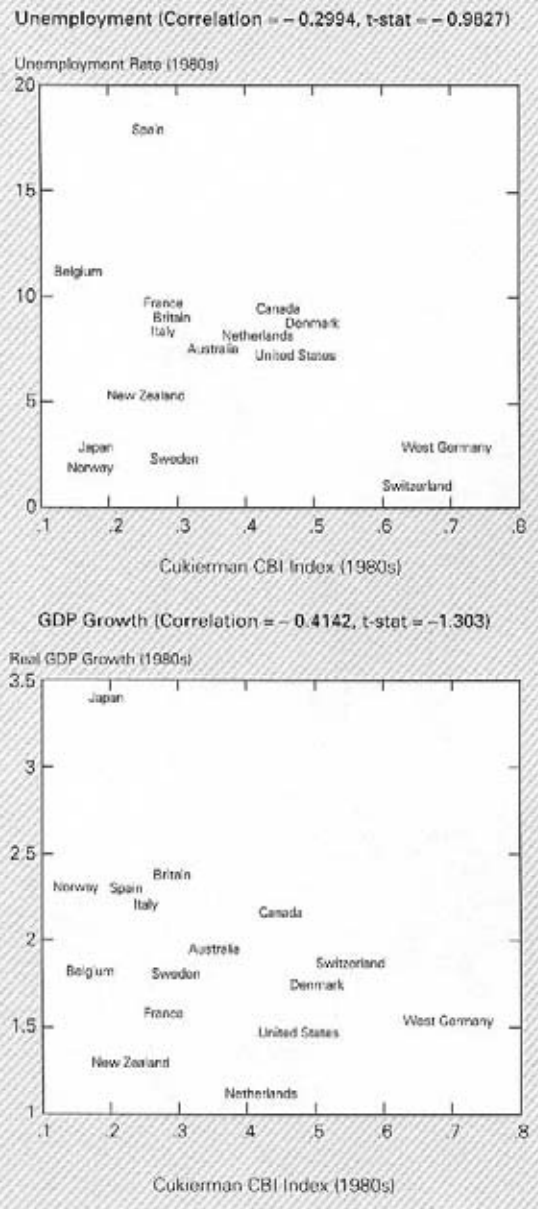
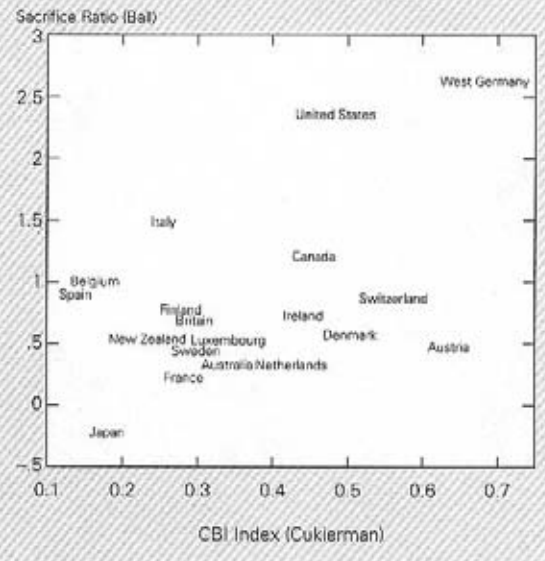


Figure 5

The Sacrifice Ratio and Central Bank Independence

Ball Subsample of Countries



included that measures the degree to which a European country pegs its currency to the deutsche mark. This variable could be of importance for some European countries because, as mentioned above, the country could "import" its CBI simply by pegging its currency to the mark, without making any institutional changes to its own bank's structure.

With this data set the question of the robustness of the CBI/inflation correlation can be addressed econometrically. Table 1 presents simple regression results for a variety of specifications and country samples. The first row of each block in the table displays the simple cross-sectional regression of the average inflation rate from 1950 to 1989 on the average CBI index (the pure cross-section regression).[13] This regression should correspond directly to the scatter diagrams discussed above. The first and second columns in each row display the t-statistic on the CBI index coefficient, and the overall $\bar{R}^2$ for the regression. The second row of each block controls for the cross-

[13] Following Cukierman (1992), we use the "depreciation of money," defined as $1 - 1/(1 + \pi)$, as the dependent variable, rather than inflation. This transformation makes zero inflation correspond to zero depreciation of money, and infinite positive inflation correspond to total depreciation of money. The transformation affords a more sensible comparison of triple-digit (and higher) inflation rates from less-developed countries with single-digit inflation rates from more-developed countries. All of the results in Tables 1 to 4 were run with the simple inflation variable; the results are not sensitive to this transformation.

Table 1
Influence of CBI on Inflation

	Primary Regression (fixed effects)		Regression of CBI on fixed effects
	T-statistic[a]	$\bar{R}^2$	$\bar{R}^2$
Sample			
Explanatory Variables			
All countries			
Average CBI, only cross-section	.030	.001	
All variables, only cross-section	−.043	.083	
All variables, time and cross-sec., no CBI	.159	.694	−.020
All variables, current CBI, time and cross	.387	.692	
Instruments, current CBI	1.155		
Countries with unemployment data			
Average CBI, only cross-section	−.357	.004	
All variables, only cross-section	−1.439	.170	
All variables, time and cross-sec., no CBI	−.392	.559	−.040
All variables, current CBI, time and cross	.016	.559	
Instruments, current CBI	.273		
OECD countries			
Average CBI, only cross-section	−.938	.016	
All variables, only cross-section	−.757	.414	
All variables, time and cross-sec., no CBI	−1.060	.749	.006
All variables, current CBI, time and cross	−1.307	.727	
Instruments, current CBI	−.991		
Alesina-Summers countries			
Average CBI, only cross-section	−3.243**	.084	
All variables, only cross-section	−1.861	.275	
All variables, time and cross-sec., no CBI	−.687	.712	−.037
All variables, current CBI, time and cross	1.045	.600	
Instruments, current CBI	.453		

Notes for Tables 1 to 4

[a] The t-statistic for the "All variables, no CBI, time" rows is the t-statistic for the coefficient on CBI in the regression of the fixed effects on CBI.

* indicates significance at the 5 percent level or better; ** indicates significance at the 1 percent level or better.

The definition of the country samples appears in the Appendix Table.

The dependent variable in all cases for Table 1 is the "depreciation of money," defined as $1 - 1/(1 + \pi)$, where π is the annual inflation rate.

The macroeconomic variables on the right-hand-side of the cross-sectional and time-variation regressions (in addition to the CBI index and lagged inflation) include the unemployment rate (where available), the deficit-to-GDP ratio, the central bank-controlled short-term nominal interest rate, the growth rate of real GDP, and the Bleaney (1996) index of attachment to the Bundesbank.

Average CBI, only cross-section is the pure cross-sectional regression of average inflation on the average Cukierman weighted CBI index.

All variables, only cross-section is the pure cross-sectional regression of average inflation on the time-averages of all control variables, including the Cukierman weighted CBI index.

All variables, time and cross-section, no CBI is a fixed effect regression of annual inflation for each country on annual values of the explanatory variables excluding CBI; the right-hand column shows the correlation between the fixed effect and the CBI index.

All variables, current CBI adds the Cukierman CBI index (which varies over time) to the above fixed effects regression.

Instruments, current CBI uses two lags of the explanatory variables plus lags 1–3 of CBI as instruments for current CBI in the fixed effects regression.

Random effects regressions were run for each specification, but in almost every case, the standard tests indicated rejection of the random effects at the 5 percent level or lower.

The $\bar{R}^2$ is the multiple correlation coefficient for the regression, corrected for degrees of freedom. The $\bar{R}^2$ is not included for the instrumental variables regressions, because the dependent variable is not regressed on the original regressors, but on the fitted values of the regressors from the first stage.

Table 2
Influence of CBI on Inflation Variability

	Primary Regression (fixed effects)		Regression of CBI on fixed effects
	T-statistic[a]	$\bar{R}^2$	$\bar{R}^2$
Sample			
Explanatory Variables			
All countries			
Average CBI, only cross-section	.057	.001	
All variables, only cross-section	.158	.318	
All variables, time and cross-sec., no CBI	.336	.854	−.018
All variables, current CBI, time and cross	.350	.854	
Instruments, current CBI	.274		
Countries w/unemployment data			
Average CBI, only cross-section	−.321	.002	
All variables, only cross-section	.061	.101	
All variables, time and cross-sec., no CBI	.204	.769	−.046
All variables, current CBI, time and cross	−.342	.756	
Instruments, current CBI	.465		
OECD			
Average CBI, only cross-section	−1.224	.026	
All variables, only cross-section	.609	.259	
All variables, time and cross-sec., no CBI	−.760	.791	−.022
All variables, current CBI, time and cross	−.127	.791	
Instruments, current CBI	−.786		
Alesina-Summers countries			
Average CBI, only cross-section	−3.779**	.088	
All variables, only cross-section	−.699	.150	
All variables, time and cross-sec., no CBI	−.351	.683	−.062
All variables, current CBI, time and cross	−.513	.664	
Instruments, current CBI	−.021		

country variation in the macroeconomic variables described above. The third row of each block controls for the effects of annual variation in the lagged macroeconomic variables, including lagged inflation, for each country. A "fixed effect"—the country-specific intercept term in each regression—is estimated for each regression; it captures remaining cross-sectional variation in inflation after accounting for the macroeconomic variables. For this row, the first column displays the t-statistic for the regression of the fixed effect on the CBI index, as a way of estimating the amount of the remaining cross-section variation that can be explained by the CBI index. The $\bar{R}^2$ for this second-stage regression is displayed in the third column.[14]

The fourth and fifth rows in each block of the table show summary statistics for fixed-effects regressions that include the CBI index as a time-varying regressor. In the fifth row, the CBI index is instrumented to control for the possibility that the CBI index and inflation are jointly determined at the annual frequency; if they are, the regression coefficients will be subject to simultaneity bias. The changes in the CBI index value for any country are infrequent, but it is possible that a large annual shock to inflation might prompt a legislative change in CBI for a country. If so, the CBI index could be correlated with the annual inflation residual, causing simultaneity bias in the estimated coefficient for CBI and the other coefficients in the regression. The instrumental variables technique corrects for this possible defect.[15]

Table 1 demonstrates a variety of interesting facts about CBI and inflation performance across countries and across time. First, for the "all country" sample, none of the regressions show any significant correlation between CBI and inflation, whether due to cross-country variation (the pure cross-section regressions) or to time variation within countries (as in the fixed-effect regressions).

Second, the only evidence of a significant nega-

[14] The standard tests for the validity of the random effects estimator uniformly reject the random effects specification. Thus, we use the fixed effects estimator, and use the results presented in the tables to approximately decompose cross-sectional and across-time variation in the data. Note also that the presence of a lagged dependent variable will lead to a biased and inconsistent estimate of the fixed effects in the regression, which could also bias the coefficient on CBI. To correct for this, first-differenced regressions, which eliminate the fixed effect and the lagged dependent variable-induced bias, are run. The results are not affected.

[15] The instruments used include two lagged values of the macroeconomic variables listed above, as well as lagged values of the central bank independence index. Sensitivity to the beginning lag date of the index instruments is explored, and found not to change the qualitative results. The instruments generally explain a significant fraction of the variance of the index ($\bar{R}^2$s in the first stage regressions of 0.58 to 0.84).

tive correlation between inflation and CBI arises in the Alesina-Summers country sample for the simple bivariate regression. The cross-country regression that controls for cross-country differences in real growth, unemployment, deficit-to-GDP ratios, and so on, estimates the significance of the negative coefficient for the Alesina-Summers sample to be outside the 5 percent range. Interestingly, the results for OECD countries and countries with unemployment data suggest even less significant CBI coefficients. Note that, throughout, the overall explanatory power of the regressions is quite good; except for the simple bivariate cross-section regression, the cross-country $\bar{R}^2$s range from 0.08 to 0.41, while the $\bar{R}^2$s for regressions that include time variation range from 0.56 to 0.75. Note that while the CBI index no longer enters significantly after controlling for variation in other macroeconomic variables, many of the other macroeconomic variables do. The central bank-controlled interest rate, real growth, and unemployment almost always enter with high significance (better than 1 percent). The significance of the deficit-to-GDP ratio is less systematic.

Table 3
Influence of CBI on Real Growth

	Primary Regression (fixed effects)		Regression of CBI on fixed effects
	T-statistic[a]	$\bar{R}^2$	$\bar{R}^2$
Sample			
Explanatory Variables			
All countries			
Average CBI, only cross-section	−.703	.001	
All variables, only cross-section	−.249	.050	
All variables, time and cross-sec., no CBI	−.569	.088	−.014
All variables, current CBI, time and cross	−.773	.076	
Instruments, current CBI	−1.295		
Countries with unemployment data			
Average CBI, only cross-section	−1.213	.008	
All variables, only cross-section	−1.898	.157	
All variables, time and cross-sec., no CBI	−1.868	.134	.102
All variables, current CBI, time and cross	.136	.120	
Instruments, current CBI	.294		
OECD			
Average CBI, only cross-section	−.612	.002	
All variables, only cross-section	−.012	.016	
All variables, time and cross-sec., no CBI	−1.147	.108	.016
All variables, current CBI, time and cross	.545	.120	
Instruments, current CBI	.063		
Alesina-Summers countries			
Average CBI, only cross-section	−1.183	.011	
All variables, only cross-section	−2.628*	.166	
All variables, time and cross-sec., no CBI	−2.340*	.135	.230
All variables, current CBI, time and cross	.400	.075	
Instruments, current CBI	.004		

Table 2 assesses the extent to which CBI is correlated with inflation variability. Alesina and Summers document a strong negative correlation between CBI and inflation variability, as might be expected given the strong positive correlation between the level of inflation and its variability. Once again, Table 2 shows that the *only* specification for which a significant negative correlation can be developed between CBI and inflation variability is the simple bivariate regression with the Alesina-Summers country sample. Once cross-country or cross-time variation in other variables is accounted for, this simple correlation vanishes.

The results in Table 1 would seem to question the empirical support for the benefits (measured in lower inflation) to higher levels of CBI, regardless of the country sample chosen and regardless of whether the question rests on cross-country comparisons or within-country, across-time comparisons. The same conclusions may be drawn for the Alesina-Summers sample if the Alesina-Summers CBI index is used instead of the Cukierman index; these results are not shown in Table 1.

Finally, Tables 3 and 4 assess the correlations between real growth (Table 3) or unemployment (Table 4) and CBI. The literature has extensively cited the lack of correlation between CBI and real outcomes across countries as evidence that CBI buys a country a "free lunch." Greater CBI lowers inflation without imposing any costs on the economy.

If anything, Table 3 suggests the opposite result for the link between CBI and real growth. The only significant correlations in this table show a *negative*

Table 4
Influence of CBI on Unemployment

	Primary Regression (fixed effects)		Regression of CBI on fixed effects
	T-statistic[a] for CBI	$\bar{R}^2$	$\bar{R}^2$
Sample			
Explanatory Variables			
Countries with unemployment data			
Average CBI, only cross-section	−.693	.007	
All variables, only cross-section	.262	.112	
All variables, time and cross-sec., no CBI	−.844	.947	−.013
All variables, current CBI, time and cross	2.544*	.838	
Instruments, current CBI	1.497		
Alesina-Summers countries			
Average CBI, only cross-section	−1.121	.014	
All variables, only cross-section	.337	.040	
All variables, time and cross-sec., no CBI	−.793	.958	−.025
All variables, current CBI, time and cross	2.296*	.880	
Instruments, current CBI	1.201		

relationship. The fixed effects regressions that exclude CBI show that, once the time variation in the macroeconomic control variables is accounted for, the remaining cross-sectional variation in growth is negatively associated with CBI. This correlation is statistically significant for the Alesina-Summers sample. For the full OECD sample and the all-country sample, no significant correlation was found. In addition, the pure cross-sectional regression for the Alesina-Summers sample shows a significant negative correlation between CBI and real growth, once cross-country variation in the macroeconomic control variables is accounted for.

Table 4 presents a complementary picture for the relation between CBI and unemployment. The cross-country regressions show no significant correlation between CBI and unemployment. Within a country, however, the fixed effect regressions in Table 4 suggest that countries that increase their degree of CBI over time suffer significantly *higher* unemployment rates.

In sum then, this empirical evidence casts doubt on the robustness of the correlations between CBI indexes and inflation, inflation variability, real growth, or unemployment. In general, the benefits imputed to CBI are evident only in the simplest bivariate cross-country regressions. Once other cross-sectional attributes are controlled for, or variations over time in determinants of inflation are controlled for, the correlation disappears.

Similarly, the evidence on the absence of costs associated with CBI is less conclusive than is portrayed in the literature. The only significant correlations developed in the specifications examined here suggest a *negative* correlation between CBI and real growth, and a *positive* correlation between CBI and unemployment. There goes the free lunch!

Conclusion

Discussions over the appropriate structure for the central bank in the European Union, Canada, Australia, and New Zealand have centered on the need for central bank independence and on the attainment of price stability as the primary (or sole) goal of the central bank. These two tenets of policy arose from a literature that explained the high inflation experience as a consequence of the inherent inflationary bias that attaches to central banks. A near consensus has formed around these tenets as solutions to the inflationary bias problem and as critical elements in a well-structured central bank.

Interestingly, many countries around the world appear to have achieved successful disinflation *without* changes in the institutional structure of the central bank. In some cases, lower inflation was obtained through the appointment of a conservative central banker, in accord with the theoretical arguments proposed by Rogoff (1985). In other cases, existing central bankers viewed the economic costs of high and unpredictable inflation as sufficient incentive to embark on a disinflationary program. Only in a handful of cases did a central bank achieve disinflation in conjunction with announced inflation targets, and the evidence, while inconclusive, suggests that these countries suffered the same output losses in disinflating as others that had not announced targets did.

There appears to be little argument that some degree of central bank independence is desirable. A central bank forced to finance the profligate spending of a rogue fiscal authority would have little scope for conducting monetary policy to stabilize prices and employment properly. The question is whether the varying degrees of independence observed in developed countries (as mea-

sured by the available indexes) have systematically yielded varying degrees of economic outcomes.

The answer to this question is necessarily empirical. Among the countries studied in this article, no clear relationship is found between central bank independence and any measure of economic performance, either inflation or real activity. The only statistically significant relationships found indicate some real costs to increased independence, with no benefits in terms of lowered inflation. This result holds when the data are analyzed both in the cross-country dimension and over time within countries.

One should not infer from these empirical results that central bank independence is of no consequence in determining the effectiveness of monetary policy institutions. However, the existing empirical results used to buttress the arguments in favor of high levels of independence—where high is measured relative to other developed countries in the OECD, for example—are quite fragile.

Appendix

Appendix Table
Definition of Country Subsamples

	Sample				Sample		
Country	Unemployment data	OECD	Alesina-Summers	Country	Unemployment data	OECD	Alesina-Summers
Argentina	x			Malta			
Australia	x	x	x	Mexico			
Austria	x	x		Morocco			
Bahamas				Nepal			
Barbados				Netherlands	x	x	x
Belgium	x	x	x	New Zealand	x	x	x
Bolivia				Nicaragua			
Botswana				Nigeria			
Brazil	x			Norway	x	x	x
Britain	x	x	x	Pakistan			
Canada	x	x	x	Panama			
Chile	x			Peru	x		
China				Philippines	x		
Colombia	x			Poland			
Costa Rica				Qatar			
Denmark	x	x	x	Romania			
Egypt				Singapore	x		
Ethiopia				South Africa			
Finland	x	x		South Korea	x		
France	x	x	x	Spain	x	x	x
Ghana				Sweden	x	x	x
Greece		x		Switzerland	x	x	x
Honduras				Tanzania			
Hungary				Thailand			
Iceland		x		Turkey		x	
India				Uganda			
Indonesia				United States	x	x	x
Ireland		x		Uruguay			
Israel				Venezuela	x		
Italy	x	x	x	West Germany	x	x	x
Japan	x	x	x	Western Samoa			
Kenya				Yugoslavia			
Lebanon				Zaire			
Luxembourg		x		Zambia			
Malaysia	x			Zimbabwe			

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