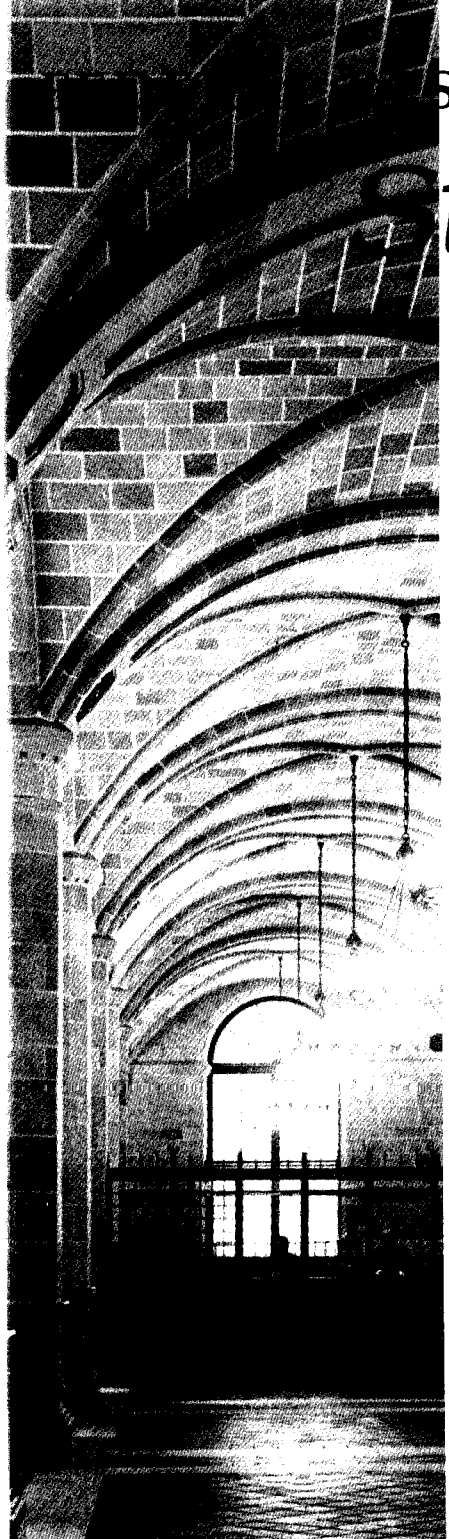

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Central Bank Independence and Disinflationary Credibility: A Missing Link?

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A Missing Link?

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Abstract:

Granting central banks independence from short-term political control is widely assumed to decrease inflation by increasing the credibility of commitments to price stability. This paper analyzes public- and private-sector behavior in a sample of seventeen OECD countries for evidence of variations in disinflationary credibility with monetary institutions. The paper does not find evidence that the costs of disinflation are lower in countries with independent central banks, even when differences in contracting behavior are taken into account. It also does not find evidence that central bank independence inhibits government collection of seignorage revenues or manipulation of economic policy for electoral gain. These results raise questions about some explanations of the negative correlation between central bank independence and inflation, as well as the empirical relevance of government time-inconsistency problems as a source of inflation differences.

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Central bank independence is rapidly becoming the worldwide norm for the organization of monetary authorities. A remarkably broad consensus of academics and policymakers, conservatives and liberals, have rallied around the idea that freeing monetary policymaking from political direction eases the attainment of price stability at little or no real economic cost.[1] The erection of legal barriers to elected government control of monetary policy has been agreed to (where barriers were not already in place) in virtually all the member countries of the European Union, most of the remaining members of the Organization for Economic Cooperation and Development (OECD), and a growing number of both newly industrializing economies and former Communist economies in transition.

This convergence upon a particular institutional fix for inflation stems from the wide acceptance of the analysis of two stylized macroeconomic facts in the papers of Kydland and Prescott (1977) and Barro and Gordon (1983): that the long-run Phillips curve is vertical, that is, inflation has no permanent effect on real outcomes; and that governments nonetheless have an incentive to spring inflationary surprises upon the public. As a result, these papers argued, a primary cause of inflation was government's inability in the eyes of the public to commit credibly to a low inflation policy. One could remove the time-inconsistency problem by making government unable to renege upon a commitment to low inflation. In Rogoff (1985), the appointment of a conservative central banker was

[1] Argued most clearly in Alesina and Summers (1993). The negative correlation between central bank independence and average inflation was brought to light by, among others, Alesina (1988), Grilli, Masciandaro, and Tabellini (1991), and Cukierman, Webb, and Neyapti (1992).

shown to be one means to that end. Since then, legal central bank independence has been identified with a credible commitment to price stability.[2] This credibility bonus is presumed to be the source of the widely known negative correlation between central bank independence and average inflation rates.

Despite the theoretical and policy attention paid to central bank independence, however, no previous study[3] has directly examined the postwar experience prior to recent developments for evidence of credibility effects of central bank independence. The coexistence of the Barro-Gordon/Rogoff explanation with the robust negative inflation correlation with central bank independence seems to have satisfied curiosity on this point.[4] Yet, this coexistence, while necessary to establish a causal link between central bank independence and low inflation, is insufficient to do so. If independent central banks' policies are inherently more credible, not only inflation levels but also

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[2] Grilli et al. (1991) state that "the primary advantage of an independent central bank is its credibility." Similarly, Cukierman (1992) believes granting central bank independence "can be viewed as an act of partial commitment," and Dornbusch and Fischer (1993) list changes in central bank independence as "innovations in credibility management" in their discussion of moderate inflations. Note that this increased central bank independence and a stronger anti-inflationary preference are not distinguished from each other (as loose money policies are always credible/require no independence).

[3] Since an earlier version of this paper was first presented (November 1993), two other papers have appeared that overlap somewhat with the investigations of the cost of disinflation in Section II: Debelle and Fischer (1994) and Walsh (1994). Neither paper, however, attacks the question of disinflationary credibility directly, and as a result of this alternate emphasis, the statistical analysis of sacrifice ratios in both papers suffers from omitted variable bias. In the case of Walsh (1994), this bias leads to a conclusion in favor of his model of optimal indexing response to monetary arrangements. Since the present paper was searching from the start for evidence of private-sector reactions to central bank independence differences, it directly tests the predictive power of central bank independence for nominal wage rigidity and rejects any link.

[4] The contrast is particularly striking with the volume of empirical work that tests whether countries joining the European Monetary System gained in credibility (for example, Weber 1991), despite a similar prima facie case for assuming so.

expectations of monetary policy must differ systematically across countries with differences in central bank independence. This paper examines cross-sectionally public- and private-sector behavior in a sample of seventeen OECD countries from 1950-89 for evidence of such differences.

A direct link between central bank independence and disinflationary credibility is not supported by this paper's results. Disinflation appears to be consistently *more* costly and no more rapid in countries with independent central banks, even holding wage indexation constant. Moreover, neither wage nor price rigidities as measured in this paper are found to vary significantly across countries with different central bank institutions. This invariance indicates that the greater price stability correlated with central bank independence does not induce the greater willingness to forgo the costs of recontracting one might expect from a credibility-caused inflation reduction. Furthermore, the hypothesis that the elected governments' attempts to collect seignorage revenues or to manipulate macroeconomic policy for electoral gain will be less prevalent where central banks are more independent is unsupported in this sample.

The paper is organized as follows. Section I discusses what theory predicts would be the effects on the disinflationary process and on contracting behavior of increased central bank independence if such an increase represents a greater credibility of commitment to price stability. Section II examines the historical record for evidence of these predicted private-sector behavior differences. Section III discusses how public-sector behavior should be affected by central bank independence if the independence does credibly constrain government opportunism with monetary policy, and performs a search across countries for evidence of those predicted differences. Section IV summarizes the results and considers their implications for explanations of the negative correlation between

central bank independence and inflation, and for the emphasis upon government time-inconsistency problems as a major source of inflation.

I. Predicted Effects of Central Bank Independence as a Credibility Enhancement

Let us start with the assumptions upon which the whole argument for central bank independence (if not the majority of contemporary macroeconomic theory) is based: Individuals are (at least somewhat) forward looking and the long-run Phillips curve is vertical. Under those assumptions, if central bank independence is a mechanism through which governments increase the credibility of their commitments to price stability, then an increase in a country's central bank independence should lead that country's private decision makers to stop altering their behavior to protect themselves from government-induced inflation surprises. Inflation rates should be lower in countries with higher central bank independence, but only as an observable result of differences in the behavior of private agents. The purpose of this section is to derive empirically testable predictions from these theorized effects.

The first logical place to look for private-sector effects of more credible monetary policymaking is in disinflations. That is to say, when a change in policy, such as a monetary tightening, is announced, what does it matter that people are more likely to believe in and respond to the announcement when a more independent central bank makes it? Of course, the role of credibility in determining the course of disinflations has long been widely discussed, especially since Sargent (1982). In the flexible price, natural rate world that he describes--the world in which the Barro-Gordon (1983) analysis also is set--expected money

growth has no real effect. Consequently, it is evident that a disinflationary announcement that is believed changes the price level with no cost in terms of unemployment or output.

More interestingly, credibility appears to have an effect in less classical worlds as well. In all the various New and neo-Keynesian models that rely on staggered contracts, sticky prices, or sticky wages to produce real effects of monetary policy--including Barro and Grossman (1976), Fischer (1977), Taylor (1980), Calvo (1982), and Buiter and Miller (1982)--the presence of price *level* inertia is no impediment to costless disinflation if the announced policy is completely believed and properly timed.[5] Fischer (1985) and Chadha et al. (1992) work through simulations of disinflations under differing levels of credibility for specific staggered long-term wage contracting models, and both find that as the time necessary for the public's expectations of monetary policy to match actual monetary policy shrinks, so do the costs of disinflation. Ball (1992) derives the general result that increased credibility[6] decreases the costs of disinflation, even where staggering of price and wage setting exists.

In short, recession will occur with monetary tightening only to the degree that the rate of growth of the money stock falls more than expected. Enhanced credibility of monetary policy, whether in a flexible or sticky wage-price environment, should reduce the distance between expectations and reality. Thus, we are led to our first prediction for the importance of central bank independence as a credibility enhancement mechanism:

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[5] Buiter and Miller (1985), Chadha et al. (1992), and Ball (1990, 1992) discuss this point at length.

[6] Defined as the public's subjective probability that the monetary authority will pursue an announced disinflationary policy rather than make a "U-turn."

Prediction One - Where central bank independence is greater, the cost of disinflation should be lower, ceteris paribus.

There are, of course, other factors that determine the slope of the Phillips curve or output-inflation trade-off, but to whatever extent people are able to react to policy (for example, are not bound by long-term contracts), the clearer signal that a more credible policy conveys must translate into a smaller real effect of monetary policy.[7]

Naturally, the extent of private actors' freedom to react to policy is itself a matter of choice. People can be supposed to pick the nature of their contracting arrangements in response to the situation in which they find themselves. In all the models discussed above, however, the degree of nominal rigidity (from zero in Barro-Gordon [1983] to high and highly specified in Fischer [1985]) in the economy is treated as parametric. While this modeling assumption is understandable for the purposes of those papers, it shapes this paper's investigation of the credibility effects of central bank independence in two ways. The first, straightforward way is that a clear set of control variables to use in isolating the credibility bonus of central bank independence suggest themselves. Uncontrolled regressions of sacrifice ratios on central bank independence will likely have significant omitted variable bias toward a smaller effect as nominal rigidity flattens the Phillips curve.

The second, more significant impact of recognizing the endogeneity of contracting behavior is to yield a new set of predictions with which to test for credibility effects of central bank independence. If we assume that people in a low-inflation and low-inflation-uncertainty environment would prefer to contract in longer nominal terms in order to economize on the costs of renegotiating,

[7] This is the insight of Lucas (1973).

information gathering, and so on,[8] then a policymaking regime that offers greater credibility for price stability should encourage greater nominal rigidity than one that does not. Consequently:

Prediction Two - Where central bank independence is greater, nominal wage rigidity should be greater.

Since product pricing is subject to many influences outside of the monetary environment, such as market concentration or international openness, direct measurement of the influence of central bank independence upon it is infeasible in this paper. Decisions about indexation and duration of wage contracts, on the other hand, are presumed to be largely driven by the national macroeconomic surroundings.

Nonetheless, it is not necessary to give up entirely on looking for credibility effects of central bank independence upon product-pricing behavior. Building on the New Keynesian approach from Ball, Mankiw, and Romer (1988) and Ball (1993), it is possible to argue that the lower inflation levels that we know to be strongly correlated with central bank independence will lead to greater nominal rigidities and thus higher costs of disinflating, ceteris paribus. In that case, we can make:

Prediction Three - A higher level of inflation at the beginning of any disinflationary episode should result in lower costs of disinflation (holding nominal wage rigidity constant).

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[8] This commonly made assumption of some nonzero but not overwhelming costs involved in real contracting and re-contracting is necessary to explain the fact that in low-inflation countries people do contract in nominal terms, while we believe they care about real outcomes. Grey (1978) models this intuition for wage indexation, while Ball, Mankiw, and Romer (1988) bring out this implication of menu costs for goods markets.

Naturally, support of this hypothesis would not provide the direct evidence of contracting behavior responding to degrees of central bank independence the way tests of Prediction Two would. Nonetheless, a rejection of Prediction Three would be difficult to reconcile with central bank independence credibly inducing expectations of a low-inflation environment.

Longer nominal contracting might appear at first glance to have another effect on the course of disinflation beyond its cost: As contracts remain binding, disinflation would be slowed. The opposite, however, is the case. In the staggered wage contract model of Fischer (1985), when an announced disinflationary policy is fully credible, two things occur: First, the central bank has the incentive to set the lag between announcement and implementation so as to allow all contracts to adjust; second, parties to each individual contract have the incentive upon expiration to reset their inflation-driven wage demands to match the central bank's target level at the preannounced date of policy onset. When the central bank's actual contraction in money growth kicks in, the inflation level adjusts fully, that is, the duration of disinflation from time of policy implementation is zero under perfect credibility.

The only threat to this scenario is that the policymaker would have an incentive to renege on the preannounced money growth decrease once the early-in-cycle contracts are written based upon this announcement. Of course, the credible commitment not to renege in such a situation is precisely what central bank independence is supposed to provide.[9] In flexible price-wage models of monetary policy, such as that of Barro-Gordon (1983), the only reasons that an announced disinflation would not be instantaneous upon implementation would be

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[9] Fischer (1985) notes in his discussion of this point, "It is clear from these examples that a lack of credibility of policy can substantially prolong the adjustment of output and the inflation rate to disinflationary policy."

if an information imperfection were introduced, either of adaptive expectations by the public or of uncertainty about central bank preferences. In either case, a more credible policymaker's policy would disinflate at least as quickly as a less credible one's would. Accordingly, we have:

Prediction Four - Where central bank independence is greater, disinflation from time of implementation of contractionary policy should be faster.

It is important to distinguish this prediction from recommendations made in articles that treat the speed of disinflation as a choice variable and argue about the relative real costs of gradualism versus quick disinflation (for example, Ball 1993). Sargent (1982) goes so far as to argue that speed increases credibility (and thereby decreases the cost of disinflation). Prediction Four is the distinct statement that if the monetary policymaker is more credible, taking that credibility as fixed, speedier disinflations should occur.

II. Evidence of Effects of Central Bank Independence on Private-Sector Behavior

Since credibility differences cannot be directly observed, the hypothesis that central bank independence enhances the credibility of commitments to price stability can only be empirically supported by the verification of certain implications of assuming the hypothesis to be true. The four predictions of the previous section are all empirically testable implications of this underlying hypothesis. Predictions One and Four stem directly from the very concept of credibility in the monetary policy context, and are not dependent on any specific

model assumptions.[10] As a result, they are necessary conditions for upholding the hypothesis that central bank independence enhances credibility.

Predictions Two and Three each require a little more than the basic hypothesis--the former assumes that choices of contracting arrangements will respond to the monetary environment, and the latter assumes the same and specifically Ball et al.'s (1988) argument about initial inflation affecting decisions to bear menu costs--but not much more. The rejection of these two predictions would at a minimum be an indication that the credibility benefits of central bank independence are not sufficiently large as to induce changes in contracting behavior, and thus unlikely to be of enough importance to explain the national inflation differences ascribed to central bank independence. If all four predictions are rejected, the absence of a relationship between nominal rigidity and differences in degrees of central bank independence severely weakens the claim that central bank independence confers a credibility bonus.

The sample of country observations and the measurements of central bank independence to be used in this paper for the testing of Predictions One through Four (as well as the further predictions about public-sector response to central bank independence in Section III) are outlined in Table 1. Observations by decade from 1950-89 of seventeen countries from the OECD are included in this sample.[11] The time period was chosen to begin with the establishment of the postwar economic order and end before the current fashion for granting central

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[10] Beyond those mentioned at the start of Section I, a vertical long-run Phillips curve and at least partially forward-looking expectations.

[11] The countries are Australia, Austria, Belgium, Canada, Denmark, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Spain, Switzerland, the United Kingdom, and the United States. These are the same seventeen countries examined, and for which central bank independence measures are generated, in Grilli et al. (1991) and Alesina and Summers (1992).

bank independence began. Table 1 lists each country's forty-year average values for central bank independence for each of the four major published scales of central bank independence (Bade-Parkin, Grilli-Masciandaro-Tabellini,[12] Alesina-Summers, and Cukierman-Webb-Neyapti); sample summary statistics for each of the four measurement scales also are listed. In all four cases, a higher score is meant to indicate greater central bank independence.

As can be seen from the Spearman rank correlations computed here of each of the other measures with Cukierman et al.'s scores for the various sample countries, the four measures are reasonably consistent with one another (all correlations greater than 0.61). This is not surprising as virtually all[13] are based on the coding of legal statutes having to do with the appointment and tenure of central bank governors, the required services of the central bank for the government treasury, the stated goals of the central bank, and so forth, and all classify Germany, Switzerland, and the United States as the countries with the most independent central banks. For the rest of this paper's statistical investigations, whenever central bank independence is referred to, the scores from Cukierman et al.'s index were used. Substitution of any of the other three measures in the analyses included in this paper did not change any results meaningfully.[14]

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[12] The scores reported here are actually after Grilli et al.'s number has been converted to a four-point (from a seventeen-point) scale, as was done in Alesina and Summers (1992).

[13] Except Alesina-Summers, which is simply an average of the four-point Grilli et al. score and the Bade-Parkin score.

[14] The results using each of these other measures are available directly from the author. The Cukierman et al. measure was selected for the reported results because it has been implemented for a broader set of countries than those included in this sample, arises out of more detailed analysis of country statutes, and is normalized to run continuously from zero to one. For a more detailed discussion of choice of measure, see Posen (1995).

Testing of Prediction One--that where central bank independence is higher, the cost of disinflation should be lower--is conducted through the ordinary least squares (OLS) regression of the cost of disinflation[15] upon central bank independence and various control variables. That is, the equation:

$$(1)\ R = \beta_0 + \beta_1(\text{CBI}) + \beta_2(\text{Episode Length}) + \beta_3(\Delta\pi) + \beta_4(\text{NWR})$$

is estimated, where β_0 is a constant, Episode Length is the number of months from peak to trough inflation, $\Delta\pi$ is the total change in inflation over that period, and NWR is a measure of nominal wage rigidity (discussed below).

The expected signs on the coefficients are that greater nominal wage rigidity increases the cost of disinflation, longer episodes (as a means of measuring the speed of disinflation) increase the cost (Sargent 1982), the total change in inflation decreases the cost (when extensive disinflation is required, people are more likely both to adapt and to believe that something will be/is being done), and central bank independence reduces costs through enhancing credibility, as in Prediction One.

I have relied upon Ball (1993) to identify disinflationary episodes from the OECD data any time inflation drops for four or more straight quarters after having risen (that is, peak to trough). He has compiled two basic samples: a subset of episodes where quarterly output data were available, and a full set of annual data episodes. For the seventeen countries in this paper's sample, there are fifty-six annual data episodes and twenty-eight quarterly data episodes. For each of these episodes Ball has computed a sacrifice ratio--total point-years of unemployment

[15] Measured either by sacrifice ratios from all disinflationary episodes involving the sample countries in the relevant period, computed in Ball (1993), or by output-inflation trade-offs, estimated in Ball, Mankiw, and Romer (1988). See discussion below.

above that at episode start, divided by total points of inflation lost--which is used as the dependent variable in these regressions.

When a control variable for nominal wage rigidity is included, fewer observations are employed in the regressions because the two measures used--that of nominal wage rigidity by Grubb, Jackman, and Layard (1983) and that of nominal wage responsiveness by Bruno and Sachs (1985)--do not cover all of the sample countries. It should be noted that coefficients on these two measures are expected to have opposite signs because the Bruno and Sachs measure is one of nominal wage responsiveness, not rigidity, and so should have a negative coefficient. As noted below, particular outlier observations of these wage measures are suspicious and lead to inconsistencies between them. As a result, the regressions are run both with and without these observations.

The results of the regressions are reported in Tables 2 and 3. The key result is consistent across all regressions. Central bank independence always has a significant (at the 5 percent level) *positive* coefficient, whichever sample of disinflationary episodes is examined, and whether or not any measure of nominal wage rigidity is included. In other words, central bank independence increases the cost of disinflation in direct contradiction of Prediction One and of the central-bank-independence-credibility hypothesis. Moreover, the effect is not only significant and positive, but also large--going from a dependent central bank like the Bank of Belgium (central bank independence score of 0.19) to one like the Bundesbank (0.66) adds around 1.25 point-years of unemployment to the sacrifice ratio of an average disinflation.

As expected, nominal wage rigidity does increase the cost of disinflation, though not always significantly. Consonant with the Sargent (1982) view, longer episodes (that is, more gradual disinflations) cost more--significant (at the

1 percent level) positive coefficients in ten of the twelve reported regressions--so it would appear that credibility does matter, even if central bank independence does not appear to offer it. The total change in inflation undertaken does not appear to matter to the cost of disinflation.

As a check for the robustness of this surprising result, one other cross-national dataset on the slope of the Phillips curve is examined. Table 4 reports the results of OLS regressions of Ball, Mankiw, and Romer's (1988) estimated output-inflation trade-offs on central bank independence, the two measures of nominal wage rigidity, and a constant, both for the full 1948-86 period for which Ball, Mankiw, and Romer have computed estimates, and for two subperiods around the oilshocks.[16] While the effect of central bank independence is only statistically significant in the post-1972 period, it always has a positive coefficient--in other words, the credibility hypothesis's Prediction One of a negative coefficient is rejected again. Nominal wage rigidity has the expected positive sign in five of the six regressions and, although not statistically significant, does not seem to offer evidence of collinearity with central bank independence (as there was not in Tables 2 and 3).

Of course, estimates of the relationship between the cost of disinflation and central bank independence based on the Ball, Mankiw, and Romer trade-off estimates alone would be suspect because Ball, Mankiw, and Romer impose a long-term fixed linearity on the output-inflation trade-off, which is probably

[16] In the "Full Period" regressions, the 1950-89 average values for central bank independence are used. In the 1948-72 period regressions, the averages of the 1950-59 and 1960-69 central bank independence observations are used. Similarly, in the 1973-86 period, the averages of the 1970-79 and 1980-89 values are used. Two of our sample countries are not included in the Ball, Mankiw, and Romer dataset, so the regressions here have at most fifteen observations (thirteen when the Bruno and Sachs wage rigidity measure is used, because of its limited country list).

unsound. Since our primary concern is to test for the sign, not the size, of the coefficient upon central bank independence, however, the results in Table 4 serve as a strong robustness check that the failure of central bank independence to decrease costs of disinflation is not some artifact of the two disinflationary episode samples drawn from Ball (1993).

Turning to the question of whether and how central bank independence influences contracting behavior, the relationship between central bank independence and nominal wage rigidity (Prediction Two) must be examined. As explained in the previous section, wage contracting and recontracting are costly processes. Since central bank structures, once fixed, can be depended upon to remain stable for up to decades at a time, it seems only reasonable that, if central bank independence offers wage negotiators a credibly price-stable environment, nominal wage rigidity will increase.[17]

As mentioned in the above discussion of their use as control variables, the two available measurements of national differences in nominal wage rigidity have some significant inconsistencies. While assessing these is hardly the focus of this paper, both the desire for a reasonably reliable test of Prediction Two and the fact that, despite the two nominal wage rigidity measures' wide usage in cross-national studies, this problem never seems to have been noticed before[18] indicate that a brief discussion would be in order. Bruno and Sachs (1985) and Grubb, Jackman, and Layard (1983) both tackled the same problem--assessing the degree of nominal rigidity in wage setting on a country-by-country basis--and their

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[17] Grey (1978) offers a formal model of the decision to index wages being endogenous to the price environment.

[18] For example, Ball (1993) prints results using the Bruno and Sachs measure, mentions that he checked the results by substituting the Grubb, Jackman, and Layard measure, but does not indicate any awareness of possible discrepancies between them.

measurements are well established in the literature, with Bruno and Sachs somewhat more widely cited than Grubb, Jackman, and Layard. Since the former measures nominal wage responsiveness, and the latter nominal wage rigidity, for basically the same set of countries, ideally one would see a perfect negative correlation between them.[19]

As can be seen in Table 5, the two measures actually correlate extremely poorly with one another, either by rank order or by simple correlation (to have an idea of what might be reasonable for such cross-national assessments, remember that the rank correlation of the Bade-Parkin and the Grilli et al. measures of central bank independence with the Cukierman et al. measure is around 0.62). In some instances, the correlation is positive.

One major source of the inconsistency is that each set of measurements has one country that is given an extreme outlier value, especially in comparison to how that same country is rated in the other system.[20] Even omitting these countries' observations from the correlations (and from columns 4 and 6 in both Table 2 and Table 3), however, does not completely resolve the inconsistency

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[19] Their methodologies of determining the measures, however, are completely different. Bruno and Sachs code for the existence of various wage-setting institutions and practices in the sample countries, a procedure much like that used to measure central bank independence. Grubb, Jackman, and Layard estimate both a nominal and a real wage responsiveness from 1970s wage-setting data. There is no a priori reason to think that one method is superior to the other as the reasoning given by Bruno and Sachs for their choice of institutions to code is essentially the same as the theory discussion in Grubb, Jackman, and Layard.

[20] Bruno and Sachs give Switzerland a zero on their zero-to-six scale for nominal wage responsiveness, the only country to get such a score, while Grubb, Jackman, and Layard estimate Switzerland to have nominal wage rigidity within one standard deviation of the mean; Grubb, Jackman, and Layard compute a nominal wage rigidity for the United States on their scale of 3.14, more than four standard deviations from the mean (the next highest is Belgium, at 1.1), while Bruno and Sachs rate the United States a one out of six in responsiveness.

between the two measures. Since no resolution of this problem is evident, the regressions testing Prediction Two report results for both measures, with and without the suspect observations.

Contrary to what we might expect if central bank independence represented a fundamentally more credible regime, nominal wage rigidity seems to have no significant relationship with central bank independence. As hinted at by the independent positive effects upon disinflationary costs from measures of nominal wage rigidity and central bank independence displayed in Tables 2 through 4, the predicted relationship does not exist in the data. Results of OLS regressions of the nominal wage rigidity measures on central bank independence and a constant are presented in Table 6. In fact, the evidence is mixed on what is the sign of the effect, with central bank independence having a negative coefficient in each instance, despite the oppositely oriented Bruno and Sachs and Grubb, Jackman, and Layard measures as independent variables. The one statistically significant coefficient on central bank independence--that when the dependent variable is Grubb, Jackman, and Layard's nominal wage rigidity measure, and the United States is omitted from the sample--indicates that rigidity decreases with increased central bank independence, contradicting theory. Not only do these results mean that decisions about the form of wage contracting seem to be invariant to the monetary environment, but they reaffirm that the positive relationship between central bank independence and the costs of disinflation is not occurring through this channel; in other words, central bank independence increases the costs of disinflation irrespective of the wage-setting arrangements, not by leading to potentially costlier arrangements.

Prediction Three concerns the product-market side of price setting. As explained in the previous section, if central bank independence has large

credibility effects, one would expect a similar type of phenomenon to that hypothesized (and now rejected) for nominal wage rigidity--that is, in a more price-stable environment, firms would be more willing to let nominal rigidities stand for greater lengths of time.[21] This would lead to a higher cost of disinflation at low levels of inflation. Since we know that there is an association between central bank independence and inflation levels, testing this prediction not only reexamines the credibility effects of central bank independence, it also allows us to see if we can rule out another potential explanation for the positive coefficient on central bank independence in the regressions to explain the cost of disinflation.

To test this possibility, regressions with sacrifice ratios as the dependent variable analogous to those in Tables 2 and 3 were run, including measures of nominal wage rigidity, with each episode's initial inflation level before disinflation taking the place of central bank independence as an explanatory variable. In none of the estimated equations did initial inflation ever have a significant coefficient of any sign.[22] On this evidence, a less inflationary environment does not seem to induce greater nominal rigidities, at least not on a scale sufficient to affect the costs of disinflation.

Since regressing the sacrifice ratio on simple initial inflation constrains the relationship between the costs of disinflation and the level of inflation to a linear one, two other specifications for this term were tried: the log of initial inflation, in

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[21] Ball, Mankiw, and Romer (1988) place this idea in a New Keynesian framework, and predict that where the initial inflation level before a disinflation is lower, nominal rigidities should be higher (for example, menus being less likely to be reprinted).

[22] In the interest of brevity, the results discussed in this and the next paragraph (that is, thirty-six regressions in which the explanatory variable of interest never yielded a coefficient significant at the 5 percent level) are not reported in a table. The regression results are available from the author upon request.

case costs of disinflation are rising in inflation, but marginal costs are falling (a view that seems to square with our notion of how moderate inflation countries function); and one over the square of initial inflation, in case the belief that hyperinflations cost very little to stop extends all the way back to large decreases in costs of disinflation as inflation rises, even at low levels. Neither of these explanatory variables ever yielded a statistically significant coefficient either. Once again, central bank independence's effect on inflation does not seem to be having the effect on contracting behavior that one would expect to accompany it if enhanced credibility were the source of the relative price stability. The positive relationship between costs of disinflation and central bank independence remains unexplained.

Given the rejection of Predictions One through Three (that is, the absence of evidence that central bank independence increases policymaking credibility in a way that lowers the cost of disinflation or leads to greater nominal rigidities), support for Section I's final prediction would be a surprise. Prediction Four is that disinflationary policy should have a speedier effect where central bank independence is higher. To test this prediction, two different measures of the speed of disinflation are analyzed--the number of quarters in which disinflationary episodes lasted, and the points of inflation "disinflated" over that episode, divided by that episode's length.[23] Each of these measures is regressed upon central bank independence and a constant in both of the Ball episode subsets for our sample countries.

As can be seen in Table 7, only in one of the four regressions does central bank independence have the expected (under credibility improvement) positive

[23] Ball (1993) points out that speed could mean either duration of the episode or rate of disinflation.

coefficient indicating that increased independence increases speed. In one regression using the quarterly output data subsample, central bank independence has a significant negative effect on the number of points of inflation disinflated per quarter. Since Tables 2 and 3 establish that a more gradual disinflation increases the costs thereof in accordance with a Sargent-type credibility view, Table 7 would seem to be another clear indication that increased central bank independence does not affect contracting behavior in the private sector in a way consistent with such independence working through a credibility mechanism.

III. Evidence of Public-Sector Behavioral Effects of Central Bank Independence

According to the theories underlying the recent push for central bank independence, its granting is meant to increase the credibility of commitments to price stability by constraining the elected government's ability to inflate. Nevertheless, just as earlier research has not explicitly addressed the effect of central bank independence on the private sector, no study to date has looked for direct evidence that governments in countries with more independent central banks engage in less inflationary behavior.[24] If the negative correlation between central bank independence and inflation levels is to be understood using current theories, then government behavior must differ cross-nationally along with central bank independence. The analysis in this section finds no evidence of such differences.

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[24]Johnson and Siklos (1994) compute reaction functions for seventeen OECD country central banks (not coincident with this paper's sample) and find that the pattern of coefficients that emerges from their vector autoregressions does not appear consistent with the usual ranking of central bank independence. These results, while suggestive, are both subject to identification problems and constitute less than direct tests of the relevant hypothesis.

What does central bank independence actually consist of that we should consider it a credible constraint on governmental inflationary tendencies? Both in the design of all the published measures of central bank independence by academic economists and in the recent policy discussions that took place in countries such as France and New Zealand before their changes in monetary authority structure, independence for central bankers was identified to consist of laws protecting three things: the security of tenure of the central bank governors once appointed; the ability of central bank governors to refuse to monetize public debt; and the primacy of the price-stability goal in central bank policymaking.

These three sets of barriers to government interference with monetary policy correspond to the three main motivations for there being a time-inconsistency problem if monetary policy is left in an elected government's hands: pressure to expand the economy at particular times (presumably for electoral motivations), desire for seignorage revenues, and preferences for a long-run unsustainable point on the unemployment/inflation trade-off. As a result, the first and second of the above aspects of central bank independence lead directly to testable predictions of the hypothesis that central bank independence affects public-sector behavior. That is:

Prediction Five - Where central bank independence is greater, government use of seignorage for revenue should be less, ceteris paribus.

Prediction Six - Where central bank independence is greater, manipulation of economic policy for electoral gain should be less evident.

The third aspect, concerning policy preferences, is best considered in the context of all of this paper's other results, and is returned to in Section IV.

It may appear strange at first to be examining whether laws designed to prohibit specific governmental behavior in fact do so. What is being examined at the same time, however, is whether governments actually find themselves subject to the time-inconsistency dilemma posed in the models of Cukierman (1992) and Rogoff (1985).[25] A general result of these models is that it is a Pareto improvement for the government to give up control of monetary policy to the central bank. Having done so, the country's government should no longer have an incentive to pursue policies whose benefits are premised upon a short-run nominal expansion,[26] or otherwise seek to interfere with the monetary policy choices made by the central bank. Moreover, in these models, the only incentive a central bank would have for deviating from the pursuit of price stability is the pressures that arise out of a lack of independence. If these models capture the important aspects of reality for monetary policymaking, central bank independence laws should be self-enforcing for both elected governments and central banks.

Legal barriers to seignorage play a significant role in the formation of both Grilli et al.'s (1991) and Cukierman et al.'s (1992) measures of central bank independence. This is not unreasonable, for while seignorage is frequently considered to be more a trait of less developed countries and countries with unstable governments, it also reached non-negligible levels in a number of OECD members in the 1960s and 1970s. Furthermore, as part of the view that conscious government monetary expansions are the major source of inflation, the bottom line determinant of inflation is the extent of monetization of government deficits. Accordingly, Prediction Five is an important implication of the mainstream

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[25] Among others who have worked on the problem initially framed in Kydland and Prescott (1977) and Barro and Gordon (1983).

[26] Not to be confused with the potentially still-rational policy of offsetting external shocks.

theories to explain the association of central bank independence with lower average rates of inflation.

To test whether greater central bank independence decreases government reliance on seignorage revenues, four equation systems of seemingly unrelated regressions, with average annual seignorage by decade as the independent variable, were estimated. The choice of the seemingly unrelated regression technique was made to take advantage of continuities and overlapping information between decades in explaining national levels of seignorage (the results were checked for robustness to being treated as pooled data). The equations took the general form:

$$(2) \qquad S_i = \beta_{0i} + \beta_{1i}(\text{CBI}) + \beta_{2i}(\text{Division}) + \beta_{3i}(\text{Instability}),$$

where i is an index for observations by decade (1950s-80s). Central bank independence is defined as throughout this paper, and the expected coefficient on it is negative, as in Prediction Five. Division is meant to capture the expected effect that where elected government is more split (ideologically or otherwise), it should be less able to agree on a tax system or other decisions to raise revenue, and therefore should be more reliant upon seignorage; its coefficient should be positive. Division is proxied for by party fractionalization, the probability that any two representatives chosen from that country's legislature will belong to two different parties.[27] Instability is any one of a number of measures of turnover in government control, and is meant to proxy for perceived illegitimacy of the government by the populace; the coefficient on instability is expected to be

[27] The fractionalization data are taken from Grilli et al. (1991). See there and Posen (1995) for further discussion of the concept.

positive because governments without popular support are expected to have difficulty collecting revenues from sources outside of the printing of money.[28]

The results of estimating one such system of equations are given in columns 1-4 of Table 8. In no decade did central bank independence have its predicted significant negative effect on seignorage, although central bank independence measures are at least one-third defined by strictures on the monetization of deficits; in fact, coefficients on central bank independence were often positive in individual decades. This result proved robust to substituting different measures of political instability[29] for number of government changes per decade, to the exclusion of political fractionalization or political instability or both, and to running a set of similar two-equation seemingly unrelated regression systems for the 1970s and 1980s, including the start of the decade's debt/GNP ratios as an additional explanatory variable.[30] Finally, this result was cross-checked with a regression of 1950-89 averages of seignorage on averages of central bank independence and the control variables (column 5 of Table 8). While the coefficient on fractionalization had a significant opposite sign from that expected, central bank independence still had a positive insignificant coefficient, in direct contradiction of Prediction Five.

Finally, we come to the question of manipulation of monetary and budgetary policy for electoral gain. In the words of Goodhart (1994), "The case for central

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[28] For a discussion of the political economy of seignorage, as well as the source of the seignorage data, consult Cukierman, Edwards, and Tabellini (1990).

[29] Number of elections/decade or number of significant government changes/decade as computed and defined in Taylor and Jodice (1983).

[30] The start of the decade's national debt/GNP ratio should increase seignorage because of the pressure of outstanding debt, and it always had the expected positively signed coefficient upon inclusion. Unfortunately, even for our sample countries, International Monetary Fund data to compute this ratio were only available for the 1970s and 1980s.

bank independence is based on two intellectual concepts. . . . The first is the 'no-trade-off,' vertical longer-term Phillips curve. . . . The second is the concept of the political business cycle." Central bank independence measurements and laws place such an emphasis upon safe tenure for central bank governors precisely because they intend to impede government demands for a specific policy at a specific time, like a pre-election expansion. While the actual occurrence of such blatant manipulation may be rare, its possibility looms large in all discussions of central bank independence, and enhancing that independence should effectively preclude it, as stated in Prediction Six.

This prediction may be tested through analysis of the results from Alesina, Cohen, and Roubini's (1992) definitive study of the existence of political budgetary and monetary cycles across the developed countries.[31] Their main test for the existence of such cycles is to see whether dummy variables corresponding to the four quarters before an election have a significant positive coefficient in time-series of budget deficits and of money growth. They applied their analysis to fifteen of our sample countries for the period 1960-89 (among others). I take their estimated coefficients for each country in my sample (of which, it should be noted, only a handful are significant at the 5 percent level, either for budgetary or monetary cycles), and cross-tabulate them with national central bank independence levels, performing chi-squared tests of the hypotheses that political business or monetary cycles are independent of central bank independence. The results are reported in Table 9.

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[31] I am grateful to Gerald Cohen for his sharing of data. Note that these data refer to what may be called "naive political business cycles" and have nothing to say about the existence of "rational partisan cycles"--which there is no reason to believe that central bank independence affects one way or another.

The hypothesis of independence between central bank independence and either form of political manipulation of macroeconomic policy cannot be rejected at the 5 percent level. Surprisingly, the hypothesis that central bank independence prevents political budget cycles comes about as close to significance as the hypothesis of political monetary cycles, although one would expect political monetary cycles to have an even tighter link to central bank independence. Even more surprisingly, Germany is the only country in this paper's sample that Alesina et al. determined has statistically significant evidence of both political business and political monetary cycles, despite the Bundesbank.[32] In this sample, neither reliance on seignorage nor attempts to induce political business cycles by elected governments appear to vary across countries with differences in central bank independence.

IV. So What Does Central Bank Independence Do and How?

This paper's investigations find no evidence to support the hypothesis that the mechanism by which central bank independence leads to low inflation is the enhancement of credibility of commitments to price stability. In our sample of seventeen OECD member countries from 1950-89, there is no indication that any of the implications for public- and private-sector behavior necessarily associated

[32] The idea (attributed to Cukierman) is raised in a footnote to their study that perhaps this result arises because the German Phillips curve is so flat that there is a large benefit to engaging in such expansions. Of course, if that were the reason, given the results of Section II of this paper, one has to wonder why the curve is so flat and what then causes the low inflation, especially since expectations do not adjust to this fact being exploited. Moreover, this hypothesis does nothing to respond to the basic problem posed at the beginning of this section--in Cukierman's (1992) own models, a government with high central bank independence has no incentive to engage in such expansions irrespective of the slope of the Phillips curve.

with the existence of such a credibility bonus hold. Disinflations cost more, rather than less, and take just as long in countries with relatively high central bank independence. Countries with high central bank independence exhibit no signs of greater nominal rigidity in contracting than those with low central bank independence.[33] Governments facing independent central banks are just as likely to engage in the monetization of deficits and the electoral manipulation of macroeconomic policy as those with direct control of monetary policy.

If central bank independence does not provide disinflationary credibility for monetary policymakers, then two questions arise in tandem. First, why doesn't it? Why does an institutional arrangement explicitly designed to bolster credibility fail to do so? Second, what then does explain its negative correlation with inflation? Is the correlation spurious, or is central bank independence associated with inflation levels through some other mechanism? This paper's results, while raising these questions, only hint at answers to them.

Considering the first question, the apparent failure of central bank independence to provide the hypothesized credibility bonus must be attributed to one of two factors: the measurement of central bank independence or the appropriateness of the assumptions behind central bank independence. On the first count, there always remains the possibility that the measures of central bank independence based on legal codings used in this research do not actually capture what is the central bank independence and preference for hard money that is modeled in Rogoff (1985), Cukierman (1992), and others. One often hears this from current and former central bankers.

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[33] Which also underlines the absence of an explanation for the positive disinflationary cost of increased central bank independence consistent with the credibility hypothesis.

While legal codings may not capture the full give and take of a central bank's room to maneuver, it seems only reasonable to assume that they do represent some sort of long-run average set of capabilities of the monetary regime. The designers of the new Reserve Bank of New Zealand certainly believed that changing the appropriate laws was a granting of independence to the Reserve Bank. More importantly, it is reasonable to demand that if other factors beyond those listed in the usual measures consistently determine "real" central bank independence, they must be specified. And until those factors are specified, an approach based on measurement error does nothing to explain the negative correlation between central bank independence and inflation, the second question raised.

It could be argued instead that the results of Section III provide a clear reason for the results of Section II. Where there is no fiscal restraint, it is impossible to make tight money credible over the long run, and central bank independence does not appear to constrain seignorage or election-time expansions. Thus, people could be reacting rationally to a less than credible commitment. Yet, as stated in Section III, if the usual models of central bank independence are correct, when the central bank has independence it is in neither the government's nor the central bank's interest to engage in such expansionary policies--the commitment should be credible. While it is possible to attribute the lack of central-bank-independence-induced change in private-sector behavior to the lack of change in public-sector behavior, the public sector's behavior remains to be explained.

In other words, an alternative to the time-inconsistency dilemma motivation for granting central bank independence must be developed in order to reconcile its coexistence with low inflation levels, expansionary government behavior, and no

credibility effects. Posen (1995) offers one such explanation, taking the costly disinflation documented in this paper as parametric[34] and arguing from there that central bank independence will be endogenous to the ability of an interest group (likely the financial sector) to protect its ability to disinflate. Consistent with the argument there, measures of effective financial opposition to inflation are shown to predict both central bank independence and inflation levels. Other approaches treating central bank independence as a signal of a social preference for reacting strongly to inflationary shocks, rather than as a credibility enhancement mechanism, are also possible and seem to be a promising avenue for future research. Whatever may develop, this paper's finding that enhanced credibility does not appear to be the source of the negative correlation between central bank independence and lower inflation casts doubt upon the empirical relevance of government time-inconsistency problems as an explanation for inflation in the industrialized democracies.

[34] And therefore assuming both that the Phillips curve remains nonvertical for extended periods of time and that the main source of inflation is external shocks, rather than expectations about government policy.

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Table 1
Summary of Measures of Central Bank Independence

	Bade-Parkin	Grilli et al.	Average from A-S	Cukierman et al.
Mean	2.179	2.221	2.529	0.388
Std. dev.	0.992	0.927	0.943	0.161
Minimum	1.000	1.000	1.000	0.090
Maximum	4.000	4.000	4.000	0.660
Rank cor. w/ Cukierman's	0.6544	0.6185	0.6226	-
Australia	1	3	2	0.30
Austria	-	1	3	0.57
Belgium	2	2	2	0.19
Canada	2	3	2.5	0.46
Denmark	2	3	2.5	0.47
France	2	2	2	0.28
Germany	4	4	4	0.66
Greece	-	1	1	0.52
Ireland	-	2	2	0.45
Italy	1.5	2	1.75	0.25
Japan	3	2	2.5	0.18
Netherlands	2	3	2.5	0.42
New Zealand	1	1	1	0.26
Spain	1	2	1.5	0.12
Switzerland	4	4	4	0.64
U.K.	4	2	2	0.32
U.S.	3	4	3.5	0.51

Table 2
Sacrifice Ratio and Central Bank Independence
Episodes Based on Annual Data
Dependent Variable: Sacrifice Ratio

Constant	-0.997**	-1.077**	-0.660	-0.706	-0.972*	-1.440**
	(-2.420)	(-2.539)	(-1.442)	(-1.519)	(-2.234)	(-2.757)
CB indep.	2.366**	2.468**	2.035*	2.310*	1.939*	2.499**
	(3.070)	(3.153)	(2.343)	(2.263)	(2.528)	(2.935)
Episode length	0.301**	0.280**	0.401**	0.409**	0.401**	0.379**
	(4.211)	(3.673)	(3.192)	(3.186)	(3.585)	(3.415)
Total change π		0.019	-0.094	-0.105	-0.105	-0.086
		(0.830)	(-1.515)	(-1.633)	(-1.948)	(-1.597)
N. wage resp. (B/S)			-0.005	-0.005		
			(-0.865)	(0.929)		
N. wage rigid. (GJL)					0.594**	1.119*
					(3.673)	(2.552)
No. obs.	56	56	53	49	53	50
Adjus.R^2	0.278	0.274	0.225	0.264	0.385	0.325
SE of reg.	0.919	0.922	0.899	0.881	0.801	0.790

Notes: T-statistics are given in parentheses. Columns 4 and 6 rerun columns 3 and 5, omitting outliers in nominal wage measures.

* Significant at the 5 percent level.
** Significant at the 1 percent level.

Table 3
Sacrifice Ratio and Central Bank Independence
Episodes Based on Quarterly Data
Dependent Variable: Sacrifice Ratio

Constant	-0.047	0.243	0.384	0.609	0.279	0.241
	(-0.114)	(0.629)	(0.588)	(0.916)	(0.755)	(0.529)
CB indep.	3.176**	2.503**	2.355*	2.751**	2.012*	2.038*
	(3.672)	(3.042)	(2.335)	(2.675)	(2.423)	(2.324)
Episode length	0.025	0.087**	0.088**	0.077*	0.095**	0.093**
	(1.129)	(2.779)	(2.737)	(2.382)	(3.148)	(2.907)
Total change π		-0.144**	-0.146*	-0.131*	-0.153**	-0.143*
		(2.589)	(-2.553)	(-2.270)	(-2.865)	(-2.446)
N. wage resp. (B/S)			-0.026	-0.097		
			(-0.274)	(-0.920)		
N. wage rigid. (GJL)					0.245	0.111
					(1.822)	(0.020)
No. obs.	28	28	28	26	28	25
Adjus. R^2	0.355	0.475	0.453	0.503	0.521	0.439
SE of reg.	0.747	0.674	0.687	0.678	0.644	0.679

Notes: T-statistics are given in parentheses. Columns 4 and 6 rerun columns 3 and 5, omitting outliers in nominal wage measures.

* Significant at the 5 percent level.
** Significant at the 1 percent level.

Table 4
Output-Inflation Trade-off and Central Bank Independence

Independent Variable	Full Period	Full Period	1948-72 Trade-off	1948-72 Trade-off	1973-86 Trade-off	1973-86 Trade-off
Dependent Variables						
Constant	0.258	0.068	0.487	0.221	-0.098	-0.023
	(0.679)	(0.337)	(1.541)	(1.298)	(-0.335)	(-0.125)
CB indep.	0.648	0.654	0.266	0.324	1.518**	1.270**
	(1.083)	(1.442)	(0.534)	(1.298)	(3.301)	(3.107)
N. wage resp. (B/S)	-0.034		-0.049		0.010	
	(-0.622)		(-1.073)		(0.246)	
N. wage rigid. (GJL)		0.094		0.109		(0.061)
		(0.919)		(1.270)		(0.663)
No. obs.	13	15	13	15	13	15
Adjus. R^2	0.039	0.060	0.183	0.162	0.550	0.365
SE of Reg.	0.310	0.286	0.259	0.240	0.239	0.258

Notes: T-statistics are given in parentheses. Estimates of output-inflation trade-offs are taken from Ball, Mankiw, and Romer (1988).

* Significant at the 5 percent level.
** Significant at the 1 percent level.

Table 5
Correlations of Nominal Wage Rigidity Indices

	Bruno-Sachs Nominal Wage Responsiveness	Grubb-Jackman-Layard Nominal Wage Rigidity
Mean	3.85	0.65
Std. dev.	1.83	0.73
Minimum	0	0.09
Maximum	6	3.14
No. of countries in sample	14	16

Simple Correlation	G-J-L N.W. Rigidity	G-J-L Omitting U.S.
B-S N.W. responsiveness	-0.33	0.26
B-S omitting Switzerland	-0.59	-0.03

Spearman Rank Correlation	G-J-L N.W. Rigidity	G-J-L Omitting U.S.
B-S N.W. responsiveness	0.03	0.23
B-S omitting Switzerland	-0.22	0.01

Table 6
Nominal Wage Rigidity and Central Bank Independence

Dependent Variable	B-S Resp. Index	B-S Resp. Index (w/o Switz.)	G-J-L Rigidity Measure	G-J-L Rig. Meas. (w/o U.S.)
Independent Variables				
Constant	5.829**	5.081**	0.648	0.805**
	(4.689)	(4.308)	(1.346)	(4.610)
CB indep.	-5.010	-2.474	-0.006	-0.878*
	(-1.706)	(-0.843)	(-0.005)	(-2.037)
No. of obs.	14	13	16	15
Adjusted R^2	0.128	-0.025	-0.071	0.184
SE of reg.	1.712	1.537	0.751	0.271

Notes: T-statistics are given in parentheses.

* Significant at the 5 percent level.
** Significant at the 1 percent level.

Table 7
Speed of Disinflation and Central Bank Independence

Dependent Variable	Length of Disinflation (Annual Data Episodes)	Length of Disinflation (Quarterly Data Episodes)	Average Points/Year Disinflated (Annual Data Episodes)	Average Points/Qtr. Disinflated (Quarterly Data Episodes)
Ind. Variables				
Constant	3.734**	9.885**	2.721**	0.694**
	(6.262)	(3.312)	(2.945)	(5.697)
CB indep.	-1.976	7.012	-1.735	-0.553*
	(-1.371)	(0.948)	(-0.777)	(-1.833)
No. of obs.	56	28	56	28
Adjusted R^2	0.015	-0.004	-0.007	0.080
SE of reg.	1.749	6.496	2.710	0.265

Notes: T-statistics are given in parentheses. Episodes are taken from Ball (1993).

* Significant at the 5 percent level.
** Significant at the 1 percent level.

Table 8
Seignorage and Central Bank Independence

	(I)	(II)	(III)	(IV)	(V)
Dep. Variable	1950s Seignorage	1960s Seignorage	1970s Seignorage	1980s Seignorage	Average Seignorage
Ind. Variables					
Constant	0.984*	0.793	0.454	2.397	1.172**
	(2.505)	(1.657)	(0.581)	(1.495)	(2.602)
CB indep.	0.221	-0.360	1.786	0.434	0.524
	(0.302)	(-0.386)	(2.033)	(0.022)	(0.943)
Fractionaliz.	-1.054	-0.082	-2.303	-3.117	-2.683**
	(-1.494)	(-0.100)	(-1.952)	(-1.203)	(-3.345)
No. of gov't. changes/ decade	0.074*	0.676	0.282**	0.104	0.248**
	(2.973)	(1.734)	(5.142)	(0.984)	(6.980)
No. of obs.	17	17	17	17	17
Adjusted R^2	0.502	0.334	0.725	0.192	0.744
SE of reg.	0.451	0.543	0.491	1.062	0.342

Notes: Equations I-IV are estimated using seemingly unrelated regressions; Equation V is estimated using OLS. Data on seignorage are taken from Cukierman, Edwards, and Tabellini (1990). T-statistics are given in parentheses.

* Significant at the 5 percent level.
** Significant at the 1 percent level.

Table 9
Electoral Influence on Macroeconomic Policy
and Central Bank Independence

Political Monetary Cycles:

	Low PMC Coefficient	High PMC Coefficient	Row Total
Low CB independence	7 (53.9%)	1 (50.0%)	8 (53.3%)
High CB independence	6 (46.1%)	1 (50.0%)	7 (46.7%)
Column total	13 (86.6%)	2 (13.4%)	15 (100.0%)

Notes: Chi-square (1 d.f.) = 0.919. The hypothesis of independence cannot be rejected at the 5 percent significance level. Coefficients estimated by country are taken from Alesina, Cohen, and Roubini (1992).

Political Business Cycles:

	Low PBC Coefficient	High PBC Coefficient	Row Total
Low CB independence	4 (57.1%)	4 (50.0%)	8 (53.3%)
High CB independence	3 (42.9%)	4 (50.0%)	7 (46.7%)
Column total	7 (46.7%)	8 (53.3%)	15 (100.0%)

Notes: Chi-square (1 d.f.) = 0.077. The hypothesis of independence cannot be rejected at the 5 percent significance level. Coefficients estimated by country are taken from Alesina, Cohen, and Roubini (1992).