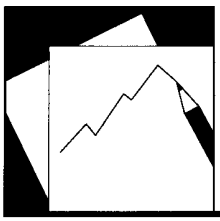
WP/06/256



IMF Working Paper

Goal-Independent Central Banks: Why Politicians Decide to Delegate

Christopher Crowe

INTERNATIONAL MONETARY FUND

 WP/06/256

IMF Working Paper

Research Department

Goal-Independent Central Banks: Why Politicians Decide to Delegate

Prepared by Christopher Crowe[1]

Authorized for distribution by Paolo Mauro

November 2006

Abstract

A motivation for central bank independence (CBI) is that policy delegation helps politicians manage diverse coalitions. This paper develops a model of coalition formation that predicts when delegation will occur. An analysis of policy preferences survey data and CBI indicators supports the predictions. Case studies, drawn from several countries' recent past and the nineteenth-century United States, provide further support. Finally, the model explains why the expected negative relationship between CBI and inflation is not empirically robust: endogenous selection biases the estimated effect towards zero. The data confirm this.

JEL Classification Numbers: C31, C72, D72, E31, E58

Keywords: Central bank independence, inflation, coalition formation, treatment effects

Author's E-Mail Address: ccrowe@imf.org

[1] The author would like to thank, subject to the usual caveats, colleagues at the London School of Economics, the IMF, and elsewhere who have provided useful comments on earlier drafts of this paper, particularly my thesis supervisor Gianluca Benigno and also Tim Besley, Ellen Meade, and David Stasavage.

Contents Page

I. Introduction

> I'm the decider, and I decide what is best.
> President George W. Bush, April 18, 2006.

Politicians are generally happy to exercise their power to decide things. Monetary policy is perhaps the most glaring exception. Delegation to an independent central bank is now the norm.

However, the type of delegation differs widely across countries. One broad institutional model is **goal independence**, under which the principal (the government) delegates to the agent (the central bank) full policymaking powers, including the power to decide the appropriate policy target. The U.S. Federal Reserve, which has a broad mandate to target stable prices and full employment, is considered by most commentators to enjoy goal independence. It has the authority to prioritize between its employment and price stability goals and to interpret the latter (and operationalize via targets for monetary aggregates, inflation, etc.) as it sees fit. By contrast, the Bank of England (post-1997) has **instrument independence**. Its authority to act autonomously is well established within fairly narrowly defined limits: it enjoys freedom of action over its policy instruments in pursuit of a policy target decided by the government.

Of the two models, instrument independence seems to conform with other common institutional arrangements in democratic societies. Other government-sponsored bodies (such as the police, statistical agencies, electoral commissions) usually operate on this basis. The much broader mandate implied by goal independence, on the other hand, is rather anomalous. Perhaps only the judiciary enjoys the same degree of autonomy, but even here the delegated authorities (judges) are generally limited to enforcing and interpreting either laws passed by the executive or legislative branch of government or a written constitution, rather than legislating on their own account (Goodhart and Meade, 2004).

One could argue that the independence enjoyed by goal-independent central banks (GICBs) is particularly striking given the political sensitivity of their core role — the conduct of monetary policy. However, this political sensitivity could explain the decision to delegate. Because monetary policy is contentious, it can split otherwise homogeneous political coalitions. Taking monetary policy "off the table" makes it easier for these political actors to effectively combine to control policy with respect to other key issues. Far from being constrained, politicians who decide to delegate may see their overall freedom of action enhanced.

To analyze this question, I present a model of an economy whose agents hold heterogeneous views over monetary policy and other policy areas. Specifically, preferences are assumed to differ over monetary policy and a second dimension, where both are dichotomous. Policymaking is modeled via a political economy game which has three stages. In the first stage of the game, "factions" (groups of agents with similar preferences) can form coalitions with each other. In the second stage, coalitions determine their policy platforms. In the final stage, the largest coalition is given the opportunity to set policy.

The game has a zero-sum element, so that the benefit of forming a broad coalition is obvious: the largest coalition is the one that sets policy. The cost of coalition formation lies in the second stage of the game: individual factions within coalitions must engage in (potentially costly) political lobbying in an effort to influence the coalition's platform.[2] This cost arises from the heterogeneity of potential governing coalitions, which in turn reflects the multiplicity of the policy space.

The motive for delegating the monetary policy decision to a fully (goal-) independent central bank is that it removes the intracoalition conflict over monetary policy from the political arena.[3] I derive the conditions under which delegation will occur. In equilibrium, the cost of coalition formation depends upon the relative sizes of the factions within each coalition. Since effective lobbying strength depends on faction size (because larger factions have lower per-member lobbying costs), equal-sized factions (with equal chances of winning) will invest heavily in lobbying for their preferred outcome. The contest will therefore be costly for the coalition as a whole, motivating both sides to take monetary policy "off the table." By contrast, if one faction dominates in terms of size, then lobbying strengths are clearly mismatched, the likely victor in the policy dispute is clear, and no faction will commit significant resources in the dispute. Incentives to delegate will be minimal.

How can we test this prediction? Since (as I demonstrate) coalitions form in equilibrium based on unanimity along one policy dimension and disagreement over the other dimension, then the relative size of the factions within each coalition is determined by the correlation between agents' positions with respect to the two policy dimensions. When this correlation increases, coalition preferences become more homogeneous (one faction dominates) and the costs of political campaigning relative to its benefits are lower. Correlated preferences make it easier to partition society politically and lessen the need for institutional remedies. Other things being equal, GICBs are less likely to be established in societies where preferences over the two policy dimensions are more closely correlated. This is the prediction I take to the data.

The model has a further implication: if goal independence is selected endogenously as in the model, then its estimated effect on inflation will be biased upwards, towards zero if the causal effect is actually negative (as seems likely). This is because goal independence will be endogenously selected when the central banker is likely to be neither too "hard" nor too "soft" on inflation, and since central bankers are conservative on average, it is largely the former ("inflation nutters") who are ruled out. This could then explain why the estimated negative effect of CBI on inflation, at least according to the standard de jure measures, has not been identified outside a narrow subset of advanced economies (Eijffinger and De Haan, 1996). Section III includes a further discussion of these issues, while section IV presents

[2] This policy game can be thought of as representing all agents in the economy, although it might make more sense to think of the players in the game as political representatives, drawn in rough proportion to the population as a whole. The first, coalition-formation, stage of the game can then be interpreted as either pre-election party formation (in a majoritarian system), post-election coalition-building inside a legislature (in a proportional system), or simply as factionalism within a ruling group (in a nondemocratic system).

[3] Delegation is assumed to require unanimity amongst all factions (so that only Pareto-improving delegation occurs).

evidence of this bias in Ordinary Least Squares (OLS) estimates of the effect of CBI on inflation and of a strong negative effect of CBI on inflation once endogenous selection is modeled explicitly.

This paper draws on and contributes to several strands of literature: a mainstream macroeconomics literature on CBI; a political science critique of this approach; a newer political economy literature that combines elements of both; a parallel political science literature that takes a historical, case-study approach; and game theoretic literatures on both lobbying and coalition formation. Of these literatures the first is perhaps the largest and best known (see the surveys in Persson and Tabellini, 2000; Drazen, 2000; and Eijffinger and De Haan, 1996, for useful summaries). For our purposes its key contribution (Fischer, 1995) has been to clarify the distinction between goal independence—the full delegation embodied in Rogoff's (1985) "conservative" central banker model—and instrument independence—the kind of relationship suggested by agency models (Walsh, 1995). This paper makes the distinction more concrete by illustrating how the different institutional forms mold political incentives.

These economists' accounts of central bank behavior have come under criticism from a political science approach to institutional behavior, which has tended to focus on the actions and incentives of heterogeneous, conflicting groups in society (Wooley, 1984; Bowles and White, 1994). This paper takes heterogeneity seriously: indeed, it provides an account of CBI based on how preference heterogeneity shapes political incentives.

In this respect it follows other recent contributions to the political economy literature that have started to address agent heterogeneity, conflict over policy, and the role of the central bank within such an environment. The role of delegation in these accounts typically lies in its ability to alter the strategic interaction between political actors in the determination of monetary policy. For instance, Keefer and Stasavage (2003) show that an independent central bank can partially solve the time inconsistency problem even if policymakers can decide to overrule its decisions, but only if there are "multiple veto players," that is, checks and balances. Moser (1999) uses similar logic to predict that delegation is more likely under political systems with checks and balances.

The motivation for delegation in these papers is the standard time-inconsistency problem.[4] However, the almost exclusive focus on time inconsistency has been criticized (Blinder, 1997; and Posen, 1993). This paper focuses on the coalition-formation process as an alternative rationale for delegation, presenting in a game theoretic framework ideas that have been explored more discursively in the political science literature. For instance, Bernhard (1998) argues that delegation helps to reduce informational asymmetries between different members of the governing political coalition, reducing the potential for costly

[4]Eggertsson and Le Borgne (2003) model the decision to delegate in a similar economic framework, as a balance between the cost (inability to remove incompetent officeholders via the electoral process) and the benefit (the independent central banker can focus on a longer time horizon).

political disputes.[5] Bernhard and Leblang (2002) focus on the wider benefits of CBI in terms of coalition formation. Monetary policy rules (including CBI) "take monetary policy 'off the table,' *removing a potential source of conflict and allowing parties to focus on issues that unite them*. ... Monetary commitments, therefore, can help political parties manage diverse coalitions."[6]

Bernhard and Leblang (2002) show that CBI tends to improve the durability of cabinet governments and also discuss some case studies that provide further support for their argument; in section V, I present a synthesis of their arguments along with some further historical evidence that supports the coalition-formation account of delegation. The historical record provides a rich vein for analyzing these issues, which other authors have drawn on to motivate their accounts of CBI. For instance, Goodman (1991) argues that CBI is more likely in countries where there exists a powerful coalition in favour of price stability (such as a powerful banking sector), and when this coalition does not expect to be in power for long and therefore wants to bind the hands of its successor.[7] He draws on the postwar experience of several European countries, notably (West) Germany, to support this contention.[8]

This paper also contributes to the game theoretic literature on coalition formation, and its exploration of the costs and benefits of coalition formation echoes themes explored elsewhere.[9] For instance, Levy (2004) argues that coalitions (or political parties) allow groups of politicians in multidimensional policy environments to commit to a policy platform drawn from a wider subset of policies than their individual preferred policies. Similarly, in the model presented in this paper, heterogeneous coalitions can commit to offer (in probabilistic terms) an outcome different from the ideal policy of any of their constituent factions, since in a multidimensional policy setting political actors are willing to compromise on one dimension to secure their preferred policy on another. However, there is a tension between coalition size and preference heterogeneity which can be diffused by delegation. These opposing centripetal and centrifugal forces have been discussed elsewhere in the coalition formation literature (Demange, 1994). To model these forces

[5] Interestingly, Bernhard (1998) finds that the heterogeneity of class support for left-wing parties (captured in the "Alford Index") is positively related to CBI. His argument is that heterogeneity within (potential) governing coalitions increases the probability that informational asymmetries could trigger costly political disputes, thereby increasing the role of delegation.

[6] Bernhard and Leblang (2002), p. 807. Italics added for emphasis.

[7] Although when the policymaker is motivated by electoral success rather than ideological or policy preferences, it might be advantageous to not bind the hands of any successor. For instance, a "conservative" candidate might prefer not to delegate policy to a conservative central banker, so that the electorate's fear of higher inflation under the opposing candidate would motivate them to vote for the conservative (see Milesi-Ferretti, 1994, where a similar argument is pursued with respect to wage indexation).

[8] Lohmann (1998) makes similar points, arguing that Germany's federal constitution and the strong role of the *Lander* in the governance of the Bundesbank helped to cement the institution's independence over time.

[9] See Osborne and Rubinstein (1994, Section IV) for a discussion of the application of cooperative game theory to the issue of coalition formation. Bloch (1997) analyses the application of noncooperative game theory to the issue. Bloch argues that noncooperative game theory is more useful for analysing games where agents' payoffs depend on the entire partition of society (as in this paper) and not merely the coalition(s) of which they are members. Levy (2002) contains an application of both cooperative and noncooperative techniques, illustrating the relative merits of the two.

more concretely, I develop a rent-seeking model derived from Hillman (1989) that captures the costs of coalition formation.[10] My contribution to this literature is to demonstrate how faction size can endogenously determine effective lobbying strength.

The rest of the paper is organized as follows. Section II presents the model. Section III outlines (a) the model's key prediction with respect to the distribution of preferences over monetary policy and the likely institutional choice, and (b) some implications for the estimated relationship between institutional choice and inflationary outcomes. Section IV presents some empirical tests, while section V discusses some case-study evidence that supports the theory. Section VI concludes.

II. The Model

A. Demographics, Preferences, and the Political Economy Game

The economy consists of a large, even, finite set of agents N with preferences over policies on two dimensions $\left\{\underline{\theta}, \overline{\theta}\right\}$, where each policy choice is dichotomous. Each agent derives the same utility $V^j, j \in \left\{\underline{\theta}, \overline{\theta}\right\}$ from the implementation of each of her preferred policy choices and no utility from the implementation of each of the alternative policies. The dimensions are defined according to the relative utility (i.e., how "contentious" the policy is): $V^{\overline{\theta}} \geq V^{\underline{\theta}}$. Agents are therefore of four types depending on their ideal policy pair $\left\{\underline{\theta}, \overline{\theta}\right\}$. Opinion over each policy dimension is distributed evenly so that a proportion $\frac{1}{2}$ prefers each policy outcome for each policy dimension. Define the proportion of agents with ideal policy $\{0,0\}$ as $\frac{\sigma}{2} \in \left[\frac{1}{4}, \frac{1}{2}\right]$. Then by definition the proportions of agents with ideal points $\left\{\underline{\theta}^i, \overline{\theta}^i\right\}$ (where agents who share preferences are denoted as *factions*) are given by:[11]

$$\begin{aligned} \{j,j\} &: \frac{\sigma}{2} \\ \{j,1-j\} &: \frac{1-\sigma}{2} \end{aligned}$$

Note that σ parameterizes the degree of correlation between agents' preferences along the two policy dimensions. When $\sigma = \frac{1}{2}$, there is no correlation between policy preferences; $\sigma = 1$ denotes full correlation.[12]

Agents within each faction act collectively. This allows us to treat the coalition-formation game (see below) as played between four representative players, one drawn from each faction, but weighted according to faction size.

Policymaking is modeled via a political economy game that has three stages:

[10] The rationale for using a rent-seeking model rather than a simple Nash bargaining model is that Pareto-improving delegation requires some welfare cost of policy disagreement. The rent-seeking model with dissipated rents provides a simple and intuitive means of introducing such a cost.

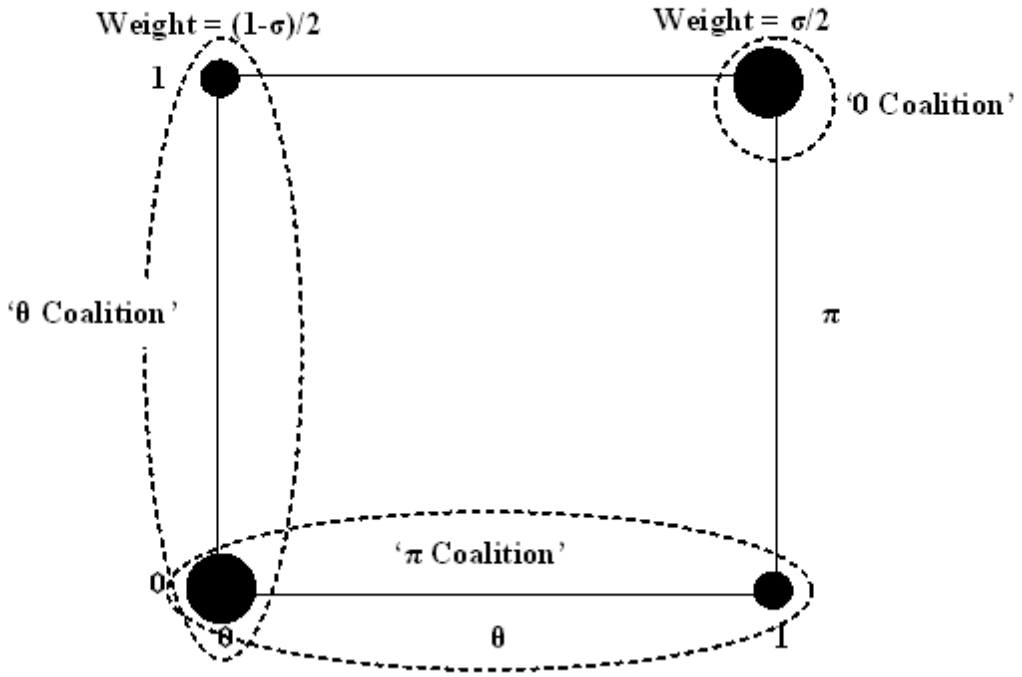
[11] See Figure 1 for a graphical representation of the agents in the economy.

[12] The correlation coefficient, $\rho\left(\underline{\theta}, \overline{\theta}\right) \equiv \frac{Cov\left(\underline{\theta}, \overline{\theta}\right)}{\left(Var(\underline{\theta}) Var\left(\overline{\theta}\right)\right)^{\frac{1}{2}}} = 2\sigma - 1 \in [0,1]$

1. First, in the **coalitional subgame**, players i join a coalition.
2. Each coalition chooses a policy platform. If coalition members disagree about either or both policy dimensions, then policy is contested via a **rent-seeking subgame**, similar to that in Hillman (1989).
3. An **electoral subgame** then gives the largest coalition the opportunity to set policy.

The coalitional subgame is described in Appendix I. I first describe the second and third stages.

Figure 1. Distribution of Agents in the Economy and Some Potential Coalition Structures



Rent-seeking subgame

Assume a given coalition structure. Each policy dimension has two choices $\{0, 1\}$; hence any policy disputed within a coalition has two factions competing for control. Denote the benefit of having one's preferred policy implemented (on a particular policy dimension) V.[13] Each faction $J \in \{S, L\}$ within the coalition makes a dissipated bid to control policy,

[13] Since we are looking at one policy dimension alone, we can drop the superscript.

with value x^J.[14] This cost is shared equally among all members of the faction. The faction that makes the highest bid then sets the coalition's policy platform according to its members' preferences. Since no solution to this problem exists in pure strategies (Drazen, 2000), I assume that factions adopt mixed strategies denoted by the cdf $\Gamma^J(x)$ (from Hillman, 1989, we know that a mixed strategy equilibrium exists).

The n^J agents in each faction $\left(n^L \geq n^S\right)$ make an equal individual contribution $x_i^J = \frac{x^J}{n^J}$ to the bid. Denote the probability of the coalition in question actually controlling policy as $\alpha \in [0,1]$. Then the payoffs for a given x^J with respect to the disputed policy for typical members of each faction are given as:

$$E\left[V_i^L\right] = \alpha\Gamma^S\left(x^L\right)V - \frac{x^L}{n^L} \tag{1}$$

$$E\left[V_i^S\right] = \alpha\Gamma^L\left(x^S\right)V - \frac{x^S}{n^S} \tag{2}$$

The faction's objective is to maximize the expected average payoff of its members.

Electoral subgame

Denoting factions according to their preferences over policies $\left\{\underline{\theta}, \overline{\theta}\right\}$, assume that faction $\{0,1\}$ will never form a coalition with faction $\{1,0\}$ and similarly faction $\{1,1\}$ will never form a coalition with faction $\{0,0\}$: the rent-seeking subgame generates payoffs such that this assumption holds; see equation (4) below. Hence, the choice for faction $\left\{\overline{\theta}^i, \underline{\theta}^i\right\}$ is over forming a coalition with faction $\left\{\overline{\theta}^i, 1-\underline{\theta}^i\right\}$ (a "$\overline{\theta}$ coalition"), with faction $\left\{1-\overline{\theta}^i, \underline{\theta}^i\right\}$ (a "$\underline{\theta}$ coalition"), or on its own (a "0 coalition").

I assume a general electoral decision rule (a function mapping the partition of agents (i.e., the coalition structure) into probabilities of winning for each coalition) in which the probability of winning for each coalition is an increasing function of its size and a decreasing function of the size of other coalitions. More specifically, I assume that the function is sufficiently elastic that a $\overline{\theta}$ or $\underline{\theta}$ coalition (with size $\frac{1}{2}$) wins against a 0 coalition (with maximum size $\frac{\sigma}{2} < \frac{1}{2}$) with probability $\alpha = 1$; that in a contest between two equal-sized coalitions each wins with probability $\alpha = \frac{1}{2}$; and in a four-way contest the larger two factions each win with probability $\alpha = \frac{1}{2}$ and the smaller coalitions have zero probability of winning.

B. Solution

The game can be solved by backwards induction. I first solve the intracoalition lobbying game (stage 2) for a given coalition structure (the third stage of the game then follows automatically from the coalition structure as described above). This gives the payoff for a given coalition structure which then allows us to solve the first stage of the game.

[14] S, L denote, respectively, small and large factions ($n^L \geq n^S$).

The objective of each faction is to maximize the payoff of a representative member. In any mixed strategy equilibrium the expected payoff must be the same for all bids x^J assigned a positive probability. Moreover, no faction's per-member bid will exceed the expected gain from winning αV, and the larger faction's maximum per-member bid will be lower because it only has to match the maximum *total* bid of the smaller faction and can share the cost more widely. Hence:

$$E\left[V^{iL}\right] = \alpha V - \frac{\alpha V n^S}{n^L} = \alpha\left(\frac{n^L - n^S}{n^L}\right)V \tag{3}$$

$$E\left[V^{iS}\right] = \alpha V - \frac{\alpha V n^S}{n^S} = 0 \tag{4}$$

Hence, we can solve for the bidding strategy summarized by $\Gamma(x)$:

$$\Gamma^L(x) = \frac{x}{\alpha V n^S}; x \in \left[0, \alpha V n^S\right] \tag{5}$$

$$\Gamma^S(x) = \frac{n^L - n^S}{n^L} + \frac{x}{\alpha V n^L}; x \in \left[0, \alpha V n^S\right] \tag{6}$$

The associated pdf for each faction's bid is given by:

$$\gamma^L = \frac{1}{\alpha V n^S}; x \in \left[0, \alpha V n^S\right] \tag{7}$$

$$\gamma^S = \frac{1}{\alpha V n^L}; x \in \left[0, \alpha V n^S\right] \tag{8}$$

The probability of the **larger** faction's policy being chosen, defined as ϕ, is then given by:

$$\begin{aligned}\Pr\left[x^S \leq x^L\right] &\equiv \phi = \int_{x^L=0}^{\alpha V n^S} \Gamma^S\left(x^L\right)\gamma^L\left(x^L\right)dx^L \\ &= \int_{x^L=0}^{\alpha V n^S}\left(\frac{n^L - n^S}{n^L} + \frac{x^L}{\alpha V n^L}\right)\frac{1}{\alpha V n^S}dx^L \\ &= 1 - \frac{n^S}{2n^L} \geq \frac{1}{2}\end{aligned} \tag{9}$$

Note that since the small faction sees all its rents dissipated, factions that disagree on both dimensions of policy have no incentive to form a coalition. Hence, as discussed above, only three coalition options for each faction are possible ($\overline{\theta}$ coalition, $\underline{\theta}$ coalition, or 0 coalition).

Before discussing the solution to the first stage of the game, it is worth commenting briefly on the rent-seeking subgame. First, the fact that the smaller faction sees all gains from cooperation dissipated, whereas the larger faction retains some of the gains from controlling policy, simply restates Hillman's result that the faction with less to gain from control sacrifices all its rents. The new contribution is that the relative gain from control is endogenously related to faction size (the small faction gains less because its per-member

lobbying costs are higher). Second, coalition membership entails a dissipated bidding cost $\frac{n^S}{2n^L}\alpha V = (1-\phi)\,\alpha V$ for all agents. The cost of disagreement falls as the outcome becomes more certain (ϕ increases towards 1). This is the mechanism driving Proposition 1, below.

Appendix I gives the solution to the coalition-formation subgame using the sequential game structure and equilibrium concept (stationary perfect equilibrium) developed by Bloch (1996). It shows that only the coalition structure $\left[\overline{\theta},\overline{\theta}\right]$ (two coalitions formed along the $\overline{\theta}$ policy dimension) is consistent with stationary perfect equilibrium.

The key features of the equilibrium are as follows:

- Agents inside each coalition agree unanimously on the most contentious policy dimension $\overline{\theta}$.
- Disagreement on the other policy dimension $\underline{\theta}$ is overcome through a process of lobbying as discussed above.
- Each coalition wins the last stage and sets policy with probability $\alpha = \frac{1}{2}$.
- Expected utility for the larger and smaller factions in each coalition, denoted superscript $\{L, S\}$ respectively, is given by: $U^L = U^S = \frac{1}{2}\left[V^{\overline{\theta}} + \frac{3\sigma-1}{2\sigma}V^{\underline{\theta}}\right]$

To make the analysis more specific, the two policy dimensions $\left\{\underline{\theta},\overline{\theta}\right\}$ can be interpreted as monetary policy $\pi \in \{0,1\}$ and a second dimension of policy $\theta \in \{0,1\}$. The second dimension θ can be thought of as "all other policies" or alternatively as an indicator of agent "type" (e.g. working class/middle class or poor/rich) as a predictor of preferences on other policies. Define an economy where $\overline{\theta} = \theta$ (i.e., the second dimension is most important) as a "θ coalition economy," and an economy where $\overline{\theta} = \pi$ (the monetary policy dimension is most important) as a "π coalition economy." Since both factions in each coalition have the same expected payoff, the payoff for all agents in each coalition depends only on the division of coalitions (θ coalition vs. π coalition):

$$U = \frac{1}{2}\left[V^{\theta} + \frac{3\sigma-1}{2\sigma}V^{\pi}\right];\ \theta \text{ coalition} \tag{10}$$

$$U = \frac{1}{2}\left[V^{\pi} + \frac{3\sigma-1}{2\sigma}V^{\theta}\right];\ \pi \text{ coalition} \tag{11}$$

III. Predictions

A. Delegation of Policy

Agents have the option of delegating the monetary policy decision to a GICB prior to the coalition-formation stage of the game. In the question of delegating policy, all agents are assumed to have the power of veto, with political control over policy the fall-back position.

In order to derive expected utilities with the GICB, we need to specify how policy is determined in this environment. Clearly, the GICB could choose either policy stance, and its preferences (or ability to act on them) might be unclear to the politicians. To capture this uncertainty, I assume that policy is set probabilistically, with policy set at $\pi = 1$ with probability p and $\pi = 0$ with probability $1 - p$, where p, drawn from a continuous distribution over $[0, 1]$ with cdf $F(p)$, is common knowledge.

Note that delegation of policy over π by definition removes that dimension of policy. Hence, coalitions form along the policy dimension θ if delegation occurs (coalitions have weight $\frac{1}{2}$ and each has a probability $\frac{1}{2}$ of controlling policy and implementing its favored policy with respect to θ). Note also that the equilibrium coalition structure is also changed by the decision to delegate, if (absent delegation) coalitions would form along the dimension π.

We are now ready to state the central proposition of this paper:

Proposition 1 As σ increases, the probability of policy delegation to a GICB falls. This implies that the probability of observing goal independence is negatively related to the correlation between preferences over π and θ.

Proof. Consider first the case of a θ coalition economy. Superscript P denotes payoffs under political control of π, superscript C denotes central bank control. Then payoffs under each regime are given as:

$$U^P = \frac{1}{2}\left[V^\theta + \frac{3\sigma - 1}{2\sigma}V^\pi\right] \tag{12}$$

$$U^C = \frac{1}{2}V^\theta + \widehat{p}^i V^\pi \tag{13}$$

where $\widehat{p}^i \in \{1 - p, p\}$ depends on the agent i's preferred policy $\pi^i = i \in \{0, 1\}$.

Hence, $U^C \geq U^P$ iff:

$$\widehat{p}^i \geq \frac{1}{2}\left[1 - \frac{1 - \sigma}{2\sigma}\right] = \frac{3}{4} - \frac{1}{4\sigma} \tag{14}$$

Since CBI relies upon unanimity, CBI requires that (14) holds for $\widehat{p}^i = \{1 - p, p\}$. When $\sigma = \frac{1}{2}$ (its minimum value) the range of values for p for which this condition holds for both $1 - p, p$ is relatively wide: $p \in \left[\frac{1}{4}, \frac{3}{4}\right]$. However, as σ increases, the range narrows: at $\sigma = 1$, only $p = \frac{1}{2}$ allows CBI to occur.

To show this formally, the substitution $\widehat{p}^i = \{1 - p, p\}$ into the above condition yields:

$$\text{CBI chosen iff } p \in \left[\left(\frac{3}{4} - \frac{1}{4\sigma}\right), \left(\frac{1}{4} + \frac{1}{4\sigma}\right)\right] \equiv \left[\underline{p}, \overline{p}\right] \tag{15}$$

Then:

$$\Pr\left(p \in \left[\underline{p}, \overline{p}\right]\right) \equiv P = F\left(\overline{p}\right) - F\left(\underline{p}\right) \tag{16}$$

And:

$$\frac{\partial P}{\partial \sigma} = -\frac{1}{4\sigma^2}\left(f\left(\overline{p}\right) + f\left(\underline{p}\right)\right) \leq 0 \tag{17}$$

Now consider a π-coalition economy. Then payoffs under each regime are given as:

$$U^P = \frac{1}{2}\left[V^\pi + \frac{3\sigma - 1}{2\sigma}V^\theta\right] \tag{18}$$

$$U^C = \frac{1}{2}V^\theta + \widehat{p}^i V^\pi \tag{19}$$

Hence, $U^C \geq U^P$ iff:

$$\widehat{p}^i \geq \frac{1}{2}\left[1 - \frac{1-\sigma}{2\sigma}\frac{V^\theta}{V^\pi}\right] \tag{20}$$

And

$$\text{CBI chosen iff } p \in \left[\frac{1}{2}\left[1 - \frac{1-\sigma}{2\sigma}\frac{V^\theta}{V^\pi}\right], \frac{1}{2}\left[1 + \frac{1-\sigma}{2\sigma}\frac{V^\theta}{V^\pi}\right]\right] \equiv \left[\underline{p}, \overline{p}\right] \tag{21}$$

Then:

$$\Pr\left(p \in \left[\underline{p}, \overline{p}\right]\right) \equiv P = F\left(\overline{p}\right) - F\left(\underline{p}\right) \tag{22}$$

$$\frac{\partial P}{\partial \sigma} = -\frac{1}{4\sigma^2}\left(f\left(\overline{p}\right) + f\left(\underline{p}\right)\right)\frac{V^\theta}{V^\pi} \leq 0 \tag{23}$$

■

To restate Proposition 1 in nontechnical language, the model predicts that goal independence is more likely to occur when the correlation between preferences over monetary policy and the second policy dimension is low, this being the environment where coalition formation is harder. This proposition is tested in the empirical section and found to be supported by the available data.

B. Inflation and Endogenous Central Bank Independence

The standard argument in favor of GICBs (formalized in Rogoff, 1985) is that the pool of potential central bankers is dominated by conservative (inflation-averse) types.[15] This would suggest that the distribution of p across countries should place a higher weight on low values, and a lower weight on high values, so that $E\left[p\right] < \frac{1}{2}$.

[15] Of course Rogoff's arguments are more complex than this, since the role of the conservative central banker is in reducing the inflationary bias caused by time inconsistency. In this model time-consistency considerations are not relevant.

Ignoring endogenous selection, this would indeed make observed inflation in countries with such institutions lower than in countries with political control over policy targets. Mapping the dichotomous inflation policy variable $\pi = \{0, 1\}$ into inflation rates $\widehat{\pi} = \{\underline{\pi}, \overline{\pi}\}, \overline{\pi} > \underline{\pi}$, expected inflation under the two types of regime (**ignoring endogeneity**) is given as:

$$\widehat{\pi}^{POL} = \underline{\pi} + \frac{1}{2}(\overline{\pi} - \underline{\pi}) > \widehat{\pi}^{CBI} = \underline{\pi} + E[p](\overline{\pi} - \underline{\pi}) \tag{24}$$

However, controlling for endogeneity makes the relationship between inflation and CBI more complex. In particular, the relationship depends on what assumptions one makes about the distribution of p and σ across countries. Expected inflation under political control remains the same. However, expected inflation under CBI depends upon the average p under CBI, *conditional on p being within the range under which CBI occurs endogenously*, and where the range is determined by the value of σ:

$$\begin{aligned}
\widehat{\pi}^{CBI} &= \underline{\pi} + E\left[p \mid p \in \left[\underline{p}, \overline{p}\right]\right](\overline{\pi} - \underline{\pi}) \\
&= \underline{\pi} + (\overline{\pi} - \underline{\pi}) \int_{\sigma=\frac{1}{2}}^{1} \left[\frac{\int_{p=\left(\frac{3}{4}-\frac{1}{4\sigma}\right)}^{\left(\frac{1}{4}+\frac{1}{4\sigma}\right)} p f_p(p)\, dp}{F_p\left(\frac{1}{4}+\frac{1}{4\sigma}\right) - F_p\left(\frac{3}{4}-\frac{1}{4\sigma}\right)} \right] f_\sigma(\sigma)\, d\sigma
\end{aligned} \tag{25}$$

Hence, the value of $\widehat{\pi}^{CBI}$ depends not on the entire distribution of p, but on the distribution given that independence is selected endogenously. The key portion of the distribution F_p is that bounded by $\underline{p}, \overline{p}$, where these values themselves depend on σ. There is no automatic link between the unconditional expectation of p and its expected value within the critical range, and one can easily generate counterfactuals where $\widehat{\pi}^{CBI} > \widehat{\pi}^{POL}$ even if central bankers are conservative on average.[16] The intuition for this is that the simple argument for CBI—that it hands monetary policy to a group that tends to be inflation-averse—ignores the fact that if the group is *too* likely to be inflation-averse then delegation will be blocked by more inflation-tolerant sections of society.

Endogenous selection has serious implications for existing studies of the effect of CBI on inflation. Because only "middle" ranges of p are consistent with endogenous goal

[16] As an illustration, consider the following simple degenerate (cross-country) distribution for p: $F(p) = \{0.75 \mid p < 0.6; F(p) = 1 \mid p \geq 0.6\}$. In this example, the *unconditional* expectation of inflation under CBI (ignoring endogeneity) is $\widehat{\pi}^{CBI} = \underline{\pi} + 0.15(\overline{\pi} - \underline{\pi}) < \widehat{\pi}^{POL}$; whereas the *conditional* expectation under endogenous CBI, for $\sigma = 0.5$, is given as $\widehat{\pi}^{CBI} = \underline{\pi} + 0.6(\overline{\pi} - \underline{\pi}) > \widehat{\pi}^{POL}$. In this example, Central Bankers tend on average to be inflation-averse. However, where the Central Banker is too likely to be inflation-averse (inflation-tolerant with probability 0), CBI is blocked by the inflation-tolerant group. The predicted relationship between inflation and CBI will then be positive, even though, in a causal sense, delegation delivers control of policy to a group that is on average more inflation-averse than the public.

independence, the measured effect of independence on inflation may be biased towards zero even if the causal relationship is negative. Econometrically, the problem is one of endogeneity. Specifically, the decision to delegate is related to p, while the latter also affects expected inflation under the GICB, $\widehat{\pi}^{CBI}$. Given that low draws of p are more likely than high draws if independent central bankers are conservative on average, then the average value of p in cases where goal independence is not chosen will be relatively low, with delegation generally associated with higher than average realizations of p. The endogeneity problem arises because the unmeasured parameter p enters the residuals for both the selection equation and the inflation equation, causing the error terms to be positively correlated.

To capture central banker conservativeness, I assume that central bankers are low inflation types with probability at least one-half ($p \in \left[0, \frac{1}{2}\right]$). This implies that:

$$\widehat{p} \equiv E\left[p\right] \leq \widehat{p}^{1} \equiv E\left[p \mid p \in \left[\underline{p}, \frac{1}{2}\right]\right] \leq \frac{1}{2} \tag{26}$$

Then the coefficient estimate measuring GICB's influence on inflation will be biased. The true effect, holding p constant, is $\delta \equiv -\left(\overline{\pi} - \underline{\pi}\right)\left[\frac{1}{2} - \widehat{p}\right]$, while the effect estimated by OLS, ignoring endogenous selection, is $\delta^{OLS} \equiv -\left(\overline{\pi} - \underline{\pi}\right)\left[\frac{1}{2} - \widehat{p}^{1}\right]$. Since $\widehat{p}^{1} > \widehat{p}$ the measured effect is biased toward zero. This could explain why the existing empirical literature on the issue has failed to identify a negative relationship between de jure measures of CBI and inflation outside a narrow set of advanced economies (see Eijffinger and De Haan, 1996).

In section IV I show that when one accounts for endogenous selection (via a treatment effects, TE, model) there is indeed evidence that the error terms in the selection equation and the inflation equation are positively correlated, supporting the endogenous selection argument and suggesting that the OLS estimate is indeed biased towards zero. Moreover, the TE estimate of the coefficient δ is negative and statistically significant. This supports the view that granting central banks independence reduces inflation.

IV. Empirical Tests

A. Data Sources

Data on central bank independence is derived from Fry and others' (2000) rich dataset of central bank characteristics.[17] This dataset is particularly useful for our purposes as it differentiates between goal and instrument independence. Central banks enjoying a goal independence rating of 100 percent are characterized as goal independent, those with ratings of less than 100 percent are characterized as not being goal independent.[18] Data on inflation is taken from the IMF *International Financial Statistics*. Comparable (PPP) data on real GDP is obtained from the Penn World Tables v. 6.1 (Heston, Summers and Aten, 2002). Data on countries' political system is taken from the Polity IV database (Marshall and Jaggers, 2001).

Finally, I obtain information on inflationary preferences from the World Values Survey second and third waves (observations covering 1990 and 1995–1998 respectively).[19] This dataset contains individual-level survey information on respondents' views on a number of social and economic issues. Specifically, three questions ask respondents to highlight their first and second choices from a set of four alternative "aims" for their country. Each set includes one economic aim, one aim pertaining to authority and order, and two broader aims about the nature of society, touching on issues of rights, democracy and the environment amongst others.[20] One question has "fighting rising prices" as the economic objective, while a second question asks respondents to rate "a high level of economic

[17] Any classification carries a degree of subjectivity. I compared the classifications in this dataset with (approximately) comparable internal IMF classifications for end-2003. Of the 32 countries in our dataset covered by these classifications, 12 were classified differently (all taking on a value of $GICB = 0$ in our dataset). Of these, 7 were countries whose central banks were subsequently subsumed by the ECB in 1999 (and took on the latter's goal independence rating in 2003) and were likely less independent prior to this (for instance, exchange rate parities within the Exchange Rate Mechanism were set by the Council of European Finance Ministers ECOFIN, with varying degrees of central bank participation). Of the five other countries, two appeared to have reformed their monetary policy frameworks between 1998 and 2003 to grant their central banks far greater independence, and hence seem to have been correctly designated in 1998. Three remaining countries therefore appear to have a questionable goal independence rating in our dataset. As a robustness check I adjusted the goal independence indicator from zero to one for these countries. The results remain substantially unaltered.

[18] The original data allowed for a mid-point of 50 percent for countries where policy is decided by government and the central bank acting in tandem. Since a degree of direct political control is included in this environment, the 50 percent observations are treated as being non-independent for the purposes of assessing the model in this paper. In fact, few countries report a score of 0, so that the major variation is between countries with scores of 50 percent and 100 percent respectively (coded 0 and 1).

[19] The Third Wave is closest in terms of date to the 1998 Central Bank institutional structure information. However, including second wave observations for those countries for which second wave observations are available but third wave observations are not available increases the sample size from 26 to 36 countries.

[20] The twelve aims, grouped by question and then category (economy, authority, society($\times 2$)) are: (1): 'a high level of economic growth', '...strong defence forces', 'seeing that people have more say about how things are done...', 'making our cities and countryside more beautiful'; (2): 'fighting rising prices', 'maintaining order...', 'giving people more say in important government decisions', 'protecting freedom of speech'; and (3): 'a stable economy', 'fight against crime', '...a less impersonal and more humane society', '...a society where ideas count more than money'.

growth" over other policy objectives. Answers to these two questions are then used to generate a series of indices measuring the extent to which agents prefer lower inflation. These indices are proxies for π. I then use proxies for θ taken from the same dataset to generate (absolute) correlation coefficients between the two. These are used as proxies for σ to test the main propositions of the paper.

Data are available for a total of 36 countries (constrained by the joint availability of institutional and preferences data). Table 1 gives the preferences (σ) and institutions (existence of GICB) data used in the empirical analysis.

B. Monetary Policy Preference Indices π

For robustness (since any particular index can be criticized methodologically) I derive four alternative indices for assessing monetary policy preferences. Each method calculates an individual relative inflation aversion index $\widehat{\pi}_j^i$ (where i indexes individuals and $j \in \{1, 2, 3, 4\}$ methods).

The first method codes $\widehat{\pi}_1^i = 0$ if agent i chooses "fighting rising prices" as the top priority in the relevant question, $\widehat{\pi}_1^i = 1$ if the agent chooses another option as the top priority, and leaves the variable uncoded if the respondent does not answer the question. The second method is similar, but codes $\widehat{\pi}_2^i$ according to whether the respondent chooses "fighting rising prices" as either the first or second choice ($\widehat{\pi}_2^i = 0$) or not at all ($\widehat{\pi}_2^i = 1$).

These two measures have the advantage of simplicity. However, they are vulnerable to two criticisms. First, they ignore the notion of a (short-term) trade-off between inflation and other economic objectives. Second, they ignore the role of the other alternatives in the survey question (which imply that agents' choice of "fighting rising prices" as a major policy objective is affected by how they rank other noneconomic policy objectives mentioned in the survey question).

The third method explicitly treats inflation aversion as a trade-off by combining the answers to the two key survey questions. A variable is generated for each of the two questions. Agents are allocated a score of 2 if the economic objective is rated as the most important objective, 1 if it is rated second, and zero if it is not rated in first or second place. If the agent does not respond to either the first or second preference question, the variable is coded as missing. Define S^{π} as the score for the question that has inflation as a category and S^{g} as the score for the growth question. Then overall relative inflation aversion for agent i is given by:

$$\widehat{\pi}_3^i = \frac{S^{gi} - S^{\pi i}}{2} \in \{-1, -.5, 0, .5, 1\} \tag{27}$$

Table 1. Proxies for σ and GICB Status for 36 Countries in Sample

Panel A: Income Percentile Proxy for θ

	$\sigma(\theta_1\pi_j)$				
	(π_1)	(π_2)	(π_3)	(π_4)	GICB
Armenia	0.072181	0.119647	0.115265	0.098188	0
Australia	0.093723	0.143055	0.15341	0.18269	0
Austria	0.122834	0.217616	0.14961	0.145941	0
Bangladesh	0.08063	0.113319	0.09089	0.043764	0
Belgium	0.152572	0.14691	0.195305	0.192679	0
Bulgaria	0.124529	0.167281	0.169688	0.046934	0
Canada	0.061013	0.111865	0.13978	0.102969	0
Croatia	0.113509	0.216966	0.241609	0.178777	0
Estonia	0.15537	0.203902	0.223778	0.160493	0
Finland	0.061336	0.089085	0.105421	0.114715	0
Georgia	0.016176	0.036131	0.054931	0.040477	0
Hungary	0.082675	0.08658	0.222986	0.226934	0
Italy	0.130667	0.133505	0.163213	0.171703	0
Korea	0.046913	0.07353	0.066157	0.042075	0
Lithuania	0.168409	0.189931	0.221374	0.151873	0
Macedonia, FYR	0.066524	0.000102	0.112791	0.106848	0
Mexico	0.070101	0.027579	0.187546	0.164571	0
Netherlands	0.121799	0.170102	0.241597	0.24765	0
Norway	0.12688	0.17383	0.207507	0.195065	0
Portugal	0.137284	0.202444	0.262919	0.191993	0
Russia	0.126837	0.150464	0.198302	0.138089	0
Spain	0.105299	0.13524	0.141631	0.148558	0
Taiwan Province of China	0.13334	0.093822	0.07262	0.071378	0
Turkey	0.120117	0.212977	0.238331	0.185702	0
Ukraine	0.018296	0.090471	0.090802	0.037869	0
United Kingdom	0.205758	0.225084	0.311065	0.356451	0
Chile	0.07088	0.119149	0.120632	0.067659	1
Germany	0.113202	0.094628	0.120856	0.099264	1
India	0.145698	0.093275	0.127744	0.134817	1
Japan	0.029249	0.022043	0.08373	0.083281	1
Latvia	0.065171	0.157596	0.167804	0.121949	1
Moldova	0.011091	0.09881	0.125412	0.122966	1
South Africa	0.09412	0.007424	0.149369	0.132076	1
Sweden	0.054685	0.048772	0.098961	0.123242	1
Switzerland	0.058532	0.086576	0.194153	0.164233	1
United States	0.094409	0.086665	0.116844	0.087265	1

GICB derived from the "target independence" measure in Fry and others (2000);
Preference correlation measure σ derived as absolute correlation between monetary policy preference measure (π) and second dimension measure (θ); Author's calculations using WVS data.
Source: Fry and others (2000); World Values Survey (1990-91; 1995-97).

Table 1. Proxies for σ and GICB Status for 36 Countries in Sample (continued)

Panel B: Social Class Proxy for θ

	$\sigma(\theta_2\pi_j)$				
	(π_1)	(π_2)	(π_3)	(π_4)	GICB
Armenia	0.021577	0.016206	0.024447	0.035101	0
Australia	0.072984	0.137155	0.111054	0.129258	0
Austria	0.156494	0.293565	0.172774	0.185928	0
Bangladesh	0.061552	0.136062	0.087669	0.055424	0
Belgium	0.137965	0.135731	0.167023	0.140925	0
Bulgaria	0.165456	0.228658	0.264503	0.121197	0
Canada	0.065892	0.122928	0.162067	0.163034	0
Croatia	0.139383	0.231754	0.254903	0.148175	0
Estonia	0.154114	0.141599	0.109267	0.083371	0
Finland	0.12994	0.105429	0.088921	0.114645	0
Georgia	0.053477	0.083909	0.06099	0.032718	0
Hungary	0.136777	0.130344	0.247201	0.289887	0
Italy	0.132018	0.161544	0.188533	0.190819	0
Korea	0.058944	0.040704	0.05889	0.0439	0
Lithuania	0.113254	0.14565	0.087591	0.023523	0
Macedonia, FYR	0.063539	0.036029	0.069685	0.083121	0
Mexico	0.066283	0.046074	0.158484	0.150583	0
Netherlands	0.17928	0.254978	0.164853	0.206642	0
Norway	0.09268	0.095579	0.11148	0.097044	0
Portugal	0.152468	0.222512	0.288567	0.194336	0
Russia	0.127936	0.139919	0.20314	0.159414	0
Spain	0.077757	0.071015	0.131464	0.094921	0
Taiwan Province of China	0.06682	0.041466	0.047129	0.071914	0
Turkey	0.050497	0.081736	0.113313	0.122195	0
Ukraine	0.041038	0.052972	0.070568	0.051288	0
United Kingdom	0.175543	0.185445	0.280117	0.323407	0
Chile	0.136701	0.138891	0.142658	0.141543	1
Germany	0.106871	0.071886	0.070805	0.054471	1
India	0.109377	0.1068	0.174205	0.179953	1
Japan	0.026196	0.035665	0.045286	0.076673	1
Latvia	0.071068	0.08681	0.101255	0.016914	1
Moldova	0.078875	0.126635	0.067501	0.011548	1
South Africa	0.113791	0.004319	0.096688	0.079556	1
Sweden	0.049229	0.086757	0.078578	0.082299	1
Switzerland	0.089802	0.101558	0.15363	0.118155	1
United States	0.068274	0.040196	0.093037	0.077226	1

GICB derived from the "target independence" measure in Fry and others (2000); Preference correlation measure σ derived as absolute correlation between monetary policy preference measure (π) and second dimension measure (θ); Author's calculations using WVS data. Source: Fry and others (2000); World Values Survey (1990-91; 1995-97).

The strengths of this measure are that it explicitly treats inflation aversion as a trade-off against economic growth, in keeping with the standard Phillips curve type argument, and also that it captures intensity by having a five-point scale rather than a simple binary measure. The weakness of the measure is that it does not eliminate the possible impact of preferences over the noneconomic policy objectives.[21]

The fourth measure attempts to deal with this last problem by screening out respondents whose preferences over inflation versus economic growth are unclear. This measure is derived using a revealed preference methodology, and relies on making further assumptions on preferences over some of the alternative policy options in the two questions.

Agents are assigned a (binary) score for $\widehat{\pi}_4^i$ according to the following rule:

$$\begin{aligned}
\widehat{\pi}_4^i &= 1 \text{ if a transitive preference ordering ranks high growth above low inflation;} \\
\widehat{\pi}_4^i &= 0 \text{ if a transitive preference ordering ranks low inflation above high growth;} \\
\widehat{\pi}_4^i &= \text{. if no transitive preference ordering is identifiable.}
\end{aligned}$$

The strength of this revealed preference measure is that it eliminates the effect of other non-economic policy choices and provides a clear preference ordering between the two economic policy objectives. The weakness is that it relies on additional assumptions on agents' preferences which may not be valid.[22]

C. Proxies for Second Preference Dimension θ

I again use multiple proxies (two in this case). The first measure takes respondents' income (normalized as the estimated percentile of the income distribution) as the relevant characteristic.[23] The rationale for using income is that, over economic policy in particular, the primary divisions in society are likely to be along income lines. The second measure uses a closely aligned concept, of social class (self-assigned), to proxy for θ. This measure might be less accurate than the income measure since the definition of social class is more subjective.[24]

With four measures of inflation aversion $\{\widehat{\pi}_1, ..., \widehat{\pi}_4\}$ and two second-dimension proxies $\left\{\widehat{\theta}_1, \widehat{\theta}_2\right\}$, there are eight different measures of the absolute correlation between the two. All eight are then entered individually as possible explanatory variables in probit regressions – corresponding to σ in the theoretical model.

[21] This measure is not a binary measure, as in the model, but can be thought of as mapping into the binary measure; intensity can be thought of as the certainty with which the measure maps into either $\pi = 1$ or $\pi = 0$.

[22] The exact derivation of the index is detailed in Appendix II.

[23] The derivation of the income percentiles is described in Appendix III.

[24] I constructed more complex proxies for θ by combining data on income and/or social class with other indicators, such as survey responses to questions on reducing inequality, public ownership, and making social changes, through factor analysis. The derived results were qualitatively and quantitatively similar to those using the simple proxies.

D. Central Bank Independence and Preference Dispersal

Table 2 tests the central proposition of this paper (Proposition 1). Eight different proxies for σ are used, corresponding to the four proxies for preferences over monetary policy $\{\widehat{\pi}_1, ..., \widehat{\pi}_4\}$ each interacted with the two proxies for the second preference dimension $\left\{\widehat{\theta}_1, \widehat{\theta}_2\right\}$. The table's panels are organized with respect to the latter dimension, with each of both panels' four columns corresponding to the former dimension. Each column gives the results of a probit regression where goal independence $\{0, 1\}$ is the dependent variable. The single control is the country's average autocracy score a (from the Polity IV dataset) for the 1990s.[25]

Panel A shows that the four proxies derived from the income proxy $\widehat{\theta}_1$ perform relatively well. All are statistically significant (three at the 5 percent level, one at the 10 percent level) and carry the predicted negative sign on the point estimate. Panel B shows that all the proxies derived from the social class measure $\widehat{\theta}_2$ are also statistically significant in predicting goal independence (two at the 1 percent level, one at the 5 percent level, and one at the 10 percent level), and again all carry the negative sign predicted by the theory.

Table 2. Probit Regression Results, Goal Independence

Panel A: Income Percentile Proxy $\widehat{\theta}_1$				
Proxy for π	$\widehat{\pi}_1$	$\widehat{\pi}_2$	$\widehat{\pi}_3$	$\widehat{\pi}_4$
σ	-11.5^{**}	-14.1^{**}	-10.7^{**}	-7.63^{*}
	(5.71)	(6.49)	(4.92)	(4.16)
a	-2.44^{**}	-3.79^{***}	-3.04^{*}	-2.77^{*}
	(1.18)	(1.42)	(1.65)	(1.46)
constant	.745	1.28	1.32	.713
	(.596)	(.848)	(.808)	(.664)
$\chi^2\,(2)$	6.17^{**}	7.48^{**}	5.07^{*}	4.42
Observations	36	36	36	36
Panel B: Social Class Proxy $\widehat{\theta}_2$				
Proxy for π	$\widehat{\pi}_1$	$\widehat{\pi}_2$	$\widehat{\pi}_3$	$\widehat{\pi}_4$
σ	-11.1^{*}	-14.7^{***}	-10.2^{***}	-9.40^{**}
	(5.85)	(5.69)	(3.95)	(4.14)
a	-2.63^{**}	-3.99^{***}	-2.96^{**}	-2.84^{**}
	(1.23)	(1.39)	(1.31)	(1.23)
constant	.799	1.31^{*}	$.997^{*}$	.758
	(.666)	(.711)	(.580)	(.538)
$\chi^2\,(2)$	5.21^{*}	10.1^{***}	8.94^{**}	8.23^{**}
Observations	36	36	36	36

[25] Other potential political and economic controls were entered into the equation but were not found to be statistically significant. Robust standard errors in parentheses. Significance levels in this and subsequent tables denoted by $\{^{***}: 1 \text{ percent}; ^{**}: 5 \text{ percent}; ^{*}: 10 \text{ percent}\}$.

Table 3. Predictive Ability of the Model

Panel A: Income Percentile Proxy $\widehat{\theta}_1$; Full Sample									
	Proxy for π	$\widehat{\pi}_1$		$\widehat{\pi}_2$		$\widehat{\pi}_3$		$\widehat{\pi}_4$	
	Actual GICB	0	1	0	1	0	1	0	1
Predicted	0	23	6	22	6	23	5	24	7
GICB	1	3	4	4	4	3	5	2	3
Panel B: Class proxy $\widehat{\theta}_2$; Full Sample									
	Proxy for π	$\widehat{\pi}_1$		$\widehat{\pi}_2$		$\widehat{\pi}_3$		$\widehat{\pi}_4$	
	Actual GICB	0	1	0	1	0	1	0	1
Predicted	0	23	6	23	5	22	5	24	5
GICB	1	3	4	3	5	4	5	2	5
Panel C: Income Percentile Proxy $\widehat{\theta}_1$; Advanced Economies									
	Proxy for π	$\widehat{\pi}_1$		$\widehat{\pi}_2$		$\widehat{\pi}_3$		$\widehat{\pi}_4$	
	Actual GICB	0	1	0	1	0	1	0	1
Predicted	0	9	2	10	1	10	1	11	3
GICB	1	2	3	1	4	1	4	0	2
Panel D: Class proxy $\widehat{\theta}_2$; Advanced Economies									
	Proxy for π	$\widehat{\pi}_1$		$\widehat{\pi}_2$		$\widehat{\pi}_3$		$\widehat{\pi}_4$	
	Actual GICB	0	1	0	1	0	1	0	1
Predicted	0	10	2	10	1	10	1	11	2
GICB	1	1	3	1	4	1	4	0	3
Panel E: Income Percentile Proxy $\widehat{\theta}_1$; Emerging Market Economies									
	Proxy for π	$\widehat{\pi}_1$		$\widehat{\pi}_2$		$\widehat{\pi}_3$		$\widehat{\pi}_4$	
	Actual GICB	0	1	0	1	0	1	0	1
Predicted	0	14	4	12	5	13	4	13	4
GICB	1	1	1	3	0	2	1	2	1
Panel F: Class proxy $\widehat{\theta}_2$; Emerging Market Economies									
	Proxy for π	$\widehat{\pi}_1$		$\widehat{\pi}_2$		$\widehat{\pi}_3$		$\widehat{\pi}_4$	
	Actual GICB	0	1	0	1	0	1	0	1
Predicted	0	13	4	13	4	12	4	13	3
GICB	1	2	1	2	1	3	1	2	2

Table 3 uses the regression results to predict GICB status (with a threshold for predicted $GICB = \{0, 1\}$ at 0.5). Panels A and B present results for the full sample. It shows that the models tend to predict $GICB = 0$ (the dominant state) very well (with a success rate of around 85 to 90 percent), while their ability to predict $GICB = 1$ is less good (between 30 and 50 percent). In Panels C through F I analyze whether this result holds for all countries in the sample by dividing the sample into advanced and emerging market economies and tabulating the predicted and actual delegation decisions for each subgroup. Clearly, the predictive power of the model is far higher for advanced countries (Panels C and D, where the predictive power for $GICB = 0$ and $GICB = 1$ is up to 100 percent and

80 percent respectively) than for emerging market countries (Panels E and F).[26]

E. Inflation Performance and Central Bank Independence

Table 4 presents the results of regressing inflation against a dummy for goal independence and a control (PPP GDP per capita, *gdp*). Column I presents results for the 78 countries for which data are available, while columns II and III present the same results for two subgroups, advanced and emerging market economies, respectively. The results confirm the results of most other empirical investigations (see Eijffinger and de Haan, 1996): there is a negative correlation between independence and inflation for advanced countries but not for other countries or for the sample as a whole.

Table 4. OLS and Treatment Effects Regression Results, average inflation, 1998-2000

	I	II	III	IV	V	VI
Method	OLS	OLS	OLS	OLS	TE (MLE)	TE (MLE)
Sample	Full	Advanced	EMEs	Restricted	Restricted	Restricted
$GICB$	1.02	-1.32^{***}	.979	-2.74	-19.23^{***}	-17.4^{***}
	(3.03)	(.436)	(4.17)	(4.69)	(5.15)	(4.76)
$gdp \times 10^{-3}$	$-.551^{***}$	.00334	$-.600^{*}$	$-.595^{**}$	$-.539^{**}$	$-.485^{**}$
	(.161)	(0476)	(.359)	(.241)	(.260)	(.207)
constant	14.0^{***}	2.12^{*}	14.4^{***}	16.9^{***}	20.8^{***}	19.5^{***}
	(2.40)	(1.03)	(3.45)	(4.05)	(4.97)	(4.00)
			Hazard Equation for $GICB$			
Proxy for σ					$\left(\widehat{\theta}_{inc};\widehat{\pi}_2\right)$	$\left(\widehat{\theta}_{soc};\widehat{\pi}_2\right)$
σ					-7.76^{***}	-9.24^{**}
					(2.40)	(4.58)
a					-3.59^{***}	-4.64^{***}
					(.721)	(.943)
constant					$.730^{**}$	$.797^{*}$
					(.333)	(.485)
ν					$.972^{***}$	$.908^{***}$
F Statistic	6.04^{***}	5.38^{**}	1.57	3.41^{**}		
$\chi^2\,(2)$					14.4^{***}	17.6^{***}
R^2	.139	.374	.0549	.176		
Observations	78	21	57	35	35	35

However, the weakness of the observed relationship may be caused by endogenous

[26] One obtains similar results from running separate regressions for the two subgroups. In this respect this analysis is similar to the empirical tests of the inflation/CBI relationship reported in Eijffinger and De Haan (1996) which find that the traditional models also perform far better in predicting behavior in industrial economies.

selection, as discussed in section III. Columns IV – VI present results for a smaller sample (35 countries with preference correlation data σ) which allows us to test this hypothesis. Column IV presents OLS results for this limited sample, while columns V and VI present results from maximum likelihood estimation of a treatment-effects (TE) model (essentially an instrumental variables model with a binary endogenous regressor), in which endogenous selection is explicitly modeled.[27] In the OLS model (column IV) CBI is found to have no effect on inflation (replicating the result from the broader sample presented in column I). However, when endogenous selection is introduced explicitly (columns V and VI) the estimated effect of CBI is negative and quantitatively and statistically significant. As predicted by the discussion in section III, the covariance between the error terms in the hazard equation and the second stage equation, ν, is positive, consistent with the OLS estimate of the coefficient on GICB being biased upwards towards zero. This suggests that endogenous selection could be an important factor in explaining why many empirical studies have failed to find a robust relationship between CBI and inflation, while also providing further support for this paper's account of endogenous selection.

V. Case Studies

So far the empirical results have abstracted from the mechanics of coalition formation and analyzed how the distribution of agents in the economy according to their preferences over monetary policy and other politically salient dimensions (income, social class) can dictate the decision to delegate. The "missing link" in this discussion is the coalition-formation stage of the game. I therefore briefly outline some recent cross-country evidence and nineteenth-century U.S. evidence on coalition formation and monetary policy delegation that provides some anecdotal support for the view that delegation reflects difficulties in forming coalitions.

A. Cross-Country Evidence

Bernhard and Leblang (2002) cite Bernhard (2000) to argue that the German Bundesbank's strong independent status helped the left-wing Social Democrats and the

[27] In the treatment effects model, the primary regression equation is given by:

$$y = \mathbf{x}\boldsymbol{\beta} + \delta z + \epsilon$$

where z is a binary decision variable (in our case, $GICB = \{0, 1\}$) that stems from an unobservable latent variable:

$$\begin{aligned} z^* &= \mathbf{w}\boldsymbol{\gamma} + u; \\ z &= \begin{cases} 1, \text{ if } z^* > 0 \\ 0, \text{ otherwise} \end{cases} \end{aligned}$$

where ϵ, u are bivariate mean-zero normal with covariance matrix $\begin{bmatrix} \eta & \nu \\ \nu & 1 \end{bmatrix}$. Maddala (1983, p. 122) provides an exposition of the model and associated likelihood function. Columns V and VI present results with $w = [\sigma, a]$, using two different proxies for σ.

liberal market-oriented third party, the Free Democrats, to form a governing coalition in the 1970s, "despite their differences on economic policy." Similarly, "strong monetary commitments in the Netherlands (a relatively independent central bank, a stable fixed exchange rate) may have facilitated an unlikely coalition between the Labor party (PvdA) and the Liberal party (VVD) in the 1990s by removing monetary policy as a potential source of conflict." Bernhard (1998) argues that in the German case, because the right-wing Christian Democrats and likely coalition partner the Free Democrats shared "similar economic priorities," the former had fewer incentives to maintain the Bundesbank's independence. As a result, "Christian Democratic governments have twice attempted to gain more authority over the Bundesbank" (in the 1950s and 1990s).[28]

Bernhard (1998) contrasts this with the situation in the United Kingdom, where the "Bank of England's dependence reflected ... [the fact that] Conservative and Labour parties each appealed to constituents with fairly homogeneous monetary policy preferences."[29] Elgie and Thompson (1998) confirm that both Labour and Conservative governments showed little inclination to delegate authority, although by the late 1980s "the idea of giving the Bank of England greater autonomy may have seemed an attractive position ... [given] the escalating public war of words between [prime minister] Margaret Thatcher and [finance minister] Nigel Lawson over monetary and exchange rate policy." One might interpret the subsequent decision to delegate—in the form of joining the European Exchange Rate Mechanism (ERM) in 1990—as a response to this costly policy dispute.

The experience of South Africa is also instructive. Under the pre-1990 apartheid regime, when South Africa was ruled by a homogeneous elite whose economic policies directed resources and rents to its (ethnic) constituency, the South African Reserve Bank (SARB) was subordinate to the executive (Padayachee, 2001). However, the SARB was granted goal independence in the 1994 and 1996 constitutions under the auspices of South Africa's transition to democracy.

One could argue that CBI was a response by the elite to democratization, essentially a means of maintaining its monetary policy preferences into the democratic era.[30] On the other hand, it is instructive that the African National Congress (ANC) –led government

[28] This illustrates a more general point: the existence of coalition governments is entirely consistent with less autonomous central banks. The key question is whether coalition partners differ on monetary policy issues (in which case autonomy will likely be preferred) or share similar platforms on this issue (in which case a less autonomous institutional arrangement is preferable).

[29] This is reflected in our data: the UK has the highest correlation in our sample between income or social class and monetary policy preferences, according to all but one of our measures for σ.

[30] Boylan (1998) makes this argument in the case of Chile, noting that "the fact that the [pre-democracy] regime waited until it had been defeated in the plebiscite [on the restoration of democracy] in order to ratify the central bank reform lends plausibility to the argument that its timing was dictated by political reasons." The series of center-left coalition administrations that have governed Chile since 1990 have not reversed the reform. Boylan argues that this is because "they were powerless to do so" as a result of constitutional restrictions. On the other hand, our model could also be invoked in the Chilean case. The governing *Concertación* (coalition) included parties ranging from the center-right to the left, whose economic policy preferences were diverse. Particularly in the delicate early period following the restoration of democracy, there were presumably considerable benefits from maintaining a broad-based and stable coalition. Keeping the reform in place likely helped.

that took power in 1994 included a wide coalition of interests and monetary policy was a potential flashpoint. Padayachee (2001) argues that internal disagreement over the SARB's status demonstrated "the tensions and struggle that existed within the ANC alliance over economic policy directions in the mid-1990s." Lodge (2004) concurs, arguing that "government economic policies have continued to engender contention between the ANC and its allies." South Africa's experience — a dependent central bank under a narrow and homogenous ruling coalition and an independent institution under a broad and potentially fractious coalition — therefore provides further anecdotal support for our model.

B. The United States in the Nineteenth Century

The Federal Reserve's current comparatively high degree of autonomy can be rationalized by the absence of a clear partisan split on monetary policy (Corder, 1998). This contrasts with the nineteenth century. Opinion on banking and monetary matters was often split geographically, divided between the Northeast on the one hand and the South and West on the other.[31] This cleavage can be explained by the greater concentration of debtors (often farmers) in the South and West, who generally favored a more lax monetary policy to mitigate the effects of frequent deflations on the real value of debt (Timberlake, 1994, p. 108).[32]

Assuming this regional split, we can analyze the extent to which the dominant political coalitions in the nineteenth century were divided along the same geographic fault line (implying a high value for σ, and predicting politically-motivated policymaking in our model) or drew their support from heterogenous groups (a low level of σ, predicting delegation). Coalitions are defined in terms of the dominant parties of the time (the Democrats versus the Whigs or Republicans).[33] As a proxy for σ, Figure 2 below plots the degree to which support for the executive was specific to its "home" region: assumed to be the North-East for Whigs and Republicans, and the South and West (i.e., states outside the Northeast) for the Democrats. The degree of regional specificity is measured as the winning candidate's popular vote share in his home region (not necessarily the region including the candidate's own state) divided by his share in his non-home region.[34]

[31] This split was apparent from the first Congressional debates over the establishment of Alexander Hamilton's Bank of the United States in the 1790s (Timberlake, 1994, p. 7), through Andrew Jackson's assault on the Second Bank of the United States in 1832 (Wilentz, 2005), to debates over the return to the gold standard after the Civil War (Timberlake, 1994, p. 108).

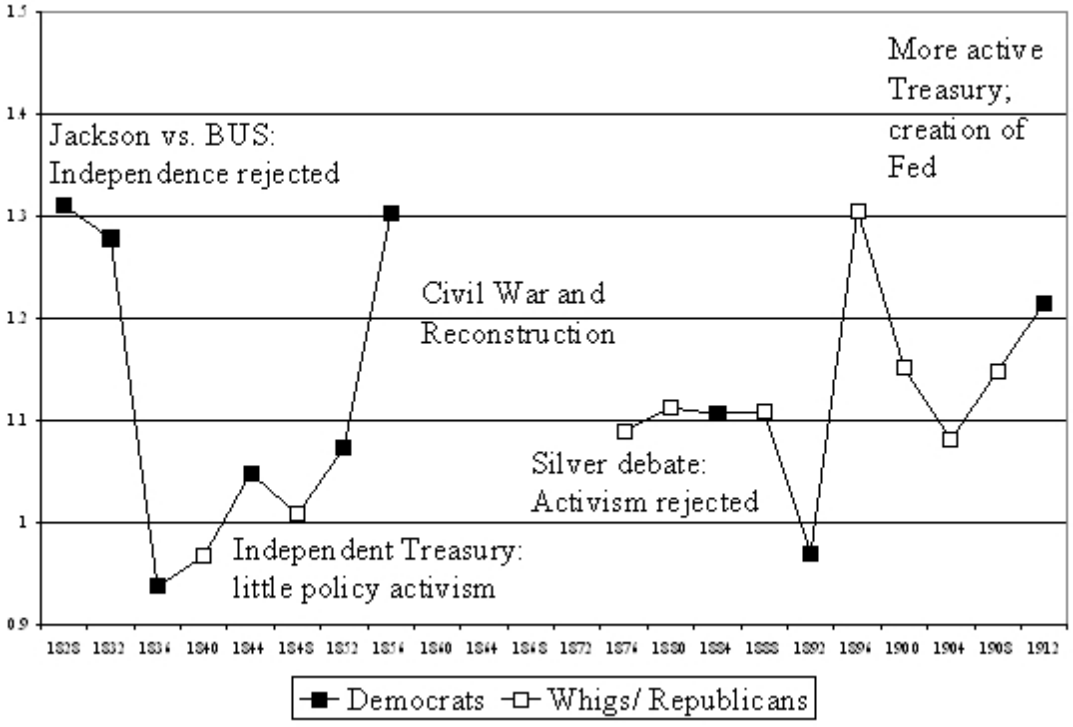
[32] There was also a widely held perception that the banking system led to a drain of commodity money to the North-East from other parts of the country (Brands, 2005; p. 466).

[33] Jackson's opponents in 1828 and 1832 were National-Republicans.

[34] Data from Leip (2006). In three cases the executive's support is marginally stronger in its non-home region, but home-region support is generally much stronger, supporting our assignment of home region to the various parties. Figure 2 plots this measure from 1828 to 1912. Elections prior to 1824 were not particularly competitive, and the election of 1824 was effectively won by Jackson but John Quincy Adams was awarded the presidency by a constitutional sleight of hand (Adams' support, incidentally, was highly region-specific: his vote share in the North-East was almost three times his share in other areas). The 1912 election was the last before the creation of the Federal Reserve. Elections during the anomolous period of the Civil War and Reconstruction are ignored.

Four episodes in the development of monetary institutions over the period illustrate how this changing distribution of preferences across coalitions influenced politicians' decisions to delegate. The first was Andrew Jackson's battle with the Second Bank of the United States (BUS). Jackson was elected in 1828 and reelected in 1832, his support highly skewed towards his rural Southern and Western powerbase. His 1832 decision to veto the charter renewal of the BUS—an autonomous institution whose operations were increasingly "resembling a modern central bank"—became the central issue in his reelection campaign.[35] As de Tocqueville noted in his *Democracy in America*, his antipathy to the BUS was a divisive issue, but acted to unite his coalition: "the educated classes ... line up behind the bank, while the people are for the President."[36] Jackson could take a strong line on the issue because his coalition held a unified position.

Figure 2. Regional Specificity of Winner's Support, U.S. Presidential Elections, 1828–1912



The second episode concerns attempts during subsequent decades to create a more arms-length institution to replace the network of "pet banks" created by Jackson. Monetary issues had become divisive within rather than between potential governing coalitions: Figure 2 shows that the presidents that followed Jackson drew diffuse regional

[35] Wilentz (2005), p. 394.
[36] Brands (2005), p. 458.

support, while Wilentz (2005, p. 664) comments that, by the 1850s, "many of the ancient economic and constitutional issues that long divided mainstream Democrats and Whigs had become virtually irrelevant." Politicians avoided taking a stand on the issue, seeking where possible to delegate responsibility (Timberlake, 1994, pp. 68–83). Hence, the creation of the Independent Treasury in 1846 drew support from politicians of different parties, and while the institution was not de jure autonomous its passive approach to monetary policy combined with the link to gold meant that monetary policy was "off the table."

The return to the gold standard after the inflationary finance of the Civil War and the subsequent agitation for, and rejection of, the monetization of silver in the 1880s and 1890s are also illustrative. The executive drew its support from a regionally diverse coalition during this period (Figure 2). Views on monetary policy, particularly the silver question, remained geographically polarized; however, up until 1892 the major parties had kept it "a sectional rather than a party issue."[37] The 1892 election, in which the silver issue featured prominently, delivered both the executive and the legislature to the Democrats. However, their presidential candidate attracted regionally diverse support, while the monetization of silver—seen as a means of implementing a more active monetary policy—was "a divisive issue between [president] Cleveland and the Democratic Congress." Hence, by the 1880s "the federal government had disengaged itself from discretionary control over the monetary system." Moreover, divisions between the different branches of the Democrat-controlled government also precluded a return to policy activism after 1892, despite pro-silver forces' strength in Congress.[38]

Elections from 1896 onwards witnessed a return to a more regionally-divided politics (Figure 2), coinciding with greater monetary policy activism. Timberlake (1994; p. 249) argues that "by 1906 the Treasury was more a central bank in its deliberate attempts to influence the monetary system than the Second Bank had ever been."[39] The 1913 creation of the Federal Reserve system was in part Congress's reaction to the enhanced executive power that the Treasury's Central Banking role created. However, the new institution's governance structure retained a substantial degree of political control (Friedman and Schwartz, 1963; pp. 190–5). This can be rationalized in the context of the model by the relatively homogeneous governing coalition elected in 1912 (the victorious presidential candidate drew his support disproportionately from his "home" region, while his party simultaneously regained control of congress).

These four episodes therefore provide some evidence that the degree of autonomy the central bank-like institutions enjoyed during the nineteenth and early twentieth centuries reflected the extent to which dominant political coalitions at the time were divided either

[37] Quotations relating to this episode taken from Timberlake (1994), pp. 164–182.

[38] This episode also illustrates how divisions over monetary policy can lead to costly internal disputes. Agitation over silver during 1892–96 put monetary policy back on the table. Both sides commited substantial political resources to winning the debate: Cleveland agressively wielded the President's power of patronage to promote his anti-silver platform, while pro-silver senators in his own party resorted to the fillibuster to block him. This infighting led to the dramatic Republican victory in 1896. The GOP's success reflected the fact that it "had successfully compromised the silver issue within itself" whereas "the Democrats engaged in an internecine conflict that ruined their chances of political success for the next eighteen or twenty years."

[39] Friedman and Schwartz (1963) come to a similar conclusion.

between or within themselves over monetary policy. Monetary policy could be a contentious issue, and internal disagreement over policy had the potential to inflict serious damage on a party. Hence divided parties were more keen to delegate policy, and united parties less so.

VI. Conclusions

This paper argues that policy delegation can cut the cost of coalition formation by reducing the dimensionality of political conflict. The model delivers an empirically testable proposition, that delegation is more likely when the correlation of agents' preferences across different policy dimensions is lower.

This proposition is supported by an analysis of survey data from the World Values Survey and institutional data taken from a Bank of England survey of central banks. Anecdotal support for the model is provided by the experiences of several countries in recent times, and also by the development of monetary institutions and monetary politics in the United States in the nineteenth century. In varied circumstances, delegation has been preferred by politicians seeking to build or maintain coalitions when monetary policy divides potential coalition partners.

The model has implications for the extensive empirical literature on central bank independence. It illustrates how endogenous selection could account for the relatively limited estimated effect of CBI on inflation performance. In fact, once one controls for endogenous selection, the evidence that CBI reduces inflation is significantly stronger.

The model, applied here to monetary policy, is sufficiently general that it could be used to analyze other questions, such as the delegation of responsibility over trade policy (e.g., in a customs union) or the division of fiscal responsibilities between different tiers of government. On the other hand, the model relies on quite restrictive assumptions (e.g., dichotomous policies, two policy dimensions) for tractability. Further work should focus on testing its predictions in other policy settings, and generalizing its results to less restrictive modeling environments.

Appendix I. Equilibrium Coalition Structure

I adopt the sequential coalition formation game formulated by Bloch (1996). This game is suited to our purposes because it assumes a given mapping of coalition structure into payoffs (as in our situation).[40] The game has four players, consisting of a representative member of each of the four factions. As in Bloch, the game is defined over a valuation v that maps the set of coalition structures into (four-element) payoff vectors and a rule of order ρ that defines the order in which the four players move.[41] The game is structured as follows: the first player (according to ρ) proposes the formulation of a coalition to which he belongs. Every other prospective member of this coalition then responds to this offer, in the order defined by ρ (in our case, each coalition has at most one other member, apart from the player proposing the coalition). If one of these members rejects the proposed coalition, then he makes a counter-offer (to which all prospective members of this proposed coalition must now respond, again in order according to ρ). Otherwise, if all members of the proposed coalition agree, then this coalition forms and its members withdraw from the game (they are now committed to membership of this coalition). The game then carries on (with coalition offers etc.) among the remaining players according to ρ.[42] The game ends when all players have exited.

The payoff matrix below gives the payoffs from different coalition structures (recall that each player can be a member of a $\overline{\theta}$, $\underline{\theta}$ or 0 coalition). Since the game is totally symmetric, only one set of payoffs is shown. Payoffs may differ for the larger and smaller factions $J \in \{S, L\}$.

		Own Coalition		
		$\overline{\theta}$	$\underline{\theta}$	0
Facing Coalition	$\overline{\theta}$	$\overline{A}$	n.a.	$\overline{B}_J$
	$\underline{\theta}$	n.a.	$\underline{A}$	$\underline{B}_J$
	0	$\overline{C}_J$	$\underline{C}_J$	A^0

where

$$\begin{aligned}
\overline{A} &\equiv \frac{1}{2}(V+\phi)\,; \overline{B}_S \equiv \phi; \overline{B}_L \equiv (1-\phi) \\
\underline{A} &\equiv \frac{1}{2}(\phi V+1)\,; \underline{B}_S \equiv \phi V; \underline{B}_L \equiv (1-\phi)\,V \\
\overline{C}_S &\equiv V; \overline{C}_L \equiv V + (2\phi - 1) \\
\underline{C}_S &\equiv 1; \underline{C}_L \equiv 1 + (2\phi - 1)\,V \\
A^0 &\equiv \frac{1}{2}(V+1)
\end{aligned}$$

[40] Ray and Vohra (1999) propose a similar game, but in their game the intra-coalition allocation is endogenous. For our purposes, this represents an unnecessary additional complication.

[41] The valuation is defined by the intra-coalition bidding process discussed in the text, which results in payoff vectors for each coalition structure. Hence payoffs are endogenous for the game as a whole, but exogenous to the coalition-formation subgame.

[42] Bloch (1996) provides a formal discussion of the game's structure.

and the payoffs have been normalized: $V^{\overline{\theta}} \equiv V > 1; V^{\underline{\theta}} \equiv 1$. The variable ϕ gives the probability of the disputed policy matching the preferred policy of the larger faction within the victorious two-faction coalition. From equation (9), its value is:

$$\phi = 1 - \frac{n^S}{2n^L} = \frac{3\sigma - 1}{2\sigma} \in \left[\frac{1}{2}, 1\right]$$

I adopt Bloch's equilibrium concept of **stationary perfect equilibrium**: a **subgame perfect equilibrium** that is also **stationary.** The defining feature of stationarity is that only payoff-relevant variables (any existing coalition offer, the players who have exited the game and the coalition structure (partition) of this set of exited players) affect strategies.

Proposition A.1 This game has **only one coalition structure that is consistent with stationary perfect equilibrium:** $\left[\overline{\theta}, \overline{\theta}\right]$ (two opposing coalitions form along the most contentious policy dimension $\overline{\theta}$).

Proof. By backwards induction. I first derive equilibrium strategies for the subgames when two players (factions) have formed either one or two coalitions and left the game. I show that if a $\overline{\theta}$ coalition has already formed, then only the coalition structure $\left[\overline{\theta}, \overline{\theta}\right]$ can emerge in equilibrium. I then derive equilibrium strategies for the subgames where no coalitions have already formed, and show that the first coalition to exit must be a $\overline{\theta}$ coalition. This completes the proof.

Assume that at least one coalition has formed and its members have exited the game, and that a total of two players have exited (two remain). There are then three potential partitions of the players who have exited the game: $\left\{[0,0], [\underline{\theta}], \left[\overline{\theta}\right]\right\}$ (that is, two "0 coalitions," a "$\underline{\theta}$ coalition" or a "$\overline{\theta}$ coalition").

The optimal response of an agent offered membership of a $\overline{\theta}$ coalition in either of the two feasible subgames would be to accept the offer.[43] This is because:

1. (if the coalition $\left[\overline{\theta}\right]$ has formed and exited): $\overline{A} > \overline{B}_J$;
2. (if the coalitions $[0,0]$ have formed and exited): $\overline{C}_J > A^0$.

For the same reason, in the subgame where two players have exited and formed either $\left[\overline{\theta}\right]$ or $[0,0]$, then if an offer of $\overline{\theta}$ is feasible, making the offer (which will be accepted) is optimal.

Hence, if a $\overline{\theta}$ coalition has formed, then $\left[\overline{\theta}, \overline{\theta}\right]$ is the only stationary perfect equilibrium coalition structure.

[43] Clearly if a $\underline{\theta}$ coalition has already formed and exited the game, then no $\overline{\theta}$ can form. Hence the offer is only feasible given the other two partitions of the exited players: $\left\{[0,0], \left[\overline{\theta}\right]\right\}$, and where the partition $[0,0]$ contains two players (factions) who *could have* formed a $\overline{\theta}$ coalition between them.

Now consider the subgame where two players have formed the $[\underline{\theta}]$ coalition or the same two players have formed the $[0,0]$ coalitions and exited. Then a player offered membership of a $\underline{\theta}$ coalition should accept the offer iff:

1. (if the coalition $[\underline{\theta}]$ has formed and exited): $\frac{1}{V} > \phi$ (player is 'S'); $\frac{1}{V} > 2 - 3\phi$ (player is 'L');
2. (if the coalitions $[0,0]$ have formed and exited): $\frac{1}{V} > 3 - 4\phi$ (player is 'L');

and should never accept if the coalitions $[0,0]$ have formed and exited and the player is 'S'.

Assuming that the offer will be accepted, the optimality conditions for making the offer are the same as for accepting the offer. But the players (factions) making and receiving the offer will by definition be different sizes. Hence, the optimality conditions need to hold for both types of faction $\{S, L\}$ for the offer to form the $\underline{\theta}$ coalition to be both offered and accepted. This implies that the $\underline{\theta}$ coalition cannot form when the coalitions $[0,0]$ have formed and exited.

The condition $\frac{1}{V} > \phi$ implies $\frac{1}{V} > 2 - 3\phi$ for the valid parameter ranges $\frac{1}{V} \in [0,1]$, $\phi \in \left[\frac{1}{2}, 1\right]$. Hence, in the subgame where two players have exited and formed $[\underline{\theta}]$ then making the offer $\underline{\theta}$ (which will be accepted) is optimal iff $\frac{1}{V} > \phi$. Otherwise, or if the coalitions $[0,0]$ have formed and exited and an offer $\underline{\theta}$ is feasible, then the optimal strategy for the next player to move is to withdraw from the game in a '0 coalition'.

Now consider the subgame where a single player has formed a $[0]$ coalition and withdrawn unilaterally from the game. Consider a player receiving a (feasible) offer of a $\left[\overline{\theta}\right]$ coalition in this subgame. Accepting this offer is optimal because the payoff $\overline{C}_J$ received in the resulting coalition structure is higher than the payoff in any other coalition structure. Since the offer will be accepted, making the offer is optimal for the same reason. Finally, if such an offer is feasible, no player in a position to make or receive the offer will accept any other offer, because the $\left[\overline{\theta}\right]$ coalition delivers the best payoff and because, by the ordering ρ, the player will later have the opportunity to either make or accept the offer of $\left[\overline{\theta}\right]$.

This implies that, when a single player has exited from the game, the only feasible coalition structure is $\left[0, 0, \overline{\theta}\right]$. But in this case, the player that exits the game obtains the payoff $\overline{B}_J$ which is his lowest possible payoff. Hence, withdrawing from the game cannot be an optimal strategy when no coalitions have already formed. This leaves making the offer $\left[\overline{\theta}\right]$ or $[\underline{\theta}]$ as potential first moves in equilibrium. Hence, we consider the best response to these moves (assuming that no coalitions have already formed).

First, assume that a player receives an offer of a $\left[\overline{\theta}\right]$ coalition. If the player accepts the offer then the coalition forms. We know that in this case, the other $\left[\overline{\theta}\right]$ coalition will also form, giving all players the payoff $\overline{A}$. Now assume that the player receives an offer of a $[\underline{\theta}]$ coalition. If he accepts the offer, and the coalition forms, we know that the other $[\underline{\theta}]$ coalition forms iff $\frac{1}{V} > \phi$. In this case, all players receive $\underline{A}$. If the player accepts and $\frac{1}{V} \leq \phi$ then the coalition structure will instead be $[0, 0, \underline{\theta}]$ from which the player obtains $\underline{C}_J$.

What if the player rejects whatever offer he has received? The player's expected payoff now depends on what coalition structure the player expects to subsequently emerge. These expectations must be consistent with equilibrium behavior (i.e., a player cannot attach a positive probability to a coalition structure inconsistent with equilibrium behavior). We have already shown that no player will play $[0]$ first, so that the first coalition to subsequently form must be either $[\underline{\theta}]$ or $\left[\overline{\theta}\right]$. The player will either be a member of this first coalition or not be a member. Hence, there are four potential first coalition formation scenarios depending on which coalition forms and whether the player is a member. Assume that the player attaches probabilities p^i, $i = \{1, 2, 3, 4\}$ to these scenarios, where $\sum_{i=1}^{4} p^i = 1$ and the scenarios i are:

$$\begin{aligned} i &= 1 : [\underline{\theta}] \text{ coalition forms, player is member} \\ i &= 2 : \left[\overline{\theta}\right] \text{ coalition forms, player is member} \\ i &= 3 : [\underline{\theta}] \text{ coalition forms, player is not a member} \\ i &= 4 : \left[\overline{\theta}\right] \text{ coalition forms, player is not a member} \end{aligned}$$

Hence, the payoff from **not agreeing to form a coalition** is given by:

1. (if $\frac{1}{V} > \phi$):
$$(p_1 + p_3)\,\underline{A} + (p_2 + p_4)\,\overline{A} \in \left[\underline{A}, \overline{A}\right]$$
2. (if $\frac{1}{V} \leq \phi$):
$$p_1 \underline{C}_J + p_3 \underline{B}_J + (p_2 + p_4)\,\overline{A}$$

Clearly, in the first case, since $\underline{A} \leq (p_1 + p_3)\,\underline{A} + (p_2 + p_4)\,\overline{A} \leq \overline{A}$, the player will **always accept an offer of a $\left[\overline{\theta}\right]$ coalition and never accept the offer of a $[\underline{\theta}]$ coalition**. Since the offer of $\left[\overline{\theta}\right]$ is always accepted it is always optimal to make such an offer. Hence, for $\frac{1}{V} > \phi$, the only coalition structure consistent with stationary perfect equilibrium is $\left[\overline{\theta}, \overline{\theta}\right]$.

In the second case, note that for any *small* faction:

$$\begin{aligned} \underline{C}_S &= 1 \\ \underline{B}_S &= \phi V \geq \frac{1}{V} V = 1 \\ \overline{A} &= \frac{1}{2}(V + \phi) \geq \frac{1}{2}\left(V + \frac{1}{V}\right) > 1 \text{ for } V > 1 \end{aligned}$$

Hence **a small faction will never accept an offer of a $[\underline{\theta}]$ coalition**. If a small faction proposes a $[\underline{\theta}]$ coalition, he obtains $\underline{C}_S = 1$ if the proposal is accepted and some $p_1 \underline{C}_S + p_3 \underline{B}_S + (p_2 + p_4)\,\overline{A} > \underline{C}_S$ if the proposal is rejected. If he proposes a $\left[\overline{\theta}\right]$ coalition he obtains $\overline{A} = \frac{1}{2}(V + \phi)$ if the offer is accepted and some $p'_1 \underline{C}_S + p'_3 \underline{B}_S + (p'_2 + p'_4)\,\overline{A}$ if the

offer is rejected. Note that since $\overline{A} > \underline{C}_S$ and $\underline{B}_S > \underline{C}_S$, the player can only propose the $[\underline{\theta}]$ coalition if he believes that it will be rejected (otherwise proposing the $\left[\overline{\theta}\right]$ coalition strictly dominates). For his beliefs to be rational, then it must be the case that such an offer will be rejected by the other player (the large faction). Hence, **if a large faction proposes a $[\underline{\theta}]$ coalition, it is always rejected by the small faction, and if a small faction proposes a $[\underline{\theta}]$ coalition, it must always rejected by the large faction for the offer to be (rationally) made.** This implies that a $[\underline{\theta}]$ coalition can never be offered and accepted, and therefore cannot form in equilibrium. Hence, for $\frac{1}{V} \leq \phi$, the only coalition structure consistent with stationary perfect equilibrium is also $\left[\overline{\theta}, \overline{\theta}\right]$. ■

This completes the proof.

Appendix II. The Revealed Preference Proxy $\widehat{\pi}_4$

To allow the response to the two separate questions to yield a full preference ordering, I match two pairs of alternatives in the questions, assuming that agents are indifferent between the two policies within each pair. The policies are matched as follows:

Question 1 policy	Relationship	Question 2 policy
P_{11}: 'a high level of economic growth'	Policy Alternatives	P_{21}: 'fighting rising prices'
P_{12}: 'strong defence forces'	Matched	P_{22}: 'maintaining order'
P_{13}: 'seeing that people have more say about how things are done...'	Matched	P_{23}: 'giving people more say in important government decisions'
P_{14}: 'making our cities and countryside more beautiful'	Not Matched	P_{24}: 'protecting freedom of speech'

The rationale for this matching is that the second pair of policies both refer to law and order and the third pair both refer to democracy, and one would expect policy preferences over the two policies in each pair to be very similar. Preference orderings are denoted by the notation $A \succ B$: "Policy A strictly preferred to Policy B;" $A \sim B$: "Agent is indifferent between policies A and B." Then the matching is equivalent to the assumptions:

$$\begin{aligned} P_{12} &\sim P_{22} \\ P_{13} &\sim P_{23} \end{aligned}$$

Within each question k, a preference ordering can be uncovered by ranking policy alternatives according to first choice (P_k^1), second choice (P_k^2) and unchosen policies $\left(P_k^{U1}, P_k^{U2}\right)$:

$$P_k^1 \succ P_k^2 \succ \left\{P_k^{U1}, P_k^{U2}\right\}$$

Our assumptions $P_{12} \sim P_{22}$, $P_{13} \sim P_{23}$ then allow us to uncover preference orderings across questions, specifically with reference to the economic policy options P_{11}, P_{21}. For instance:

$$P_{21} \succ [P_{22} \sim P_{12}] \succ P_{11}$$

Agents can then be assigned a (binary) score for $\widehat{\pi}_4^i$ according to the following rule:[44]

$$\begin{aligned} \widehat{\pi}_4^i &= 1 \text{ if a transitive preference ordering gives us } P_{11} \succ P_{21} \\ \widehat{\pi}_4^i &= 0 \text{ if if a transitive preference ordering gives us } P_{21} \succ P_{11} \\ \widehat{\pi}_4^i &= \text{. if no transitive preference ordering is identifiable.} \end{aligned}$$

[44] The lack of a transitive preference ordering can arise in a number of cases, for instance if $P_{21} \succ [P_{22} \sim P_{12}] \succ P_{11}$ but $P_{11} \succ [P_{13} \sim P_{23}] \succ P_{21}$.

Appendix III. Calculation of Income Percentiles

For most countries the "income" variable in the WVS dataset divides the population into ten groups described as "deciles" but the income categories do not explicitly match income deciles derived from the population income distribution. This makes cross-country comparison difficult.

To overcome this problem, I use the following strategy:

1. Obtain the upper and lower nominal income limits for agents i in each income category j, per country k (number of observations in each category=n^{jk}).
2. Fit a Singh-Maddala income distribution treating the sample as representative of the population as a whole (using the initial resampling weights $\widehat{w}^{ijk}$supplied in the dataset).[45]
3. Using the estimated income distribution, derive the percentile values of the upper and lower limits on each income category $\left\{pc_{upper}^{jk}, pc_{lower}^{jk}\right\}$ and hence the median percentile of each category.

[45] The Singh-Maddala distribution has the cdf $F(y) = 1 - \frac{1}{\left(1+\left(\frac{y}{b}\right)^{a}\right)^{q}}$ (see Singh and Maddala, 1976). As McDonald (1984) demonstrates, this distribution is a special case of the Generalised Beta of the Second Kind and is itself a generalisation of both the Weibull and the Fisk or Sech distributions. McDonald finds it provides the best fit of all the three-parameter distributions he considers, and also fits the data considerably better than the log-normal.

REFERENCES

Bernhard, William, 1998, "A Political Explanation of Variations in Central Bank Independence," *American Political Science Review*, Vol. 92, No. 2, pp. 311–27.

———, 2000, *Banking and Reform: Political Parties and Central Bank Independence in the Industrial Democracies* (Ann Arbor: University of Michigan Press).

Bernhard, William, and David Leblang, 2002, Political Parties and Monetary Commitments," *International Organization*, Vol. 56, No. 4, pp. 803–30.

Blinder, Alan, 1997, "What Central Bankers Could Learn from Academics—and Vice-Versa," *Journal of Economic Perspectives*, Vol. 11, No. 2, pp. 3–19.

———, 1998, *Central Banking in Theory and Practice* (Cambridge, Massachusetts: MIT Press).

Bloch, Francis, 1996, "Sequential Formation of Coalitions with Externalities and Fixed Payoff Division," *Games and Economic Behavior*, Vol. 14, pp. 90–123.

———, 1997, "Noncooperative Models of Coalition Formation in Games with Spillovers," in *New Directions in the Economic Theory of the Environment*, ed. by C. Cararro and D. Siniscalco (Cambridge: Cambridge University Press).

Bowles, Paul, and Gordon White, 1994, "Central Bank Independence: A Political Economy Approach," *Journal of Development Studies*, Vol. 31, No. 2, pp. 235–64.

Boylan, Delia, 1998, "Preemptive Strike: Central Bank Reform in Chile's Transition from Authoritarian Rule," *Comparative Politics*, Vol. 30, No. 4, pp. 443–62.

Brands, Henry W., 2005, *Andrew Jackson: His Life and Times* (New York: Doubleday).

Corder, J. Kevin, 1998, *Central Bank Autonomy: The Federal Reserve System in American Politics* (New York: Garland Publishing Inc.).

Crowe, Christopher, 2005, The Political Economy of Macroeconomic Policy: Policies, Preferences, and Institutions (Ph.D. Thesis; London: University of London).

Demange, Gabrielle, 1994, "Intermediate Preferences and Stable Coalition Structures," *Journal of Mathematical Economics*, Vol. 23, pp. 45–58.

Drazen, Allan, 2000, *Political Economy in Macroeconomics* (Princeton, New Jersey: Princeton University Press).

Eggertsson, Gauti, and Eric Le Borgne, 2003, "A Political Agency Theory of Central Bank Independence," IMF Working Paper 03/144 (Washington: International Monetary Fund).

Eijffinger, Sylvester, and Jakob De Haan, 1996, *The Political Economy of Central Bank Independence*, Special Papers in International Economics, No. 19 (Princeton, New Jersey: International Financial Section, Department of Economics, Princeton University).

Elgie, Robert, and Helen Thompson, 1998, *The Politics of Central Banks* (London; New York, NY: Routledge).

Fischer, Stanley, 1995, "Central Bank Independence Revisited," *American Economic Review*, Vol. 85, No. 2, pp. 201–6.

Friedman, Milton, and Anna Schwartz, 1963, *A Monetary History of the United States 1867–1960* (Princeton, N.J.: Princeton University Press).

Fry, Maxwell, DeAnne Julius, Lavan Mahadeva, Sandra Roger, and Gabriel Sterne, 2000, "Key Issues in the Choice of Monetary Policy Framework," in *Monetary Policy Frameworks in a Global Context*, ed. by Lavan Mahadeva and Gabriel Sterne (London: Routledge).

Goodhart, Charles, 2003, "The Constitutional Postion of the Central Bank," in *Money, Inflation and the Constitutional Position of the Central Bank*, ed. by M. Friedman and C. Goodhart (London: Institute of Economic Affairs).

———, and Ellen Meade, 2004, "Central Banks and Supreme Courts," in *Moneda y Crédito* 218, pp. 11–42 (Madrid: Fundacion Santander Central Hispano).

Goodman, John B., 1991, "The Politics of Central Bank Independence," *Comparative Politics*, Vol. 23, No. 3, pp. 329–49.

Heston, Alan, Robert Summers, and Bettina Aten, 2002, *Penn World Table Version 6.1* (Philadelphia, Pennsylvania: Center for International Comparisons at the University of Pennsylvania).

Hillman, Arye L., 1989, *The Political Economy of Protection* (Chur, Switzerland: Harwood Academic Publishers).

Jaggers, Keith, and Ted Gurr, 1995, "Tracking Democracy's Third Wave with the Polity III Data," *Journal of Peace Research*, Vol. 32, No. 4, pp. 469–82.

Keefer, Philip, and David Stasavage, 2003, "The Limits of Delegation: Veto Players, Central Bank Independence and the Credibility of Monetary Policy," *American Political Science Review*, Vol. 97, No. 3, pp. 407–23.

Leip, Dave, "Dave Leip's Atlas of U.S. Presidential Elections," April 3, 2006. Available via Internet: http://uselectionsatlas.org/.

Levy, Gilat, 2002, "Endogenous Parties: Cooperative and Non-cooperative Analysis," (unpublished; London, U.K.: Department of Economics, LSE).

———, 2004, "A Model of Political Parties," *Journal of Economic Theory*, Vol. 115, No. 2, pp. 250–77.

Lodge, Tom, 2004, "The ANC and the Development of Party Politics in Modern South Africa," *Journal of Modern African Studies*, Vol. 42, No. 2, pp. 189–219.

Lohmann, Susan, 1998, "Federalism and Central Bank Independence: The Politics of German Monetary Policy, 1957–1992," *World Politics*, Vol. 50, No. 3, pp. 401–46.

Maddala, G. S., 1983, *Limited-Dependent and Qualitative Variables in Econometrics* (Cambridge: Cambridge University Press).

Mahadeva, Lavan, and Gabriel Sterne, eds., 2000, *Monetary Policy Frameworks in a Global Context* (London: Routledge).

Marshall, Monty G., and Keith Jaggers, 2001, "Polity IV Project: Political Regime Characteristics and Transitions, 1800-1999," Availabe via the Internet: www.cidcm.umd.edu/inscr/polity/.

McDonald, James B., 1984, "Some Generalised Functions for the Size Distribution of Income, *Econometrica*, Vol. 52, No. 3, pp. 647–64.

Milesi-Ferretti, Gian-Maria, 1994, "Wage Indexation and Time Inconsistency," *Journal of Money, Credit and Banking*, Vol. 26, pp. 941–50.

Moser, Peter, 1999, "Checks and Balances, and the Supply of Cnetral Bank Independence," *European Economic Review*, Vol. 43, pp. 1569–93.

Osborne, Martin, and Ariel Rubinstein, 1994, *A Course in Game Theory* (Cambridge, Massachusetts: MIT Press).

Padayachee, Vishnu, 2001, "Central Bank Transformation in a Globalized World: The Reserve Bank in Post-Apartheid South Africa," *Journal of International Development*, Vol. 13, pp. 741–65.

Persson, Torsten, and Guido Tabellini, 2000, *Political Economics: Explaining Economic Policy* (Cambridge, Massachusetts: MIT Press).

Posen, Adam, 1993, "Why Central Bank Independence Does Not Cause Low Inflation: There Is No Institutional Fix For Politics," in *Finance and the International Economy 7*, ed. by R. O'Brien (Oxford: Oxford University Press).

Ray, Debraj, and Rajiv Vohra, 1999, "A Theory of Endogenous Coalition Structures," *Games and Economic Behavior*, Vol. 26, pp. 286–336.

Rogoff, Kenneth, 1985, The Optimal Degree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics*, Vol. 100, pp. 1169–90.

Singh, S. K., and G. S. Maddala, 1976, "A Function for Size Distribution of Income," *Econometrica*, Vol. 44, No. 5, pp. 963–70.

Timberlake, Richard, 1994, *Monetary Policy in the United States: An Intellectual and Institutional History* (Chicago: University of Chicago Press).

Walsh, Carl, 1995, "Optimal Contracts for Central Bankers," *American Economic Review*, Vol. 85, pp. 150–67.

Wilentz, Sean, 2005, *The Rise of American Democracy: Jefferson to Lincoln* (New York: W. W. Norton & Company).

Wooley, John T., 1984, *Monetary Politics: The Federal Reserve and the Politics of Monetary Policy* (London: Cambridge University Press).

World Values Survey, 1990-1991, (Ann Arbor, Michigan: Institute for Social Research, University of Michigan).

———, 1995-1997 (Ann Arbor, Michigan: Institute for Social Research, University of Michigan).

Yi, Sang-Seung, 1997, "Stable Coalition Structures with Externalities," *Games and Economic Behavior*, Vol. 20, pp. 201–37.