Checks and Balances, Private Information, and the Credibility of Monetary Commitments

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Introduction

Positive models of monetary policy have focused on the fundamental difficulty that governments can encounter in establishing the credibility of their policy commitments. After governments have announced their monetary policy and the public has taken actions that rely on that policy, such as signing wage contracts, governments may have an incentive to increase the rate of inflation *ex post*. Two information asymmetries complicate attempts to solve this credibility problem. First, the public may have little information about policymaker preferences and therefore about the incentives of policymakers to renege on any policy commitments they make. Second, because the public may not be able to observe policymaker actions, they have more difficulty detecting whether policymakers have adhered to an announced policy. Considerable research has investigated the use of central bank independence and exchange-rate pegs as instruments that governments might use to establish policy credibility. In this article, we address two related puzzles that have received less attention in the literature: Why is it more costly for politicians to revoke central bank independence or fixed exchange rates than to abandon more simple commitments, such as a promise to maintain a specific rate of inflation? And why does the presence of an independent central bank or a pegged exchange rate deliver more information to the public than simple policy announcements?

To answer these questions, we first investigate whether the presence of multiple veto players in government makes it more difficult for governments to renege on exchange-rate pegs or central bank independence. We next consider whether the public finds it easier to observe government policy actions when an exchange-rate peg or central bank independence has been adopted. We find that the effectiveness of central bank independence in solving credibility problems depends on the

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presence of multiple veto players in government. Following earlier contributions, we show that independent central banks enhance the credibility of monetary policy to the extent that there are multiple veto players in government.[1] However, we argue that central bank independence does not improve the public's ability to observe policymaker actions.

In contrast, we suggest that the effectiveness of exchange-rate pegs in solving credibility problems *does not* depend on the number of veto players in government. Instead, following arguments made by Chris Canavan and Mariano Tommasi and by Berthold Herrendorf, we argue that the primary contribution of exchange-rate pegs is to make it easier for the public to judge whether a policymaker has deviated from a previously announced commitment.[2] In other words, they help reduce the information asymmetries between government and the public. Exchange-rate pegs should therefore have a larger anti-inflationary effect in contexts where it would otherwise be difficult for the public to observe policymaker actions.[3]

Our empirical results strongly support these propositions; they are robust to alternative specifications emphasizing the effect of democratic institutions more generally on monetary commitments. These findings are also general—we obtain them using a sample of seventy-eight developed and developing countries over the period from 1975 to 1994.

Our investigation has direct implications for the question posed by William Bernhard, Lawrence Broz, and William Clark: If commitment mechanisms like central bank independence unambiguously improve general welfare, why do all countries not adopt them?[4] One possible answer is that the social welfare function assumed in the literature incompletely reflects the social tradeoffs between inflation and economic growth. If institutional reforms such as central bank independence reduce social welfare in some countries, governments would be naturally reluctant to embrace them. The institutional and information hypotheses that we analyze offer a different answer to the question: even if central bank independence increases social welfare, commitment mechanisms like central bank independence may simply not work.

We organize the remainder of this article as follows. We first consider the conditions under which central banks and exchange-rate pegs will increase credibility of monetary policy in a world of complete information. We then consider the conditions under which these two instruments provide more information about the preferences of policymakers than do the underlying policies enacted by policymakers. The influence of political institutions is analyzed in both sections. We then

1. See Lohmann 1998; Moser 1999; and Keefer and Stasavage 2000.
2. See Canavan and Tommasi 1997; and Herrendorf 1999.
3. On the idea that exchange rate pegs provide a more transparent form of commitment, see also Broz 2002.
4. Bernhard, Broz, and Clark 2002. See also Bernhard 1998; Maxfield 1997; Broz 2002; Clark and Maxfield 1997; and Bernhard and Leblang 1999.

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present cross-country empirical tests of several propositions and evaluate the robustness of our findings.

Political Institutions and Monetary Commitments

Central Bank Independence and Political Institutions

In the canonical contribution on central bank independence, Kenneth Rogoff argued that delegation to an independent central bank might solve the time consistency problem in monetary policy and be welfare-improving.[5] The crucial implicit assumption in this work is that the central bank acts with irreversible, full autonomy. If, however, central bank decisions are no more difficult for political actors to override than are economic policies themselves, independent central banks may do little to prevent *ex post* reneging on inflation commitments. Instead of solving the time-consistency problem, central bank independence would merely displace it, as governments would have an incentive to first announce central bank independence and subsequently renege on this commitment.

Central bank independence could be protected from override by constitutional guarantees. Susanne Lohmann clarifies the precise effect of constitutional guarantees: legal central bank independence is likely to make a difference for policy outcomes if a larger number of veto players is required to revise a central bank's statute than would be required to make a change in monetary policy if the government had regained discretionary control over policy.[6] For example, if the executive alone set monetary policy under discretion, but revisions of the central bank charter required the agreement of both the executive and the legislature, delegation to an independent central bank could increase the credibility of monetary policy.[7]

However, it is not evident in practice that a greater number of political actors is required to consent to changes in a central bank charter than is required to change monetary policy in the absence of an independent central bank. The central bank charters of most countries are laws voted by legislatures rather than inscribed in constitutions; thus central banks are no less vulnerable, in principle, to having their actions or independence overturned by political authorities than would be other types of legislation. Moreover, as the literature on legislative control of bureaucratic institutions emphasizes, failure to observe frequent changes in central bank statutes is an unreliable indicator of independence, since if the threat of a statutory revision

5. Rogoff 1985.

6. Lohmann 1998. More generally, comparative research on political institutions and policymaking has demonstrated that it is more difficult to pass laws in countries where decision making is divided among multiple veto players, whether a separate executive and legislature in the case of presidential systems or multiple parties within a coalition government within parliamentary systems (for a recent comprehensive discussion, see Tsebelis 2002).

7. Whether or not credibility increases also depends on the preferences of the different veto players.

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is credible, central banks will face incentives to modify their policies to avoid revision.[8]

It might be argued that only the executive, rather than the executive and legislature, has full control of monetary policy if there has been no decision to delegate. However, this is not always accurate. In a coalition government, the party controlling the finance ministry may nominally have full control of monetary policy, but in practice, other coalition members can threaten to leave the coalition when confronted with finance ministry actions to which they are strongly opposed. Likewise, in a presidential system, the legislature also exerts influence on monetary policymaking to the extent that there are spillovers from fiscal policy to monetary policy. Thus in practice, a similar number of actors may be required to consent to changes in central bank laws as would be required to consent to changes in monetary policy in the absence of an independent central bank.

The important question that remains, therefore, is how delegation of policymaking authority to an independent agency can make a difference for policy when the number of veto players required to overturn delegation and to change monetary policy is the same. In earlier work, we address this question by comparing the effects of delegation under a variety of institutional arrangements.[9] We expand the classic Barro-Gordon model to investigate how monetary policy outcomes depend on the number of veto players in a political system and on whether there has been a prior decision to delegate to an independent central bank.

In the case where there has not been a prior decision to delegate and monetary policy is set directly by government, the order of moves in the game is as follows: first the public establishes its inflation expectations, then a random supply shock occurs, then monetary policy is chosen. If there is only one veto player, then that veto player sets policy unilaterally. If there are two veto players, then one of the two players is assumed to have the agenda power to make a "take it or leave it" offer to the other player. If the offer is refused, then the default outcome is determined by the wage contracts signed by the public. In earlier work we have shown that the policy the veto players select depends on whether the more inflation-averse or less inflation-averse veto player has agenda control.[10] It also depends on whether expected inflation is higher than the preferred inflation outcome of the less inflation-averse political actor, lower than the preferred inflation of the most inflation-averse actor, or between the two, each case resulting in the two actors agreeing to a different inflation outcome.

Outcomes may differ significantly if there has been a prior decision to delegate to a central bank. In this case the game proceeds as follows.

8. See, especially, Weingast and Moran 1983.

9. See Keefer and Stasavage 2000. Moser 1999 has also considered this question with a model that assumes policy outcomes, under checks and balances, with no delegation, are the result of a simple bargain among the veto players. The results then show that delegation by multiple political actors can lead to lower inflation expectations than would prevail in the absence of an independent central bank.

10. Keefer and Stasavage 2000.

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1. The public establishes inflation expectations and signs wage contracts.
2. A random supply shock occurs.
3. The central bank chooses monetary policy.
4. The veto player(s) decide whether to override the central bank—a decision to which both must agree, by definition. If all veto player(s) do not agree to override, then the inflation rate chosen by the central bank prevails and the game ends.
5. If the veto player(s) decide to override the central bank, then they choose a new policy, as in the case where there is no central bank.

In this model the central bank has agenda-setting power, yet unlike other models of monetary delegation, it is possible for politicians to override the central bank. As a result, the relationship between political actors and the central bank in our earlier work reflects the logic of "agency drift" models of legislative control over bureaucratic institutions.[11] When there are two veto players, the key difference between monetary policy made under discretion (without central bank independence [CBI]) and monetary policy made under delegation (CBI) is the change in the default outcome that confronts the political decision makers.

In the case without CBI, the default outcome is the rate of inflation that results from the price increases written into wage contracts by the private sector. Under delegation, in contrast, if veto players are unable to agree to override the central bank, the default outcome is the rate of inflation chosen by the central bank. Knowing this, the central bank has an incentive to choose a rate of inflation that is override-proof. More specifically, if we assume that the central bank is more averse to inflation than any veto player, then it will choose a rate of inflation that leaves the most inflation-averse veto player no worse off than if the two veto players overrode the central bank and subsequently agreed on a new rate of inflation.

One of the core predictions from the model in our earlier work is that central bank independence can only have an effect on inflation outcomes if there are multiple veto players in government.[12] To see this, consider first what options a central bank that has been granted control of monetary policy has in a political system with only one veto player. Any attempt to pursue a lower rate of inflation than that preferred by the single veto player would be overridden. As a result, when there is only one veto player in government, inflation outcomes will be identical regardless of whether there has been a prior decision to delegate. In contrast, when political power is divided between multiple veto players, then a prior decision to delegate to an independent central bank can have a significant impact on inflation outcomes. Provided that veto players do not share the same preferences, the central bank can now successfully implement a policy that one veto player would prefer to override,

11. See McCubbins, Noll, and Weingast 1987; and Epstein and O'Halloran 1999.
12. Keefer and Stasavage 2000.

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as long as a second veto player would refuse to override. The end result is that the inflation outcome will be different from the outcome in the case where there has not been a prior decision to delegate, and veto players must bargain over the inflation rate. This leads to our first main proposition.

PROPOSITION 1: *Central bank independence is more effective as an anti-inflationary device when there are multiple veto players in government.*

This basic result, that the effect of central bank independence will be greater when there are multiple veto players, would also hold under a variety of assumptions different from those used in our earlier work.[13] For example, if we assumed that veto players bore some exogenous political cost from deciding to override, then delegation to a central bank could have an effect on outcomes even when there was only one veto player, but the effect of CBI would still be larger when there are multiple veto players in government. In the second half of the article, we present tests of the proposition that emerges from this discussion.[14]

Exchange-Rate Pegs and Political Institutions

Exchange-rate pegs are widely believed to serve as a form of credible commitment, because adopting a peg reduces the ability of a government to conduct an independent monetary policy. As is well known, to the extent that foreign assets are substitutable for domestic assets, a country's money supply—and hence its inflation rate—are exogenously determined from the point of view of the policymaker. All a government need do to establish such a peg is to declare that it is willing to sell foreign currency for domestic currency at a fixed rate. If private actors believed that the exchange-rate peg were immutable, their domestic inflation expectations would then simply equal expected world inflation. As Maurice Obstfeld shows, however, if a policymaker has a standard Barro-Gordon model loss function, then she would have an *ex post* incentive to devalue—to abandon the peg—to generate a higher rate of inflation.[15]

Obstfeld suggests that exchange-rate pegs may nonetheless increase monetary policy credibility if devaluation imposes additional political costs on governments. To model this possibility, he simply adds a parameter to the policymaker's utility function representing the exogenous costs the policymaker confronts if she abandons the peg.[16] This solution parallels the assumption made by Rogoff regarding the

13. Keefer and Stasavage 2000.

14. In our empirical tests, we assume, as is conventional, that central bankers on average have conservative preferences with regard to output-inflation tradeoffs.

15. Obstfeld 1996.

16. Inclusion of this additional parameter also generates the possibility of multiple equilibria, an issue we do not discuss here.

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irrevocability of central bank independence.[17] As with that assumption, it is not clear why governments that abandon exchange-rate pegs suffer larger political costs than governments that renege on simpler policy pledges to maintain a specific rate of inflation or to maintain a specific rate of money growth.[18]

Since institutional factors appear to be a crucial foundation of the efficacy of central bank independence, one might first ask whether the presence of multiple veto players in government also ensures the effectiveness of a pegged exchange rate in reducing expected inflation. Three examples suggest that this is unlikely to be the case.

First, it is common in the literature to assume that countries peg their currencies to the currencies of foreign countries with inflation much lower than their own. This pegging strategy implies that domestic inflation under the exchange-rate peg could be lower than the minimum level of inflation acceptable to even the most inflation-averse domestic government veto player. Following the logic in our earlier model, such inflation outcomes would be overturned by domestic political veto players, no matter how many veto players there are.[19] Under these conditions, a peg would fail to serve as a form of credible commitment, regardless of whether there are checks and balances in government.

A second crucial point is that pegs are often established by the executive branch alone, without legislative approval. If abandoning a peg is also a matter only of executive discretion, we reach a similar conclusion: no matter how many veto players are present in government, the peg will not reduce inflation expectations because the decision to abandon the peg will be the prerogative of a single veto player.

Third, even if foreign inflation outcomes are not extremely low and the introduction of a peg is a decision of both the legislature and the executive branch, checks and balances may still not improve the efficacy of the peg. In fact, they may detract from it by making it more difficult for government to respond to shocks that threaten the peg. Take a case where economic circumstances are such that government intervention is necessary to avoid de facto devaluation and abandonment of the peg. Under these circumstances, the default outcome under a peg—de facto devaluation—converges to that under a flexible exchange rate (where the same circumstances would lead to a depreciation). A peg could come under threat whenever economic circumstances trigger an outflow of foreign reserves and those reserves are scarce. Any exogenous shock that increases domestic inflation would trigger such an outflow. Under these conditions, if foreign reserves are scarce and a country is exposed to inflationary shocks, a pegged exchange rate leads to nearly the same outcome as a flexible exchange rate in the absence of countervailing government action. Under these conditions, even in the

17. Rogoff 1985.
18. See the observation by Persson and Tabellini 1994, 17.
19. Keefer and Stasavage 2000.

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presence of checks and balances, the pegged exchange rate will do little to "tie the hands" of policymakers.[20]

We have omitted several institutional variations from the foregoing discussion. Their introduction does not fundamentally change the analysis, however. For example, what if the responsibility for defending an exchange-rate peg is assigned to an independent central bank, or, even more stringently, what if a currency board arrangement is established by law? In this case, it would be the independence of the bank or the legal status of the currency board that provides the commitment and not the peg itself.[21] Similarly, it is sometimes the case that governments attempt to make pegs credible by giving a central bank the right to refuse a request by the government for monetary financing of a fiscal deficit. This makes it difficult for government to entertain fiscal policies that would trigger a loss of foreign exchange under a peg. Again, in this case it would be the presence of central bank independence that secures policy credibility and not the peg, per se. These arguments therefore suggest a second testable hypothesis that emerges from this analysis.

PROPOSITION 2: *Exchange-rate pegs are not more effective as anti-inflationary devices when there are multiple veto players in government.*

Monetary Commitments and Information Asymmetries

Attempts by governments to establish credibility for their monetary policies are further complicated by asymmetric information. First, the public may be uncertain about the relative importance that government veto players attach to inflation stabilization versus output stabilization and, therefore, government incentives to renege on their monetary policy commitments. Second, the public may observe policymaker actions imperfectly, because policymakers have incomplete control of inflation.[22] In particular, the public may find it difficult to determine the extent to which observed inflation results from deliberate governments actions versus the realization of exogenous shocks that are beyond government control. Uncertainty about preferences creates incentives for policymakers to take actions that "signal" their preferences to the public. Imperfect control of inflation makes these signals more difficult for the public to interpret. The literature has identified both central

20. We do not consider the possibility that a government would deal with a problem of scarce reserves by imposing exchange controls because we restrict our attention to the case of exchange-rate pegs with full convertibility. This option might preserve a peg, but since it would also allow the government to regain control of the domestic money supply, it would also imply that the peg was no longer effective as a commitment device.

21. In many cases where independent central banks have operational responsibility for managing a peg, the decision whether to maintain or abandon the peg remains the prerogative of the finance ministry. We thank an anonymous referee for alerting us to this consideration.

22. See Canzoneri 1985.

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bank independence and pegged exchange rates as tools that governments can use to send more reliable signals about their policy preferences and actions.

Central Bank Independence and Private Information

Sylvia Maxfield has argued that many recent efforts to increase central bank independence can be explained as attempts by governments to signal policy preferences.[23] The government announces the creation of an independent central bank and claims that it is staffed by inflation-averse individuals. If the public subsequently observes high inflation, it understands that this cannot be consistent with the planned inflation of a conservative central bank. The public is therefore likely to believe that high inflation is due to meddling by the government. This could make the adoption of an independent central bank a potentially valuable signal.

The difficulty with this logic is that it does not clearly demonstrate why central bank independence has greater signaling value than do other types of policy announcements. The government could just as easily announce a particular inflation or monetary growth target at the beginning of the period, and the public could draw the same conclusions after observing final inflation.

One reply to this argument is that central bank independence might make it easier for the public to observe political interference in monetary policy decisions. However, Broz argues that it is the transparency of a political system that makes such actions observable, not central bank independence per se.[24] Just as importantly, governments do not need to undertake the very visible action of revoking the charter of a central bank or replacing a central bank governor to pressure central banks to pursue a more generous monetary policy. They can instead exercise subtler and less visible forms of pressure, ranging from reducing the resources of the central bank to social ostracism of the central bank leadership.

It might also be the case that central bank independence improves the problem of imperfect observability of policy. Here, however, recent literature has suggested that it is not independence that improves observability of policy, but rather the extent to which central banks, independent or not, are transparent in their operations and procedures.[25]

It might finally be the case that, within some institutional frameworks, central bank independence has more signaling value than in others.[26] We know from the earlier argument that government interference in central bank decision making is more difficult in the presence of checks and balances. However, the key issue in a signaling context is whether, under checks and balances, meddling with central bank decisions is easier for the public to detect. There are a number of reasons to suspect

23. Maxfield 1997.
24. Broz 2002.
25. See Faust and Svensson 2001; Chortareas, Stasavage, and Sterne forthcoming; and Stasavage 2001.
26. Clark and Maxfield 1997 also emphasize the importance of examining the institutional context.

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that this might be the case. For example, override of a central bank may require a legislative act that is more public than would be a simple instruction from a president to a *dependent* central bank. Competing political actors inside government may have a greater incentive to register public complaints about the treatment of the central bank when it has been granted legal independence. We leave the more rigorous exploration of this issue to further work, however. Still, even in these cases, it would be difficult to argue that the effectiveness of central bank independence derives primarily from such signaling benefits rather than from the straightforward notion that multiple veto players hinder excessive meddling in central bank decisions.

Central bank independence is likely, then, to be a weak response to the problems of asymmetric information in monetary policy. Whether or not asymmetric information is severe should therefore have little impact on the efficacy of central bank independence in reducing inflation, giving rise to our third testable proposition.

PROPOSITION 3: *Central bank independence will not be more effective in reducing inflation when it is more difficult for the public to observe policymaker actions.*

Exchange-Rate Pegs and Private Information

Because deviation from exchange-rate pegs is transparent, pegging can potentially be more effective than central bank independence in overcoming problems of private information in monetary policy.[27] In particular, abandonment of a peg may be a more transparent indicator of inflationary government practices than either a high rate of growth of the money supply (which may be generated by an unanticipated change in the money multiplier) or a high rate of inflation (which may result from a shock to money demand). Pegging the exchange rate can avoid the uncertainties surrounding the connection between unobserved government policy and observed final inflation, allowing the public to better infer the preferences and actions of government actors.[28]

Canavan and Tommasi and Herrendorf have formalized this argument using somewhat different models.[29] Both models provide a rigorous explanation of previous empirical findings showing that countries that have adopted fixed exchange-rate pegs have lower inflation than others. However, the specific predictions of these models have not been empirically tested. The basic conclusion of both is

27. See Broz 2002.

28. The principal exception to this argument concerns devaluations that are triggered by circumstances such as herd behavior by investors or other actions beyond the control of governments. Such factors might reduce the extent to which exchange-rate pegs provide a transparent indicator of government actions. Also, while exchange-rate pegs may be transparent, intermediate exchange-rate regimes such as those that allow the exchange rate to fluctuate within a band are less likely to be so. Frankel, Schmukler, and Serven 2000 have shown that in practice it may take considerable time for markets to distinguish between these intermediate regimes and a float.

29. See Canavan and Tommasi 1997; and Herrendorf 1999.

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that pegging should be more effective in environments in which it is difficult for the public to distinguish the contribution of government policy to inflation. Canavan and Tommasi show that inflation should be lower the greater the precision with which the public can observe the contribution of the government's policy action to final inflation. Since, in their model, the point of pegging the exchange rate is to increase this precision, if precision is high to begin with (in the absence of a peg), we would expect the peg to have little impact on inflation.

As with central banks, we can also ask whether the effect of pegs in solving problems of private information depends on the presence of multiple veto players in government. It is evident that abandoning a peg that was previously established is as visible to the public when there are multiple veto players as when there is only one. The signaling value of the peg does not, therefore, change. The question of whether pegs are more or less likely to be adopted under checks and balances is the more important and complex one, exceeding the bounds of this article.[30]

This argument, then, yields our fourth and final proposition, that pegged exchange rates are likely to reduce inflation rates because they reduce information asymmetries. They should therefore have their greatest impact on inflation when the public has the greatest difficulty discerning government policy contributions to inflation outcomes, due for example to volatility of money demand. We test all four propositions in the following section.

PROPOSITION 4: *Exchange-rate pegs are more effective in reducing inflation when it is more difficult for the public to observe policymaker actions.*

Empirical Tests

To test our propositions, we examine economic and political determinants of inflation in a sample of seventy-eight countries covering the period 1975–1994. We chose the end of the Bretton Woods era to determine this time period, and determined sample size by data availability. Our empirical tests follow the specifications used in recent papers investigating the effect of monetary institutions on inflation outcomes.[31] Because the institutional variables with which we are concerned change relatively infrequently, we follow the majority of recent papers in the literature by investigating period averages. We report results both from cross-section regressions (averaging values for each country over the entire period) and from cross-section time-series regressions where variables are averaged across five-year time periods.

30. See Bernhard and Leblang 1999.

31. See Franzese 1999; Hall and Franzese 1998; Campillo and Miron 1996; and Cukierman, Webb, and Neyapti 1992.

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Presentation of Data

We use inflation as our dependent variable, following the logic that where the inflation bias due to time-consistency problems is higher, so also is average inflation. To control for the effect of countries with extremely high levels of inflation, we use the log of the inflation rate.[32]

To measure central bank independence, we use the index developed by Alex Cukierman, Steven Webb, and Bilin Neyapti,[33] since this is the one indicator that covers a sample of both Organization for Economic Cooperation and Development (OECD) and non-OECD countries. It is based on sixteen different characteristics of central bank statutes, such as provisions for monetary policy decisions, resolution of conflicts between central bank and government, and provisions for replacing the central bank governor. While Cukierman, Webb, and Neyapti's original data set runs only up to 1989, more recent studies have compiled updated information on central bank independence and, in some cases, data on new countries.[34]

The International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions presents information on exchange-rate pegs.[35] We classified countries according to those that adopt some form of a nominal exchange-rate peg (peg = 1) and those that do not. This covers countries that peg their currency to a single other currency and those that peg to a basket of currencies. Countries that allow a very limited amount of nominal exchange-rate flexibility (for example, the European Monetary System) are also classified as having pegged regimes. We opt for this binary classification (peg versus no peg) because economic theory does not offer firm predictions about the extent to which some types of pegs might be more effective than others.[36]

In this study, we also use newly developed cross-country data on political institutions. Philip Keefer developed a measure of checks and balances in government based on objective indicators assembled by Thorsten Beck et al.[37] The index counts the number of veto players present in a political system, including both what George Tsebelis has called "constitutional" veto players as well as "partisan" veto players.[38] For presidential systems, the variable CHECKS counts the number of veto players, counting the executive and legislative chamber(s) separately only if they are controlled by different parties. For parliamentary systems, CHECKS counts the

32. Based on CPI data from the International Monetary Fund (IMF), *International Financial Statistics*.

33. Cukierman, Webb, and Neyapti 1992.

34. See, in particular, Cukierman, Miller, and Neyapti 1998. The de facto indicator of central bank independence that they have developed—rates of central bank governor turnover—is not appropriate for our tests, since we are precisely interested in the extent to which legal prescriptions prevent this sort of intervention.

35. See Ghosh et al. 1995. We have updated this data set to cover the period 1990–94.

36. Though, as previously mentioned, economic theory does offer reasons to believe that these pegs might be more effective anti-inflationary devices than regimes where the exchange rate is allowed to fluctuate within a wider band.

37. See Keefer 2002; and Beck et al. 2001.

38. Tsebelis 2002.

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number of parties in the government coalition, based on the assumption that individual coalition members will enjoy veto power over policy. The index is modified to take into account the effect that certain electoral rules (closed list versus open list) have on the cohesiveness of governing coalitions.[39] The probability that at least one actor prefers the status quo increases with the number of veto players counted by CHECKS. However, the rate of increase is lower at higher levels of CHECKS. We therefore use a log version of check, LOG CHECK, in our regressions.

Testing the informational propositions 3 and 4 requires variables that capture the public's difficulty in distinguishing between inflation generated by government policy and inflation generated by exogenous shocks. We use several different proxy measures for the public's uncertainty, achieving significant results with all of them.

The first measure we use to proxy for the degree of uncertainty about the policymaker's intended rate of inflation is instability in a country's money multiplier, as suggested by both Canavan and Tommasi and by Herrendorf. We use the variable VOLATILITY M2/M0, the standard deviation of the ratio of broad money (M2) to base money (M0), as our first measure of uncertainty about the policymaker's intended rate of inflation. The idea is that the government or central bank controls base money directly, but inflation outcomes also depend upon changes in broad money that are in part beyond the central bank's control. When the money multiplier is volatile, the public faces a larger challenge in inferring monetary policy intentions from inflation outcomes.[40]

The second measure of the noise that interferes with the public's ability to infer government policy is the volatility of the terms of trade. The variable VOLATILITY TOT measures the standard deviation of the annual change in a country's capacity to import as a share of national income.[41] The capacity of a country to purchase imports out of its exports can increase either because the world prices of a country's imported goods have fallen relative to those of its exports, or because a country has experienced a positive supply or income shock so that it can afford more imports (for example, if its costs of production have exogenously declined). Under a flexible exchange rate, both shocks have implications for domestic prices. Consequently, the larger the VOLATILITY TOT measure, the larger the shocks that make it difficult to

39. For presidential systems, CHECKS is the sum of 1 for the president and 1 for each legislative chamber. The value is increased by one if an electoral competition index developed is greater than four (out of a possible seven). Also, in closed-list systems where the president's party is the first government party, the legislature is not counted. For parliamentary systems, CHECKS is the sum of 1 for the prime minister and 1 for each party in the governing coalition. If elections are based on a closed-list system and the prime minister's party is the first government party, then this sum is reduced by one. As for presidential systems, the value of CHECKS is modified upwards by one if the value of the index for electoral competition is greater than four.

40. In discussing the robustness of our results, we also ask whether including volatility in the money multiplier as an explanatory variable creates a simultaneity bias in our regressions.

41. *World Development Indicators CD-ROM*. The terms-of-trade adjustment variable that we use equals capacity to import less exports of goods and services. Data are in constant local currency. We preferred this to a more standard terms-of-trade measure (price of exports/price of imports) largely because of data availability, but also because the extent to which terms-of-trade shocks affect domestic inflation depends not only on the size of the shocks, but also on the degree of openness of an economy.

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judge a policymaker's intended rate of inflation, and the larger the impact that we would expect the introduction of a peg to have on inflation.[42]

The third proxy we use to gauge the public's difficulty in observing planned inflation is the quality of a country's economic data. As Herrendorf argues, when a country's consumer price statistics are known to include frequent errors, it is more difficult for the public to assess the true rate of inflation and therefore more difficult to extract the intended rate of inflation from the officially reported rate of inflation.[43] The introduction of a peg has a greater impact on the precision with which the public can assess government policy when consumer price index (CPI) data are of poor quality; therefore, peg introduction should have a larger downward impact on inflation. The quality of a country's CPI data cannot be measured directly, but there are indicators available that are designed to measure the overall quality of a country's economic statistics. The Penn World Tables data set includes a measure of data quality, GRADE, which is based on results of United Nations surveys. A higher value for GRADE indicates more reliable data.

In addition to the institutional and informational variables, the regressions include three further variables to control for determinants of inflation that are unrelated to our theoretical arguments. First, there are both strong theoretical and empirical reasons to believe that political instability is causally linked with inflation. To measure political instability with improved precision, we developed a new variable, POLITICAL INSTABILITY, based on information in the database reported in Beck et al., which measures, for each country and each period, the fraction of all veto players who were replaced from the period earlier. In authoritarian systems with only one veto player, this amounts to measuring the rate of government turnover. In systems with more than one veto player, however, this variable captures the possibility that although governments might frequently change, some coalition partners might be present in several successive governments.

Following David Romer, we also include a measure of openness based on the argument that incentives for policymakers to generate surprise inflation should be weaker in countries that are more open to trade.[44] The variable OPENNESS is measured in the standard manner as the sum of exports plus imports, divided by a country's gross domestic product (GDP).

We also include the log of real GDP per capita as a control variable. Poorer countries tend to have less well-developed tax systems, and under these conditions governments have an increased incentive to rely on seignorage for revenue. A further rationale is that some of our institutional variables are highly correlated with levels of income. Including LOG GDP in the specification addresses concerns that our

42. It is interesting to note here that governments with volatile terms of trade will face an acute dilemma. If exchange-rate pegs have a greater anti-inflationary impact in countries with more volatile terms of trade, governments that peg will also find it more difficult to achieve real exchange-rate adjustments, and this cost will be greater the more volatile are the terms of trade.

43. Herrendorf 1999.

44. Romer 1993.

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TABLE 1. *Summary statistics*

Variable	*No. obs.*	*Mean*	*Std. dev.*	*Min.*	*Max.*
LOG INFLATION	277	−2.02	1.43	−5.39	3.90
CBI	297	0.35	0.13	0.10	0.82
LOG CHECK	293	0.95	0.48	0	2.08
PEG	297	0.53	0.41	0	1
GRADE	266	2.43	1.04	1	4
VOLATILITY M2/M0	226	1.07	2.45	0.02	27
VOLATILITY TOT	258	0.02	0.03	0	0.16
POLITICAL INSTABILITY	289	0.15	0.14	0	0.68
OPENNESS	279	68.4	52.4	10	394
LOG GDP	275	8.06	1.62	4.57	10.7

political and informational variables are merely proxying for overall levels of development between countries.

Testing Propositions 1 and 2

We evaluate our first and second propositions by using a model with interaction terms, which allows the marginal effect of central bank independence and exchange-rate pegs on inflation to vary with the extent of checks and balances. The general form of our regressions is as follows:

$$\begin{aligned}\text{LOG INFLATION} = {} & \alpha + \beta_1 \text{ CBI} + \beta_2 \text{ PEG} + \beta_3 \text{ CBI} \times \text{LOG CHECK} + \beta_4 \text{PEG} \\ & \times \text{LOG CHECK} + \beta_5 \text{ OPENNESS} + \beta_6 \text{ INSTABILITY} + \beta_7 \text{ LNGDP} \\ & + \beta_8 \text{ LOG CHECK} + \epsilon\end{aligned}$$

Proposition 1 predicts that the interaction term CBI × LOG CHECK has a negative coefficient, while Proposition 2 predicts the interaction term PEG × LOG CHECK to be insignificant. The net effect of central bank independence, given by $\beta_1 + \beta_3 \times$ LOG CHECK, should be negative at high levels of checks and balances. In contrast, Proposition 2 does not deliver a firm prediction about whether the net effect of pegging, $\beta_2 + \beta_4 \times$ LOG CHECK, should be positive or negative at high levels of checks and balances.

Regressions 1 and 2 in Table 2 report results of baseline regressions that do not include interaction terms. In both regressions, the estimated anti-inflationary effect of adopting an exchange-rate peg is statistically and economically significant. In contrast, in both samples the coefficient on CBI is actually positive and significant, suggesting that higher central bank independence is actually associated with higher rates of inflation when one controls for other determinants. This is a strong

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TABLE 2. *CBI, exchange-rate pegs, and political institutions*

Depvar: log inflation	*(1)*	*(2)*	*(3)*	*(4)*
Constant	1.15	0.33	−0.33	−0.56
	(0.91)	(0.62)	(1.61)	(0.66)
OPENNESS	0.001	−0.002	0.001	−0.003
	(0.003)	(0.002)	(0.00)	(0.002)
LOG GDP	−0.36	−0.27	−0.37	−0.26
	(0.11)	(0.12)	(0.10)	(0.11)
POLITICAL INSTABILITY	1.52	1.34	0.43	1.21
	(1.52)	(0.40)	(1.46)	(0.41)
CBI	2.14	1.84	10.3	5.15
	(1.03)	(0.48)	(4.15)	(1.75)
PEG	−2.07	−0.84	−4.50	−1.33
	(0.61)	(0.20)	(1.11)	(0.56)
LOG CHECK	−0.04	−0.36	1.73	0.54
	(0.54)	(0.19)	(1.62)	(0.51)
CBI × LOG CHECK			**−7.58**	**−3.20**
			(3.91)	**(1.50)**
PEG × LOG CHECK			**2.05**	**0.44**
			(0.95)	**(0.38)**
R^2	0.40	0.29	0.46	0.30
N	78	258	78	258
p-value for Chi-sq.	$p < .01$	$p < .01$	$p < .01$	$p < .01$

Note: OLS with White's heteroskedastic consistent standard errors for Regressions 1 and 3 reported in parentheses. Regressions 2 and 4 are estimated using panel corrected standard errors.

indication that legal central bank independence on its own is, on average, unlikely to deliver anti-inflationary credibility.

Regressions 3 and 4 test our propositions about the effect of political institutions on the credibility of monetary commitments. In both regressions, the coefficient on the interaction term CBI X CHECKS is negative and statistically significant at the five percent level. The substantive results of the regressions are also consistent with Proposition 1. Based on the estimates in Regression 3, in a parliamentary system with a three-party coalition (LOG CHECK = 1.6), an increase of 0.2 in CBI (equivalent to moving from the twenty-fifth percentile to the seventy-fifth percentile in the sample) would be associated with a thirty-one percent decrease in the annual rate of inflation. The effect of the same increase in CBI in a parliamentary system with a single-party majority (LOG CHECK = 1.1) would actually be an *increase* in inflation of forty-eight percent.

To provide a graphical representation of our findings, Figure 1 shows the estimated effect on log inflation of a 0.2 increase in CBI at different levels of LOG CHECK (based on Regression 3). The solid line represents the estimated effect, the two dotted lines represent the boundaries of the ninety percent confidence interval,

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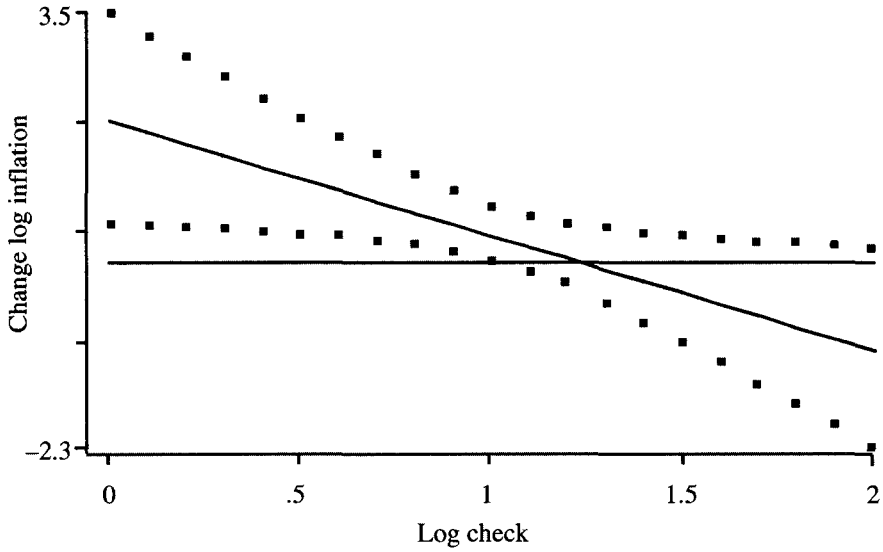


FIGURE 1. *Estimated effect of 0.2 increase in CBI (at different levels of log check)*

and the horizontal line represents zero change in inflation.[45] The evidence suggests that increased central bank independence has a negative effect on inflation only in the set of countries with relatively high levels of checks and balances (within the highest quartile of our sample).

Regressions 3 and 4 in Table 2 suggest that exchange-rate pegs may actually be less, rather than more, effective as anti-inflationary commitments when there are multiple veto players in government. This result is consistent with Proposition 2. The interaction term PEG × CHECKS is positive in both regressions and significantly in the case of the cross-sectional estimation. In both regressions, the estimated effect on inflation of adopting an exchange-rate peg is negative for nearly all sample values of checks and balances (the maximum value of LOG CHECK is 2.07). However, the magnitude of this effect is much smaller in countries where there are multiple veto players in government.

Taken together, the above results provide support for the idea that the structure of political institutions plays an important role with regard to monetary commitments, and the idea that this effect varies dramatically depending upon the type of monetary commitment under consideration. While central bank independence is likely to have

45. Since the effect of a change in CBI here depends on both β_1 and β_3, we calculated the standard error of the effect using a formula that takes into account both the variance of each individual coefficient and its covariance.

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a bigger impact on credibility in political systems with multiple veto players, the opposite may well occur with exchange-rate pegs.

Testing Propositions 3 and 4

If central banks or exchange-rate pegs help governments credibly commit because they are transparent, then their anti-inflationary effects should be greatest in countries where it is particularly difficult for the public to distinguish between inflation attributable to deliberate government decisions and inflation attributable to exogenous shocks. We have argued that exchange-rate pegs should exhibit this characteristic, but that central bank independence is unlikely to be an informative signal. As with Propositions 1 and 2, these propositions can best be tested in a model with interaction terms, which follows the specification below.

We use three different proxies for the ability of the public to distinguish the contribution of government policy to final inflation outcomes: the Summers and Heston grade for data quality (GRADE), instability of the money multiplier (VOLATILITY M2/M0), and a variable capturing instability in terms of trade (VOLATILITY TOT). Based on Proposition 3, we predict that the interaction term PEG × GRADE should have a positive sign (because data quality is higher in countries where the value of GRADE is high), while the interaction terms PEG × VOLATILITY TOT and PEG × VOLATILITY M2/M0 should be negative. We again report results from both cross-section regressions and from regressions based on five-year period averages.

$$\begin{aligned}\text{LOG INFLATION} = {} & \alpha + \beta_1 \text{ CBI} + \beta_2 \text{ PEG} + \beta_3 \text{ CBI} \times \text{LOG CHECK} \\ & + \beta_4 \text{ INFORMATION VARIABLE} \\ & + \beta_5 \text{ PEG} \times \text{INFORMATION VARIABLE} + \beta_6 \text{ OPENNESS} \\ & + \beta_7 \text{ INSTABILITY} + \beta_8 \text{ LNGDP} + \beta_9 \text{ LOG CHECK} + \epsilon\end{aligned}$$

The results in Table 3 suggest that exchange-rate pegs are more effective as anti-inflationary commitments under conditions where data quality is poor and there is significant economic volatility, which makes it more difficult for the public to observe government policy choices. In Regressions 1 and 2, the interaction term PEG × GRADE is positive and highly significant, as predicted. The economic significance of the peg effect is also quite large. Based on Regression 2, for a country with a Summers and Heston grade for data quality equivalent to the twenty-fifth percentile of the sample (1.7), adopting an exchange-rate peg is estimated to result in a sixty-two percent reduction in the annual rate of inflation. A country with a grade for data quality equivalent to the seventy-fifth percentile would, in contrast, be predicted to experience a forty-five percent increase in annual inflation.

In Regressions 3–6, coefficients on the interaction terms for PEG × VOLATILITY TOT and PEG × VOLATILITY M2/M0 are negative as predicted and generally highly significant. Once again, these results are also substantively significant. For example,

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TABLE 3. *CBI, exchange rate pegs, and information*

Depvar: log inflation	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Constant	−3.09	−2.17	−3.03	−1.68	−1.50	−1.52
	(1.16)	(0.47)	(1.36)	(0.70)	(1.75)	(1.01)
OPENNESS	−0.01	−0.01	−0.002	−0.004	0.002	−0.001
	(0.002)	(0.001)	(0.002)	(0.002)	(0.004)	(0.002)
LOG GDP	0.26	0.18	−0.22	−0.19	−0.37	−0.29
	(0.14)	(0.03)	(0.11)	(0.09)	(0.15)	(0.12)
POLITICAL INSTABILITY	−0.43	0.82	0.87	1.16	0.43	1.14
	(1.07)	(0.44)	(1.44)	(0.33)	(1.72)	(0.44)
CBI	10.2	6.56	10.2	5.12	10.2	6.15
	(2.96)	(1.45)	(4.26)	(2.13)	(4.80)	(1.46)
PEG	−3.37	−2.14	−1.43	−0.47	−2.04	−0.24
	(0.93)	(0.52)	(0.63)	(0.28)	(1.16)	(0.24)
LOG CHECK	2.96	0.76	2.82	0.94	2.59	0.80
	(1.15)	(0.61)	(1.39)	(0.60)	(1.82)	(0.43)
CBI × LOG CHECK	−7.37	−2.40	−8.20	−3.58	−7.73	−3.65
	(3.20)	(1.63)	(4.01)	(1.65)	(4.64)	(1.43)
GRADE	−1.20	−0.73				
	(0.49)	(0.21)				
PEG × GRADE	**0.90**	**0.68**				
	(0.27)	**(0.12)**				
CBI × GRADE	**−0.79**	**−1.26**				
	(1.00)	**(0.48)**				
VOLATILITY TOT			27.1	22.2		
			(22.0)	(22.9)		
PEG × VOLATILITY TOT			**−39.2**	**−24.0**		
			(15.9)	**(10.9)**		
CBI × VOLATILITY TOT			**14.1**	**−0.33**		
			(78.5)	**(45.3)**		
VOLATILITY M2/M0					0.15	0.72
					(0.29)	(0.23)
PEG × VOLATILITY M2/M0					**−0.05**	**−0.55**
					(0.30)	**(0.18)**
CBI × VOLATILITY M2/M0					**−0.15**	**−0.42**
					(0.48)	**(0.47)**
R^2	0.65	0.45	0.56	0.34	0.32	0.34
N	67	247	74	246	62	202
p-value for Chi-sq.	$p < .01$	$p < .01$	$p < .01$	$p < .01$	$p < .01$	$p < .01$

Note: OLS with White's heteroskedastic consistent standard errors for Regressions 1 and 3 reported in parentheses. Regressions 2, 4, and 6 are estimated using panel-corrected standard errors.

based on the estimates in Regression 6, adopting an exchange-rate peg would cause a thirty-two percent drop in inflation for a country with relatively low volatility in its money multiplier (0.27, the value for the twenty-fifth percentile); the effect for a country with high volatility (1.01, the value for the seventy-fifth percentile) would be a fifty-five percent drop in annual average inflation. Figure 2 illustrates the estimated effect of adopting an exchange-rate peg, showing the effect of a peg

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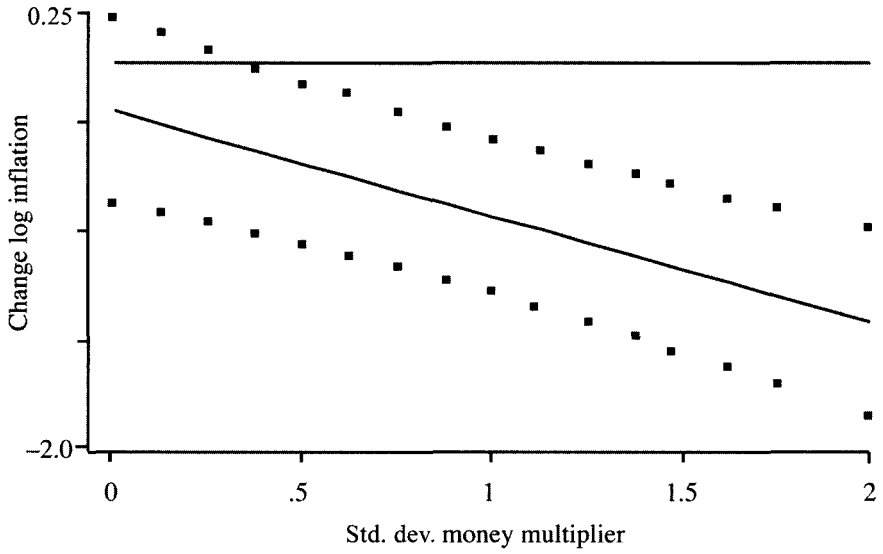


FIGURE 2. *Estimated effect of an exchange-rate peg (at different levels of volatility)*

(together with the estimated ninety-percent confidence interval) at different levels of money multiplier volatility (based on Regression 6 in Table 3). The horizontal line represents zero change in log inflation.

In stark contrast with our results with regard to exchange-rate pegs, the effect of central bank independence does not seem to vary significantly with the extent of either terms-of-trade volatility or volatility in a country's money multiplier. The coefficients CBI × VOLATILITY M2/M0 and CBI × VOLATILITY TOT are not statistically significant in Regressions 3–6. The results with regard to data quality are more mixed. While, as our theory predicts, the interaction term CBI × GRADE is not significant in Regression 1, it is significant in Regression 2.

Robustness of Results

Several issues might affect the robustness of our results: our institutional variables may proxy for more general features of political systems; the significance of the results may be exaggerated by autocorrelation; and finally, the results may be biased by the endogeneity of central bank independence to inflation.

The first problem is whether our institutional variables are measuring the phenomena we claim, or whether they might in fact be capturing more general features of political systems, such as levels of democracy or levels of income. The simple correlation between the variable DEMOCRACY from the Polity III data set and

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TABLE 4. *J-tests against alternative specifications*

Regression	*Null hypothesis*	*Alternative hypothesis*	*p-value*
Table 2(4)	LOG CHECK	DEMOCRACY	$p = .00$
	DEMOCRACY	LOG CHECK	$p = .08$
Table 3(2)	GRADE	DEMOCRACY	$p = .54$
	DEMOCRACY	GRADE	$p = .00$
Table 2(4)	LOG CHECK	LOG PER CAP. GDP	$p = .00$
	LOG PER CAP. GDP	LOG CHECK	$p = .09$
Table 3(2)	GRADE	LOG PER CAP. GDP	$p = .00$
	LOG PER CAP. GDP	GRADE	$p = .00$

our variable CHECKS is fairly high (0.52), and the simple correlation between our measure of data quality (GRADE) and DEMOCRACY is even higher (0.74). Similar conclusions might be drawn from the high correlation of GRADE and CHECKS with per capita income.[46]

The alternative hypothesis to test, then, would be whether the effects of central bank independence and of exchange-rate pegs vary with levels of democracy or income, instead of with the number of veto players or the extent of economic volatility. To test this alternative against our own propositions, we used the *J*-test methodology developed by Russell Davidson and James Mackinnon.[47] This test involves estimating the two specifications to be compared and then re-estimating each specification while including the fitted values from the alternative model as an explanatory variable in each regression.[48] The *t* statistic on the fitted values can be interpreted as a test of the null that the alternative specification (for example, the specification using DEMOCRACY or income) *would not* add explanatory power to the existing model. One can then repeat the test while reversing the variables, which are considered as the "null" and the "alternative." It is common with *J*-tests comparing two specifications A and B to find that one rejects the null when A is the null and B is the alternative, but that one also rejects the null when B is the null and A is the alternative. In this case, one can conclude that each specification adds explanatory power to the other (or that neither specification encompasses the other).

Table 4 reports results of *J*-tests where we tested Regression 4 from Table 2 and Regression 2 from Table 3 against two alternative specifications. The first alternative involved replacing the relevant institutional or informational variable with the

46. The simple correlations of our two other information variables, VOLATILITY TOT and VOLATILITY M2/M0, with either LOG GDP or DEMOCRACY, did not exceed 0.35. We do not consider the possibility that these specifications are picking up effects due to levels of GDP or democracy.

47. Davidson and MacKinnon 1981.

48. For an application of *J*-test methodology to compare alternative political economy hypotheses, see Franzese 1999.

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Polity III measure DEMOCRACY. The second alternative specification involved replacing the relevant institutional or informational variable with LOG PER CAPITA GDP. The test statistics are significant in most cases at the one percent level and in all but one case at the ten percent level of confidence. We find, first, that all of the specifications using our institutional and informational variables add explanatory power to regressions using only DEMOCRACY and LOG PER CAPITA GDP (using the ten percent level as a cutoff). We can therefore reject the hypothesis that our institutional and informational variables are simply proxies for more general phenomena.

However, in three out of four cases, specifications using only DEMOCRACY or LOG PER CAPITA GDP also add explanatory power to our existing specifications from Tables 2 and 3. The exception here is Regression 2 from Table 3, where we clearly reject the hypothesis that DEMOCRACY adds explanatory power to the GRADE specification. These findings suggest that more general features of democracy or levels of income may also have an influence on the effectiveness of central bank independence or exchange-rate pegs as commitment mechanisms.

We also considered whether our statistical tests might be affected by serial correlation of error terms. Standard Lagrange multiplier tests detected autocorrelation in our five-year period regressions. Using a Prais-Winsten regression rather than ordinary least squares (OLS) would be one way to deal with this problem. However, using this technique depends upon accepting the restriction that the autoregressive process influencing each of the variables in our regression is identical. Standard testing procedures strongly reject this restriction. As a result, we have chosen to retain our OLS estimates. Although autocorrelation is present and difficult to address in the five-year data, it is nevertheless the case that our cross-section results, by definition not subject to autocorrelation, are also significant.

As a final robustness test, we also considered the possibility that there might be biases in our results due to the endogeneity of certain explanatory variables. This could involve the endogeneity of legal central bank independence to past levels of inflation. For central bank independence, Granger causality tests failed to establish that current levels of CBI were "Granger-caused" by lagged levels of log inflation. It could also involve simultaneity bias, such as that created by shocks that affect both CBI and LOG INFLATION within the same time period. Volatility in the money multiplier (VOLATILITY M2/M0) might also be subject to this problem. Logically, simultaneity bias is unlikely to be responsible for our results. For such biases to explain the results in Tables 2 and 3, for example, omitted variables or shocks would have to be such that they made the interaction of pegs and volatility, but not the interaction of central bank independence and volatility, significant. Similarly, they would have had to generate a significant estimate of the interaction of checks and central bank independence, but not of pegs and central bank independence. In any case, a Hausman specification test did not reject OLS estimates from Table 2 when compared with estimates that instrumented for current values of central bank independence with past values. For volatility in the multiplier VOLATILITY M2/M0, a Hausman specification test also failed to reject the consistency of the OLS estimates.

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Conclusion

In this article, we have developed and tested several new hypotheses about the anti-inflationary effect of central bank independence and exchange-rate pegs across different institutional and informational contexts. Theory provides a strong reason to believe that, while central bank independence will prove more effective as a commitment mechanism in countries with multiple veto players in government, these multiple veto players will not increase the credibility of exchange-rate pegs. We reach an opposite conclusion with regard to the effect of central bank independence and exchange-rate pegs in different informational contexts. In economically volatile conditions, where it is more difficult for the public to distinguish inflation deliberately generated by government from inflation created by unanticipated economic shocks, the anti-inflationary effect of central bank independence will be unchanged, while the effectiveness of exchange-rate pegs will be significantly enhanced. Cross-country tests using newly developed data provide strong support for both our institutional and our informational propositions.

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