
Exchange Rate Regimes and Independent Central Banks: A Correlated Choice of Imperfectly Credible Institutions

Cristina Bodea

Abstract Theory and empirical evidence show that low inflation is a precondition for economic growth. Independent central banks and fixed exchange rates are institutional mechanisms that help keep inflation low by lending monetary policy credibility to governments. However, the two institutions are commonly analyzed as substitutes that tie the hands of inflation prone governments. Thus, the literature has difficulties describing why governments would adopt both institutions and the interaction between them. This paper presents a model that allows policymakers the simultaneous choice of monetary institutions and shows that imperfectly credible institutions will overlap: when exchange rates are fixed but adjustable and central bank independence is not fully ascertainable, governments choose both institutions. More generally, the paper generates hypotheses about the conditions that make fixed exchange rates and independent central banks complements or substitutes, thus contributing to an explanation of the diversity of global monetary institutions in the post-Bretton Woods period.

If the policymaker's wrists were already bound by exchange target duct tape, what would be the effects of an additional pair of handcuffs from inflation targets and yet another loop of rope from central bank independence? One could argue that the effect would be nil, because the exchange rate commitment already credibly limited the central banker's discretion. One could instead argue that the effect would still be greater credibility, albeit with diminishing returns, because inflationary government officials are escape artists and

I thank Randy Stone, Kevin Clarke, Thomas Sattler, Robert Walker, and my colleagues at Michigan State University for discussions at various stages of this project. Thomas Plümper and the *IO* editors and reviewers have been particularly helpful in bringing the article to its final shape. I have also benefited from comments at the Watson Brown Bag Series at the University of Rochester, the Annual Conference of the MPSA, Chicago 2004, the EITM Workshop, UC Berkeley, 2005, and the IPES Inaugural Meeting, Princeton 2006. Work on this article was completed while I was on leave at the European Central Bank in Frankfurt, Germany. The views expressed in this article are those of the author and do not necessarily reflect those of the European Central Bank.

International Organization 64, Summer 2010, pp. 411–42
© 2010 by The IO Foundation.

doi:10.1017/S0020818310000111

the more restraints the better ... Theory gives no single answer to this empirical question.¹

Economic theory and empirical evidence show that high inflation cannot deliver employment and economic growth. In fact, not only is inflation a way for the government to cheat small savers and the poor, but bringing down inflation from high levels is also likely to cause a deep recession. Altogether, the recent consensus stresses the importance of maintaining stable prices and avoiding inflationary spikes. The overall economic policy of a country, however, is sometimes inconsistent with the goal of low inflation. The literature identifies independent central banks and fixed exchange rates as the main institutional mechanisms that governments use to gain anti-inflationary credibility. Both institutions are argued to increase credibility and help maintain price stability because both restrain the use of monetary policy by governments. In this article I explore how governments design the set of institutional constraints they place on themselves when it comes to inflation and monetary policy. To this end, I develop a model describing when and why policymakers would choose independent central banks and fixed exchange rates together, alone, or not at all, given that the two institutions lack perfect credibility and policymakers are partisan.

In terms of framework, this article draws on recent research suggesting that the choice of the exchange-rate regime and the degree of independence of the central bank are correlated processes as opposed to unconnected decisions.² The argument is that if both institutions work similarly to insure stable prices and the focus is on inflation fighting, there is a need to explain why countries adopt different mixes of institutions. In this light, it is puzzling that a notable 26 percent of countries after the collapse of the Bretton Woods system of fixed exchange rates choose both an independent bank and fixed exchange rates, whereas the rest of the countries choose only one institution or none.³ In a more specific example, all postcommunist countries struggled with high inflation and lack of credibility during the transition to market economy. Yet, these countries adopted diverse mixes of anti-inflationary institutions with very different timing as well: the Czech Republic in 1993 chose both a fixed exchange rate and an independent central bank. Similarly, Bulgaria in 1997 adopted a currency board and granted more independence to its central bank. However, Moldova in 1995 chose only a very independent central bank, while in the early 1990s, Romania had neither fixed rates nor an independent bank. The examples above show that governments engage in “comparative shopping” when it comes to delegation of monetary policy, and that, potentially, there is both complementarity and substitution between fixed rates and independent central banks. To try to explain the diversity of monetary institutions in the post-Bretton Woods period, in this article the government has at its disposal a

1. Kuttner and Posen 2001, 12.

2. Bernhard, Broz, and Clark 2002.

3. *Ibid.*

larger set of actions than in much of the previous literature:⁴ it can choose fixed or flexible exchange rates and a dependent or independent central bank.

In addition, I explicitly consider the benefits and costs of the two monetary institutions and extend the analysis by allowing the government to choose more realistic institutions than previous studies. Focusing on stable prices, the benefit of adopting fixed exchange rates or an independent central bank is increased credibility in monetary policy. The major cost of delegation is common to both fixed rates and independent central banks: the government is restricted in the use of monetary policy to react to domestic economy slowdowns. Yet fixed rates and independent central banks also have particular disadvantages. Central bank procedures and performance lack transparency when compared to fixed rates.⁵ Visible fixed rates, on the other hand, run the risk of severe misalignment and currency devaluations.⁶ These shortcomings diminish the ability of each individual institution to deliver increased credibility, thus making it worthwhile for governments to doubly tie their hands in monetary policy.

The question of what type of constraints countries place on themselves in monetary policy has remained salient as the answers have changed over time due to the liberalization of global capital transactions and a growing recognition of the importance of transparency for achieving stable prices. In the last two decades, delegation to an independent central bank has been on the rise, most notably in developing countries,⁷ but also in Western Europe, in the context of the Economic and Monetary Union, and Japan in 1998. Independent central banks have been argued to reduce inflation because central bankers tend to take a longer view of the policy process and are, on average, more conservative about price stability than elected politicians.⁸ However, while there have been efforts to improve central bank transparency (publication of macroeconomic projections, direct inflation targeting), central bank procedures and performance remain more vague when compared to fixed rates, and are harder to monitor in the short run.⁹ Fixed exchange rates, on the other hand, work by tying domestic economic policy to that of a low inflation country, thus 'importing' the lower foreign inflation.¹⁰ The advantage of fixed exchange rates is that both the fix and the subsequent adjustments are visible

4. See, for example, Barro and Gordon 1983; Rogoff 1985; Giavazzi and Pagano 1988; and Milesi-Ferretti 1995. Clark 2002 is an exception.

5. See Keefer and Stasavage 2002; and Broz 2002.

6. See Edwards 1996; and Frankel 2005.

7. See Cukierman, Miller, and Neyapti 2002; and Jácome and Vázquez 2005.

8. Cukierman, Webb, and Neyapti 1992.

9. A monetary policy rule such as inflation targeting—putting a number on what it means to have stable prices—has undoubtedly increased the transparency of central bank objectives. Still, targets are not easy to monitor in the short term because central banks have only imperfect control over inflation and targeting has a medium term horizon (see Svensson 1997; and Canavan and Tommasi 1997). Also, the literature suggests that an independent and accountable central bank is a precondition for successful inflation targeting (see Eichengreen et al. 1999; Masson, Savastano, and Sharma 1997; and Agénor 2001).

10. See Ghosh et al. 1997; and Levy-Yeyati and Sturzenegger 2003.

and relatively easier to monitor. On the down side, in a world of mobile capital, fixed exchange rates can be and are devalued and generate political costs for governments when a currency devaluation occurs. In the post–Bretton Woods period, most countries that had a de jure fixed exchange rate regime adjusted it at some point, remaining within the fix or moving to flexible exchange rates.¹¹ In the terminology of Reinhart and Rogoff, the reality is that many de jure fixed rate arrangements become de facto floating rates, due to devaluations.¹² Also, while fixed exchange rates remain the choice of a monetary institution in the majority of developing countries, in the past two decades the risk of a costly adjustment has reduced countries' appetite for formally fixing their currency.¹³

In terms of results, this article is able to replicate key findings from the literature on inflation and monetary institutions and, more importantly, it has novel hypotheses as well. The first set of new findings pertains to the issue of institutional complementarity. In this article, institutions overlap with respect to the goal they need to achieve (low inflation) but each institution can only achieve its goal imperfectly. The model shows that governments operating in such a monetary policy institutional environment end up with a mix of institutions that keep inflation in check. In particular, a complementary relationship and a mix of monetary institutions is likely when the political costs of fixed exchange rate adjustments are low and delegation to an independent central bank is relatively transparent. The second set of results identifies specific conditions that make the two monetary institutions complements or substitutes. For example, when monetary institutions are not trusted, right-wing governments start behaving the way one would expect the left to behave in normal times. That is, in bad times for macroeconomic stability, the right is more likely to adopt an independent central bank either alone or in combination with a fixed exchange rate. In hyperinflation episodes or in countries democratizing after an authoritarian regime, the model predicts that the right will be more likely to adopt a monetary institution that is conservative but whose independence is not entirely clear to the public.

The Fall 2002 issue of *International Organization* aimed to explain the evolution of monetary institutions in the post–Bretton Woods period by analyzing independent central banks and fixed exchange rates together. The present article builds on this research in that it explicitly considers a correlated institutional choice by the government and allows the two institutions to have different degrees of transparency. In addition, this article's main contribution is threefold: first, by letting fixed exchange rates be an imperfect commitment instrument, it takes into account real world features that figure prominently in the current thinking about exchange

11. For example, Slovakia fixed its exchange rate in 1993 but adjusted the fixed rates in 1993, 1994, 1996, and 1997. Similarly, Bolivia in the late 1970s and early 1980s adopted fixed exchange rates that were adjusted several times in 1979, 1982, 1983, and 1985.

12. Reinhart and Rogoff 2004.

13. International Monetary Fund 2006.

rate regime classification. Also, by allowing the government the choice of two imperfect policy instruments, it gives a motivation to governments to choose a mix of institutions. Second, the literature on the political economy of monetary institutions has had mixed results on the relevance of partisanship.¹⁴ Contributing to this literature, this article suggests that the effect of partisanship on the adoption of monetary institutions is likely to be conditional on economic and political circumstances influencing the credibility of institutions. Finally, the article generates new testable hypotheses and suggests ways to operationalize the parameters of the model.

Inflation, Central Banks, and Exchange Rates

The traditional monetary policy model goes back to Barro and Gordon's seminal 1983 article.¹⁵ In such a model, executives make inflation announcements, private actors make decisions based on their inflationary expectations, and policymakers act again, trying to cheat by introducing surprise inflation after private actors have made decisions about the quantity of money they will hold. The effect of this cheating, if it comes as a surprise, is to increase output and employment. A rational public, however, anticipates government's moves and does not believe the initial inflation announcements. The result is higher inflation than optimally desired by the government without the benefit of increased employment and output.

Rational expectations and the incentives to cheat underlined above combine to create a time-inconsistency problem. Policymakers facing such a problem find it difficult to make credible commitments by themselves. In this context, Rogoff, Giavazzi and Pagano, Alesina and Grilli, and Milesi-Ferretti show the advantages of delegating monetary policy by fixing the exchange rate or by allowing the central bank to be independent.¹⁶ The two mechanisms restrain opportunistic politicians and achieve the same goal of low inflation, albeit in different ways. Granting independence to the central bank works because central bankers, generally, come from business, financial, or academic circles, tend to take a longer view of the policy process, and are, on average, more conservative about price stability than elected politicians or the median voter. Fixed exchange rates work by tying domestic economic policy to that of a less inflation-prone country, thus 'importing' the lower foreign inflation.

For open economies, the major cost of delegation is common to both fixed rates and independent central banks: the government is restricted in its use of monetary policy to smooth large negative shocks to the domestic economy. In a recession, for example, policymakers lack flexibility in using monetary policy to stimulate

14. See, for example, Broz and Frieden 2001; and Frieden 2002.

15. Barro and Gordon 1983.

16. See Rogoff 1985; Giavazzi and Pagano 1988; Alesina and Grilli 1992; and Milesi-Ferretti 1995.

output and employment.¹⁷ Lohmann addresses the loss of flexibility due to delegation and designs an optimal delegation rule that allows flexible policy response to unforeseen large shocks to the economy.¹⁸ Her model allows the government the choice of the degree of central bank conservatism as well as the cost at which it could override the central banker in setting inflation. In equilibrium, the government never overrides the central banker, as the central banker accommodates the government when large negative shocks occur.

The more recent literature addresses additional political economy issues relevant to monetary policy delegation. Moser studies the cost of withdrawing the independence granted to the central banker.¹⁹ He analyzes the interaction between a conservative central banker and two legislative bodies with veto power over legislation to amend the independence of the central banker. He shows that a nominally independent bank can freely choose monetary policy only if the two legislative bodies have heterogeneous preferences. Keefer and Stasavage show empirically that the presence of multiple political veto players is crucial to the effectiveness of independent central banks in reducing inflation.²⁰ They also find that fixed exchange rates have a greater anti-inflationary impact when it is hard for the public to ascertain the sources of the inflationary process, emphasizing the transparency qualities of fixed rates. Further, Broz argues that central bank independence and fixed rates are alternative monetary commitments that vary in transparency and that the transparency of political systems is a substitute for the transparency of monetary commitment devices.²¹ He finds empirical evidence that dictatorial regimes are more likely to use fixed exchange rates. Copelovitch and Singer also find that inflation is significantly higher in countries where central banks have regulatory responsibilities, although this effect is conditional on the choice of exchange rate regime and the relative size of the banking sector.²²

Closer to this article in terms of methodology, Canavan and Tommasi investigate the incentives created by incomplete information about a government's type in a game where the choice is over the transparency of a single policy instrument.²³ Transparency of commitment institutions is a central concern in this article, yet the structure of the model is more similar to that of Clark.²⁴ Clark explores

17. Even more, Iversen 1998 suggests that the nature of the monetary regime (accommodative or not for the central bank or the exchange rate regime) in combination with the structure of wage bargaining (decentralized to highly centralized) could have permanent costs in terms of the equilibrium level of unemployment. The size of delegation costs could be different for the two institutions if the domestic and foreign central bankers have different levels of preferred inflation (O'Mahony 2007).

18. Lohmann 1992.

19. Moser 1999.

20. Keefer and Stasavage 2002.

21. Broz 2002.

22. Copelovitch and Singer 2007.

23. Canavan and Tommasi 1997.

24. Clark 2002.

the policymaker's choice of two commitment institutions—the exchange rate regime and the status of the central bank—in a one period game of complete information.²⁵ The value added in Clark's model is that he takes seriously the potential for both institutional substitution (fixed rates and independent central banks) and policy substitution (fiscal and monetary policy). In doing so, however, he chooses to model a perfectly predictable economy. The problem with assuming no unanticipated shocks to output is that delegation of monetary policy ceases to be costly if one allows players to be strategic and use rational expectations. Clark's model takes inflation expectations as exogenously determined, while admitting that endogenizing beliefs is desirable.²⁶ With endogenous rational expectations on the part of markets, the policymaker that does not delegate monetary policy faces the time inconsistency problem and ends up in a situation with high inflation and no output growth. If the economy is considered perfectly predictable the traditional problem of delegation—credibility versus flexibility—disappears as policymakers do not need flexibility to react to future unanticipated downturns in the business cycle. The immediate solution to the game, then, is that the policymaker always prefers to delegate monetary policy under a contract specifying appropriate action for all contingencies. Such a result is problematic because, in practice, monetary policy delegation is a hotly debated domestic policy choice and delegation is not ubiquitous. The analysis in this article departs in several ways from that of Clark: the model allows inflation expectations to be determined endogenously, and allows the economy to suffer shocks unanticipated by either markets or the policymaker. Most importantly, I let both fixed exchange rates and independent central banks be imperfect commitment institutions.

Central Banks and Exchange Rates—Imperfect Institutions

To date, there is limited systematic research investigating the complementarity between fixed rates and an independent central bank, as well as the conditions that make the two institutions complements or substitutes.²⁷ In particular, the theoretical literature on time-inconsistent monetary policy has overlooked the fact that central banks and fixed rates have specific disadvantages. The two commitment institutions are flawed in different ways. In the short term, central bank proce-

25. Clark and Hallerberg 2000 also have a complex institutional setup, including a central bank that can be more or less independent, an exchange rate that can be fixed or flexible, and international capital that can be more or less mobile. In the paper, however, the institutional setup is given at the beginning of the game and the choice is over budgetary spending by the government and domestic inflation by the central bank. An indirect implication from Clark and Hallerberg 2000 that is worth pursuing in future analytical work is that governments in countries with independent central banks could move to a fixed rate because they can gain price stability while maintaining the ability to run fiscal deficits in electoral years.

26. Clark 2002, 731.

27. *International Organization* 2002.

dures and performance lack transparency and clarity when compared to fixed rates, and therefore central bank actions are more difficult to monitor.²⁸ Many times, central banks do not publish their intermediary targets for achieving price stability, or it is hard for markets to understand central bank targets or public statements, as well as the relationship between inflation and intermediary targets, such as the growth rates of money.

More recently, however, central banks in a number of countries have adopted a monetary rule that directly targets the rate of inflation.²⁹ Such a rule specifies the numerical inflation target as well as the time frame for it to be achieved. Undoubtedly, inflation targets are improving the transparency of central bank objectives. Still, it is the case that central banks have only imperfect control over inflation and targeting has a medium-term horizon, as inflation reacts with considerable time lags to changes in interest rates and is also influenced by factors beyond the control of monetary policy.³⁰ This means that in the short run, it is still difficult for the public to identify the reasons behind an increase in inflation. It is also difficult to assess whether, after a spike, inflation will be falling within the time frame specified in the law for the inflation target to be achieved. For these reasons, fixed rates are easier to monitor even than an independent central bank with an inflation target.³¹ For example, following the recent spike in oil and food prices in 2007–2008, most inflation targeting central banks failed to achieve their targets. Also, the estimated time frame for a return to price stability was anywhere from a couple of months to a year or longer.³² Moreover, the literature identifies various preconditions for successful inflation targeting, one of which is to have an independent and accountable central bank.³³ Such preconditions appear all the more

28. See, for example, Broz 2002, for a discussion of the relative transparency of fixed rates when compared to independent central banks. Note, however, that not all central banks are equally transparent (Stasavage 2003), as will also be reflected in this article.

29. Twenty-two countries in 2003, see Mukherjee and Singer 2008.

30. See, for example, Svensson 1997; and Canavan and Tommasi 1997.

31. The model in this article can account for monetary rules such as inflation targeting within the discussion of the parameter, p —the probability that the announcement of an independent central bank by the government is not believed by the public. In particular, the probability, p , will be lower for independent central banks that are more transparent, including those already pursuing inflation targeting or the ones for which independence comes together with inflation targeting.

32. In the case of the Bank of England, the inflation target set by the government is 2 percent. By law, when inflation goes out of a ± 1 percent band around the target, the Bank of England governor writes a letter to the Chancellor of the Treasury explaining why inflation has moved from target, the time frame to return to the target, and the actions taken by the bank to make such a return feasible. The very large uncertainty surrounding the price outlook and the monitoring difficulty is clear from the content of such letters: in his June 2008 letter, the Bank of England governor estimated that it may take inflation about a year to return to target, after estimating earlier in April that prices would return to target in a mere a matter of months (Bank of England, “Letter from the Governor to the Chancellor”, 16 June 2008, available at <http://www.bankofengland.co.uk/monetarypolicy/pdf/cpiletter080616.pdf> accessed 2 April 2010; and Bank of England, “Letter from the Governor to the Chancellor”, 16 April 2008, available at <http://www.bankofengland.co.uk/monetarypolicy/pdf/cpiletter070417.pdf> accessed 2 April 2010).

33. See Eichengreen et al. 1999; Masson, Savastano, and Sharma 1997; and Agénor 2001.

important in times with large price shocks, such as the 2007–2008 increases in commodity prices. In such circumstances, the independence and reputation of the central bank can anchor inflation expectations and prevent broad-based wage indexation, despite temporary deviations from inflation targets.

By comparison, fixed exchange rates are clear and visible rules for the behavior of the currency and the public can recognize quickly a devaluation of the fixed rate. In the short term, markets can monitor easily whether a commitment has been broken. For example, Eichengreen and colleagues compare fixed exchange rates and inflation targets with respect to their visibility: “even when countries have accomplished a successful transition to a more flexible exchange rate, there is a tendency for the easily monitored exchange rate to become the focal point of private sector expectations, to the detriment of the less visible and more medium term inflation target.”³⁴

Yet, fixed rates are not a perfect commitment mechanism either. First, they present the risk of serious misalignment and are prone to being abandoned: “aside from a few minor tourist economies, oil sheikdoms and heavily dependent principalities, only a very small number of fixed exchange rates have survived the past years intact.”³⁵ Compared to fixed rates, reversals in central bank independence are rare. In the last decades, countries have generally moved toward granting their central banks more legal independence. For example, in Eastern Europe and the former Soviet Union after the fall of communism, there are only two cases of countries changing central bank legislation in the direction of less independence: Belarus in June 2001 and the Czech Republic in April 2002. In Latin America and the Caribbean, most central banks were granted substantial independence in the 1990s.³⁶ Still, opposition to independent central banks has gained some ground in recent years and countries passed new legislation undermining autonomy. For example, the Colombian Constitutional Court decided in 1999 to cap mortgage interest rates. Also, amidst a severe currency crisis and economic

34. See Eichengreen et al. 1999. Also, in this paper, the fixed rates given as a choice to the government are pronounced, *de jure* exchange rates. As Reinhart and Rogoff 2004 show, however, countries also maintain at times a *de facto* fixed exchange rate, without any pre-announced arrangement by the government (about 50 percent of the countries that have a managed float actually operate *de facto* pegs). In the case of *de facto* rates, the government does not assume a specific commitment. Still Calvo and Reinhart 2002 argue that countries choose to limit exchange rate volatility with the use of *de facto* rates precisely because of chronic credibility problems. Furthermore, Calvo and Reinhart suggest that exchange rate stabilization (*de facto* fixed rates) provides a transparent anchor for inflation expectations while interest rate stabilization does not. This suggests that pegging is a more transparent commitment than central bank independence even when it is not formally announced. I thank one of the anonymous *IO* reviewers for making the point, as this increases the potential applicability of the model to the large universe of countries using informal exchange rate fixing.

35. Obstfeld and Rogoff 1995, 94, who go on: “governments often feel that if they could pull off a sudden realignment ‘just once’ and thereby put fundamentals right, they would thereafter enjoy the fruits of a credibly fixed rate, including exchange-rate certainty and domestic price discipline. They are wrong” (81). Reinhart and Rogoff 2004 also show that many *de jure* fixed rates behave like floats or bands due to devaluations.

36. Jácome and Vázquez 2005.

recession, Argentina changed the central bank charter to allow central bank financing of the fiscal deficit in 2002.³⁷ Second, policymakers face important political costs in the event of a devaluation or a collapse of the fixed exchange rate regime. Cooper shows that in the aftermath of devaluations, nearly 30 percent of governments fell within twelve months, as opposed to 14 percent in a contemporaneous control group.³⁸ Frankel goes on and expands Cooper's sample to 103 developing countries over the period 1971–2003.³⁹ He finds that the chief executive lost office 22.8 percent of the time in the six months following a currency crash, as opposed to 11.6 percent of the time otherwise.

In sum, independent central banks and fixed rates have specific disadvantages while bearing the same major cost of a constrained monetary policy. This article, then, assumes fixed rates that can be devalued and central banks whose independence cannot be clearly ascertained, and goes on to describe the conditions under which partisan policymakers choose institutions that help them improve monetary policy credibility. The possible institutional outcomes in this game are: flexible exchange rates and a dependent central bank; flexible exchange rates and an independent central bank; fixed rates and a dependent central bank; fixed rates and an independent central bank.⁴⁰ In the following sections I set up the model, translate the imperfect institutions discussed here into modeling assumptions, derive the conditions that make independent central banks complements or substitutes and discuss policy implications.

Model Setup

There are two actors in the model, the government and the wage setters. The government has a quadratic loss function with a trade-off between inflation and deviation of output growth from target. Wage setters are rational and their utility depends only on the real wage. Production takes place according to an expectation-augmented Philips curve.

The preferences of the government are described by the quadratic loss function:

$$L_t^i(\pi_t, y_t) = (\pi_t)^2 + a_i(y_t - ky^*)^2; k > 1; \quad i \in \{L, R\}. \quad (1)$$

37. Empirically, the legal independence granted to the central bank translates into low inflation more or less efficiently depending on the number of veto players needed to change bank legislation (Keefer and Stasavage 2002) or on whether a country is democratic (Broz 2002).

38. Cooper 1971.

39. Frankel 2005.

40. This article focuses on solutions to time-inconsistent inflation preferences and institutions as commitment devices. There are other potential reasons for countries to adopt fixed exchange rates, most notably for reducing the costs and risks of international trade. For example, the Bretton Woods fixed exchange rate system was set up in order to foster the growth of international trade. Also, Frieden 2002 finds that intra-European trade and investment are important determinants of smaller currency devaluations and less currency volatility in a sample of European countries from 1973 to 1994.

The loss function reflects the fact that there are distributional consequences to the choice of inflation rates. Capital owners who see the value of their holdings diminish with inflation prefer low inflation. To be sure, no one in the economy likes high inflation. However, labor is more vulnerable to economic recessions associated with tough anti-inflationary policies and is more willing to tolerate some inflation if that helps employment. Therefore, there are two types of government that differ with respect to the trade-off between inflation and output: the right (R), representing capital holders and the left (L), representing labor. By assumption, the right cares less than the left than about a drop in production below some target level ky^* , so $a_R < a_L$. π_t is the contemporaneous inflation, y_t is the output produced in the economy, and y^* is the market clearing level of output. k is greater than one because in the presence of distortions (income and labor taxation, unemployment compensation, minimum wage) y^* is smaller than the socially optimal level of output ky^* .⁴¹ Because the market clearing level of output is too low and given the production equation (2), the government has incentives to increase inflation above expectations in order to raise output.

The specification of the loss function in equation (1) does not reflect the political cost, c , incurred by the government in situations when the fixed exchange rate commitment is abandoned.⁴² The political costs of fixed rates are introduced later on, as omitting them simplifies computations and does not affect the establishment of the first set of results that show the complementarity between fixed rates and independent central banks.⁴³

Output in the economy takes place according to an expectations-enhanced Phillips curve:

$$y_t = y^* + (\pi_t - \pi_t^e) + \epsilon; E(\epsilon) = 0; \text{Var}(\epsilon) = \sigma^2, \quad (2)$$

where π_t^e represents the expected rate of inflation. All variables are expressed in natural logarithms. In this economy, output y_t grows above y^* if inflation is above expected inflation, or if the shock to the economy ϵ is positive. As k is greater than one, the policymaker will have incentives to inflate the economy. The shock to the domestic country's output (ϵ) reflects the policymaker's dilemma in choosing between flexibility and credibility. By choosing to delegate monetary policy, the executive forfeits not only the option to behave opportunistically and inflate the economy after wages have been locked in, but also the liberty to react to negative output shocks.

41. Clark 2002 identifies $k > 1$ as an indication of political pressure to push growth above the natural rate. Here I interpret minimum wage regulation or income taxation as the result of political economy pressure on the policymaker.

42. See Cooper 1971; and Frankel 2005.

43. The effect of fiscal policy under a fixed exchange rate regime (Clark 2002) can be introduced in similar manner. In this case, the net cost of fixed exchange rates would be given by the positive effect of a super-effective fiscal policy minus the political costs incurred when the fixed rates are abandoned.

The workers in this model aim to anticipate inflation and care about maintaining a constant level of the real wage:

$$w_t = E(p_t).^{44} \quad (3)$$

The Game with Imperfect Monetary Institutions

The analysis in this section shows (1) how the imperfect institutions described previously translate into modeling assumptions, (2) the sequence of moves for the game with such imperfect institutions, (3) the solution concept for the game, and (4) derives the expected loss for the government for each terminal node of the game.

In the real world, one observes mixes of institutions. Bernhard and colleagues describe the monetary regimes after 1973 and show that about 26 percent of the sample has had an independent central bank and also sustained a pegged exchange rate regime for long periods of time.⁴⁵ It is quite clear then, that in many instances monetary institutions coexist. Consequently, in this article the government has a choice of two policy instruments: a fixed exchange rate regime and an independent central bank. Giving the executive the simultaneous choice of institutions is not enough, however, to be able to describe separate solutions for the adoption of individual institutions, a mix, or no institutions. With rational expectations and perfect commitment instruments, the government's set of two choices is superfluous. By construction, fixed rates and independent central banks are substitutes. The choice of either represents a commitment to low inflation rates.⁴⁶ With the more realistic assumption that institutions lack perfect credibility, the model is able to describe separate solutions for the adoption of individual institutions, a mix, or no institutions.

As shown earlier, the assumption that exchange rate commitments are fixed forever is not realistic. Countries sometimes are forced to give up fixed rates in the midst of speculative attacks, or governments simply renounce fixed rates after accomplishing the desired low inflation levels.⁴⁷ Suppose that the government

44. $\pi_t - \pi_t^e = p_t - w_t$ where p_t is the price level and w_t is the wage level.

45. Bernhard, Broz, and Clark 2002.

46. I assume that the preferred inflation rate of the independent domestic central banker is the same as the inflation rate induced by fixing the exchange rate if the fixed rate survives by the end of the game ($\pi = 0$). This is a useful simplification that allows me to focus on the imperfections attributed to the two institutions. In practice, one may observe the divergence of preferred inflation rates and this could be one reason to observe the choice of an institutional mix (for example, Germany in the late 1960s; see also O'Mahony 2007). Yet from a modeling point of view, this is a simple problem of comparing preferred rates (results are derived directly from assumed preferences) that would only increase the parameter space of the model.

47. Economists expect that many governments will give in to speculative attacks and allow the currency to lose value. Still, both scenarios are possible: Poland in the 1990s, for example, adjusted repeatedly the parity at which the exchange rate was fixed without facing speculative pressure. The government adjusted the fixed rate in times with plentiful foreign reserves, thus loosening their commitment and pre-empting future pressure on the currency.

announces a fixed rate regime and fixes the exchange rate at the beginning of the period. The public observes the fixed rate yet it does not believe the commitment will last forever, that is, the public expects that monetary policy may not be consistent with maintaining a fixed exchange rate and that an adjustment of the fix will come sooner or later.⁴⁸ The exchange rates are fixed but adjustable. In the game, I model the situation by introducing an exogenous probability, $q \in (0, 1)$, that the announced fixed exchange rate regime collapses at the end of the period, after workers have set inflation expectations, and that inflation will be determined by the government under the flexible exchange rate regime.

Further, I assume that the status of the central bank is not clearly ascertainable to the public making decisions about their wage level. Central banks tend to be less transparent than fixed rates with respect to their goals. Also, in the short run, transgressions against the independence of the central bank or missing inflation targets are more difficult to detect by the public. Therefore, I assume that when the government chooses and announces an independent central bank, there is an exogenous probability, p , that the announcement is not believed ($p \in (0, 1)$). The public, on the other hand, takes the executive's choice to have a dependent central bank at face value: if the government chooses and announces that it will have a dependent bank, it is believed. In countries with a history of inflation and successive failed attempts at stabilization, the public has good reason to doubt the rhetoric of the government in economic policy, and for p to be positive. With learning, and as the central bank establishes its own reputation for inflation toughness, p may slowly go down to zero. Also, a more transparent inflation-targeting central bank that achieves its target will also help lower the probability, p . By comparison, however, the probability, q , remains essentially stochastic, reflecting the fact that while there are economic and political fundamentals that influence its relative size, q will be greater than zero due to the possibility of multiple equilibria in balance of payments crises or sudden reversal of market sentiment and heard behavior.⁴⁹

The play of the game is as follows:

1. The government chooses the mix of institutions: flexible exchange rate and a dependent central bank (terminal node 1); flexible exchange rate and an independent central bank (terminal node 2); fixed exchange rate and a dependent central bank (terminal node 3); fixed exchange rate and an independent central bank (terminal node 4).

48. Reinhart and Rogoff 2004.

49. See Obstfeld 1986. The focus in the model is on the credibility problem of the policymaker with respect to intra-temporal choices. The probabilities q and p assigned to the two monetary policy instruments reflect an additional layer of the credibility problem, that is, what Drazen 2000 calls the credibility of the policy announcements or instruments. The political economy behind p , for example, has been analyzed in Keefer and Stasavage (2002), who find that legal central bank independence—or declarations of independence—are credible and thus effective in reducing inflation when there are multiple veto players in the political system.

2. Workers set inflation expectations π^e ; if the government has made the central bank independent, workers are not entirely sure whether to believe the government or not; when setting expectations, workers also anticipate that there is a chance that fixed rates do not survive.
3. The government observes the realization of the output shock, ϵ .
4. The fixed exchange rate collapses or maintains.
5. The government sets inflation if the fix has collapsed and if it chose flexible rates or a dependent central bank in the beginning of the period; the central bank sets inflation to zero if it was granted independence; inflation is zero if the fixed rate has survived.

The model is a sequential game of complete information solved by backward induction and the solution to the game is the subgame perfect Nash equilibrium.⁵⁰ In the game, the government chooses the institutional mix and the rate of inflation that minimizes its loss function, given the parameters a_i , k , σ^2 , q , and p . The public wants to anticipate inflation correctly and sets inflation expectations according to the institutional setup selected by the government. To be able to discuss the institutional choice of the government, for each terminal node I compute below the expected loss function of the government $E(L)$, that is, the loss function of the government at the beginning of the game when it looks down the path of play and anticipates how the game will unfold given its institutional choices. The government chooses the optimal institutional mix by comparing the expected loss function for each arrangement.

Terminal Node 1: Flexible Exchange Rate and a Dependent Central Bank

The government is assumed to be unable to commit to a specific inflation rate when the central bank is dependent or the exchange rate is flexible. Wage setters are aware

50. Complete information applies only to the types of policymaker. That is, markets can distinguish the government's objective trade-off between inflation and employment. There is substantial uncertainty in the model, however. Uncertainty with respect to the future rate of inflation emerges because the institutional solutions available to policymakers are imperfect. Also, note that the model is quasi-dynamic as introduced by expectations. The modeling choice of a one period game has been used for reasons of tractability. While repeated interaction would enlarge the possible outcomes of the game, one would be hard pressed to describe the interactions induced by policymakers having the choice of two imperfect commitment institutions. One possibility for future work to account for repeated interaction is to consider the probability, q , as stochastic and unaffected by the past behavior of the executive and introduce a learning rate parameter for the convergence of the probability, p , to zero, reflecting the ability of the central bank to build a reputation for toughness. The learning rate parameter can reflect real political economy circumstances. For example, a government that abstains from interfering with the declared independence of the central bank around election times will help lower p toward zero faster.

of the government’s problem and would not believe inflation promises. With no commitment, expected loss to the government is (see Appendix for derivation):⁵¹

$$E(L_{CBI=0}^{Flex}) = a_i(1 + a_i)H^2 + \frac{a_i}{1 + a_i} \sigma^2, \text{ where } H = (k - 1)y^*. \tag{4}$$

Terminal Node 2: Flexible Exchange Rate and an Independent Central Bank

When the government chooses a flexible exchange rate and an independent central bank, if wage setters believe that the central bank is truly independent, by assumption, they expect zero inflation. Yet, central bank independence is not perfectly visible: With some positive probability, p , wage setters do not believe the government and expect inflation to be the same as under a dependent central bank. In the beginning of the game, when it decides to delegate monetary policy to an independent central bank, the government knows that the public expects a rate of inflation higher than zero: $\pi_{gov}^e = (1 - p)\pi_{1-p}^e + p\pi_p^e$, where π_{1-p}^e is the public’s expected inflation if it believes that, in fact, the central bank is independent, and π_p^e denotes the expectation of nonbelievers. $\pi_{1-p}^e = 0$ and π_p^e equals a_iH as in the case when the executives chooses a flexible exchange rate and a dependent central bank. Therefore, $\pi^e = pa_iH$.

Throughout this article, the central bank is a nonstrategic player: the bank’s actions are determined by the government’s choices. Specifically, if the government chooses an independent central bank, the central bank adopts a zero inflation rate ($\pi = 0$ if $CBI = 1(p)$). The behavior of the central bank is consistent with a situation in which the bank tries to establish its reputation and incurs an initial welfare loss by not matching high inflation expectations. Initially, the bank deflates the economy and the government that chooses an independent bank loses utility from low output growth. The expected loss to the government from choosing an imperfectly credible central bank and a flexible exchange rate is determined by plugging equation (2), $\pi^e = pa_iH$ and $\pi = 0$ in equation (1) and equals:

$$E(L_{CBI=1(p)}^{Flex}) = a_i\sigma^2 + a_iH^2(1 + a_ip)^2. \tag{5}$$

Terminal Node 3: Fixed Exchange Rate and a Dependent Central Bank

When the government chooses a fixed but adjustable exchange rate and a dependent central bank, wage setters expect that, with probability, q , the fixed rate will

51. Notation: *Flex* represents flexible rates and *Fix*(q) denotes a fixed exchange rate that the public knows can be devalued; $CBI = 1(p)$ denotes an imperfectly credible independent central bank; $CBI = 0$ designates a dependent bank.

collapse, in which case the inflation rate will be the same as under no commitment. With probability $(1 - q)$, wage setters expect that fixed rates will maintain and inflation is zero. Public inflation expectations are then: $\pi^e = (1 - q)E(\pi^{Fix}) + qE(\pi_{CBI=0}^{Flex})$. If fixed rates collapse and the central bank is dependent, the government gets to choose the optimal rate of inflation: $\pi_i = (a_i/(1 + a_i(1 - q)))H - (a_i/(1 + a_i))\epsilon$ (proof similar with terminal node 1 in the Appendix).

The assumption is that the government is in good faith when it announces a fixed rate regime. At the beginning of the game, not even the government knows for sure whether its commitment will survive.⁵² In this case, the expected loss for the government in the beginning of the game is a convex combination of the expected loss when the fix survives and when it collapses, given expectations π^e : $E(L_{CBI=0}^{Fix(q)}) = (1 - q)E(L^{Fix}) + qE(L_{CBI=0}^{Flex})$.

$$E(L_{CBI=0}^{Fix(q)}) = \sigma^2 \frac{a_i}{1 + a_i} (1 + a_i - qa_i) + H^2 \frac{a_i(1 + a_i)}{1 + a_i(1 - q)}. \tag{6}$$

Terminal Node 4: Fixed Exchange Rate and an Independent Central Bank

When the government has selected a fixed rate and an independent central bank, inflation is chosen by the central bank and is zero ($\pi = 0$). If wage setters believe that in fact the central bank has been given independence, expected inflation is also zero ($\pi_{1-p}^e = 0$). However, if wage setters believe the central bank is dependent, the public’s inflation expectation is a linear combination between the expected inflation under a fix and expected inflation under a float: $\pi_p^e = (1 - q)E(\pi^{Fix}) + qE(\pi^{Flex}) = (qa_i/(1 + a_i(1 - q)))H$.

Given p and q , in the beginning of the game the government anticipates a rate of inflation that is a linear combination between the inflation expected by the public if it believes the government has delegated monetary policy to an independent central banker, and the inflation expected by the public if it believes no delegation took place: $\pi_{gov}^e = (1 - p)\pi_{1-p}^e + p\pi_p^e = (pqa_i/(1 + a_i(1 - q)))H$.

Government expected loss is then given by the following expression:

$$E(L_{CBI=1(p)}^{Fix(q)}) = a_i \sigma^2 + H^2 a_i \left[1 + \frac{pqa_i}{1 + a_i(1 - q)} \right]^2. \tag{7}$$

52. Regarding this point, Frankel (2005, 9) writes: “I think that a still better way to view the public commitments may be as sincere expressions of a strong desire to maintain the peg. The ministers may realize that events could force the abandonment of the exchange rate policy, if speculative pressures accelerate and it develops that reserves are about to run out, leaving little other option. And they may realize that making an explicit statement beforehand increases the chances that they will have to resign if and when the peg is abandoned. But making the promise is a way of buying a bit of credibility, and buying some time. Specifically it is a device for signaling that their determination to hold the line on the currency is so strong that they are willing to risk sacrificing their jobs.”

The Choice of Imperfectly Credible Institutions

The ultimate goal of the model is to describe the decision process of the government over its two institutional choices and to define the specific circumstances when independent central banks and fixed exchange rates are complements or substitutes. This section compares the expected loss function of the government for the different institutional solutions and describes the main results of the model based on the loss function comparisons.

The finding in proposition (1) below shows formally the complementarity between fixed rates and an independent central bank. To derive the result, I compare the government's expected loss for the institutional mix with the other three outcomes:

- Two institutions are preferred to no commitment at all when the following holds: $E(L_{CBI=1(p)}^{Fix(q)}) \leq E(L_{CBI=0}^{Flex})$. This is equivalent to $\sigma^2 \leq H^2\alpha(p, q, a_i)$.⁵³
- Two institutions are preferred to just fixing the exchange rate when $E(L_{CBI=1(p)}^{Fix(q)}) \leq E(L_{CBI=0}^{Fix(q)})$. This is equivalent to $\sigma^2 \leq H^2\beta(p, q, a_i)$.
- Without the additional political cost, c , for fixed rate adjustments, the government always prefers two institutions relative to just an imperfectly credible central bank. That is, $E(L_{CBI=1(p)}^{Fix(q)}) \leq E(L_{CBI=1(p)}^{Flex})$, for all parameter values p, q, a_i .

Proposition (2) below further characterizes the solution space of the game. To fully describe the institutional solution space, I compare the government's expected loss for the other possible outcomes—fixed but adjustable rates, imperfectly credible central bank, and no institutions at all:

- Fixed but adjustable rates are preferred to no commitment at all when $E(L_{CBI=0}^{Fix(q)}) \leq E(L_{CBI=0}^{Flex})$. This is equivalent to $\sigma^2 \leq H^2\eta(q, a_i)$.
- An independent central bank is preferred to no commitment institutions at all when $E(L_{CBI=1(p)}^{Flex}) \leq E(L_{CBI=0}^{Flex})$. This is equivalent to $\sigma^2 \leq H^2x(p, a_i)$.
- An imperfectly credible independent central bank is preferred to a fixed but flexible exchange rate when $E(L_{CBI=1(p)}^{Flex}) \leq E(L_{CBI=0}^{Fix(q)})$. This is equivalent to $\sigma^2 \leq H^2y(p, q, a_i)$.

Proposition 1. A mix of two commitment institutions is the subgame perfect equilibrium to the game when $\sigma^2 \leq H^2\beta(p, q, a_i)$ and $\beta > 0$. (Proof is in the Appendix.)

Proposition 1 establishes the conditions under which the government treats fixed exchange rates and independent central banks as complementary solutions to its credibility problem. The existence of the equilibrium and the effect of param-

53. See the Appendix for the derivation of α , β , η , x , and y .

eters on β are discussed using the graphical representation in Figure 1. Figure 1 fully describes the solution space of the institutional game as a function of H^2 and σ^2 , both of which represent important structural features of the economy and institutions of particular countries. H^2 reflects the wedge between the actual output and its socially optimal level ($H = (k - 1)y^*$). Countries have a larger or smaller H^2 as they differ in their tax policies, unemployment benefits, and minimum wage provisions. The term H^2 is relevant as time inconsistency in monetary policy arises because the government can use unanticipated inflation to push output toward its socially optimal level. Thus, higher levels of H^2 reflect more temptation on the side of the government to inflate the economy. The variance of the shock to the economy, σ^2 , is relevant because the cost of monetary policy delegation is reflected in the loss of flexibility to address large negative shocks to the economy. A large variance of the shocks facing a country implies high costs of delegation of monetary policy. The two lines in Figure 1 represent conditions ($E(L_{CBI=1(p)}^{Fix(q)}) \leq E(L_{CBI=0}^{Fix(q)})$) and ($E(L_{CBI=0}^{Fix(q)}) \leq E(L_{CBI=0}^{Flex})$) holding with equality. The two lines in the graph separate the solution space of the game. β and η are the slopes of the lines labeled (1) and (2), respectively. As β and η are functions of the parameters a_i , p , and q , the two lines can be steeper or flatter, changing the government's choice of institutions for any given pair H^2 and σ^2 .

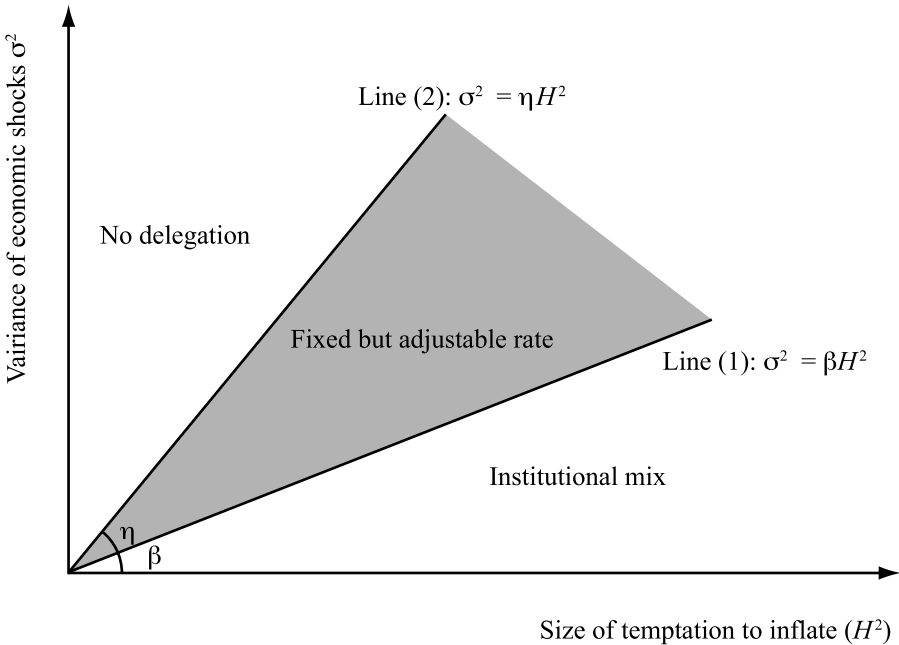


FIGURE 1. Imperfect institutions: The choice of an institutional mix ($\beta \leq \eta$)

The mix of two commitment institutions exists as an equilibrium to the game as long as $\beta > 0$. The parameter, β , is larger than zero for $0 < p < .48$ and for all values of a_i and q . This means that for a low probability that the public does not recognize the independence of the central bank, a mix of institutions is an equilibrium choice to the game. In graphic terms, the mixed solution is represented by all the points below line (1): $\sigma^2 = H^2\beta$. This means that for high levels of the credibility problem (high H^2) and low expected shocks to output (low σ^2) an institutional mix is the preferred solution to time inconsistency. However, as the variance of the shocks to the economy increases, there are fewer incentives for policymakers to doubly tie their hands with both fixed rates and an independent central bank.

The behavior of the slope, β , as a function of parameters is complex. As can be expected, for a higher probability, p , it becomes less likely that an independent bank would be adopted in addition to having a fixed exchange rate. The effect of government ideology on β depends on the levels of p and q . At low levels of public distrust of central bank independence, more leftist executives will prefer to adopt an institutional mix. However, as p approaches .48, the dynamics change: right-wing governments are more likely to adopt a mixed institutional structure as opposed to just fixing the exchange rate. Moreover, as q goes up, the change in dynamics occurs at lower levels of p and a_i .⁵⁴ Comparative statics suggest that when banks lack credibility, right-wing governments are more likely to adopt independent central banks in addition to fixed exchange rates. Also, when the fixed rate does not lower inflation expectations enough (q is large), the right starts being more likely to adopt the independent central bank at ever lower levels of p .⁵⁵

Proposition 2. A fixed exchange rate that the public knows can be devalued is the subgame perfect equilibrium to the game when $H^2\beta(p, q, a_i) \leq \sigma^2 \leq H^2\eta(p, q, a_i)$. No delegation is the subgame perfect equilibrium when $\sigma^2 \geq H^2\eta(p, q, a_i)$. An imperfectly credible independent central bank is never a single institutional solution to the game without the additional political cost, c , for fixed rate adjustments. (Proof is in the Appendix.)

Proposition 2, together with Proposition 1, fully characterize the solution space of the game. With respect to the existence of the equilibria, both no delegation and the adjustable peg are more prevalent solutions, as they exist for all $a_i, p, q \in (0, 1)$, whereas the mixed institutional solution exists only when $\beta > 0$, i.e.

54. Numerical simulations are used for the comparative statics on parameters β and x .

55. Note that the right is never more likely than the left to adopt an adjustable fixed rate alone (η is monotonically increasing in a_i). Also, in this article, it is imperfect institutions that determine the right to tie its hands relatively more than the left. Canavan and Tommasi 1997 obtain a similar result in a game of incomplete information on the type of policymaker, where executives choose the visibility of a single commitment instrument. In their model, the right signals its type by choosing more visible mechanisms. Also, Milesi-Ferretti 1995 has the right preferring to restrict monetary policy in a model with elections and uncertainty about election results.

when the probability, p , is not too large. Comparative statics show that the slope, η , increases in the partisanship parameter, a_i , and decreases in the probability, q . That is, left-wing governments are more likely to choose a fixed but adjustable exchange rate regime, yet, fixed rates lose their appeal when the public believes there is a large probability that they will be adjusted. Proposition 2 also shows that an independent central bank is never a single institutional solution to the simple game in which fixed rate devaluations are assumed to be costless for politicians. The explanation for this is that for the government, adopting an independent central bank that is not completely believed by the public generates a cost that increases with p . The cost to the government is in terms of lost output due to inflation expectations that are higher than the zero inflation rate pursued by the independent banker. A costless fixed rate, even if markets know it can be devalued, lowers the cost of an independent bank that sets inflation at zero when the public believes that inflation will be positive.

So far the analysis has left out the political costs of fixed exchange rates because of simpler computations that do not affect establishing the first set of results showing the complementarity between fixed rates and independent central banks. However, the assumption that politicians face penalties when they abandon or devalue fixed exchange rates is well documented. As described below, making the model more realistic by adding political costs maintains the existence results from proposition (1) and only restrains the parameter space for which an institutional mix of institutions is the equilibrium solution (Figure 1 versus Figure 2). Also, the more realistic analysis offers additional empirical implications.

Previous work has shown that politicians are punished for mistakes in exchange rate policy. Cooper finds that devaluation of fixed exchange rates entails significant political costs for governments in developing countries. Building on Cooper, Frankel discovers that when one month prior to a devaluation, government members had given assurances that there would be no devaluation, and a devaluation did subsequently occur, the probability that the chief executive would lose his or her job within twelve months was .67.⁵⁶ Where there was no evidence of such assurances, the frequency of job loss was only .39, despite the devaluation. Clarke, Ho, and Stewart also find that in the aftermath of the 1992 devaluation of the British Pound, government approval ratings in Great Britain dropped by 18 to 19 percent.⁵⁷ Furthermore, Blomberg, Frieden, and Stein show that, due to political costs, governments postpone the exit from a pegged exchange rate until after elections.⁵⁸

56. See Cooper 1971; and Frankel 2005.

57. Clarke, Ho, and Stewart 2002.

58. See Blomberg, Frieden, and Stein 2005. One may also ask whether there are costs associated with reversals in the independence of the central bank. I argue that such costs are likely to be substantially lower because (1) reversal in central bank independence is unlikely to be associated with recession in the domestic economy, which makes it less of an electoral concern; and (2) most transgressions against bank independence are likely to be undetectable in the short run to the public (Lohmann 1998) and, therefore, punishment is less of a concern for politicians.

In the model, accounting for the costly devaluation of fixed rates, the loss function from equation (1) becomes a mix of social welfare and political survival motivations: $L_i^i(\pi_t, y_t) = (\pi_t)^2 + a_i(y_t - ky^*)^2 + \varphi c$, where $\varphi = 1$ if the peg does not survive and $\varphi = 0$ if the peg maintains. That is, politicians incur the cost, c , if the fixed exchange rate does not maintain.

Proposition 3. With costly devaluation of fixed rates, an imperfectly credible central bank is a subgame perfect equilibrium to the game when the cost, c , is larger than c^ , $\sigma^2 \leq H^2 y(p, q, a_i)$, $\sigma^2 \leq H^2 x(p, a_i)$, and $x > 0$. (Proof is in the Appendix.)*

Figures 2 and 3 show graphically the solution space when fixed exchange rate adjustment is costly. When the cost, c , is low, $c < c^*$ (Figure 2), policymakers still prefer a mix of two institutions to an independent central bank alone. The executive chooses to supplement an institution that pays an up-front and certain cost (the independent central bank) with an institution that entails the delayed and probabilistic cost, c (the fixed rate). However, with adjustment costs, it becomes less likely that the policymaker chooses fixed exchange rates either alone or in combination with an independent central bank.

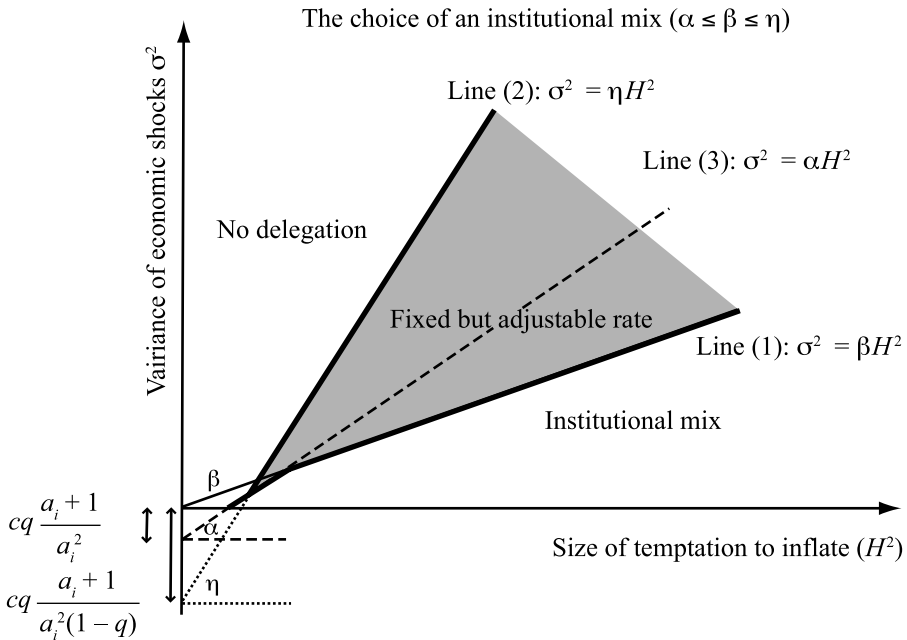
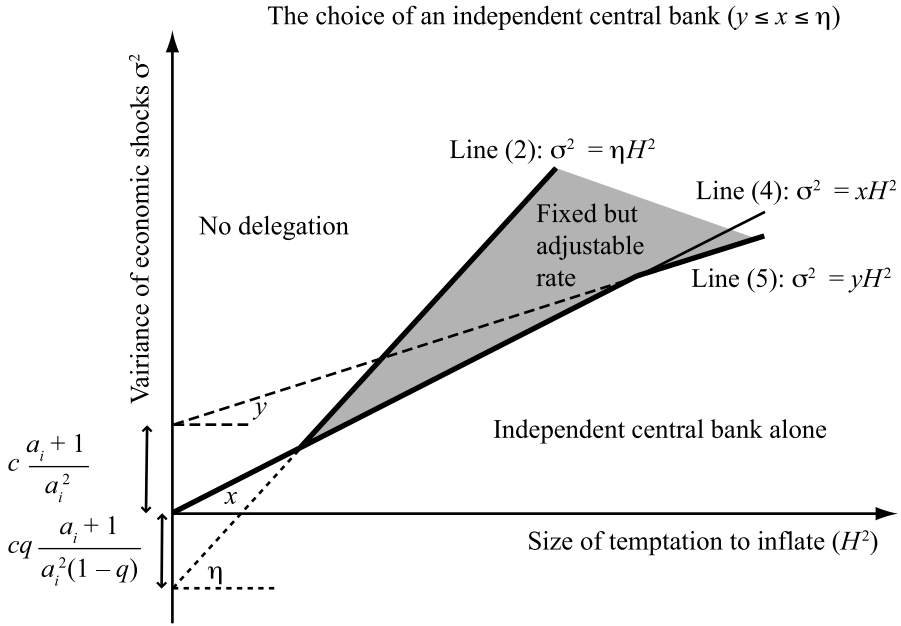


FIGURE 2. Imperfect institutions and costly devaluation: $c < c^*$

Figure 3 shows the solution space of the game when the cost of a fixed rate devaluation is large: $c > c^*$. When c is large, a peg that can be devalued stops



being an institutional arrangement that makes an imperfectly credible independent bank more attractive. That is, a mixed institutional solution is not an equilibrium anymore. An independent central bank alone is the equilibrium solution when $x > 0$, which holds for small values of the probability, p ($p < .5$). The comparative statics of x with respect to the ideology of the policymaker, a_i , are similar to the comparative statics of the parameter, β : in an environment where delegation of monetary policy to an independent central banker has large chances of being believed by the public ($p \leq .36$), left-wing policymakers will be more likely to adopt an independent central bank. However, circumstances marked by deep distrust in the inflation policy of the government ($.37 \leq p \leq .5$) induce a reversed dynamic. That is, right-wing, conservative politicians will be more prone than the left to delegate monetary policy to an independent central banker.

Discussion and Policy Implications

The model has several implications that are in line with previous work. For example, in countries that are expected to face large negative shocks to the domestic economy, politicians do not limit their discretion to use monetary policy in recessionary periods. Another implication similar to the existing literature is that, in

general, the government with the worst inflation-fighting credentials will be more likely to adopt institutions that restrain inflation. That is, left-wing governments that are known to cater to labor are more prone to tie their hands in monetary policy.

More importantly, however, this article generates new hypotheses characterizing the conditions that make monetary institutions complements or substitutes. In general terms, the model shows that if institutions do not suffer from similar weaknesses and are able to only partly fulfill their role, then one observes some institutional proliferation. In particular, one can expect to see an independent central bank coupled with fixed exchange rates when the political costs of fixed exchange rate adjustments are low and delegation to an independent central bank is relatively transparent. Previous research suggests that the cost, c , of a fixed rate adjustment is likely to vary along several dimensions, including (1) the degree of accountability of political regimes, (2) the clarity of responsibility for policy actions of elected politicians, and (3) the rules for electoral competition.

In the case of exchange rate policy, surprise changes in the exchange rate regime generate a range of negative outcomes from loss of purchasing power to larger debt if debt is denominated in foreign currency, bankruptcies, and unemployment.⁵⁹ In accountable political systems, the presence of free media and disputed elections allows domestic political audiences to vote according to the state of the economy and punish governments renegeing on commitments, especially when breaking promises has negative economic consequences.⁶⁰ Autocratic regimes, on the other hand, survive with the support of a small number of domestic actors.⁶¹ Such regimes need not be concerned about the aggregate costs of exchange rate crises because they survive by using rents targeted at a restricted selectorate. In such autocratic regimes, then, the costs of fixed exchange rate realignments are low. However, autocracies are also characterized by limited transparency of central bank independence.⁶² In the model, low political costs of fixed rate realignments and a relatively transparent independent central bank are both necessary conditions for a mix of institutions to exist. One empirical implication is that autocracies would prefer a fixed exchange rate due to the low political costs of adjustment. This result is consistent with findings in Broz and suggests that his causal mechanism (relative transparency of fixed rates) is augmented by the costliness of

59. For example, Guillermo Ortiz Martinez, the Governor of the Bank of Mexico writes about the costs of the exchange rate crisis in Mexico in 1994–95: “From the start of the crisis, the government carefully calculated the cost of support to the banking system and its debtors, in order to maintain a sound fiscal position. The fiscal cost of supporting the financial system is estimated at 14.4 percent of gross domestic product (GDP) for 1997, to be amortized over 30 years” (quoted in Martinez 1998, 9).

60. Economic voting is well documented in established democracies, starting with the seminal work of Downs 1957. Cooper 1971 and Frankel 2005 document specifically the political costs of fixed exchange rate devaluations.

61. Bueno de Mesquita et al. 2003.

62. Broz 2002.

fixed rate adjustments.⁶³ Another empirical implication is that autocracies will prefer a mix of monetary institutions only if their general lack of transparency is mitigated by specific circumstances. Such mitigating conditions include the presence of a strong financial sector with a preference for low inflation,⁶⁴ a central bank that publishes macroeconomic forecasts,⁶⁵ or the presence of external monitoring by foreign investors or international organizations, such as the International Monetary Fund. Also, in the presence of mitigating conditions, the model suggests that autocracies would prefer a mix of institutions to an independent central bank alone.

Beyond the dichotomy between democracies and autocracies, political costs vary across democracies with the clarity of responsibility for economic policies and the type of electoral competition. Powell and Whitten suggest that when policy responsibility cannot be clearly attributed to the parties in the governing coalition, the executive may actually face low costs from breaking a commitment.⁶⁶ Also, political costs are low when governments can call elections before the mandatory end of their term, as well-timed elections which coincide with an expanding economy or an economy without a crisis improve the re-election prospects of incumbents.⁶⁷ The important empirical implication is that countries with multiparty coalition governments, a proportional representation electoral system, or endogenous election timing will be more likely to choose fixed exchange rates either alone or in combination with an independent central bank.⁶⁸

The comparative statics of parameter, β , generate further testable implications. In particular, the model predicts that right-wing and left-wing governments are bound to adopt an independent central bank coupled with a fixed exchange rate at different times. The policymakers more concerned with inflation, the right, will be more likely to choose an independent central bank in addition to a fixed rate in bad times for macroeconomic stability, that is, when there is a low probability that the public believes announcements made by politicians about monetary institutions. The reverse argument applies to the left: in good times, it is more likely that the left would doubly tie its hands. For empirical testing, either qualitative or quantitative, examples of bad times range from hyperinflationary episodes to swift transitions from authoritarian rule to democracy. In periods of regime transition, both q and p are arguably high due to a general and acute lack of credibility of all domestic institutions and politicians. In hyperinflation cases, on the other hand, it

63. Broz 2002.

64. Posen 1995.

65. Stasavage 2003.

66. Powell and Whitten 1993.

67. See Palmer and Whitten 2000; Kayser 2005; and Blomberg, Frieden, and Stein 2005.

68. The reverse conditions should make it more likely for monetary institutions to be substitutes: democracies with majoritarian electoral systems, one-party majority governments, and fixed elections are likely to have either a fixed exchange rate or an independent central bank, but not both. The rate of substitution among fixed rates, the independent central bank, and no delegation at all will depend critically on the structural features of each country, as well as on the credibility of monetary institutions.

is specifically monetary institutions that lack credibility, and innovations such as a newly independent central bank or a fixed exchange rate are likely to be regarded with skepticism by the public.

Furthermore, the probabilities p and q can be gauged more directly. For example, Keefer and Stasavage identify specific economic circumstances that capture uncertainty about the policymaker's intended rate of inflation, which are reflected in low central bank credibility.⁶⁹ Accordingly, the probability, p , that the announced independence of the central bank will not be believed by the public is higher when there is (1) a high volatility in a country's money multiplier (the ratio of base money, M_0 , which is under the control of the central bank, to broad money, M_2 , which is not entirely under the control of the central bank); (2) a high volatility of the terms of trade; or (3) low quality in a country's economic data, in particular frequent mistakes in the consumer price statistics. Moreover, independent central banks that publish their macroeconomic forecasts⁷⁰ or come with specific targets such as inflation targets or monetary targets are more likely to be believed by the public (lower p) because they come with specific institutional features that allow the public to verify target compliance over the medium term.⁷¹

The probability, q , that a fixed exchange rate will be adjusted can be predicted from research that specifically studies the likelihood of devaluations. For example, Klein and Marion study the determinants of devaluations of fixed exchange rates in Latin American countries.⁷² The predicted probabilities from their model (which can also be computed out of sample) directly reflect the parameter, q . Moreover, the probability, q , is likely to be influenced by the chances of speculative attacks on the currency, which are instances when markets lose confidence in the fixed rate and pressure the government to adjust or completely give up the fixed exchange rate regime.⁷³ Because speculative attacks increase the costs of maintaining the fixed rate (higher interest rates and spending of foreign reserves), a greater vulnerability of a country to a speculative attacks increases the probability, q .⁷⁴ Also, Reinhart and Rogoff suggest that countries with a large black market premium versus the official exchange rate face a larger probability, q , of an adjust-

69. Keefer and Stasavage 2002.

70. Stasavage 2003.

71. Fatas, Mihov, and Rose 2007 show that countries with quantitative goals for monetary policy, and especially those countries where targets have been achieved, have a more credible monetary policy in that they have lower inflation. Some of the previous work points out that a fixed exchange rate is not compatible with inflation targeting because independent monetary policy cannot coexist with a pegged exchange rate regime in a world of mobile capital (for example, Mishkin and Savastano 2001). However, there is still a debate on the role of the exchange rate for an inflation-targeting country and there is evidence that inflation-targeting countries in the developing world take into account the nominal exchange rate when setting interest rates (Mohanty and Klau 2005). That is, many inflation-targeting countries consider that stabilizing the exchange rate is beneficial for achieving the inflation target.

72. Klein and Marion 1997.

73. See, for example, Eichengreen, Rose, and Wyplosz 1996; and Berhard and Leblang 2000.

74. Cukierman, Goldstein, and Spiegel 2004 study exchange rate choice under the shadow of speculative attacks.

ment to the official rate.⁷⁵ Furthermore, the probability, q , is likely to be affected by the capital controls that a country has in place. In recent decades there has been a move toward the liberalization of capital transactions, which partly accounts for the moderation of countries' interest in the fixing of their currencies.⁷⁶ Nevertheless, there are still global discrepancies⁷⁷ and countries with lower capital mobility will face a lower probability, q , of an exchange rate regime adjustment.

Conclusion

Institutions, along with policymaker and voter preferences, shape economic policy outcomes. Therefore, understanding outcomes involves understanding the factors that influence the choice of particular institutional structures. This article started out with a question: "If the policymaker's wrists were already bound by exchange target duct tape, what would be the effects of an additional pair of handcuffs from inflation targets and yet another loop of rope from central bank independence?"⁷⁸ This article offers an explanation as to why governments choose a mixture of institutions to reign in inflation. I show that when exchange rates are fixed but adjustable and central bank independence is not transparent, policymakers can choose both of these institutions. That is, institutional solutions will overlap if policymakers are not fully able to control inflation due to their particular imperfections. The model has specific, testable hypotheses for the existence and prevalence of the mixed institutional solution and, more generally, for the conditions that make fixed exchange rates and independent central banks complements or substitutes. This article also suggests ways to operationalize the parameters of the model for empirical testing, thus contributing to an understanding of the diversity of monetary institutions in the post-Bretton Woods period.

In addition, this article has implications for the partisan design of institutions, conditioning the effect of partisanship on the prevailing economic conditions. I find that in a situation where declarations about central bank independence are not entirely believed by the public (lack of bank transparency), it is the right-wing policymaker that is more likely to choose a central bank that is conservative but not credible. The right wing is also more likely to choose an independent central bank, in addition to a fixed exchange rate that markets do not trust, as such a fixed rate does not reduce inflation sufficiently. Hyperinflation episodes and periods of deep distrust of public institutions can be examined to get support for the hypotheses developed in the model. For example, the most recent Bulgarian hyperinflation was brought to a halt by the adoption of a fixed exchange rate under a currency board arrangement in July 1997. The policy was carried out by the right-wing government of Ivan Kostov, which came to power in elections held in April 1997.

75. Reinhart and Rogoff 2004.

76. International Monetary Fund 2006.

77. For example, Brune 2009.

78. Kuttner and Posen 2001.

In Bulgaria, the currency board and a more independent central bank were adopted despite initial opposition from the right-wing Sofiyanski government that was arguing that the currency board arrangement imposed too much constraint on the government. Another similar example is Argentina in the beginning of the 1990s. The Argentine economy went through a series of severe recessions and hyperinflation episodes in the 1980s. In March 1991, the neo-liberal Economy Minister Domingo Cavallo pushed through the Convertibility Plan, establishing a currency board with an explicitly legislated, fixed exchange rate and a requirement that the central bank back two-thirds of monetary base with international reserves. Further, in 1992, the same center-right Argentine government granted substantial independence to the central bank. The stated purpose of the Convertibility Plan and the move to a more independent central bank was to improve policy credibility and to generate macroeconomic stability. In the case of Argentina, as expected from the model, the policy changes occurred under a liberal-leaning government in a period of clear lack of credibility of monetary policy institutions.

In the past decades, the world economy has moved toward the liberalization of global capital transactions. This trend has also been accompanied by more independent central banks and the increased use of inflation targeting. Together, the two developments point to higher costs of fixing the exchange rate due to the risk of adjustment, and more transparent central banks due to the medium term inflation accountability afforded by targets. In this context, this article suggests that one is likely to see further moderation of countries' interest in formally fixing their exchange rates, consistent with the trend recently pointed out by the International Monetary Fund. This prediction comes with caveats, however. Most central banks in the developing world have a limited ability to implement the inflation-targeting framework and, in the meanwhile, a fixed exchange rate remains the more visible, transparent policy instrument. Specifically, central bankers in developing countries still need to improve their understanding of the transmission mechanism of domestic monetary policy and to develop reliable inflation forecasting models able to predict accurately future inflation, and hence, to support inflation target announcements. In addition, the very recent 2007–2008 experience with high and volatile oil and food prices shows the more general challenges faced by the inflation-targeting framework. In the face of imported inflation, most inflation-targeting countries have failed to achieve their targets. Given such developments, future work will have to determine more precisely the relationship between inflation targeting and central bank independence, and to what extent central bank independence is important in anchoring inflation expectations when inflation targets are missed. Finally, while the formal fixing of their exchanges is on a downward trend, developing countries are still likely to continue to use *de facto* fixed rates both due to the fear of floating, pointed out by Calvo and Reinhart, and because exchange rate stabilization has proven helpful in achieving inflation targets.⁷⁹

79. Calvo and Reinhart 2002; and Mohanty and Klau 2005.

A more general implication of the article is that if institutions do not suffer from similar weaknesses and are able to only partly fulfill their role, then one will observe some degree of institutional proliferation. Beyond the choice of monetary commitment institutions, the results and modeling framework can contribute to the understanding of rational institutional design. As an illustration, the results could be relevant to the literature on international organizations where there has been renewed interest in the reasons behind the proliferation of international institutions.⁸⁰ The findings in this article suggest that, as long as existing general-purpose institutions covering multiple issues are fostering country interests only imperfectly and countries are not limited to devise additional arrangements that focus on specific areas, proliferation is a very likely outcome. Consistent with this framework, Drezner shows that powerful states engage in forum-shopping in the sphere of international regimes and, if need be, do not hesitate to create new fora.⁸¹ After the Asian financial crisis of 1997, Drezner stresses the ability of the global economic powers to arbitrate between governance structures to advance their common preferences for new codes and standards. Thus, big countries used the International Monetary Fund and the World Bank. However, since such institutional structures worked imperfectly to advance their interests, the great powers also created new coordination venues, such as the Financial Stability Forum, and empowered pre-existing ones, such as the Bank for International Settlements.

Appendix

Terminal Node 1

With no commitment, the government observes the output shock and simply minimizes its loss function (1) subject to the output equation (2). The game lasts for only one period, so time subscripts are dropped. The optimal inflation rate is: $\pi_i = (a_i/(1 + a_i))(\pi^e - \epsilon + H)$, where $H = (k - 1)y^*$. Workers make their decision before the output shock is observed but have rational expectations, so $\pi = \pi^e$. Therefore, expected inflation equals $\pi^e = a_i H$ (A1). The time consistent inflation rate is obtained by making π^e in the previous equation equal to $a_i H$: $\pi_i = a_i H - (a_i/(1 + a_i))\epsilon$ (A2). The expected loss to the government if it decides to choose flexible rates and a dependent central bank is computed by plugging equations (2), (A1), and (A2) in equation (1): $E(L_{CBI=0}^{Flex}) = a_i(1 + a_i)H^2 + (a_i/(1 + a_i))\sigma^2$.

Expected loss comparisons

1. $E(L_{CBI=1(p)}^{Fix(q)}) \leq E(L_{CBI=0}^{Flex})$. This is equivalent to: $\sigma^2 \leq H^2\alpha(p, q, a_i)$, where $\alpha = [(1 + a_i)/a_i][((1 + a_i)(1 + a_i - a_i q)^2 - (1 + a_i - a_i q + a_i q p)^2)/(1 + a_i - a_i q)^2]$.

80. See, for example, Drezner 2007; Koremenos, Lipson, and Snidal 2003; and Jupille and Snidal 2006.

81. Drezner 2007.

2. $E(L_{CBI=1(p)}^{Fix(q)}) \leq E(L_{CBI=0}^{Fix(q)})$. This is equivalent to: $\sigma^2 \leq H^2\beta(p, q, a_i)$, where $\beta = [(1 + a_i)/a_i q] \{ [(1 + a_i)(1 + a_i - a_i q) - (1 + a_i - a_i q + a_i q p)^2] / (1 + a_i - a_i q)^2 \}$.
3. $E(L_{CBI=0}^{Fix(q)}) \leq E(L_{CBI=0}^{Flex})$. This is equivalent to: $\sigma^2 \leq H^2\eta$, where $\eta = (1 + a_i)^2 / (1 + a_i - q a_i)$.
4. $E(L_{CBI=1(p)}^{Flex}) \leq E(L_{CBI=0}^{Flex})$. This is equivalent to: $\sigma^2 \leq H^2x$, where $x = [(1 + a_i)/a_i] [1 + a_i - (1 + p a_i)^2]$.
5. $E(L_{CBI=1(p)}^{Flex}) \leq E(L_{CBI=0}^{Fix(q)})$. This is equivalent to: $\sigma^2 \leq H^2y$, where $y = [(1 + a_i)/a_i q] \{ [(1 + a_i)/(1 + a_i - a_i q) - (1 + a_i p)^2] \}$.

Proposition 1 Proof. For an institutional mix to be a solution to the game, the expected loss from adopting a mix of institutions needs to be smaller than the expected loss from a fixed rate alone ($\sigma^2 \leq H^2\beta(p, q, a_i)$ and $\beta > 0$), and it should be the case that a mix generates a lower expected loss than no institutions at all ($\sigma^2 \leq H^2\alpha(p, q, a_i)$ and $\alpha > 0$). In the absence of costly devaluation of fixed rates, a mix of institutions is always preferred to an independent bank alone. Moreover, $\alpha \geq \beta$ for all a_i, p and $q \in (0, 1)$, so it is only needed that $\sigma^2 \leq H^2\beta(p, q, a_i)$ and $\beta > 0$.

Proposition 2 Proof. The slope η is larger than β for all p, q , and a_i . Therefore, as shown graphically in Figure 1, the adjustable peg is the equilibrium solution of the game for $H^2\beta \leq \sigma^2 \leq H^2\eta$, or the points above line (1) and below line (2). No delegation is the equilibrium for all the points above line (2) $\sigma^2 = H^2\eta$. Also, an imperfectly credible independent central bank would be an equilibrium solution to the government's time inconsistency problem if $x > 0, y > 0$ and $\beta < 0$. However, $x < 0$ for all parameter values (a_i, p , and q) for which $\beta < 0$, and if $\beta > 0$ an institutional mix is always preferred to just having an independent central bank.

Proposition 3 Proof. The cost c^* makes the government just indifferent between choosing an independent bank alone or together with a fixed rate: $E(L_{CBI=1(p)}^{Flex}) = E(L_{CBI=1(p)}^{Fix(q)})$. c^* is derived from the indifference condition and equals $c^* = (a_i/q)H^2[(1 + p a_i)^2 - [1 + (a_i p q)/(1 + a_i - a_i q)]]^2$. For an independent central bank alone to be the solution to the game: $c > c^*$. In addition, $E(L_{CBI=1(p)}^{Flex}) \leq E(L_{CBI=0}^{Flex})$ and $E(L_{CBI=1(p)}^{Flex}) \leq E(L_{CBI=0}^{Fix(q)})$ need to hold. That is, $\sigma^2 \leq H^2x(p, a_i)$ and $\sigma^2 \leq H^2y(p, q, a_i)$, or all the points in Figure 3 that are below both line (4) and line (5). The binding condition for existence is $x > 0$ and the solution space is illustrated in Figure 3.

References

- Agénor, Pierre-Richard. 2001. Monetary Policy Under Flexible Exchange Rates: An Introduction to Inflation Targeting. Working Paper 124. Santiago: Central Bank of Chile.
- Alesina, Alberto, and Vittorio Grilli. 1992. The European Central Bank: Reshaping Monetary Politics in Europe. In *Establishing a Central Bank: Issues in Europe and Lessons from the US*, edited by Matthew B. Canzoneri, Vittorio Grilli, and Paul R. Masson, 49–77. Cambridge: Cambridge University Press.
- Barro, Robert J., and David B. Gordon. 1983. A Positive Theory of Monetary Policy in a Natural Rate Model. *Journal of Political Economy* 91 (4):589–610.

- Berhard, William, and David Leblang. 2000. The Politics of Speculative Attacks in Industrial Democracies. *International Organization* 54 (2):291–324.
- Bernhard, William, J. Lawrence Broz, and William Roberts Clark. 2002. The Political Economy of Monetary Institutions. *International Organization* 56 (4):693–723.
- Blomberg, S. Brock, Jeffrey Frieden, and Ernesto Stein. 2005. Sustaining Fixed Rates: The Political Economy of Currency Pegs in Latin America. *Journal of Applied Economics* 8 (2):203–25.
- Broz, J. Lawrence. 2002. Political System Transparency and Monetary Commitment Regimes. *International Organization* 56 (4):863–89.
- Broz, J. Lawrence, and Jeffrey A. Frieden. 2001. The Political Economy of International Monetary Relations. *Annual Review of Political Science* (4):317–43.
- Brune, Nancy. 2009. Building Credibility in Global Financial Markets: Financial Liberalization and the International Monetary Fund. Paper presented at the 67th Annual Conference of the Midwest Political Science Association, April, Chicago.
- Bueno de Mesquita, Bruce, Alastair Smith, Randolph M. Siverson, and James D. Morrow. 2003. *The Logic of Political Survival*. Cambridge, Mass.: MIT Press.
- Calvo, Guillermo A., and Carmen M. Reinhart. 2002. Fear of Floating. *Quarterly Journal of Economics* 117 (2):379–408.
- Canavan, Chris, and Mariano Tommasi. 1997. On the Credibility of Alternative Exchange Rate Regimes. *Journal of Development Economics* 54 (1):101–22.
- Carstens, Agustín, and Luis I. Jácome. 2005. Latin American Central Bank Reform: Progress and Challenges. Working Paper 05/114. Washington, D.C.: International Monetary Fund.
- Clark, William Roberts. 2002. Partisan and Electoral Motivations and the Choice of Monetary Institutions Under Fully Mobile Capital. *International Organization* 56 (4):725–49.
- Clark, William Roberts, and Mark Hallerberg. 2000. Mobile Capital, Domestic Institutions, and Electorally Induced Monetary and Fiscal Policy. *American Political Science Review* 94 (2):323–46.
- Clarke, Harold, Karl Ho, and Marianne C. Stewart. 2002. Major's Lesser (not Minor) Effects: Prime Ministerial Approval and Governing Party Support in Britain Since 1979. *Electoral Studies* 19 (2/3):255–73.
- Cooper, Richard. 1971. Currency Devaluations in Developing Countries. *Princeton Essays in International Finance* 86. Princeton, N.J.: Princeton University.
- Copelovitch, Mark, and David Andrew Singer. 2007. Financial Regulation, Monetary Policy, and Inflation in the Industrialized World. *Journal of Politics* 70 (3):663–80.
- Cukierman, Alex, Itay Goldstein, and Yossi Spiegel. 2004. The Choice of Exchange-Rate Regime and Speculative Attacks. *Journal of the European Economic Association* 2 (6):1206–241.
- Cukierman, Alex, Geoffrey P. Miller, and Bilin Neyapti. 2002. Central Bank Reform, Liberalization and Inflation in Transition Economies: An International Perspective. *Journal of Monetary Economics* 49 (2):237–64.
- Cukierman, Alex, Steven Webb, and Bilin Neyapti. 1992. The Measurement of Central Bank Independence and Its Effect on Policy Outcome. *World Bank Economic Review* 6:353–98.
- Downs, Anthony. 1957. *An Economic Theory of Democracy*. New York: Harper and Row.
- Drazen, Allan. 2000. *Political Economy in Macroeconomics*. Princeton, N.J.: Princeton University Press.
- Drezner, Daniel W. 2007. *All Politics Is Global: Explaining International Regulatory Regimes*. Princeton, N.J.: Princeton University Press.
- Edwards, Sebastian. 1996. The Determinants of the Choice Between Fixed and Flexible Exchange-Rate Regimes. NBER Working Paper 5756. Cambridge, Mass.: National Bureau of Economic Research.
- Eichengreen, Barry, Paul Robert Masson, Miguel Savastano, and Sunil Sharma. 1999. Transition Strategies and Nominal Anchors on the Road to Greater Exchange-Rate Flexibility. *Princeton Essays in International Finance* 213. Princeton, N.J.: Princeton University Press.
- Eichengreen, Barry, Andrew K. Rose, and Charles Wyplosz. 1996. Contagious Currency Crises. NBER Working Paper 5681. Cambridge, Mass.: National Bureau of Economic Research.
- Fatas, Antonio, Ilian Mihov, and Andrew K. Rose. 2007. Quantitative Goals for Monetary Policy. *Journal of Money, Credit and Banking* 39 (5):1163–76.

- Frankel, Jeffrey A. 2005. Mundell-Fleming Lecture: Contractionary Currency Crashes in Developing Countries. *IMF Staff Papers* 52 (2):149–92. Washington, D.C.: International Monetary Fund.
- Frieden, Jeffrey A. 2002. Real Sources of European Currency Policy: Sectoral Interests and European Monetary Integration. *International Organization* 56 (4):831–60.
- Ghosh, Atish R., Anne-Marie Gulde, Jonathan D. Ostry, and Holger C. Wolf. 1997. Does the Nominal Exchange Rate Regime Matter? NBER Working Paper 5874. Cambridge, Mass.: National Bureau of Economic Research.
- Giavazzi, Francesco, and Marco Pagano. 1988. The Advantage of Tying One's Hands: EMS Discipline and Central Bank Credibility. *European Economic Review* 32 (5):1055–75.
- International Monetary Fund. 2006. Inflation Targeting and the IMF. Unpublished manuscript. Washington, D.C.: IMF.
- International Organization*. 2002. Special Issue: The Political Economy of Monetary Institutions 56 (4).
- Iversen, Torben. 1998. Wage Bargaining, Central Bank Independence, and the Real Effects of Money. *International Organization* 52 (3):469–504.
- Jácome, Luis I., and Francisco Vázquez. 2005. Any Link Between Legal Central Bank Independence and Inflation? Evidence from Latin America and the Caribbean. IMF Working Paper 05/75. Washington, D.C.: International Monetary Fund.
- Jupille, Joseph, and Duncan Snidal. 2006. The Choice of International Institutions: Cooperation, Alternatives and Strategies. Available at (<http://www.princeton.edu/smeunier/Jupille-Snidal.pdf>). Accessed 2 April 2010.
- Kayser, Mark Andreas. 2005. Who Surfs, Who Manipulates? The Determinants of Opportunistic Election Timing and Electorally Motivated Economic Intervention. *American Political Science Review* 99 (1):17–27.
- Keefer, Philip, and David Stasavage. 2002. Checks and Balances, Private Information, and the Credibility of Monetary Commitments. *International Organization* 56 (4): 751–74.
- Klein, W. Michael, and Nancy P. Marion. 1997. Explaining the Duration of Exchange Rate Pegs. *Journal of Development Economics* 54 (2):387–404.
- Koremenos, Barbara, Charles Lipson, and Duncan Snidal. 2003. *The Rational Design of International Institutions*. Cambridge: Cambridge University Press.
- Kuttner, Kenneth N., and Adam S. Posen. 2001. Beyond Bipolar: A Three-Dimensional Assessment of Monetary Frameworks. Working Paper 52. Vienna: Austrian National Bank.
- Levy-Yeyati, Eduardo, and Federico Sturzenegger. 2003. To Float or to Fix: Evidence on the Impact of Exchange Rate Regimes on Growth. *American Economic Review* 93 (4):1173–93.
- Lohmann, Susanne. 1992. Optimal Commitment in Monetary Policy: Credibility Versus Flexibility. *American Economic Review* 82 (1):273–86.
- . 1998. Federalism and Central Bank Independence: The Politics of German Monetary Policy, 1957–92. *World Politics* 50 (3):401–46.
- Martinez, Guillermo Ortiz. 1998. What Lessons Does the Mexican Crisis Hold for Recovery in Asia? *Finance and Development* 35 (2):6–9.
- Masson, Paul R., Miguel A. Savastano, and Sunil Sharma. 1997. The Scope for Inflation Targeting in Developing Countries. IMF Working Paper 97/130. Washington, D.C.: International Monetary Fund.
- Milesi-Ferretti, Gian Maria. 1995. The Disadvantage of Tying Their Hands: On the Political Economy of Policy Commitments. *Economic Journal* 105 (433):1381–402.
- Mishkin, Frederic S., and Miguel A. Savastano. 2001. Monetary Policy Strategies for Latin America. *Journal of Development Economics* 66 (2):415–44.
- Mohanty, Madhusudan S., and Marc Klau. 2005. Monetary Policy Rules in Emerging Market Economies: Issues and Evidence. In *Monetary Policy and Macroeconomic Stabilization in Latin America*, edited by Rolf J. Langhammer and Lúcio Vinhas de Souza, 205–46. Berlin, Germany: Springer-Verlag.
- Moser, Peter. 1999. Checks and Balances, and the Supply of Central Bank Independence. *European Economic Review* 43 (8):1569–93.

- Mukherjee, Bumba, and David Andrew Singer. 2008. Monetary Institutions, Partisanship, and Inflation Targeting. *International Organization* 62 (2):323–58.
- Obstfeld, Maurice. 1986. Rational and Self-fulfilling Balance-of-Payments Crises. *American Economic Review* 76 (1):72–81.
- Obstfeld, Maurice, and Kenneth S. Rogoff. 1995. The Mirage of Fixed Exchange Rates. *Journal of Economic Perspectives* 9 (4):73–96.
- O'Mahony, Angela. 2007. Escaping the Ties That Bind: Exchange Rate Choice Under Central Bank Independence. *Comparative Political Studies* 40 (7):808–31.
- Palmer, Harvey D., and Guy D. Whitten. 2000. Government Competence, Economic Performance and Endogenous Election Dates. *Electoral Studies* 19 (2/3):413–26.
- Posen, Adam S. 1995. Declarations Are Not Enough: Financial Sector Sources of Central Bank Independence. In *NBER Macroeconomics Annual 1995*, Vol. 10, edited by Ben S. Bernanke and Julio J. Rotemberg, 253–74. Cambridge, Mass: MIT Press.
- Powell, Bingham G. Jr., and Guy D. Whitten. 1993. A Cross-National Analysis of Economic Voting: Taking Account of the Political Context. *American Journal of Political Science* 37 (2):391–414.
- Reinhart, Carmen M., and Kenneth S. Rogoff. 2004. The Modern History of Exchange Rate Arrangements: A Reinterpretation. *Quarterly Journal of Economics* 119 (1):1–48.
- Rogoff, Kenneth S. 1985. The Optimal Degree of Commitment to an Intermediate Monetary Target: Inflation Gains Versus Stabilization Costs. *Quarterly Journal of Economics* 100 (4):1169–89.
- Stasavage, David. 2003. Transparency, Democratic Accountability, and the Economic Consequences of Monetary Institutions. *American Journal of Political Science* 47 (3):389–402.
- Svensson, Lars E.O. 1997. Exchange Rate Target or Inflation Target for Norway? In *Choosing a Monetary Policy Target*, edited by Anne Berit Christiansen and Jan Fredrik Qvigstad, 120–38. Oslo, Norway: Scandinavian University Press.