The Limits of Delegation:
Veto Players, Central Bank Independence and the Credibility of Monetary Policy

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Abstract: Governments unable to make credible promises hinder economic development and effective policy making. Scholars have focused considerable attention on checks and balances and the delegation of authority to independent agencies as institutional solutions to this problem. The political conditions under which these institutions enhance *credibility*, rather than policy *stability*, are still unclear, however. We show that checks – multiple veto players – enhance *credibility*, depending on the extent of uncertainty about the location of the *status quo*, on how agenda control is allocated among the veto players, and on whether veto players have delegated policy making authority to independent agencies. In the context of monetary policy and independent central banks, we find evidence supporting the following predictions: delegation is more likely to enhance credibility and political replacements of central bank governors are less likely in the presence of multiple political veto players; this effect increases with the polarization of veto players.

Two circumstances significantly circumscribe the ability of politicians to pursue their private or political objectives: when their promises are not credible, and when they must implement their decisions through bureaucratic agents who do not share their preferences. When governments are unable to make credible commitments (e.g., to follow a set of rules tomorrow that they announce today), they cannot stimulate economic growth (and tax collections) by, for example, promising a stable tax and regulatory environment for firms. Scholars have argued that political systems characterized by checks and balances mitigate this credibility problem, but less is known about one of the questions motivating this paper: under what conditions do checks and balances enhance credibility?

The literature on delegation presents the reverse situation. Scholars have analyzed how politicians face a tradeoff between the risks of delegating to unsympathetic bureaucratic agents who could subvert their intentions and the benefits of delegating in order to maximize the contribution of experts to policymaking. They have not considered, however, the political conditions under which delegation improves government credibility, the question examined in this paper.

Taking as our point of departure the credibility of government promises regarding monetary policy, the analysis below contributes to three lines of scholarly inquiry. The first is the literature on veto players. Veto players are the actors – individual politicians or political parties – who can block proposals to move away from current, or *status quo* policies. In this paper we also use the term "veto point" to refer to a political institution, the holder of which has the power to block a proposed change in policy. Scholars in this area, particularly Tsebelis (1995, 2002), offer the most thorough analysis of the effects of political checks and balances, emphasizing, for example, that the effects of additional veto players on policy outcomes depend on whether their preferences diverge from those of existing veto players. The concern in the veto player literature, however, is not policy *credibility* but policy *stability*, an important distinction that is explored below. In the analysis that follows, we show that policy credibility varies with the number and polarization of preferences of veto players, but the underlying logic is different. For example, we find that where there is greater uncertainty about

which *status quo* will prevail in the future, additional veto players have less effect on credibility.

We also contribute to a large literature on the role of delegation in policy making. In much of this literature, the focus is on politicians who need expert agencies to make policy but who must confront the challenge of controlling agency shirking (see, e.g., Epstein and O'Halloran 1999, Bawn 1995, Lupia and McCubbins 1999 and McCubbins, Noll and Weingast 1987). Our results suggest that politicians might also delegate to increase policy credibility, but that delegation has this effect only in the presence of multiple veto players with polarized preferences.

Finally, this paper contributes to a large literature on the role of central banks as sources of credibility in monetary policy. Beginning with Rogoff (1985), scholars have argued that central bank independence can cement the credibility of government policy commitments. With few exceptions, they abstract from the interaction of politicians and central banks and assume that, once delegated, the policy authority of agencies (central banks) can never be revoked. We relax this assumption in order to ask: what are the political and institutional preconditions necessary for delegation to an independent agency to increase policy credibility?

Monetary policy is an especially convenient target of investigation because the policy attribute we care about, but cannot directly measure – credibility – maps directly onto a policy outcome that we can measure, inflation. To establish an appropriate benchmark for the effects of delegation, we therefore first develop a model of inflation outcomes under a government with two veto players. We then compare outcomes under this model to a second model, in which monetary policy has been delegated to an independent central bank. The detailed empirical tests in the second half of the paper strongly support our predictions. These tests use new data both on political institutions and on political polarization and show that multiple veto players can increase credibility (reduce inflation), that legal central bank independence is more likely to reduce inflation in the presence of multiple political veto players, and that all of these effects strengthen when political veto players are more polarized.

A review of solutions to the credibility problem in monetary policy

Multiple veto players or checks and balances (we use the terms interchangeably), are the institutional arrangement that has received greatest attention as a solution to the problem of credible commitment, at least since classic theorists of representative government like Madison and Montesquieu. North and Weingast (1989) argue that constitutional changes increasing the British Parliament's role as a constraint on the monarch following the Glorious Revolution of 1688 encouraged lenders to reduce the risk premium on loans to the British crown. Stasavage (2003) shows that the preferences of the members of Parliament, and the pattern of coalition formation within Parliament, played an equally important role in establishing credibility of debt repayment in the UK.

These arguments invoke some of the same concepts that are common in the application of veto player analysis to the issue of policy stability, pioneered by Tsebelis (1995). The underlying issues – policy stability and policy credibility – are nevertheless quite distinct. Policy stability is high when the set of policies that politicians prefer to the *status quo* is small; policy is unstable when this set is large. Credible commitment introduces an explicit dynamic element, however, in which policy choices today influence the payoffs to policy options tomorrow. More to the point, policies can be stable but not credible. Politicians might prefer a particular policy today to all other alternatives, making the policy fully stable, as Tsebelis (1995) defines stability. Stability provides no guarantee, however, that once citizens have relied on the policy in their contractual, investment or other decisions, the same politicians tomorrow will not take advantage of their reliance and reverse the policy. This is a pervasive problem, and is at the core of the model below of monetary policy making.

The question of credible commitment (or "time consistency") has been central to discussions of monetary policy since Kydland and Prescott (1977) and Barro and Gordon (1983a). These articles have influenced research into government commitment problems in many other policy areas. In the model presented by Barro and Gordon (1983a) governments prefer lower inflation and

higher national income. The government is a unitary actor that would be better off if it could commit to a low rate of inflation. Before the government actually sets monetary policy, however, private actors must form inflation expectations and write contracts governing the future sale of goods and services. Once these contracts are signed, governments have an incentive to boost output by pursuing a high inflation policy. In equilibrium, agents anticipate this behavior by the government and build an 'inflation bias' into their wage contracts. Inflation is therefore higher when governments are less credible.

Barro and Gordon (1983b) argued that reputation could mitigate this problem. However, the reputational outcome is but one of multiple possible equilibria in their infinitely repeated game. Moreover, for many governments heavy discounting of the future eliminates reputational equilibria. Rogoff (1985) then offered the delegation of monetary policy to an independent central bank as a solution to the time-consistency problem in monetary policy. The central banker would place a greater weight than society at large on stabilizing prices relative to stabilizing output, and so would be less tempted than politicians to make surprise increases in the money supply to secure temporary boosts to income. Knowing this, private actors reduce the inflation premium that they build into their long-term contracts.

Most subsequent research investigating different aspects of the Rogoff solution has retained his assumption, that delegation of monetary policy authority to the central bank is irrevocable. However, substantial evidence from the study of American politics suggests that partisan identification of political actors affects the decisions of nominally independent bureaucratic agencies.[1] Recognizing this, Lohmann (1992) and Jensen (1997) explicitly analyze the potential for political reversals of central bank decisions. Jensen (1997), for example, introduces a parameter that represents the costs to political actors of overriding a central bank, essentially capturing in a "black box" formulation the potential institutional limitations of delegation. Our model opens up the institutional black box.

Lohmann (1998) and Moser (1999) also relax the irreversibility assumption in their analyses

of central bank independence. As we do, they argue that multiple veto players in government make it more difficult to reverse a decision to delegate, giving independent central banks greater scope to reduce the inflation bias. In our theoretical and empirical analysis we consider several questions not addressed by their contributions. Under what conditions do multiple veto players, by themselves, mitigate the credibility problem that increases expected inflation? How do changes in agenda control, political polarization and the level of uncertainty affect the impact of multiple veto players on the expectations of private actors? Given multiple veto players, the assignment of agenda-setting authority and political polarization, what additional influence does an independent central bank have on expected inflation?

A model of checks and balances, central bank independence and inflation

The model of the time consistency problem in monetary policy that anchors this paper follows Barro and Gordon (1983a). In the traditional model, in which "the government" is a single veto player, the government minimizes

(1) $L_G = \frac{1}{2}\pi_t^2 + \frac{1}{2}b_G(y_t - y^*)^2$ with respect to π, where

(2) $y_t = \pi_t - \pi_t^e + \varepsilon_t$,

where $\pi^e =$ expected inflation, the price increases that are programmed by the private sector in their contracts prior to the realization of the supply shock (a shock to output given by ε_t) and the policy decisions of the government. The variable y^* is desired output (with $y^* > 0$ and the trend, or "natural" rate of output normalized to zero). The parameter b_G characterizes the government's preferences regarding the tradeoff between inflation and output. Private actors first form expectations about future inflation, then write contracts that effectively set prices in the economy. A random supply shock to the economy occurs, and finally government sets actual inflation (π_t).

Private actors know that their long-term contractual decisions – and particularly the inflation expectations built into those decisions – will affect government inflation policies subsequently. They know, in particular, that the government will solve for the inflation outcome that minimizes its

losses, or, from the minimization of (1):

$$\text{(3a)} \qquad \pi = \frac{b_G(\pi^e - \varepsilon + y^*)}{1 + b_G}.$$

After taking expectations, solving for expected inflation and substituting the expression for expected inflation back into (3a), the problem yields the following well-known solution for inflation (suppressing time subscripts here and throughout).

$$\text{(3b)} \qquad \pi = b_G y^* - \frac{b_G}{1 + b_G}\varepsilon.$$

The inflation bias – the amount of extra inflation generated by the inability of the government to credibly commit to its announced inflation policy – is $b_G y^*$.

Discretionary monetary policy under checks and balances

Delegation to a central bank is traditionally analyzed within the context of the single veto player model outlined above, where the central bank has no informational or other advantages over the government. Given this, there is no obvious reason why a single veto player would not always override any central bank decision that diverged from the veto player's preferred outcome in any period.[2] A brief illustration based on Figure 1 is sufficient to show that delegation changes policy only in the presence of multiple veto players. However, this simple illustration is insufficient for understanding the credibility problem at the heart of this paper, which depends upon the existence of exogenous economic shocks and efforts by the private sector to anticipate government action.

There are two veto players, v_1 and v_2. Figure 1 shows their preferences relative to each other, with v_1 preferring a lower rate of inflation. Some *status quo* rate of inflation *sq* is located between the preferred rates of the two veto players. It is well-understood, at least since Shepsle and Weingast (1981), that one must specify how the veto players make decisions – that is, what are the agenda-setting powers of each? We assume throughout the paper that there is one player with agenda-setting authority – the ability to make a take-it-or-leave-it offer to the other player. For example, in some countries, the executive branch can propose a candidate for central bank governor to the legislature,

which must vote the choice up or down.[3] In this simple model, the second veto player v_2 has agenda control, the sole authority to propose a change in monetary policy.

[Insert Figure 1 about here]

In the absence of a central bank, policy does not shift from *sq* since there is no policy that v_2 could propose that both she and v_1 prefer to *sq*. The presence of a "conservative" central banker, *cb*, who prefers a lower rate of inflation than either veto player can therefore reduce inflation. Policy is made as follows: (i) the central bank chooses an inflation rate (ii) v_2 can propose to override the central bank's inflation rate (iii) v_1 can either accept the override proposal, in which case it is implemented, or she can reject it, in which case the central bank's rate is maintained. Given this series of moves and the alignment of preferences in Figure 1, the lowest rate of inflation that the central bank can propose without fear of override is the policy preferred by v_1, which is lower than the *status quo*.

What if v_1 or v_2 were the only veto player? Then policy would always be at their preferred outcome, with or without the central bank; any attempt by the central bank to propose a different inflation rate would be immediately overridden by the single veto player. Clearly, then, the presence of a central bank can only change policy outcomes in the presence of multiple veto players.

This model begs two basic questions that are key to analyzing delegation and credibility. The first is where the *status quo* rate of inflation originates. In this simple illustration the *status quo* is exogenous and given. Consistent with standard models of monetary policy, the default outcome we employ in the models below – the inflation that prevails in the absence of government action in the second period – is the set of price increases programmed by the private sector into its contracts in the first period.[4] In contrast to most models of policy choice, therefore, the *status quo* here is endogenous: the default inflation outcome confronting politicians is the product of private sector decisions that are made in anticipation of the decisions of politicians. The dependence of the *status quo* or default outcome on the actions of the players in the game is a pervasive feature of policy making and not exclusive to monetary policy. It is not captured in the analysis following from Figure

1, but is a key innovation in our model.[5]

The simple model depicted in Figure 1 also provides no reason for v_1 to delegate to a conservative central banker in the first place. This paradox emerges because the model assumes away economic shocks. Again, a simple example confirms this point. Delegation would occur if, in some previous unspecified period of play, v_1 controlled both veto points. She would then have a choice: to retain future control of monetary policy or to delegate to a conservative central banker. Three possible outcomes could then emerge. She could retain control of both veto points, in which case the presence of a central bank would make no difference, and her preferred inflation outcome would prevail. She could retain control of one veto point, but again the presence of a central bank would make no difference, since v_1 could veto any attempt to shift policy away from her preferred outcome. Finally, she could lose control of all veto points. In this case, policy would shift to the outcome preferred by v_2, regardless of whether there was a conservative central bank. None of the three cases provides a justification for delegation.

The possibility of unpredictable economic shocks can, however, motivate the inflation-averse veto player to delegate authority. These shocks are fundamental to the analysis of political decision making in many different policy areas, including Rogoff's (1985) analysis of monetary policy. To see how they would motivate v_1 to delegate, one can imagine an example in which v_1 prefers a two percent rate of inflation and, given that she controls all veto points, simply decides to set inflation at that rate. She then loses control of one veto point to a policy maker who prefers a four percent rate of inflation. Inflation does not change, however, since v_1 can still block all attempts to move away from the two percent rate. Finally, however, a shock occurs, such as an increase in oil prices that leads simultaneously to higher inflation and slower economic growth. At that point, both veto players prefer a higher inflation rate, say four percent for v_1 and six percent for v_2, that they believe would best allow them to minimize the impact of the oil price shock on economic growth.

It is straightforward to see that in this situation v_1 could have done better by delegating to a conservative central bank. Assume that v_1 is indifferent between inflation at two percent and

inflation at six percent – both are two percentage points away from her preferred, post-shock rate of four percent. Following the shock, and absent a central bank, v_2 therefore proposes a rate just less than six percent, which v_1 would accept. What if v_1 had previously delegated authority to a conservative central bank? The conservative central bank would have responded to the shock by setting inflation at four percent, v_1's new preferred rate. Delegation in the presence of economic shocks therefore yields inflation outcomes closer to the preferred outcome of v_1.

This heuristic example demonstrates the importance of integrating two elements into a convincing model of delegation: the emergence of the *status quo* from the interaction of the private sector and government actors; and the presence of economic shocks. The formal models we develop here do precisely this. We first analyze policy outcomes with multiple veto players in the absence of delegation.[6] We then add an independent central bank to the institutional mix in the next section. The decision making structure under each model is summarized in Table 1.

[Table 1 goes about here]

Given the decision making rules and the default outcome, the policy game with two veto players is otherwise the same as in the Barro-Gordon model: private sector actors establish their inflation expectations and then write contracts that fix prices; a supply shock ε occurs, distributed uniformly over the range $[-c, c]$; and two political actors decide what inflation policy to pursue after observing expected inflation and the shock. Now there are two political actors, A and N (the agenda setter and the non-agenda setter), who seek to minimize their respective loss functions:

$$(4) \qquad L_i = \frac{1}{2}\pi^2 + \frac{1}{2}b_i(\pi - \pi^e + \varepsilon - y^*)^2, \; i \in [A, N],$$

which is just equivalent to (1) after substituting in (2).

The more inflation-averse a veto player is, the lower is b_i. In analyzing when an additional veto player will make a difference to policy outcomes, Tsebelis (2002) emphasizes the importance of taking into account the orientation of veto player preferences with respect to the *status quo* outcome – the outcome that prevails if veto players are unable to make a decision. Where additional veto

players have policy preferences identical to some current veto players, their presence does not change policy outcomes. The preferred outcomes of the two veto players diverge here because they have different preferences regarding the tradeoff between income and inflation, $b_A, b_N > 0$ and $b_A \neq b_N$. We examine both the case where the agenda setter is more and less inflation-averse than the non-agenda setter ($b_A < b_N$ and $b_N < b_A$, respectively).

Since private actors write their contracts anticipating the actions of government, we proceed as usual by backward induction to establish what rate of price increase (expected inflation or *status quo* inflation) will be built into the private sector's contracts. In the last period, the political actors observe the price increases written into private sector contracts and the supply shock. If they do nothing, the price increases, which are (once again) the default or *status quo* outcome confronting the veto players, will constitute final inflation. If the private sector were sure that the government would not act, then it would set expected inflation, or default inflation, equal to zero. However, the private sector does not observe the random supply shock, and therefore cannot know for sure what decision the veto players will make upon observing the private sector's contracts.

Altogether there are four possible situations that the two veto players might confront, depending on the orientation of the *status quo* to the preferred inflation outcomes of the veto players. Assuming for now that the agenda setter is more inflation averse ($b_A < b_N$), the agenda setter's preferred inflation outcome must always be less than that of the non-agenda setter's.[7] The four cases therefore follow.

Case I: $\pi_{SQ} < \pi_A < \pi_N$

If the supply shock is large and negative, both veto players seek to stimulate output with an expansionary monetary policy; both therefore prefer a rate of inflation that is higher than the *status quo* rate established in private sector contracts. The non-agenda setter prefers the agenda setter's most preferred inflation policy to the default outcome. Therefore, the agenda setter makes an all-or-nothing proposal of her most preferred outcome and the non-agenda setter accepts it. Final inflation

is therefore π_A.

Case II: $\pi_A < \pi_{SQ} < \pi_N$

In Case II, the supply shock leaves output short of what the non-agenda setter prefers. Her preferred policy is therefore a stimulative monetary policy leading to higher inflation than given by the *status quo* or default outcome. The agenda setter, on the other hand, believes that the output after the supply shock is high enough that some output can be sacrificed to attack inflation more aggressively; she prefers a lower inflation outcome than the *status quo*. Therefore, no inflation outcome is preferred by both agenda setter and the non-agenda setter to the *status quo* outcome. The s*tatus quo* therefore prevails.

Case III: $\pi_A < \pi_N < \pi_{sq} < 2\pi_N - \pi_A$

If the supply shock is large and positive, both players prefer to sacrifice some output and pursue a more restrictive monetary policy that reduces inflation below the *status quo* inflation outcome. If, as in Case III, *status quo* inflation outcome is closer to the non-agenda setter's preferred inflation outcome than is the agenda setter's preferred outcome (that is, if $\pi_{sq} < 2\pi_N - \pi_A$), the agenda setter must split the difference and propose an inflation policy that lies between her preferred outcome and the outcome most preferred by the non-agenda setter. Specifically, the agenda setter successfully proposes inflation outcome π such that $\pi_N - \pi = \pi_{SQ} - \pi_N$, or $2\pi_N - \pi_{SQ} = \pi$.[8]

Case IV: $\pi_A < \pi_N < 2\pi_N - \pi_A < \pi_{SQ}$

Under Case IV the supply shock is sufficiently large and positive that the preferred inflation outcomes of both veto players are far to the left of (much lower than) the *status quo* inflation outcome and the non-agenda setter prefers even the agenda setter's preferred inflation outcome to the *status quo*. The agenda setter therefore proposes $\pi = \pi_A$ and the non-agenda setter accepts.

The four cases describe the possible government actions in the second period of the game conditional on the decisions of the private sector in the first period. Since the supply shock affects

which case will emerge, and since the private sector does not observe the supply shock prior to writing its contracts, the private sector must therefore take into account the possibility that any of the cases can occur. Private actors must therefore assess, for any inflation rate that they factor into their contracts, the probability of each of the four cases emerging. They calculate expected inflation as the solution to (5) where the q_i's are the probabilities that the government will choose each of the four different inflation outcomes after the shock is realized

(5) $\pi^e = q_1(\pi_A) + q_2(\pi^e) + q_3(2\pi_n - \pi_{SQ}) + q_4(\pi_A)$

The solution to (5) is complex, since the preferred inflation rates and the *q* probabilities are all themselves a function of expected inflation. Appendix 2 derives the solution for expected inflation when the agenda setter is less inflation-tolerant than the non-agenda setter, or $b_A < b_N$ (Equation A.12); and when the agenda setter is more inflation-tolerant (Equation A.13). Although the solution is highly non-linear and closed-form solutions do not exist, numerical simulations using plausible parameter values allow us to make three propositions.

First, the larger is the variance of the supply shock, and therefore the greater the uncertainty surrounding the default or *status quo* outcome, the less influential is the non-agenda setter in setting policy. Veto players matter less in a more uncertain environment. This is intuitively clear, since the larger is a shock, the more likely the non-agenda setter will prefer the agenda setter's preferred inflation outcome to the *status quo*.

Second, the addition of a second, non-agenda setting veto player increases policy credibility, with the effect rising in the magnitude of the preference differences between the two veto players. Of course, if the two veto players have identical preferences ($b_1 = b_2$), the second veto player has no influence at all on outcomes. Multiple veto players therefore can increase policy credibility as well as policy stability.

Third, policy credibility is sensitive to the decision making rules. If the agenda setter is the veto player who has the least incentive to renege on policy commitments (in this case, is most inflation-averse), the addition of a second veto player has little effect on credibility. In the reverse

situation, multiple veto players have a significant effect on policy credibility.

The numerical simulations generating the second and third propositions, which are most relevant to the delegation case, are illustrated in Figure 2. Differences in preferred outcomes of the two veto players are modeled as mean-preserving polarization of the preferences, where "mean-preserving" is defined as an increase in $|b_N - b_A|$ holding $(b_N - b_A)/2$ constant. The addition of a second veto player always reduces expected inflation provided interests of the two veto players are divergent; as the third result predicts, this effect is much stronger when the non-agenda setter is *less* inflation tolerant than the agenda setter. This two-veto player outcome is the benchmark against which to compare the effect of an independent central bank subsequently.

[Insert Figure 2 about here]

The introduction of an independent central bank

The key attribute of an independent central bank is that it, rather than the private sector, sets the default rate of inflation that political veto players must accept if they choose not to override it. After the private sector has acted and the supply shock has occurred, the central bank determines an inflation policy and it is this inflation policy that prevails if the two veto players do not act. The two veto players determine whether to accept the central bank's policy. If they overturn it and then do nothing, then the private sector's contractual price increases become final inflation. Consequently, the policy that prevails should they revoke the central bank's independence is precisely the policy derived earlier when there is no central bank. This policy is labeled π_{CH}, the inflation policy under checks and balances. The central bank has an effect on policy, therefore, to the extent that it can change the default or *status quo* rate of inflation relative to what would prevail in its absence.

The central banker's loss function and preferred inflation policy are, respectively,

(6) $$L_{CB} = \frac{1}{2}\pi_t^2 + \frac{1}{2}b_{CB}(\pi_t - \pi_t^e + \varepsilon_t - y^*)^2 \text{ and}$$

(7) $$\pi_{CB} = \frac{b_{CB}(\pi^e - \varepsilon + y^*)}{1 + b_{CB}}$$

Three assumptions make the analysis more compelling. First, the central bank is assumed to be more inflation-averse than either of the political actors ($b_{CB} < b_A, b_N$). Second, for simplicity, the central banker always prefers any inflation outcome lower than the inflation that would prevail were he to be overridden, π_{CH}. Third, to avoid trivial cases, the most inflation-averse veto player prefers the outcome under checks and balances to the most preferred outcome of the central banker. The third assumption means that central banker's preferred inflation outcome, π^*, is such that $\pi_A - \pi^* \geq \pi_{CH} - \pi_A$, when $b_A < b_N$, and $\pi_N - \pi^* \geq \pi_{CH} - \pi_N$ when $b_N < b_A$.[9] The lowest inflation that the central banker can propose without fear of override is a rate π that converts these expressions into equalities, $\pi = 2\pi_A - \pi_{CH}$ for $b_N < b_A$ and $\pi = 2\pi_N - \pi_{CH}$ otherwise. The rate π set by the central bank is the default outcome that prevails if political veto players do not override the central bank.

Since π_{CH}, the inflation policy that the two veto players can agree on if they override the central bank, is a key constraint on central bank decision making, the same four cases that affect the calculation of π_{CH} also influence the policy choice of the central bank. Private actors therefore set expected price increases, establishing expected inflation, using equation (8), for $b_A < b_N$, following the same logic as for equation (5).

(8) $\pi^e_{CB} = q_1(\pi_A) + q_2(2\pi_A - \pi^e_{CB}) + q_3(2\pi_A - 2\pi_N + \pi^e_{CB}) + q_4(\pi_A)$

In the earlier section, the inflation rate contracted by the private sector was labeled π_{SQ}, to denote that it constituted the *status quo* outcome. Since this is no longer the case in the presence of a central bank, equation (8) labels the private sector's inflation rate π^e_{CB}, to denote that it is the expected inflation calculated by private actors in the presence of a central bank.

The key difference in equation (8) is that the inflation policy that prevails under each of the four cases is simply the override-proof policy chosen by the central bank after having observed the shock. For example, consider a supply shock such that Case I is realized, $\pi^e_{CB} < \pi_A < \pi_N$. If the

central bank were overridden, the agenda setter would propose and the other veto player would accept the agenda setter's preferred inflation outcome, or $\pi_{CH} = \pi_A$. Knowing this, the central banker can do no better than to propose the agenda setter's preferred inflation outcome, $\pi = 2\pi_A - \pi_{CH} = \pi_A$. In Case II, the inflation outcome in the event of an override of the central bank's proposal is the default outcome, or $\pi_{CH} = \pi^e_{CB}$, so that the central bank proposes $\pi = 2\pi_A - \pi^e_{CB}$, the inflation outcome that is no further from the agenda setter's preferred outcome than the default outcome.

If the non-agenda setter is less tolerant of inflation, $b_N < b_A$, the central bank then sets policy such that the non-agenda setter has no incentive to agree to reverse the central bank. The cases remain the same as before, but the override-proof policy is now the one that leaves the non-agenda setter just indifferent between the central bank's policy and pursuit of an override. The derivation of expected inflation in this case is given in Appendix 3. The solutions for expected inflation in both cases (the agenda setter less and more tolerant of inflation) are derived in Appendix 3 and given by equations A.14 and A.15.

As before, there is no simple closed-form expression for expected inflation with an independent central bank, but numerical simulations can be used to generate three relevant propositions. First, delegation of monetary policy to a more conservative central banker always lowers expected inflation when there are multiple veto players. Second, the central banker is able to pursue a lower inflation policy as polarization of the political actors increases. Third, just as the addition of a second veto player makes the most difference when the agenda setter is *more* tolerant of inflation, so too does the addition of an independent central bank.

The numerical simulations illustrated in Figure 3 yield each of these predictions. In each case, an independent central bank achieves lower inflation than two veto players alone, the difference in inflation outcomes grows as polarization between the two veto players grows, but the biggest impact of an independent central bank occurs when the agenda setter is more inflation-tolerant. This

last claim can be verified by comparing the distances between the top and bottom lines and between the two middle lines in Figure 3.

[insert Figure 3 about here]

Why are independent central banks created?

Unlike the central banking literature, our model specifies the conditions under which politicians might override decisions made by a central bank. We give less attention to another issue: why do politicians delegate to an agency that might be more inflation-averse than they are? However, the analysis above is consistent with substantial research, beginning with Rogoff (1985), that shows that even an inflation-tolerant political actor might prefer to delegate authority to a conservative central banker in the presence of unpredictable economic shocks.[10]

As a factual matter, moreover, many governments inherit central bank legislation approved by earlier governments, frequently earlier governments controlled by inflation-averse political parties that established a central bank fearing a future in which more inflation-tolerant parties might take office. For example, Boylan (1998) has shown that the current strong independence of the Chilean central bank was introduced during the Pinochet era. The United States Federal Reserve Act was passed in an extraordinary session of Congress in 1913, when the Democrats were in control of both houses and the Presidency (Laughlin, 1914 and Leake, 1917).[11] Berger and de Haan (1999) show how the evolution of the Bundesbank independence was influenced by the institutional structures set up by the Allied powers following World War II and manifested in the Bundesbank Law of 1948. These examples provide a justification for the decision made in this paper to treat central bank independence as exogenous.

Testing the hypotheses

The model underlines the importance of taking political institutions and preferences into account when examining the impact of administrative arrangements such as central bank independence. Three predictions that emerge from the foregoing analysis are tested below.

1. *The presence of a legally independent central bank should have a more negative effect on inflation in the presence of*

multiple veto players

2. *The presence of a legally independent central bank has a more negative effect on inflation when different veto players have more divergent preferences over inflation.*
3. *Political interference, such as replacement of central bank governors, is less likely when multiple veto players are present, and when veto players have divergent preferences over inflation.*

Prediction 1 has been tested previously by Moser (1999) in a sample restricted to OECD countries, and by Keefer and Stasavage (2002), in a paper using only one proxy for checks and balances.[12] In this paper we extend this previous work by considering two different proxies for checks and balances. Tsebelis (2002) argues persuasively that the number of veto players affects policy only insofar as the veto players have divergent policy preferences. To be consistent with this condition, tests of Proposition 1 must therefore treat veto players with the same preferences as only a single veto player. The tests reported below do this. Prediction 2, regarding the effect of *increasing* polarization among veto players, has not been previously tested. Delegation improves policy credibility because it is more difficult for multiple veto players to agree to overturn an agency's decision than their own. In that case, however, we should see more evidence of overt political interference in central bank affairs when there are fewer veto players and their interests are more concordant. This is Prediction 3, which has also not been previously tested and provides supporting evidence for the primary thesis that central bank independence depends on checks and balances.[13] The theoretical model also suggests other hypotheses, related to the interaction of the agenda setter, the degree of polarization and the uncertainty about the *status quo* outcome. The absence of data on agenda setters across countries means that tests of these hypotheses must be reserved for future work.

Data

Following standard practice, in our tests of hypotheses 1 and 2 we use average levels of inflation as our dependent variable, and more specifically the log of average inflation.[14] We consider determinants of average inflation in a maximum of 66 countries (both OECD and developing) over

three time periods from 1960 to 1989.[15] As noted below, several of our tests are restricted to the two time periods 1972-1979 and 1980-89 due to limitations in political data availability.

Our measure of legal central bank independence was developed by Cukierman, Webb, and Neyapti (1992), based on sixteen different characteristics of central bank statutes such as the term of office for the governor, provisions for his or her replacement, limits on central bank lending to government, and procedures for resolution of conflicts between central bank and government.[16] The component of *CBI* which measures rules concerning the tenure of the central bank governor is also used separately for testing hypothesis 3, and we label it *CEO*.

These authors have also collected data on replacement of central bank governors. Cukierman, Webb, and Neyapti (1992) argue that high turnover of central bank governors is indicative of low independence, and they show that the rate of turnover is positively and significantly correlated with inflation in a sample including both developed and developing countries.[17] Cukierman and Webb (1995) collect data on the frequency with which central bank governors are replaced in the six months following changes in government, a period where any political influence is most likely to be exercised. We use this latter measure, which we call *governor turnover*, in our test of hypothesis 3, because it appears to be the best available proxy for the extent of political interference with central bank governors.[18]

With respect to checks and balances in government, one would ideally like to have separate measures on the number of political actors who exercise veto power over monetary policy, their inflation preferences and their respective agenda-setting power. These variables are not available in the cross-country setting that we seek to examine, so we instead employ two recently recently developed measures of checks and balances.[19] They have the advantage of being based on objective criteria and of capturing the existence of coalition governments or divided control of two chambers in a bicameral system. Henisz (1997) has developed a formula for measuring checks and balances. Although it does not measure the extent of polarization among veto players with respect to economic policy, it carefully distinguishes veto players based on the number of formal constitutional

veto points present in a political system (executive, houses of the legislature, federal sub-units, judiciary), on whether these veto points are controlled by different parties, and on the cohesiveness of the majority which controls each veto point.[20] This variable would not be appropriate for the tests below if it veto players occupying different veto points (and therefore elected, typically, by different constituencies) and from different parties had identical preferences with respect to economic policy. We do not regard this as likely, however, given that one of the principal reasons for two politicians not belonging to the same party is that they have different preferences over policy. The index, *political constraints*, is available for the last three decades of our sample (1960-89).

A second measure of checks and balances, developed by Keefer (2002), also has the advantage of being based on objective criteria and of capturing the existence of coalition governments or divided control of two chambers in a bicameral system. In addition, unlike *political constraints*, the *checks* variable is explicitly incremented when a party in the government has an economic policy orientation closer to that of the main opposition party than to that of the party of the executive. More generally, *checks* is based on a formula that first counts the number of veto players, based on whether the executive and legislative chamber(s) are controlled by different parties in presidential systems and on the number of parties in the government coalition for parliamentary systems (as described in greater detail in Beck, et al. 2001). The index is then modified to take account of the fact that certain electoral rules (closed list vs. open list) affect the cohesiveness of governing coalitions. The variable is constructed based on variables in a new database of political institutions assembled by Beck, et al. (2001) and is available for the last two decades of our sample (1972-89). Since the effects of checks and balances hypothesized in the model are likely to be strongest at lower levels of checks than at higher levels, we use a log version of *checks*, *log check*, in our regressions.[21]

The measures developed by Keefer (2002) and Henisz (1997) capture the number of veto players as well as can be done in a cross-country setting that includes both OECD and developing countries. Both of these indicators rise with the number of veto points (depending upon the number

of legislative chambers) and fall when the veto points are occupied by the same political party (depending on whether majorities are multi-party coalitions).

There is no measure available that precisely assesses the policy distance between veto players. However, to test Prediction 2 we use a reasonable substitute, the *political polarization* variable from the Database of Political Institutions (Beck, et al. 2001). The database reports the economic orientation of the four largest parties and the executive in each country, based on whether the data sources indicated parties as having an economic orientation that was left, center or right. Pairwise comparisons of economic orientation are made; the difference in economic orientation between the pair of veto players exhibiting the largest difference in orientation is the *political polarization* measure. Given the way it is constructed, the *political polarization* measure is a reasonable proxy for the degree to which the preferences of veto players diverge. In addition, however, since it takes a value of zero for systems with only one veto player, it is simultaneously a proxy for the number of veto players in a country.

We use one additional control variable, *openness*, measured as imports of goods and services divided by GDP (*International Financial Statistics*). This follows Romer (1993), who argues that as imports increase as a share of total consumption, policy makers have less of an *ex post* incentive to inflate. We also follow Cukierman, Webb, and Neyapti (1992) and include decade dummy variables to control for unobserved characteristics specific to each time period.

Testing Predictions 1 and 2: checks and balances, polarization, and central bank independence

In order to examine whether legal central bank independence has a stronger negative impact on inflation in countries with multiple veto players, and in cases where veto players are more polarized, we use a model with interaction terms that allows the marginal effect of central bank independence on inflation to vary across political systems. The general form of regressions 2 and 3 in Table 2 is shown in equation 15, where "*pol. inst.*" represents our alternative proxies for the number of veto players in government and the degree of polarization between veto players.

(15) $\textit{log inflation}_{it} = \alpha_t + \beta_1 CBI_{it} + \beta_2 \textit{pol. inst.}_{it} + \beta_3 (\textit{pol. inst.})_{it} * (CBI)_{it} + \beta_4 \textit{openness}_{it} + \varepsilon_{it}$

The interaction term is predicted to have a negative coefficient. The net effect of central bank independence, given by $\beta_1 + \beta_3$*(*pol. inst.*), should be to reduce inflation only at high levels of checks and balances (or at high levels of polarization).

[insert Table 2 about here]

Regression 1 in Table 2 suggests that, although there is some theoretical ambiguity about the effects of multiple veto players on inflation, in practice the introduction of multiple political veto players may be to reduce inflation: the coefficient on *log check* is negative and significant. As in previous research, legal central bank independence has no significant impact on inflation when it enters linearly in a sample including both OECD and developing countries, and openness is significantly and negatively correlated with inflation. The variable *political constraints* is similarly significant, economically and statistically, when substituted for *log checks* in the Regression 1 specification.

Regression 2 suggests that the effect of central bank independence on inflation is conditional on the presence of checks and balances in government. Consistent with Prediction 1, the interaction term *CBI * log check* is negative, and an increase in central bank independence is estimated to have a negative effect on inflation only at high levels of checks and balances. Regression 3 produces very similar results. The interaction term *CBI*polcon* is negative and statistically significant.

In Regression 4 we extend the inquiry to consider whether the effect of central bank independence is influenced by both the number of veto players and their degree of polarization. The variable *political polarization* captures exactly this effect, since it is zero when there is only one veto player while, in systems with more than one veto player *political polarization* can take on a positive value ranging from 0 to 2 as veto player preferences over economic policy diverge.

The coefficient on the interaction term *CBI*political polarization* in Regression 4 is negative and statistically significant, supporting Prediction 2. This result in Regression 4 is also robust to the linear inclusion of *log check* to the regression. Figure 4 plots the estimated effect of an increase in central bank independence, together with its standard error, and different levels of *political polarization*.

The model predicts that an increase in central bank independence will have a negative impact on inflation only at relatively high levels of polarization (*political polarization* >0.6). This corresponds roughly to the mean value of *political polarization* for the group of countries in which *political polarization* is not equal to 0. This result is consistent with the predictions of our theoretical model, as it suggests that multiple veto players with divergent preferences must be present for central bank independence to have a significant impact.

The results in Regressions 2 and 3 bear on an unresolved puzzle in empirical work on central bank independence. A number of papers have found a statistically significant relationship between legal measures of central bank independence and inflation in advanced industrialized economies.[22] However, this relationship has not been documented in samples that include both developed and developing countries (Cukierman, Webb, and Neyapti, 1992). Our results suggest that legal independence can reduce inflation bias in both developed and developing countries, but that this depends on the level of checks and balances in a country's political system.

Table 3 reports the estimated effect of a one standard deviation increase in CBI (0.13) at different levels of each of our proxies for checks and balances used in Regressions 2 and 3. It also reports the conditional standard errors of these effects, which depend on the variance of both the linear and interactive CBI terms, as well as their covariance. To facilitate comparison, we have chosen values for each of the two variables that would reflect a political system with one, two, or three veto players. The table provides additional evidence that in each case an independent central bank reduces inflation only where multiple veto players are present, as the theory predicts.

[insert Table 3 about here]

Cases of conflict from the Bundesbank and the Fed

Qualitative evidence emerging from specific instances of confrontation between central bankers and political decision makers provides further support for the analysis here. For example, during the Gürzenich Affair of 1955-56, the German Bundesbank was able to insist on a course of action strongly opposed by Chancellor Konrad Adenauer precisely because members of his cabinet,

Ludwig Erhard and Fritz Schäffer, supported the central bank. As Berger and de Haan (1999) document, although they were not formal veto players, these two were highly influential within the Christian Democratic Party and, more to the point, represented different interests. Adenauer sought a looser money supply to satisfy the demands of major industrial interests who were important contributors to the party; the two cabinet members were able to rely on broader public support for the autonomy of the Bundesbank. Two elements of this story are especially important. First, the two cabinet ministers were *de facto* veto players. Although public opposition eventually emerged to restricting the authority of the Bundesbank, internal cabinet opposition to Adenauer's actions seems to have been key to representing public opinion against the interests of industrialists. Only if they had *de facto* veto power could these two ministers have accomplished this. Second, although it is inaccurate to speak of the "agenda setting" authority of Adenauer versus his cabinet ministers, there is little doubt that his bargaining power was greater than that of his two ministers, given his status in the party and as Chancellor. Despite this – but as the model predicts – the Bundesbank was able to get nearly everything it wanted in the conflict with the support of these two ministers.

Wooley (1984, 144 - 47) documents several instances of conflict between the US Federal Reserve, Congress and the President. In 1975, at the trough of a two-year old recession, Federal Reserve policy was markedly more conservative than either the Republican President Ford or the Democratic Congress desired. At the outset of the 1975 94th Congress, several committee chairmen were replaced and the more liberal Henry Reuss took over the House Banking Committee, assuming a position of agenda control. He immediately introduced legislation requiring the Fed to expand the money supply at a rate of six percent per year. Within days, however, he agreed to replace this proposal with a substantially weaker one, calling only for the Fed to increase the money supply in the first half of 1975 and to maintain long-run growth in the money supply consistent with long-run potential output growth. This bill was passed and signed by the President. Since the bill had no binding effect (Wooley describes it as "toothless and compromised", p. 147), one is left to ask why stronger legislation did not succeed. The analysis here suggests that the move towards a less

inflation-averse agenda setter had little effect on policy because other, more conservative veto players remained the same (e.g., the Republican president). These veto players were constrained by concerns about the inflation outcome that would have prevailed should they have overturned Fed policy. Knowing this, the Fed was able to pursue a more aggressive policy than the veto players preferred.

Testing Prediction 3: checks and balances, polarization, and political influence on central banks

If our primary thesis is correct, then in addition to influencing observed policy outcomes, checks and balances and polarization should also have an impact on the degree to which a central bank is subject to political influence. We examine this issue by proxying for political influence with a variable collected by Cukierman and Webb (1995), which measures the frequency with which central bank governors are replaced in the six months following elections. As argued above, while even this variable is likely to be an imperfect proxy for political influence, it is a better proxy than measures that focus on the overall rate of turnover for central bank governors. We test two alternative versions of the hypothesis.

First, to the extent that the decision to replace a central bank governor must be agreed to by more than one veto player, then we should expect more infrequent turnover of central bank governors in countries with multiple veto players in government, and in particular in countries where there is evidence that there are multiple veto players with divergent preferences. This might be the case, for example, in a country with a coalition government where all coalition members might have a say in any decision to replace the central bank governor. Because our variable *governor turnover* is a direct measure of the frequency of policy change, this is a straightforward prediction.[23]

We also test a second version of Prediction 3. Logically it should be the case that the replacement of governors will become more difficult when a central bank's statutes offer tenure guarantees *and* when there are multiple political veto players with different preferences over economic policy. The most relevant tenure guarantees would involve a long term of office and provisions making it difficult for the central bank governor to be replaced in the case of a conflict over policy. In countries where decisions over replacing the central bank governor would normally

be made by a single veto player, then legal guarantees of tenure can have the effect of increasing the number of veto players whose accord is necessary to replace the central bank governor. So, for example, in the absence of tenure guarantees the executive alone might be able to dismiss the central bank governor, but once such guarantees are in place, both the executive and legislature would need to agree to pass a law removing the tenure guarantees before the governor could be removed from office. In contrast, in countries where there is only one veto player, it may be as easy to alter legal restrictions on dismissal as it would be to remove a central bank governor in a country without such restrictions. Given that we lack accurate data on the number of veto players that would normally be able to block an attempt to remove the central bank governor, in what follows we test both variants of Prediction 3.

Equation 16 is the specification of a test of this hypothesis, (recalling that *CEO* measures legal protection of the tenure of the central bank governor and the *governor turnover* measures the frequency with which central bank governors are replace following changes in government).[24]

(16) $$governor\ turnover_{it} = \alpha_t + \beta_1 CEO_{it} + \beta_2 pol\ inst._{it} + \beta_3 (pol\ inst._{it})*(CEO_{it}) + \varepsilon_{it}$$

Table 4 reports the estimates from six versions of (16). We begin in Regressions 1-3 by asking only whether governor turnover following elections is less frequent in countries with multiple veto players in government. These regressions therefore test the first variant of Prediction 3, that checks and balances in government should directly reduce the rate of governor turnover. The coefficients on both proxies for the number of veto players are negative and significant, as is the coefficient on *political polarization*. Political interference with central banks is less frequent in countries with multiple veto players having divergent preferences.

[Insert Table 4 about here]

In Regressions 4-6 we consider the second variant of Prediction 3: tenure guarantees should be more effective in reducing governor turnover in countries where there are multiple veto players in government *and* where veto players are polarized. That is, we expect the interaction term *pol inst.*CEO* to be negative. In each of the three regressions the interaction term has the expected

negative sign and is statistically significant for *log check* and *political constraints*. An increase in tenure protections *CEO* reduces *governor turnover* only for in the presence of multiple veto players (or polarized veto players in the case of *political polarization*). However, the conditional standard error of this effect is quite sizeable in all regressions – even at very high levels of checks and balances, it is impossible to reject the hypothesis that the effect is zero. We therefore find strong evidence to support the conclusion that the presence of multiple polarized veto players reduces political influence on central banks, and significant, but weaker evidencethat multiple veto players increase the effectiveness of legal protections for central bank governors.

Robustness

A number of possible concerns could be raised about our core empirical results. These include the possibilities that they are driven by serial correlation, by the endogeneity of legal central bank independence to inflation or lagged inflation, by the effect of omitted variables, or by outliers. The evidence presented in this section indicates that these do not provide plausible alternative explanations of our empirical findings.

Results of Lagrange multiplier tests suggest serial correlation of the error terms might have led to inconsistent estimates of standard errors in the tests in Table 1. However, the results in Table 1 are robust to controls for serial correlation (that is, the inclusion of log inflation, lagged one period). At the same time, it is possible that *CBI* is endogenous to inflation. Empirically, in our sample we find little evidence that central bank independence is endogenous to lagged inflation, nor is *CBI* endogenous to contemporary inflation.

A potential omitted variable in our regressions is income per capita. A country's level of income might simultaneously influence both inflation and the efficacy of an independent central bank. However, when entered into our Table 1 regressions, the log of real GDP per capita is never significant and leaves the estimates of the interaction terms nearly unchanged. Given that our checks and balances measures are highly correlated with levels of per capita GDP, we also consider whether the significance of our interaction terms *CBI**checks simply reflects the previous finding that legal

central bank independence has a more negative effect on inflation in wealthy countries. To assess this possibility, we compare the explanatory power of the specifications in Table 1 with a specification that substitutes *log GDP* and *log GDP*CBI* for the respective checks variables and checks**CBI* variables. Using *J*-tests first proposed by Davidson and MacKinnon (1981), we rejected the GDP specification in favor of the original specifications in Table 1 regressions 2-4. In regression 5 we rejected the *political polarization* specification in favor of the GDP specification.[25]

Our results are also robust to two other variables omitted in Table 1, and to the exclusion of influential outliers.[26] We find that an interaction term *openness*CBI* does not affect the results in Table 1.[27] It might also be argued that political instability explains our results: countries that exhibit checks and balances are less stable, and it is their instability, rather than checks and balances, that generates our results. The evidence suggests that this is not the case, however.[28]

Conclusion

Multiple veto players and delegation to independent agencies have attracted great attention as institutional mechanisms through which governments can enhance the credibility of their commitments. This paper advances our understanding of the role of veto players and delegation in several ways and tests these advances in the context of independent central banks in a broad set of countries.

This paper contains two contributions to the understanding of veto players. We rigorously identify theoretically and empirically the conditions under which additional veto players can mitigate the problem of credible commitment. Our analysis goes beyond the problem of policy stability that is the focus of much of the current veto player literature. In addition, the analysis shows that the impact of veto players depends on the certainty with which players can anticipate future *status quo* or default outcomes. Multiple veto players have more limited effects in more volatile policy environments characterized by exogenous shocks.

With respect to the literature on delegation, the argument here highlights an additional effect of delegation not typically discussed. Delegation enhances credible commitment, and does so the

more divergent are the interests of the competing veto players and, especially, the closer are the interests of the non-agenda setter to those of the agency to which authority has been delegated.

The evidence for many of these points is direct and, unlike much of the empirical evidence in this area it derives from diverse institutional settings in the developed and developing world. Central banks are associated with lower inflation (that is, greater credibility of government monetary policy) in the presence of checks and balances, and the turnover of central bank governors is reduced when governors have tenure protections supported by political checks and balances. We find as well, and consistent with the theory, that the impact of checks and balances on inflation (credibility) is greater in more polarized societies.

These results suggest that policy reformers face frustration if, in the absence of appropriate political institutions, they grant policy making authority to formally independent agencies. It is undeniable that these institutions, such as courts or central banks, can sometimes achieve a high level of prestige and respect such that citizens are willing to turn out governments that abridge their independence. However, at least in the case of central banks, the evidence suggests that prestige alone is insufficient to guarantee independence. Political institutions, instead, are crucial to the sustainability and effectiveness of decision making by independent agencies.

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Table 1
Setting monetary policy in four institutional frameworks

	One veto player	Two veto players
No delegation	1. Public fixes expected inflation 2. Supply shock occurs 3. Veto player sets inflation rate	1. Public fixes expected inflation 2. Supply shock occurs 3. Agenda setter proposes rate of inflation. 4. Second veto player accepts or refuses proposal. 5. If second veto player refuses, status quo rate of inflation prevails
Delegation	1. Public fixes expected inflation 2. Supply shock occurs 3. CB sets inflation rate 4. Veto player can override CB	1. Public fixes expected inflation 2. Supply shock occurs 3. CB sets inflation rate 4. Both veto players can agree to override the CB. If no override, CB inflation rate prevails 5. If veto players override, agenda setter proposes rate of inflation. 6. Second veto player accepts or refuses proposal. 7. If second veto player refuses, status quo rate of inflation prevails

Table 2

Checks and balances, polarization, and central bank independence

Dependent variable: log inflation	**(1)**	**(2)**	**(3)**	**(4)**
Constant	-0.976 (0.325)	-2.17 (0.63)	-2.30 (0.35)	-1.93 (0.31)
CBI	0.106 (0.635)	3.48 (1.82)	2.68 (1.07)	1.24 (0.88)
Openness	-1.17 (0.28)	-1.22 (0.29)	-1.20 (0.32)	-1.37 (0.34)
log check	-0.664 (0.208)	0.473 (0.533)		
*CBI * log check*		-3.16 (1.48)		
Political constraints (polcon)			1.13 (0.54)	
*CBI*polcon*			-5.10 (1.52)	
political polarization				0.558 (0.345)
*CBI*political polarization*				-1.95 (0.78)
R^2	0.21	0.24	0.36	0.16
N	123	123	164	123

Note: OLS with White's heteroskedastic consistent standard errors reported in parentheses. Period dummies not reported.

Table 3

Estimated effect on log inflation of a one-standard deviation increase in central bank independence

	Log(checks)	Political constraints
one veto player	0.002	0.238
	(0.077)	(0.110)
two veto players	-0.116	-0.094
	(0.088)	(0.058)
three veto players	-0.208	-0.182
	(0.116)	(0.066)

Note: Standard errors in parentheses. In the case with one veto player *Log(checks)* = 1.09 and *political constraints* = 0.167. With two veto players, *Log(checks)*=1.38 and *political constraints*=0.67. With three veto players *log(checks)*=1.61 and *political constraints*=0.80.

Table 4
Political influence on the central bank, checks and balances, and polarization

Dependent variable: central bank governor turnover	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Constant	.491 (.088)	.345 (.074)	.285 (.081)	.274 (.116)	.187 (.084)	.238 (.089)
CEO	.086 (.138)	.068 (.127)	.088 (.142)	.581 (.271)	.422 (.180)	.183 (.168)
log check	-.222 (.063)			.00339 (.1343)		
*CEO * log check*				-.518 (.299)		
political constraints		-.169 (.081)			.187 (.166)	
*CEO*polcon*					-.762 (.323)	
political polarization			-.086 (.044)			.045 (.132)
*CEO*polarization*						-.269 (.232)
R^2	0.10	0.05	0.02	0.12	0.07	0.03
N	112	152	112	112	152	112

Note: Period dummies not reported.

Figure 1: Delegation with two veto players

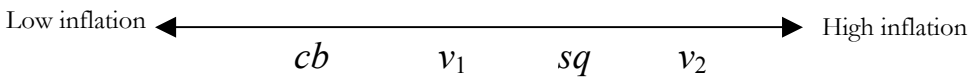
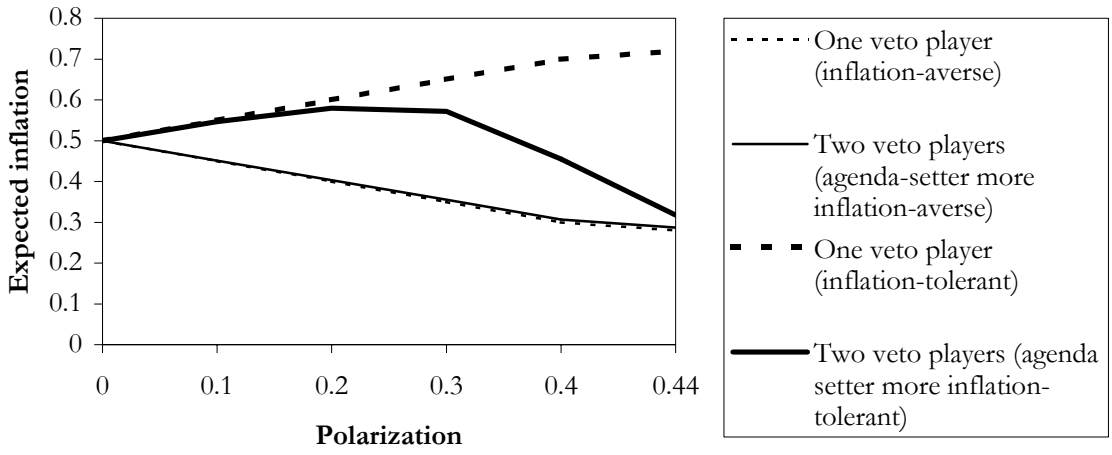
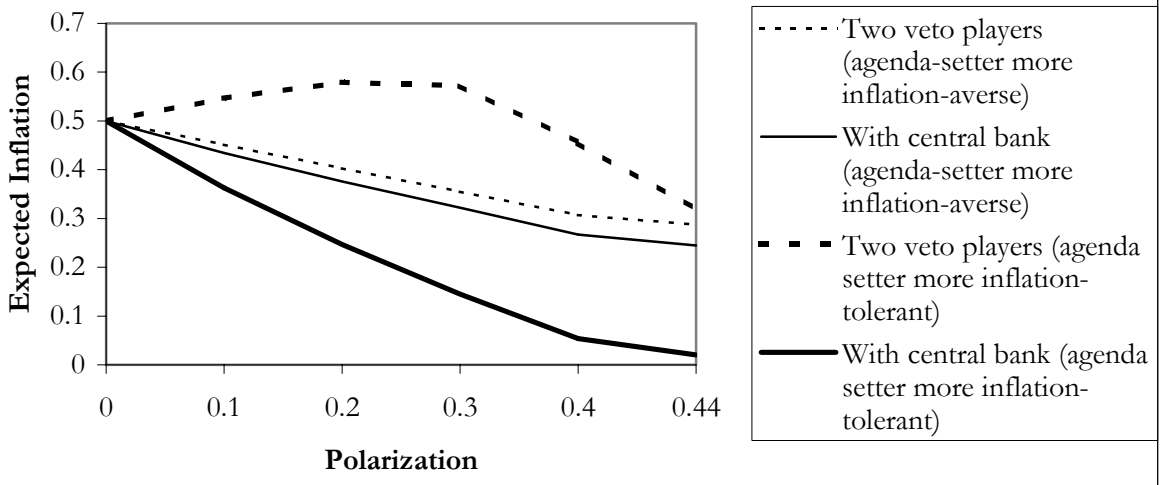


Figure 2: The effect of multiple veto players and polarization on expected inflation



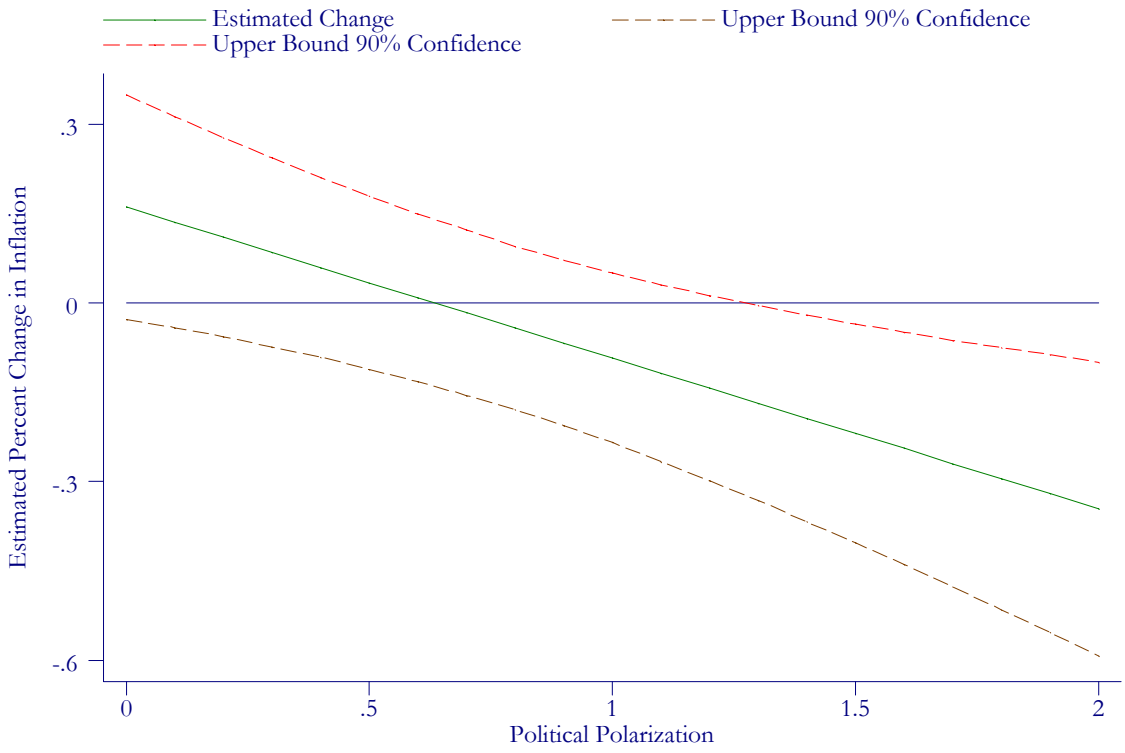
Note: At Polarization = 0, b_N=b_A=.5. Increasing polarization is mean-preserving (e.g., at polarization = .4, b_N=.7 and b_A=.3). More and less inflation-tolerant refers to whether b_N is less than or greater than b_A. The shock parameter c = 5, and desired output y^*=1. Note that the simulation is conducted over those ranges of polarization where all cases have positive probability.

Figure 3: The effect of central bank independence on expected inflation



See Figure 1 for parameter values

Figure 4: Estimated effect of an increase in central bank independence at different levels of polarization



Note: Change in CBI is one standard deviation =0.13

Appendix 1: Summary statistics, and the *checks* and *political polarization* measures

Variable	No. obs.	mean	std. Dev.	min.	max.
log inflation	217	-2.53	1.12	-5.81	0.81
CBI	236	0.34	0.13	0.09	0.69
CEO	236	0.48	0.20	0.06	0.94
Governor turnover	194	0.26	0.33	0	1.5
Executive constraints	226	4.73	2.24	1	7
log checks	133	0.95	0.47	0	1.92
political constraints	179	0.27	0.19	0	0.65
Openness	197	0.30	0.23	0.03	1.90
political polarization	132	0.51	0.78	0	2
log GDP	171	1.18	1.02	-1.26	280

Appendix 2: Derivation of expected inflation under checks and balances

Private actors solve for expected inflation using equation (5), rewritten here as $\pi^e = q_1\left[\frac{b_A(\pi^e - \hat{\varepsilon}_1 + y^*)}{1+b_A}\right] + q_2\pi^e + q_3\left[\frac{2b_N(\pi^e - \hat{\varepsilon}_3 + y^*)}{1+b_N} - \pi^e\right] + q_4\left[\frac{b_A(\pi^e - \hat{\varepsilon}_4 + y^*)}{1+b_A}\right]$ where the q_i's are the probabilities of each of the four decision making outcomes and sum to one, and the $\hat{\varepsilon}_i$ are the expected values of the range of economic shocks over which these four possible outcomes can occur.

The probability q1,describes the likelihood that the shock will be such that $\pi^e < \pi_A < \pi_N$. That is, $q1 = \text{pr}\left[\pi^e < \frac{b_A}{1+b_A}(y^* - \varepsilon + \pi^e)\right]$ or

(A.1) $q_1 = \text{pr}\left[\varepsilon < -\frac{1}{b_A}\pi^e + y^*\right]$.

Similarly, q_2 is the probability that $\pi_A < \pi^e < \pi_N$ or

(A.2) $q_2 = \text{pr}\left[-\frac{1}{b_N}\pi^e + y^* > \varepsilon > -\frac{1}{b_A}\pi^e + y^*\right]$.

q_3 is $\text{pr}\left[\pi_N < \pi^e < 2\pi_N - \pi_A\right]$, or

(A.3) $$q_3 = \text{pr}\left[-\frac{1}{b_N}\pi^e + y^* < \varepsilon < \pi^e + y^* - \frac{(1+b_A)(1+b_N)}{(1+b_A)2b_N - (1+b_N)b_A}\pi^e\right]$$

and q_4 is $\text{pr}\left[\pi_N < 2\pi_N - \pi_A < \pi^e\right]$, or

(A.4) $$q_4 = \text{pr}\left[\varepsilon > \pi^e + y^* - \frac{(1+b_A)(1+b_N)}{(1+b_A)2b_N - (1+b_N)b_A}\pi^e\right]$$

Set $K = \frac{(1+b_A)(1+b_N)}{(1+b_A)2b_N - (1+b_N)b_A}$. In order to fix the value of inflation that they expect, the private actors solve for the q_i's and $\hat{\varepsilon}_i$'s in terms of the parameters and expected inflation. They then substitute the resulting terms into equation (10) and solve for expected inflation in terms of desired output and the preference parameters b_i. To carry out this exercise, assume ε is distributed uniformly over the range $[-c, c]$. Given this uniform distribution, (A.1) can be rewritten as

(A.4) $$q_1 = \int_{-c}^{\frac{1}{b_A}\pi^e + y^*} \frac{1}{2c}\,d\varepsilon = \frac{1}{2c}\left(-\frac{1}{b_A}\pi^e + y^* + c\right)$$

The average value of the shock over this range, $\hat{\varepsilon}_1$, is therefore

(A.5) $$\hat{\varepsilon}_1 = \frac{1}{2}\left(-\frac{1}{b_A}\pi^e + y^* - c\right)$$

Proceeding in a parallel fashion with the remaining probabilities,

(A.6) $$q_2 = \frac{1}{2c}\pi^e\left(\frac{1}{b_A} - \frac{1}{b_N}\right).$$

(A.7) $$\hat{\varepsilon}_2 = \frac{1}{2}\left[2y^* - \pi^e\left(\frac{1}{b_A} + \frac{1}{b_N}\right)\right]$$

(A.8) $$q_3 = \frac{1}{2c}\pi^e\left(1 - K + \frac{1}{b_N}\right)$$

(A.9) $$\hat{\varepsilon}_3 = \frac{1}{2}\left[2y^* + \pi^e\left(1 - K + \frac{1}{b_N}\right)\right]$$

(A.10) $$q_4 = \frac{1}{2c}\left[\pi^e(K-1) - y^* + c\right]$$

(A.11) $$\hat{\varepsilon}_4 = \frac{1}{2}\left[c + y^* + \pi^e(1-K)\right]$$

Substituting these expressions into equation (10) and manipulating gives the following.

(A.12)

$$(\pi^e)^2\left[\frac{b_A}{(1+b_A)}\left(-\frac{1}{b_A}-\frac{1}{2b_A^2}+K-1+\frac{(K-1)^2}{2}\right)+\frac{1}{b_A}-\frac{1}{b_N}+\left(1-K+\frac{1}{b_N}\right)\left(\frac{2b_N}{(1+b_N)}\left(1-\frac{1}{2}\left(1-K-\frac{1}{b_N}\right)\right)-1\right)\right]-\pi^e\left(\frac{2c}{1+b_A}\right)+\frac{b_A}{1+b_A}2y^*c=0$$

If $b_A > b_N$, a similar analysis can be performed. In this case, though, the probabilities q attached to the inflation outcomes in equation (10) are reversed:

$q_1 = \text{pr}\left[\varepsilon > -\frac{1}{b_A}\pi^e + y^*\right]$, $q_2 = \text{pr}\left[-\frac{1}{b_N}\pi^e + y^* < \varepsilon < -\frac{1}{b_A}\pi^e + y^*\right]$,

$q_3 = \text{pr}\left[-\frac{1}{b_N}\pi^e + y^* > \varepsilon > (1-K)\pi^e + y^*\right]$, and $q_4 = \text{pr}\left[\varepsilon < (1-K)\pi^e + y^*\right]$. Substituting these, and the corresponding values for $\hat{\varepsilon}_i$, into equation (10) and solving, yields the following expression for expected inflation when the Executive is more inflation tolerant than the Legislature:

(A.13)

$$(\pi^e)^2\left[\frac{b_A}{(1+b_A)}\left(\frac{1}{b_A}+\frac{1}{2b_A^2}+1-K+\frac{(1-K)^2}{2}\right)+\frac{1}{b_N}-\frac{1}{b_A}+\left(K-1-\frac{1}{b_N}\right)\left(\frac{2b_N}{(1+b_N)}\left(1-\frac{1}{2}\left(1-K-\frac{1}{b_N}\right)\right)-1\right)\right]$$
$$-\pi^e\left(\frac{2c}{1+b_A}\right)+\frac{b_A}{1+b_A}2y^*c=0$$

Appendix 3: Derivation of expected inflation under checks and balances with an independent central bank

Rewriting equation (9), for $b_A < b_N$, expected inflation is given by

$$\pi^e_{CB} = q_1\left[\frac{b_A(\pi^e_{CB}-\hat{\varepsilon}_1+y^*)}{1+b_A}\right]+q_2\left[\frac{2b_A(\pi^e_{CB}-\hat{\varepsilon}_2+y^*)}{1+b_A}-\pi^e_{CB}\right]+$$

$$q_3\left[2\left(\pi^e_{CB}-\hat{\varepsilon}_3+y^*\right)\left(\frac{b_A}{1+b_A}-\frac{b_N}{1+b_N}\right)+\pi^e_{CB}\right]+q_4\left[\frac{b_A(\pi^e_{CB}-\hat{\varepsilon}_4+y^*)}{1+b_A}\right].$$

If the veto players override the central bank's proposal after the shock is revealed and the private actors have set expected inflation, the political actors make their determination of a new inflation policy exactly as if there were no central bank. The probabilities q_i and the expected shocks $\hat{\varepsilon}_i$ are calculated over the same limits as in the corresponding case in Appendix 2 ($b_A < b_N$), with no

central bank.

As in Appendix 2, substituting the expressions for the probabilities and expected shocks into equation (13) and manipulating, we obtain the following expression for expected inflation under central bank independence and checks and balances:

$$(A.14)\quad \left(\pi^e_{CB}\right)^2\left[\frac{b_A}{1+b_A}\left(-\frac{1}{b_A}-\frac{1}{2b_A^2}+K-1+\frac{(K-1)^2}{2}\right)+\frac{2b_A}{1+b_A}\left(\frac{1}{b_A}-\frac{1}{b_N}\right)\left(1+\frac{1}{2}\left(\frac{1}{b_A}+\frac{1}{b_N}\right)\right)-\frac{1}{b_A}+\frac{1}{b_N}\right.$$

$$\left.+\left(1-K+\frac{1}{b_N}\right)\left(\left(\frac{2b_A}{1+b_A}-\frac{2b_N}{1+b_N}\right)\left(1-\frac{1}{2}\left(1-K-\frac{1}{b_N}\right)\right)+1\right)\right]+\pi^e_{CB}\left[-\frac{2c}{(1+b_A)}\right]$$

$$+\frac{b_A}{1+b_A}(2cy^*)=0.$$

Since the central bank conditions its policy choice on the preferences of the most inflation-averse political decision maker, the case where $b_A > b_N$ changes the payoffs that generated A.14. In particular, the central bank does not propose policies such that the agenda setter is just indifferent between the proposal and what would prevail if the central bank decision were overridden and the checks and balances outcome (π_{CH}) prevailed, $\pi = 2\pi_A - \pi_{CH}$. Instead, the central bank proposes $\pi = 2\pi_N - \pi_{CH}$, such that the non-agenda setter is just indifferent. Expected inflation is therefore the solution to

$$\pi^e_{CB} = q_1\left[\left(\frac{2b_N}{1+b_N}-\frac{b_A}{1+b_A}\right)(\pi^e_{CB}-\hat{\varepsilon}_1+y^*)\right]+q_2\left[\frac{2b_N(\pi^e_{CB}-\hat{\varepsilon}_2+y^*)}{1+b_N}-\pi^e_{CB}\right]+$$

$$q_3\pi^e_{CB}+q_4\left[\left(\frac{2b_N}{1+b_N}-\frac{b_A}{1+b_A}\right)(\pi^e_{CB}-\hat{\varepsilon}_4+y^*)\right].$$

The probabilities q_i and the expected shocks $\hat{\varepsilon}_i$ are calculated over the same limits as in the corresponding case ($b_A > b_N$)in Appendix 2. Solving, we get the following solution:

$$(A.15)\quad \left(\pi^e_{CB}\right)^2\left[\left(\frac{2b_N}{1+b_N}-\frac{b_A}{1+b_A}\right)\left(\frac{1}{b_A}+\frac{1}{2b_A^2}+1-K-\frac{(1-K)^2}{2}\right)+\frac{2b_N}{1+b_N}\left(\frac{1}{b_N}-\frac{1}{b_A}\right)\left(1+\frac{1}{2}\left(\frac{1}{b_A}+\frac{1}{b_N}\right)\right)\right.$$

$$\left.-\frac{1}{b_N}+\frac{1}{b_A}+K-1-\frac{1}{b_N}\right]+2c\pi^e_{CB}\left(-1+\frac{2b_N}{1+b_N}-\frac{b_A}{1+b_A}\right)+2cy^*\left(\frac{2b_N}{1+b_N}-\frac{b_A}{1+b_A}\right)=0.$$

[1] See, for example, Weingast and Moran, 1983; also Muris' comment and their rejoinder (1984).

[2] Governments may refrain from overriding central bank decisions because such action may have adverse reputational effects. However, as Keefer and Stasavage (2002) argue, it is not clear why governments who could build a reputation would need a central bank, since they could also build a reputation even if they retained discretionary control of policy. In any case, if reputational concerns rather than institutions are the important force protecting central bank decisions from override, our empirical results should reject the hypotheses we derive below.

[3] While different bargaining assumptions are possible, this seems among the most plausible and substantially increases tractability.

[4] Walsh (1998 pp.205-218) presents a detailed model that further supports using private sector actions as the default outcome. His model includes a money demand equation and a more fully defined economic structure, showing clearly that actual inflation depends on both the rate of money growth chosen by policymakers and on the expected rate of inflation in private sector contracts.

[5] Our model therefore goes beyond Moser (1999), who assumes that the two veto players must *always* make a decision, avoiding the introduction of a *status quo* entirely. Our approach has the advantage of greater realism and of a closer connection to relevant literature. For example, it is widely accepted, since Romer and Rosenthal (1979), that the decisions of veto players make are influenced by the outcome that would prevail should they make no decision.

[6] There are a number of reasons why multiple political actors might have an influence on monetary policy in the absence of checks and balances. In a parliamentary system, for example, the minister of finance has nominal control of monetary policy, but monetary policy decisions may well be debated in cabinet or among members of the governing coalition. In presidential systems, legislatures may exercise veto power over the borrowing authority of government.

[7] When $b_N < b_A$, the ordering is: $\pi_{SQ} > \pi_A > \pi_N$; $\pi_A > \pi_{SQ} > \pi_N$; and $\pi_A > \pi_N > \pi_{SQ}$.

[8] In principle, the agenda setter should propose an inflation policy π such that $L_N(\pi) = L_N(\pi_{SQ})$. The expression for π resulting from this quadratic equation, however, renders subsequent analysis intractable. Nevertheless, since the equation is entirely quadratic, we also know that symmetric deviations up or down away from the most preferred π result in symmetric changes to the loss function.

[9] This simplification, without loss of generality, simply eliminates the case where the central banker just chooses his own preferred inflation outcome.

[10] Figures 1 and 2 track expected inflation, not the preferences of the veto players. One cannot infer from Figures 1 and 2, therefore, that the more inflation-tolerant agenda setter would always block the introduction of an independent central bank. On the contrary, the fact that expected inflation is higher when the more inflation-tolerant veto player controls the agenda provides a rationale for that agenda setter to support the introduction of a conservative central bank.

[11] Debate over the Federal Reserve Act was focused almost exclusively on banking regulation rather than on the inflation-fighting characteristics of an independent central bank, however.

[12] Lohmann (1998) conducts time-series tests using German data, which also support Prediction 1.

[13] This prediction does, however, involve "out of equilibrium" behavior – in our model central bank governors are never replaced, because they avoid choosing a rate of inflation that would be overridden by both political veto players. In practice this might happen if the outside opportunities of the central bank governor are adversely influenced by a weak central bank stance against inflation.

[14] This is based on consumer price index data from the IMF, *International Financial Statistics.* An alternative dependent variable used by Cukierman, Webb, and Neyapti (1992) is $\pi/(1+\pi)$.

[15] Following the initial study by Cukierman, Webb, and Neyapti, we divide the three periods as follows, 1960-71, 1972-79, 1980-89.

[16] We use Cukierman, Webb, and Neyapti's weighted index which they call *LVAW*.

[17] This data has recently been updated and corrected by Sturm and de Haan (2001).

[18] In a few cases *governor turnover* could not be coded because a country did not experience a change of government during the period. This results in the exclusion of only 4 potential observations from our Table 3 regressions.

[19] Our results are also robust to the use of a *executive constraints*, a variable from the Polity IV database. Unlike the two measures that are reported here, this is a subjective measure of the extent to which there are "checks" on the executive.

[20] All of the results we report are robust to using a version of *political constraints* that excludes the judiciary as a veto player. Details on the construction of this index can be found in Henisz (1997).

[21] Otherwise this variable would give as much weight to a change from 1 to 2 veto players as from 4 to 5; since our model speaks to the first case and is silent about the second, the log formulation is more appropriate.

[22] See for example Alesina and Summers (1993), Cukierman, Webb, and Neyapti (1992) and Grilli, Masciandro and Tabellini (1991).

[23] In contrast, in our Table 1 regressions the dependent variable, inflation, is not a direct measure of the frequency of policy change, and as a result, predictions about the effect of checks and balances on inflation depend on other intervening variables.

[24] *CEO* is itself composed of four sub-indices which measure legal length of tenure for the central bank governor, restrictions on dismissal of central bank governors in cases of policy conflict, provisions regarding appointment of governors, and restrictions on governors holding other positions simultaneously. A large number of missing observations in the individual sub-indices made it impossible to use them individually. However, given that the sub-indices regarding length of tenure and restrictions on dismissal are the most closely suited to testing Prediction 3, we also repeated Regressions 1-6 from Table 3 using an index equal to the average of these two variables. The results were similar to those reported here, in particular for Regressions 1-3.

[25] These tests involve estimating the two alternative specifications and then re-estimating each specification, adding as an independent variable the predicted value of log inflation from the alternative model. The *t*-statistic on the fitted values can be interpreted as a test of the null that the alternative specification would not add explanatory power to the existing model.

[26] Outliers were identified using dfbeta statistics for the coefficients on our political variables, as well as calculation of cook's distance for individual observations. No countries were repeated outliers across the different regressions in Tables 1 and 3.

[27] Following Romer, 1993 and Franseze, 1999, we added the interaction term *CBI* * *openness* to the Table I specifications and found that it was never significant. More importantly, the *CBI* * checks interaction terms generally retain their significance.

[28] First, the correlation between three measures of political instability and the *checks* variable (all from the Database of Political Indicators) is slightly positive (7 percent) in two cases, and negative (-17 percent) in a third case. Second, our regression results are robust to the inclusion of instability.