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The Political Economy of Conquering Inflation
The Impact of Elite Opposition and Elite Consensus on Inflation-Stabilization

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An abstract of
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James T. Laney School of Graduate Studies of Emory University
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Abstract

The Political Economy of Conquering Inflation
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By Nicole Rae Baerg

Why do political elites make public proclamations about the future? What influence, if at all, do elites' statements have on the behavior of their audience? I argue that political elites' public statements can be critical in signaling information about the economy. I examine the effect of political opposition on the content and clarity of elites' proclamations in the news. I also examine political elites' cues on households' inflation expectations and inflation outcomes. The theory offers a political economy model of elite and household information transmission where inflation expectations are endogenously determined. Unlike previous, single-sender models, I present a model where strategically minded political elites can offer counter claims to another elite's pronouncements. I find that the ability for one elite to confirm or refute another elite's message influences how precisely elites can transmit information to households. The testable hypotheses that I consider are that political opposition is associated with greater information precision and that greater information precision attenuates inflation expectations, leading to lower inflation. I then test these hypotheses using individual and country level data of 6 Latin American countries, between 1990-2010. Results provide some support for my hypotheses, however, significant across-country variation in the estimates generates many interesting new questions.

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Perhaps the best news is that I still find inflation fascinating and I truly believe that this topic is both interesting and meaningful. All errors, omissions, and limitations are my sole responsibility. I sincerely look forward to correcting and improving upon this project.

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Chapter 1

Why Communication Influences Inflation

> *"It was noted that clear communication and credibility allow the central bank to help shape the public's expectations about policy, which is crucial to managing monetary policy"* – (Federal Open Market Committee Minutes, September 2012)

1.1 Introduction

Throughout the late 1990s and into the early 2000s, a country's level of inflation was, more often than not, framed as something analogous to a medical illness. If the country was sick (had high inflation), a doctor (an economist or central banker) could use his instruments to help nurse the sick patient back to health. The doctor's typical instruments included changing government spending, interest rates, or exchange rates. Inflation, like influenza,

dysentery, or some other disease, just needed the right prescription in order to be cured. Once treatment was underway, inflation could be constrained to extremely low levels, at least by historical standards, or eradicated altogether.

The key to this successful revolution in monetary policy, it was argued, was the elimination of politics in economic policymaking. Delegating monetary policy to an autonomous institution, usually an independent central bank, meant optimal policy. Leaving it in the hands of politicians, by contrast, created economic disasters. In this vision, impartial experts would govern the country's inflation levels, ensuring low inflation, and economic prosperity for all - hence *optimal policy*. Empirically, after decades of bouts of high and hyper inflations, an increase in central bank independence coincided with low global inflation. Inflation as an economic phenomenon seemed dead or at least barely alive. While there were counter-examples such as hyperinflation in Zimbabwe, chronically high inflation in Romania, and escalating inflation in Argentina, these examples did little to dispel the common wisdom that low inflation was good and that independent and apolitical central bankers ensured that outcome. Average global inflation during this time was historically low, credit was plentiful and cheap, and growth seemed unabated.

It is important to see the development of this kind of thinking in its historical context. Throughout the 1980s and 1990s, countries associated today with great economic power such as Mexico, Brazil, and Russia all suffered very high inflation. The late 1990s and early 2000s represented their "great moderation". Economists Alesina and Drazen (1991) developed an important explanation for why some countries reformed successfully from high inflation episodes whereas other countries did not. Their explanation suggested that inflation depended on the degree of political opposition in the domestic polity. Countries with

higher degrees of disagreement about costly inflation stabilization policies were thought to delay stabilization and worsen the economy. Alternatively, countries with greater consensus over inflation policy, adopted better policies, yielding lower inflation. In similar work, Cukierman, Edwards and Tabellini (1992) suggested that countries with greater political opposition were also more likely to print additional money to cover expenses than to collect taxes. Both arguments suggested that politicians in more politically opposed countries are more likely to print money, causing inflation. There is, however, a crucial missing component from these accounts. In addition to changes in the actual money supply, forward looking variables, and especially the expectations of future prices, can produce similar inflationary effects as printing money.

This point was made forcefully by Sargent (1977, 1982) and other proponents of rational expectations theory. According to rational expectations theory, actual economic outcomes are driven by agents' perceptions of the future economy. Because agents are expected to have correct beliefs about the future economy, expected prices should be equivalent to actual prices. One of the problems with the rational expectations argument, however, is that it merely assumes that agents have correct beliefs about the future economy, yet it does little to inform us about where agents receive information in order to construct their beliefs. Moreover, an explanation that relies on homogeneous agents, each with correct beliefs about the future economy, does little to explain across-country and over-time variation in inflation outcomes, especially when institutional solutions to quell rampant inflation were applied widely, and yet outcomes diverged. In other words, if agents have rational expectations all the time, why do similar inflation stabilization policies sometimes succeed and sometimes fail?

In answering this question, the argument that I advance considers uncertainty and the political determinants of information uncertainty. Much of the political science literature suggests that citizens get their economic information from an assortment of political actors. Furthermore, these political actors are thought to have variable preferences over policy outcomes. This implies that the public *learns* things about the future economy from the things that policymakers say and that these policymakers are partial to particular outcomes. Because changes in the expectations of future prices can produce similar inflationary effects as printing money, the things that policymakers say are of consequence for inflation. While we have some understanding of the effects of political opposition on support for economic reforms, we have limited understanding of the effect of political opposition on the content (truthfulness and clarity) of policymakers' speech. To answer this question, we need a model of policymakers' communication that accounts for political opposition and its effects.

Why advance an argument about what policymakers say instead of what policymakers do? In 2008, the world experienced a severe economic crisis. This crisis precipitated two interesting consequences for political economy scholars. First, as a response to the crisis, policymakers have kept interest rates historically low in order to encourage lending. Even with historically low interest rates, however, "real" rates (inflation adjusted) remain too high for those countries struggling economically. As nominal interest rate manipulation has become a less viable tool, policymakers are increasingly relying on communication as a primary policy instrument in an effort to lower real interest rates and control inflation. It is therefore increasingly important to have a model that helps to explain the determinants of "good" speech. Second, unlike the imagined *apolitical* central banker/doctor of the

1990s and 2000s, increasingly those in charge of the economy are characterized as *political* actors. In other words, even central bankers are now perceived as strategically minded policymakers with policy preferences instead of benevolent experts concerned only with optimal policy. Considering that the public receives a wide variety of economic information from an assortment of such political elites, explanations that consider political opposition but ignore communication, or alternatively consider communication but ignore political opposition, are lacking. These explanations fail to uncover those conditions that can change agents' beliefs and as a consequence, the economy.

1.2 A New Model of Inflation

Previous models of inflation are easily classified into familiar formal models: bargaining, commitment, and signaling. The theory that I advance in this dissertation takes the insight from the bargaining literature, with its focus on multiple political elites and political opposition over economic policy, and the signaling literature, with its focus on information transmission and communication. In combining these two frameworks, I make two critical assumptions. First, I assume that there are multiple political actors in the domestic economy and that these actors have different preferences over economic policy. Second, I assume that multiple elites have better information about the economy than the average household. While political actors have better information than the household, political elites have common expert information amongst themselves. Because political elites have an information advantage relative to the household, under some conditions, information transmission occurs in a top-down fashion from political elites to the household. By setting

up my model this way, my theory identifies *political* factors that explain variation in information disseminated to the public. I find that information precision varies systematically due to the political strategies that political elites take when crafting their speech.

Strategic speech is an important topic. By highlighting the fact that inter-elite politics influences the content of elites' messaging, this research fits into a growing literature that examines why and how elites talk in public. Most of the previous literature examining central bank or government communication assumes that a monopolist proclaims messages to the public. Because he is a monopolist, dissent or possibility of dissent is absent. By enlarging the pool of actors and by assuming that multiple elites each have an interest in persuading the public, the theory introduces political competition. As a result, this brings back the insights from previous bargaining theories while keeping the insights from the literature on signaling. Interestingly, like economic theories that show how greater economic competition leads to more efficient allocation of resources, my theory contends that greater political competition conditions political elites' speech, yielding better informed households and better economic performance.

While this project is not about explicitly the benefits of democracy, one of the important contributions of my dissertation is that political competition amongst opposing but moderate political elites leads to a better informed public and a more stable economy. These benefits are of practical importance. Consider one illustration. In the summer of 2012, the Federal Open Market Committee (FOMC) publicly stated that future interest rates will remain low until "Mid 2015". A more precise statement is one where the FOMC proclaims that, in accordance with its dual mandate, the FOMC will keep interest rates low until unemployment falls to "xx" percent. My theory suggests that the reason why the FOMC did

not make a precise statement was either because inflation shocks were relatively high, or because of differences in preferences amongst committee members was too large. As a result, the public's inference of the unemployment target was more uncertain than the degree of uncertainty had the FOMC revealed a numerical unemployment target. Interestingly, in December 2012, the FOMC announced a more precise unemployment target of 6.5 percent and an inflation target of 2.5 percent. In both instances, committee member Lacker dissented, suggesting there was political opposition to the policy on the committee at the time of both announcements. According to my theory, the increase in the precision of information in December's statement resulted from either an exogenous lowering of inflation risks to the economy, or alternatively, greater consensual inflation preferences amongst elites on the committee conditional on the fact that there was opposition.

1.3 Political Determinants of Communication

Using a model of information transmission where multiple political elites attempt to influence the public, I find that the degree of *political opposition* is a critical determinant of truthful and clear speech. Political opposition is when political elites have oppositional inflation preferences relative to a representative household. In this case, different elites want to influence the household's inflation expectations in different directions: one elite wants the household to lower her inflation expectations, meanwhile another elite wants the household to increase her inflation expectations. Interestingly, when political elites have preference configurations like this, and at least one elite is moderate, political elites are expected to reveal all of their private information. Why this occurs is that both sides are

better off correctly reporting their exact information than they are if they try to misreport their information and another elite dissents.

Because of the possibility of dissent, inter-elite bargaining over information reveals the exact truth. This finding is analogous to the determinants of prices in a competitive market. Because of the threat of competition from alternative suppliers, a single firm is restricted to sell his product at the competitive market price. Because all firms are producing the same thing using the same tools, in the aggregate, all firms are constrained to charge the same price. Similarly, in a model in which multiple elites with varying preferences compete to persuade the public, because of the threat of competition from alternative suppliers of information, each elite is restricted to tell the exact truth. In a model of information transmission, when there are multiple elites each with the same information but oppositional preferences, the household receives all of elites' private information. An increase in information is predicted to reduce her uncertainty about the future economy and a reduction in uncertainty is expected to yield lower inflation.

The alternative scenario is less rosy, however. When political elites have consensual inflation preferences relative to the household, they cannot reveal their private information as precisely. This finding results from the interesting idea that while on the one hand, those elites with more extreme preferences are able to constrain more moderate elites so that they always tell the truth, the cost of doing so, however, is more imprecise information to the household. Less information means greater uncertainty about the future, and greater uncertainty is expected to increase inflation. Moreover, this proposition holds when compared against information dissemination with oppositional elites and with a monopolist sender.

Why would uncertainty necessarily increase inflation? Consider an example from mod-

ern day Iran. In the summer of 2012, Iranian inflation escalated due to changing expectations of future prices. Throughout the summer, the Iranian public began to frantically substitute the domestic currency, the *rial*, with foreign currency. This was perplexing as the money supply had not changed nor had there been a change in the monetary institutions governing Iran. This substitution away from Iranian currency occurred only as a result of greater uncertainty about the future value of money as Iran faced escalating security issues. As the public began to rapidly sell away their domestic currency holdings, the inter-temporal value of money changed. As a result, an increase in future uncertainty led to changes in the inter-temporal value of money, causing expectations of future prices to rise and with it, actual contemporaneous prices. In sum, greater uncertainty lead to greater inflation.

This dissertation project presents the first systematic exploration of political elite behavior and information and its influence on inflation. It examines six Latin American economies (Argentina, Brazil, Colombia, Mexico, Peru, and Venezuela) throughout the 1990s and 2000s. Much of the data collected and analyzed in this project are new. Chapter 4 introduces two new measures: a measure of domestic *political opposition* over monetary policy and a measure of *information precision* in the news. Political opposition is tallied and aggregated from quarterly announcements in *Exchange Commitments and Exchange Restrictions, Annual Reports* published by the International Monetary Fund. Information precision is constructed from over 9,000 inflation-related newspaper articles gathered from Reuters news. Using automated content analysis tools, I retrieve, parse, and filter a large number of individual news articles covering inflation. I then derive a measure of the proportion of information precision in the news aggregated at the country-quarter and by country-

month frequencies.

The empirical analysis in Chapter 4 indicates that variation in information precision covaries with different degrees of country-level political opposition. Furthermore, the variation seems to confirm some of what we previously know, while also generating new insights. For example, the analysis confirms previous research on policy gridlock. Countries with greater levels of political opposition are predicted to be those less likely to make an announcement. What this means is that those countries that do not make any inflation-relevant policy announcements, political opposition is more likely. I find the opposite for countries that do make policy pronouncements, however. For those countries that do enact a monetary policy reform, a greater degree of political opposition is associated with a greater degree of information precision. This is a very important and new finding. What this means is that for those countries that attempt reforms, greater levels of political elites opposition is associated with greater information precision in the news. The evidence provided in this chapter lends some support to the claim that political strategies condition the degree of information precision disseminated to the public through the news media.

Chapter 5 extends the analysis in the previous chapter and considers economic performance. This chapter examines the relationship between information precision, inflation expectations, and inflation outcomes. The evidence in this chapter suggests that countries with more precise information are more likely to have lower inflation expectations and lower inflation outcomes. Furthermore, the analysis provides consistent evidence of this, but with variation in the strength of the association across countries. Although there is a common relationship between information, uncertainty, and inflation, the evidence also indicates that the effects of information precision on inflation varies considerably across

countries. In my sample of 6 Latin American countries alone, Argentina exhibits the largest effect, suggesting that information may play a greater role in Argentina than other countries. Interestingly, Venezuela also exhibits a relatively large effect. Despite the fact that both Mexico and Venezuela have restrictive media regimes, the influence of information precision has a larger influence on inflation expectations in Venezuela than in Mexico. This finding generates questions for future research. Why do different populations vary in their responsiveness to elites' communication? What factors explain this variation?

1.4 Plan of the Dissertation

The following chapter introduces the concepts used throughout the dissertation and reviews the literature. Chapter 3 introduces the theoretical arguments, the assumptions that I make, an explanation of the model's findings and propositions, and finally, a presentation of the testable hypotheses examined in later chapters. Chapters 4 and 5 present the measurement strategy and the empirical tests of the theoretical predications. Because the measures that I use are new to the literature, I spend a substantial amount of time detailing their construction and linking them to concepts and measures already common in the literature. Chapter 6 concludes by discussing implications of the findings for the study of economic policy-making and for the field of political economy more generally. At the end of this chapter, I discuss several possible extensions of the model and alternative avenues for future research, namely, but not only, the role of communication in fiscal austerity measures and in public finance.

Chapter 2

Political Communication and Inflation Expectations

2.1 Introduction

This dissertation project presents a new theory that explains why we see across-country and over-time variation in inflation outcomes. What is particularly puzzling is the fact that some countries that experience really high inflation can stabilize to lower inflation meanwhile other countries cannot. In this dissertation project, I present an argument where, under certain conditions, *political elites*, or actors engaged in economic policymaking, disseminate important information about the future economy to households. Households can then incorporate this information into their expectations of the future. The process of changing households' beliefs, by way of acquiring information, influences actual inflation outcomes.

Previous arguments that explain inflation generally focus on issues of bargaining or

distributive concerns, commitment problems, or electoral/partisan reasons for inflation. These arguments provide important insights into how domestic politics and institutional structures influence inflation outcomes and much of the empirical evidence over the last decade supports these claims. Unfortunately, however, previous arguments ignore the fact that political elites make public statements or proclamations about the future economy to the public. There is growing empirical evidence suggesting that such statements influence economic outcomes by moving markets. Previous theories, therefore, fail to address why political elites communicate publicly about the future economy, nor can they explain what influence communication has, if at all.

Formal game theory models, which highlight the importance of communication are called signaling models. In signaling models, public statements or proclamations vary in the precision of information transmitted to those listening. Previous signaling theories used to explain inflation, however, all assume a monopolist signal sender. What this means is that previous models assume that a single actor (usually either the central bank or the government) communicates in one consensual voice. Yet, communication emanates from multiple political elites and with the possibility for dissenting views or statements. Due to the strict assumption of a single message sender, therefore, previous models, with their assumption of a unitary message, omit the inter-elite strategic politics of signaling. For the substantive case of inflation, multiple signal sending is important as inter-elite politics is thought to be central in an explanation of inflation outcomes.

Building on the signaling literature, in the next chapter I advance a theory that focuses on the influence of multiple political elites sending messages instead of only a single elite. The inclusion of multiple and potentially conflicting voices means that signaling occurs in

a competitive political environment. This competitive environment highlights the importance of inter-elite politics. Such a model retains the benefits of previous research with its attention to domestic politics, while simultaneously, builds on the claims that communication and information dissemination is an important tool in the fight against inflation. The rest of the current chapter defines the terms used in the dissertation, outlines previous explanations for inflation, and critically examines the previous literatures' theoretical and empirical claims.

2.1.1 Inflation and its Consequences

The phenomenon that my dissertation explains is inflation. Inflation refers to the rate at which the level of prices for goods and/or services are accelerating in the economy. Deceleration in prices, such that the rate of change in prices is still positive but is slowing down, is called disinflation. For example, an inflation rate of twenty percent per annum means that the price level of goods and services are rising, on average, at a rate of twenty percent, year over year. If the next year this rate is ten percent, there is inflation of ten percent, and year-over-year disinflation of ten percent. If instead price changes are negative such that the rate at which the level of prices for goods and services is negative, this is called deflation. In order to understand inflation, disinflation, and deflation, consider a metaphor: inflation can be likened to driving a car. When driving a car, the driver can either accelerate, decelerate (while still moving forwards), or move in reverse. Moving forward at an accelerating speed is inflation; moving forwards while decelerating to a stop is disinflation; finally, going in reverse is deflation.

Inflation is often measured by estimating the rate of price change in a particular basket of goods and/or services over time. One commonly used basket is changes in prices of consumer goods and services, or a consumer price index. Some consumer price baskets include household staples such as gas prices and food, whereas other measures do not, such as "core inflation." Other measures of inflation include measuring changes in producer prices, wholesale prices, commodity prices, and price changes in internationally traded goods and services. In this dissertation, because my attention is on the household, I use the terms inflation and changes in consumer prices interchangeably.

When examining inflation rates across countries and over time, one important concern is across-country and over-time comparability. Comparability is an issue because the items in the price basket may not be relevant to all countries nor consistent over time. For example, in some countries, rice may be a staple item important in the price basket whereas in other countries, wheat may be more relevant to consumers. Similarly, in some countries, government policy such as rent and housing controls may mask price changes whereas in other countries, changes in housing market prices may be more important to consumers. I spend substantial length discussing methodological and measurement issues in chapter 4. What is important, however, is that in this dissertation project, I refer to inflation as measured by either annual or monthly changes in the consumer price index.

Inflation Types

Different rates of inflation tend to have have different consequences for the economy. Because of these differences for the economy and their expected dynamics (or how inflation evolves over time), the literature has developed specific terms for inflation rates above and

below certain levels. I review these terms below and present the definitions of inflation types used in this dissertation project.

One particular type of inflation is *hyperinflation*. Hyperinflation is inflation that is very high or out of control. Hyperinflation is destructive because under conditions of hyperinflation, the monetary economy is divorced from the productive economy. What this means is that changes in a country's production of goods and services has little influence on changes in the demand and supply of money and also the reverse. In general, the problem with inflation, especially hyperinflation, is that hyperinflation consumes anything of monetary value. Hyperinflation erodes personal savings, wages, investment income, etc., making holders of assets or wage earners significantly less able to make the same purchases over time. One serious consequence is that under conditions of hyperinflation, the public has a widespread unwillingness to hold local money or invest in domestic assets. This makes traditional tools of economic policy weaker and also erodes policymakers' credibility. What makes hyperinflation particularly vexing is that it is very common that once inflation is high, it is likely that prices in the economy will quickly accelerate upwards in a self-reinforcing inflationary spiral.

The traditional definition of hyperinflation is by Cagan. Cagan (1956) defines hyperinflation as "inflation that exceeds 50 percent a month." According to Cagan's definition, however, there are no reported hyperinflation episodes between 1947 and 1984. As a milder form of hyperinflation, Fisher, Sahay and Vegh (2002) define "a very high inflation episode" as inflation above 100 percent per annum. Inflation of 100 percent per annum is equivalent to 5.9 percent per month. This definition is therefore far below Cagan's definition. I adopt the 100 percent per annum definition of inflation instead of Cagan's definition

for four reasons. First, countries with inflation above 100 percent per annum tend to exhibit similar economic characteristics. This makes such episodes comparable across countries; second, 100 percent per annum is a commonly used threshold in the literature and is therefore well understood. This makes this definition transparent; third, a 100 percent per annum threshold covers a larger number of episodes than Cagan's definition. This allows for greater variation in experiences while still being generalizable; finally, a 100 percent per annum threshold is usually sufficiently to prompt the government into attempting stabilization policies. In determining the best definition of hyperinflation, what is important is designating a high enough threshold such that the demand for local money is influenced by its perceived lack of future value, while, simultaneously, classifying a broad enough set of cases. Following from Fisher, Sahay and Vegh (2002), I define "hyperinflation" as an aggregate twelve month inflation rate that is over 100 percent.

Another type of inflation is *chronic inflation*. Chronic inflation is loosely characterized as inflation which is enough to be dangerous yet is not necessarily explosive. Unlike hyperinflation that tends to exhibit an upward, inflationary spiral, chronic inflation often manifests in a stepwise pattern. Because countries may exhibit lengthy plateaus of chronic inflation, countries with chronic inflation often develop institutional mechanisms that are used to protect against future inflation, such as wage and price indexing. One serious problem with chronic inflation is that chronic inflation reallocates resources from the productive economy into the financial sector. What this means is that, under conditions of chronic inflation, a significant amount of resources is used for the purpose of inflation hedging or insurance services instead of the production of goods and services. The reallocation of resources is thought to lead to a reduction in productivity, harming the domestic economy

and its citizens. I define chronic inflation as aggregate inflation over 25 percent per annum.

The vacillating between chronic and hyperinflation characterizes the inflation experience of a large subset of countries over the last fifty years. Many countries in Latin America and Israel suffered both chronic inflation and hyperinflation in the 1980s. The collapse of the Soviet Union in the early 1990s generated chronic and hyperinflation in Hungary, Romania, Ukraine, Yugoslavia, and other countries. Generally speaking, hyperinflation and chronic inflation have wrecked havoc on a wide variety of countries and over an extraordinarily long historical time period. The likelihood of chronic and hyperinflation in some part of the world at any given time makes it critical to understand policies that can stabilize inflationary episodes.

As a demonstration of the variety of countries' inflation experiences, table 1 below shows the length of chronic inflation and hyperinflation for a sample of countries in different geographical regions and the frequency of episodes by level of inflation. The data in table 1 is from 1960 to 2010 (World Bank, World Development Indicators, Source: International Financial Statistics). I present the start date for those countries that enter into annual inflation over 25 percent per annum. Similarly, I report the number of years until a country stabilizes, such that inflation does not go above 25 percent per annum again for at least three years. As is apparent from the table, there is significant variation in the duration of chronic and hyperinflation episodes. These range from 5 to 29 years. There is also significant variation in average inflation rates. Some countries, such as Romania, suffer multiple peaks of inflation but with relatively lower average annual rates. Other countries, such as Uruguay, exhibit sustained and chronically high inflation, with annual inflation rates over

Table 2.1: Inflation episode length and average level for a selection of countries

Country name	Start Year	End Year	Duration	Average Annual Rate
Argentina	1972	1992	20	471.18
Bolivia	1972	1977	5	2741.28
Brazil	1981	1996	15	772.85
Bulgaria	1991	1998	7	262.95
Congo, Dem. Rep.	1976	2002	26	1362.09
Croatia	1986	1995	9	513.73
Israel	1978	1986	8	165.13
Peru	1978	1994	16	809.44
Poland	1988	1993	5	196.13
Romania	1991	2001	10	121.01
Russian Federation	1993	2000	7	222.23
Turkey	1979	2004	25	62.42
Uruguay	1964	1993	29	64.51

Table 2.2: Frequency of country experiences by inflation types

Range of Annualized inflation	Number of Countries
Hyperinflation (Series Average)	13
Chronic Inflation (Average)	31
Chronic Inflation (Series Maximum)	102
Low inflation (Series Average)	185

twenty five percent per annum for three decades.

Fortunately, *low inflation* is what most countries experience most of the time. I define low inflation as inflation between 1 and 25 percent per annum. According to the World Bank, World Development Indicators, between 1960 and 2010, 185 countries have had average annual inflation below 25 percent.

Prices not only go up, they also go down. *Disinflation* is when prices are declining at a rate slower than before. The reason why disinflation is important is that, like chronic inflation or hyperinflation, disinflation may cause a loss of country-level output. Some researchers find that disinflation causes recessions (Ball, 1995). Other researchers find

that output losses accrue over time. For example, Fisher, Sahay and Vegh (2002) finds that disinflation raises output immediately and then lowers output subsequently over time. Still other research finds that if disinflation is perfectly anticipated by rational households, disinflation will not lower output (Sargent and Wallace, 1982). In order for price changes to be considered disinflation, there must be a semi-permanent reduction in the level of prices. By semi-permanent I mean the reduction in prices is sustained for a given period of time. I therefore define disinflation as inflation that falls at least 2 percent per annum below three percent year-over-year trend inflation.

Finally, *deflation* refers to negative changes in aggregate prices. Deflation is even more rare than hyperinflation. Like hyperinflation, prolonged deflation can have severe negative consequences and may be self-reinforcing. Under conditions of deflation, the real value of debt rises. Rising debts can increase the likelihood of firm and household bankruptcies. An increase in bankruptcies can then cause a further fall in the prices of assets. When a large number of firms and households go bankrupt, delinquencies and bankruptcies change the balance sheets of banks, increasing their liabilities and weakening their assets. Under some conditions, changes in the balance sheets can threaten the solvency of the banks and further restrict credit. On the household side, if wages are rigid downward, deflation may also lead to higher unemployment. Bankruptcies, falling asset prices, and rising unemployment may bring prices down even further. Like hyperinflation, the deescalation of prices may be reinforcing, sending the economy into a downward, deflationary spiral (Svensson, 2003).

While deflation is rare, it occurs. In the modern era, Japan entered deflation as early as 1995 and remains stuck in deflation until today. With the global financial crisis (2007 - present), and nominal interest rates close to or at zero, some central bankers have argued

that the industrialized economies are at risk of deflation (Williams, 2009).

The variety in country experiences, the recurrence of bouts of inflation in the same countries over time, and the differences in the inflation trajectories as well as deflationary experiences generate many important questions. Sometimes a country experiences an explosive single peak of inflation, such as what occurred in Germany, Austria, and Hungary in the 1920s, and Bolivia in the 1980s. Other times countries face persistent high and hyperinflation, such as in Argentina, Brazil and Israel throughout the 1970s and 1980s. Still other times, countries may remain at low levels of inflation, but end up at risk for deflation if the economy experiences crisis. What is puzzling is that, despite the enormous body of research explaining the causes and consequences inflation, we still do not completely understand those factors that can help quell inflation. Moreover, and perhaps even more puzzling, sometimes *inflation stabilization*, where a country attempts to lower inflation drastically in a short period of time, may fail, only to work a few years later. Furthermore, the same types of inflation stabilization policies can work in one country and yet fail in another country. My dissertation project presents a novel argument for why information is an important explanation for why we see such a wide variety of country experiences.

Policy Domains

Common solutions to inflation often revolve around three policy domains. The first policy domain is interest rate policy. In modern day central banking, a country's monetary authority sets the base rate of interest in the economy. All market interest rates are then derived from the base rate. For example, in the United States, the Federal Reserve Bank sets the federal funds rate. Because of the importance of the base interest rates to other economic

variables such as the exchange rate, employment, and inflation, economic policymakers attempt to influence these variables by making changes to the base interest rate. For example, the monetary authority attempts to control inflation by raising interest rates. An increase in interest rates entices savings and investments, and subsequently lowers the demand for money circulating in the economy.

The second policy domain of inflation stabilization is fiscal policy. The government's budget and the underlying deficit and tax policies pursued by the government are important to inflation stabilization. In fact, some scholars have argued that once the government budget is stabilized, inflation should stop (Sargent and Wallace, 1982). Therefore, much attention has been paid to the role of government deficits in causing and quelling inflation. As a solution to high inflation, an inflation stabilization policy that only (or mainly) focusses on reducing the government budget is often referred to in the literature as *orthodox* inflation stabilization.

Finally, currency policy and exchange rates is another dimension of inflation stabilization. Fixing the exchange rate (the rate at which local currency can be exchanged for foreign currency) and/or launching a new currency to replace the old currency are common inflation stabilization policies. The attempt here is to signal a *policy regime shift*, or a structural break from the old economic policies and an adoption of new economic policies. The fixing of domestic prices to an international price (the exchange rate is an international price), is a way in which policymakers attempt to delegate monetary policy to a foreign entity, with the hope of importing the foreign country's monetary credibility. As a solution to high inflation, an inflation stabilization policy that uses the exchange rate or other kinds of wage and price controls in addition to changes in the government budget is *heterodox*

inflation stabilization.

Importantly, these three policy dimensions: interest rates, fiscal spending, and exchange rate policy, all influence a country's rate of inflation. While the pursuit of any one policy, such as attention to the exchange rate, will distribute costs and benefits in ways that are very different than the distribution of costs and benefits from the pursuit of other policies, such as increasing taxes and lowering government spending, all or some of these policy tools in any given combination are used as arsenal in the war against inflation.

Solutions for deflation are similar to those discussed above. Like the above, the first policy domain is interest rate, or credit policy. Under conditions of deflation, the central bank wants to relax credit because real interest rates may be too high. One way to do this is by lowering interest rates. A situation where the central bank's nominal interest rate are really low (or zero) yet where real interest rates are too high is a situation in which interest rate policy is backed up against a *zero lower bound* (ZLB). Under ZLB conditions, the central bank can no longer use the base interest rate, such as the federal funds rate, to relax credit. This is simply because nominal interest rates cannot be lower than zero. Instead, the monetary authority may turn to other, credit generating policies. One credit generating policy is *quantitative easing* (QE). Quantitative easing is where through the acquisition of assets or through change in the composition of assets, central banks attempt to change their balance sheet. The purpose of this quantitative easing is, like the lowing of interest rates, to loosen credit and provide liquidity to the economy.

Another way to solve deflation is through government spending. How this works is that an increase in government spending raises households' inflation expectations. If the interest rate is at zero, a rise in expected inflation lowers the real interest rate. The hope

is that a rise in the real interest rate will increase private spending which will then further increase expected inflation - thus halting the downward deflationary spiral. Recent work by Eichenbaum, Christiano and Rebelo (2011) find that for those countries experiencing risks of deflation and zero nominal interest rates, government spending is more effective in generating larger gains in country level output than under non-deflationary conditions.

Finally, another remedy for deflation is by substantially devaluing the currency. Svensson (2001) finds that when interest rates are at the ZLB and a country is experiencing deflation, the monetary authority can raise inflationary expectations by substantially devaluing the exchange rate, adopting an exchange rate peg, and pre-announcing a price-level target path. Empirical results seem to support this view. In one empirical study, Coenen and Wieland (2003) find that when nominal interest rates are bounded at zero, a 6 percent real depreciation in the trade-weighted exchange rate makes inflation expectations increase rapidly (Coenen and Wieland, 2003).

In addition to these three traditional policy domains, a burgeoning body of research suggests that communication, or the things that economic policymakers say, is an additional policy instrument that can be used in the fight against inflation (deflation). The reasoning is that like fixed exchange rates, information can act as a lighthouse, helping the public to form expectations of the future that are more certain than public uncertainty without this information. It is in this way that communication can be effective, helping the public navigate through the dark sea of the future economy. Information may, therefore, help to either protect against inflationary or deflationary spirals or alternatively, help to counter the self-reinforcing dynamics of inflationary or deflationary crises.

The influence of information as an inflation stabilizer works similarly to the policy instruments discussed above. If political elites can credibly reveal important and truthful information about the economy then uncertainty will decrease. A reduction in future uncertainty will lead to lower expected future inflation. A reduction in expected future inflation may then engender lower actual inflation. By playing the role of the lighthouse, through the dissemination of information, political elites' public proclamations can help attenuate households' expectations, which can then cause changes in actual inflation outcomes.

Households' Expectations

The reasons for why an increase in expectations of future inflation can cause an increase in inflation are twofold. Expected future inflation raises nominal interest rates. Because people want to keep their real (inflation adjusted) returns on their investments intact, an increase in nominal interest rates makes holding money (as cash) relatively more expensive. Changes in the relative price of holding money, therefore, makes people want to purchase other kinds of assets instead of holding money. Once people purchase other assets instead of holding money, the demand for money goes down. As the demand for money decreases, there is surplus money in circulation relative to money demand. With more money chasing the same amount of goods and services, prices increase.

In addition to changes in money demand, expected inflation may also cause workers to negotiate higher future wages. As workers anticipate that their future wages will not be able to purchase the same amount of goods and services, their wage bargaining today will include measures to offset expected price changes tomorrow. If employers pay workers higher wages and pass these cost increases into the prices of their goods and services

tomorrow, then increases in workers' inflation expectations can also lead to an increase in the prices of goods and services in the economy. Both of these channels, either through changes in the relative value of money or changes in nominal wages, can lead to an increase in inflation.

Under conditions of uncertainty about the future, decisions made today based on the expected value of money may lead to contemporaneous changes, and in ways that may generate a vicious circle. As Issing et al. (2005) suggest, "uncertainty [about the future] is a pervasive fact of life." Because of future uncertainty, people in turn may change their perceptions, and "people's perceptions may affect outcomes, so that "the truth" will not be independent of the learning process by which perceptions are formed." Therefore, one of the ways in which economic policymakers can attempt to halt this viscous cycle is by providing information in an attempt to reduce uncertainty.

In sum, inflation varies across country and over time. Keeping inflation outside the ranges of inflationary or deflationary spirals requires that the public trusts the future value of nominal variables, whether prices, wages, or exchange rates. *Nominal price anchoring* is when a target is used to help the public trust the value of a nominal variable(s) and consequently, trusts future prices. A lack of trust in a nominal anchor means that the future value of the nominal variable(s) are less certain. Therefore, the credibility of a nominal anchor depends on whether or not the mechanism used to anchor the nominal variable has the quality of being sustained. Some classic economic variables that have acted as nominal anchors correspond to the policy domains listed above: interest rates, government deficits targets, and exchange rates. More recently, there is growing attention to the role

that information can play in acting as a nominal actor, especially when other policy tools are weak, such as during economic crises.

The rest of this chapter is organized as follows: Section II discusses previous explanations for why inflation varies across countries and how to stabilize inflation, highlighting the role of bargaining, institutional, and informational explanations. Sections III presents the argument for why multiple political elites and not a single unitary elite sends messages to the public. Section IV articulates how and why political elite information can influence households' inflation beliefs. Section V concludes.

2.2 Literature Review

Policy efforts to lower inflation often focus on solving bargaining or distributive concerns, commitment problems, or electoral/partisan effects. Some scholars argue that the key to lower inflation surrounds a country's ability to collect taxes and withstand political pressures for printing money (Alesina and Drazen, 1991; Cukierman, Edwards and Tabellini, 1992). Other scholars suggest that essential ingredients for lower inflation include good domestic institutions that solve commitment problems such as independent central banks, collectivized labor institutions, and credible exchange rate regimes (Barro and Gordon, 1983; Blomberg, Frieden and Stein, 2005; Franzese and Hall, 1998). Opportunistic or electorally motivated politicians may also cause inflation (Hallerberg and Clark, 2002; Hibbs, 1977; Nordhaus, 1989). A country's pronouncements, or official declarations, about the policies they adopt aimed at controlling inflation, may also matter. For example, Guisinger and Singer (2010) find that in the arena of exchange rate regimes, those countries that match

their official exchange rate regime pronouncements with actual market exchange rate activity also have lower inflation. The fact that pronouncements can matter to inflation outcomes is well established: countries wishing to implement stabilization policies intended to reduce inflation often make well publicized pronouncements to households. The aim of the announcements is to reduce household expectations of future inflation, and thereby reduce the costs of disinflation.

2.2.1 Bargaining

Many scholars argue that the reason why some countries have low inflation while other countries have high inflation has to do with domestic politics. It is thought that one of the main sources of inflation is a country's level of *political polarization*, or how far apart domestic political actors' preferences are from one other. Variation in political polarization is thought to predict variation in political pressures to print new money to meet government expenditures. The ability to print money is an important source of government revenues. Those arguments that look at the incentives and constraints that allow for governments to print money presume that increases in inflation results from supply side features of the economy, namely growth in the money supply. The argument is that as governments print more money, excessive money growth generates high inflation as the supply of money outpaces the demand for money. At the extreme, changes in the money supply causes monetary disequilibrium, such that changes in prices are disconnected from productive factors in the economy, and lead to hyperinflation.

Most scholarship in this vein argues that money growth results from domestic political

conflicts over the government budget. When countries cannot generate a political consensus about how to pay their expenditures, they turn to printing money for revenues. An increase in the money supply through the introduction of new money allows the government to make its necessary spending, however, the result is higher price changes. Once inflation accelerates, governments then face political obstacles, such as political polarization over tax policy or political fights over implementing austerity measures, which then prevents the government from changing course. As a consequence, inflation rises.

For example, Alesina and Drazen (1991) ask the question, for those countries with really high inflation, when will inflation stabilization occur? In their view, inflation stabilization requires not only political agreement over the need for lower inflation but also the willingness to pay the costs of inflation stabilization. These authors present a war of attrition model where *political concession*, the agreement of one side to bear a disproportionate share of taxes, only occurs when some sub-section of the economy is forced to make a concession. They argue that concessions occur when: there is a clear electoral victory where the majority elected can impose the costs of stabilization onto the electoral losers; incumbents use extraordinary powers, such as the use of economic policymaking by decrees, in order to force new taxes; and finally incumbents crackdown on labor and force the costs of stabilization onto labor thus benefiting the owners of capital.

Whether the electoral minority, the public, or labor is required to pay the costs does not matter for the model's predictions. Instead what matters is the relative size of the winners and the losers. Alesina and Drazen (1991) argue that those countries that are more politically polarized are more likely to disproportionately place the burden of costs onto the smaller group. The smaller group, knowing that it will pay a relatively larger burden of the

costs, will then dig in their heels and prolong inflation. Alternatively, those countries where the share of the costs are more equally distributed will implement inflation stabilization more quickly. In summary, their argument is that the more politically polarized a country, the greater the probability that one side with bear a disproportionate share of the costs of stabilization, and the more likely this side will oppose stabilization. Finally, the longer inflation stabilization is delayed, the higher the country's inflation rate.

Cukierman, Edwards and Tabellini (1992) also consider the puzzle that we see wide variation in inflation even in countries with similar institutions. Like Drazen and Alesina, these scholars suggest that inflation is related to the costs of monetizing government spending. Instead of focusing on present-day domestic political conflicts, however, these authors consider the incentives that result from inter-temporal political strategies. Their argument is that those countries that are more politically polarized and less politically stable are more likely to keep inefficient tax systems. Because of the country's inefficient tax system, the government then has an incentive to turn to the money printing press for its revenues.

The reason why incumbents keep the tax system inefficient is intuitive: given the likelihood of future government turnover, an inefficient tax system constrains future governments from extracting power and resources from present day incumbents and their supporters. Once a new government is in power, the new incumbent faces the same incentive and they too will depend on money printing to fund government expenditures instead of making tax-reforms. Thus, in a model with more than one period, both incumbents and the opposition rely on new money for making expenditures and this creates higher inflation. While socially suboptimal, the reliance on money printing is the result of inter-temporal political strategies, with neither side having an incentive to reform the tax system when

in power. Therefore, these authors predict that highly polarized polities are more likely to have higher inflation even if they have the same levels of tax capacity than less polarized countries.

In summary, Alesina and Drazen (1991) and Cukierman, Edwards and Tabellini (1992) stress that inflation results from underlying domestic distributional conflicts. Politicians in politically polarized countries, due to their own self-interests and strategies, have the incentive to increase the money supply in order to meet expenditures and similarly, an incentive to delay costly reforms. As a consequence, it is predicted that countries with more political polarization are more likely have higher inflation.

In evaluating these claims, the empirical evidence is mixed, however. Using a panel data set covering around 100 countries from 1975 to 1999, Aisen and Veiga (2006) find that greater political instability and greater political polarization is associated with higher inflation volatility. Work by Marcet and Nicolini (2003), however, finds that for a sample of countries exhibiting very high inflation (presumably, those countries with higher political polarization), changes in inflation are not associated with changes in the money supply. Instead, these authors find that movements in inflation vacillate between high inflation plateaus and then periodic explosions of inflation and that these plateaus and explosions are independent of injections of new money. Furthermore, in the cases of Israel, Argentina, and Brazil, decreases in government tax revenues and an associated rise in the country's deficit were triggered by the acceleration of inflation over time which reverses the causal story. Under conditions of very high inflation, by delaying tax payments, tax payers can substantially reduce the real value of their tax payments through paying taxes in arrears which reduces government revenues (Olivera-Tanzi effect). In sum, the empirical evidence

does not provide conclusive evidence that political polarization, and the influence of polarization on the government's propensity to use the printing press for resources or to delay reforms, is the main cause of variation in inflation.

2.2.2 Credible Commitment

In contrast to bargaining models, another strain of the literature examines the role of credible commitment in order to explain inflation. Like the above, these theories also assume that high inflation results from the absence of domestic political constraints on governments. In these models, governments create a socially costly inflation bias because the government has a multitude of goals and these goals often generate higher inflation. For example, the government may attempt to generate higher employment and/or easy government financing despite a marginal increase in inflation. In order to stop the government from inflating the economy, it is necessary to erect institutions that credibly constrain the government to lower inflation levels.

Delegating monetary policy to an independent institution is framed as a solution to *time inconsistency* - or the incentive structure that arises from the inter-temporal nature of policymaking- and to *credible commitment*. Originating from Kydland and Prescott (1977), this literature points out that discretionary monetary policy risks creating inflation surprises because the monetary authority has an incentive to trick the public into believing that its intentions are low inflation, but then once the public forms its inflation expectations, in the subsequent period, the monetary authority has an incentive to pursue other objectives. The public, recognizing that the policy authority has an incentive to renege, then incorporates

higher future inflation beliefs today into their expectations about inflation tomorrow. As a consequence, equilibrium inflation at the end of the second period will be higher than optimal.

To limit any inflation bias, the solution is to constrain the monetary authority, byway of rules or reputation, to stick to a low inflation target. In other words, the solution is to force the authority to commit. If the commitment is credible, the public does not anticipate inflation surprises. The public then sets lower inflation expectations which consequently, yields lower inflation.

Three kinds of political institutions have historically been popular solutions in preventing inflation. First, countries can strengthen the independence of their central banks, especially if there are additional structures in the political system that keep the bank immune from special interests (Acemoglu et al., 2008; Hallerberg, 2002; Keefer and Stasavage, 2002); this will isolate inflation policy from political demands. Second, the government can appoint a conservative central banker with lower inflation preferences (Rogoff, 1985); this directly addresses concerns of commitment and also isolates inflation policy from political demands. Third, countries can fix their exchange rates to a foreign currency or a combination of currencies (Giavazzi, 1988), thereby importing the foreign country's price level; again this takes some price fluctuation influences out of the hands of domestic politicians.

Research in political science then asks, given that central bank independence is socially optimal, why is there variation in central bank independence? Hallerberg (2002) points out that domestic political variables that produce variation in the level of central bank independence across countries. In particular, he suggests that the degree of central bank

independence is conditional on whether or not a country is a unitary or a federal system. His argument is that the number of *veto players*, or actors whose consent is necessary to make policy change, determines the degree of central bank independence. He finds evidence that in those countries where there is a single veto player, the central bank is more likely to be politically dependent, and likely to have higher inflation. He also finds evidence that federal systems are most likely to have central bank independence and more likely to have lower inflation.

Instead of examining the role of veto players to explain the origins of central bank independence, Keefer and Stasavage (2002) examine how the number of veto players influences the effectiveness of central bank independence. These authors find evidence that central bank independence lowers inflation when there are multiple veto players. Therefore, both Hallerberg (2002) and Keefer and Stasavage (2002) suggest that the number of veto players is an important determinant of inflation. Keefer and Stasavage (2002) also find that as multiple veto players have divergent preferences, or political polarization, there is greater uncertainty about future policy, and therefore higher inflation. Like Cukierman, Edwards and Tabellini (1992) and Alesina and Drazen (1991), Keefer and Stasavage (2002) predict that political polarization is positively associated with inflation.

Finally, Acemoglu et al. (2008) argue that the effect of central bank independence on inflation are non-monotonic. These authors argue that only those countries where strengthening the independence of the central bank leads to *de facto* changes in the underlying domestic political constraints will benefit from an increase in central bank independence. For example, if in England, politicians are already highly constrained such that there are numerous checks and balances on policymakers, an increase in the Bank of England's in-

dependence from the government will have a negligible effect on inflation. Similarly, if Zimbabwe has low levels of political constraints, greater central bank independence will not lower inflation. Instead, only those countries with medium political constraints will benefit from delegation of policy to independent central banks. The prediction from this argument is the same as Keefer and Stasavage (2002): an increase in the number of checks and balances will reduce inflation outcomes, however, the marginal gains in lower inflation given additional checks and balances diminish the more a country is already constrained.

In addition to central banks, exchange rate regimes, especially fixed exchange rates, are also thought to engender lower inflation. By fixing the exchange rate regime to a foreign currency or a basket of foreign currencies, a country imports the monetary policy of the foreign country. The delegation of policy is thought to solve the problem of time-inconsistency because future policy uncertainty is tied to the policy of the foreign country, which is assumed to be more credible than the domestic government.

According to Crockett, fixing the exchange rate appears to generate "either the most stable or, if the regime breaks down, the least stable prices" (Mahadeva and Sterne, 2000). How long a country can maintain a fixed exchange rate varies dramatically and also depends on which measure of exchange rate regime is used. For example, Argentina committed to a fixed exchange rate in 1991 to stabilize inflation. By some accounts, Argentina managed to hold convertibility until 2001, however, some authors argue that the fixed exchange rate started to show strains as early as 1995. This observation has led to an interesting debate concerning the difference in measurement between official exchange rate regimes and unofficial exchange rate measures (Bernanke, Reinhart and Sack, 2004; Levy-Yeyati and Sturzenegger, 2005; Shambaugh, 2004). Furthermore, some authors argue that fixed

exchange rate regimes are "good institutions," because they lower inflation (Alesina and Wagner, 2006). Recent work, however, finds that democracies are much more likely to have flexible exchange rate regimes (Bearce and Hallerberg, 2011) and also lower inflation (Desai, Olofsgard and Yousef, 2003).

Institutions, therefore, can help stabilize inflation. Institutions establish punishments to prevent reneging from stated commitments, helping to anchor the public's inflation expectations. Institutions have the ability to reduce the overall level of uncertainty in the economy by dispelling the uncertainty about the future actions of policymakers. One empirical challenge to the literature, however, is that institutions are fairly slow moving and yet, inflation stabilization exhibits different inflation outcomes even with the same institutional commitments. Argentina, Brazil, and Israel implemented nearly identical stabilization commitments at the same time and yet inflation outcomes in the three countries diverge widely. Similarly, institutional reforms may also lag inflation stabilization programs. For example, the Israeli government enacted a "No-printing Law" in September of 1985, two months after the start of the July 1985 inflation stabilization program (Hercowitz and Strawczynski, 1999). By September 1985, monthly inflation had already fallen from 10.9 percent per month in June to 2.1 percent in September (Cukierman, 1988) clearly demonstrating that the "No-printing Law" piggy-backed on the programs initial success. While it may be the case that institutional changes lock in successful inflation stabilization, empirically it seems difficult to say institutional commitments alone lead to successful inflation stabilization.

Furthermore, arguments about why the government should delegate policy do not explain why, after delegating policy, the government then sends messages to the public about future inflation. In this vein, Ehrmann and Fratzscher (2010) ask why do national govern-

ments delegate policy to an independent central bank, such as the European Central Bank, only to then publicly comment on the central bank's policy choices later on? Do national politicians acquire political gains in making public contestations? Does the public need further "proof" of success and this comes through political elites' proclamations? If the institution alone establishes credible commitment, why would the household remain uncertain about future policy? None of the arguments in the institutions literature can explain why political elites make post-commitment statements unless the commitment devises are themselves opaque to the public and their influence on inflation needs to be explained *ex post*. If the institution devises are opaque commitments, however, then the institution alone fails to reduce the overall level of uncertainty in the economy. This may simply mean that something in addition to the institution is needed in order to be an effective nominal anchor.

2.2.3 Political Business Cycles

Early political economy models claim that inflation is associate with the electoral cycle. The argument is that opportunistic incumbents attempt to manipulate the economy because they want to be re-elected and that they get reelected by increasing output. As a negative consequence of pursuing pro-growth policies, however, inflation is driven higher after the election. In order for this to work, the voting public cannot anticipate the future costs of growth strategies today in their voting decisions. What this means is that in these models the public is not forward looking. Instead, the public only evaluates the incumbents economic performance around election time (Nordhaus, 1989). The government then takes advantage of this myopic behavior by attempting to generate pre-election booms. Empir-

ically, this theory implies that there should be a positive relationship between growth and elections and also a positive relationship between elections and future inflation. Drender (2005), however, finds that for a sample of developing countries, growth has no effect on the probability of election. Other research finds that voters consider both inflation and output in their voting decisions, especially in Latin America (Laredo and Mustar, 2001).

Another theory for why some countries have inflation and others do not is that political business cycles (PBC) are induced by differences in the economic preferences of political parties. This argument presupposes that different political parties have different underlying preferences over output and inflation. The argument is that left-leaning parties are more inflation accepting than right-leaning parties. In two party systems such as the United States, this means that Democrat governments are more likely to have higher inflation than Republican governments. In testing this theory using the United States case, Hibbs (1977) finds evidence that unemployment is lower and economic growth is higher under Democrats than Republicans. If inflation is the cost of pro-growth strategies, such a finding implies that future inflation will be higher after the Democrats come to power.

Recently, Alesina, Roubini and Cohen (1997) criticize the original PBC models. These authors argue that voters have rational expectations and are forward looking. Where voters have uncertainty, however, is over the outcome of the election. Rational voters with election uncertainty shortens the duration of incumbent opportunism. In their model, political business cycles are still induced by partisan politics, however, any manipulation in output by the left is confined to the first half of the government's term. During the second half of the election cycle, any partisanship effects on output erode. Using data from developed countries, these authors show support for their theory.

One of the key critiques of PBC comes from Stokes (2001). Stokes asks, if we expect left leaning governments to enact inflation accepting policies, why do we see a number of left-leaning governments switch course and adopt anti-inflation measures once elected? She finds that politicians are more likely to switch policy positions after election if they think that by adopting different policies, voters' welfare will improve. This means that left leaning parties may promise higher growth (at the cost of higher inflation) in the first election to voters who think they want this. Left leaning governments may then switch course and pursue anti-inflation strategies during their term in an attempt and win re-election of a second term. If left leaning voters see improvements, they may then support *ex post* policies that they opposed *ex ante*. Like the PBC model, this model suggests that left leaning governments may see inflation levels converge to the levels targeted by their right leaning counterparts, but the underlying rationale is very different. In the PBC model, rational expectations punishes left leaning incumbents from pursuing pro-growth strategies after election. In Stokes' model, between elections, opportunistic governments are not punished by rational voters who worry about manipulation; instead, left leaning voters actually change their minds about their preferred policies on the basis of *ex post* policy outcomes.

2.3 Information and Uncertainty

Instead of looking at formal institutional solutions or rules, recent literature in economics and political science argues that words or *signaling*, where one actor tries to influence another through the things that they say instead of the actions that they take, can also lower inflation. As suggested above, under some conditions words may act as a nominal

price anchor, anchoring the households' expectations. Following from Crawford and Sobel (1982), single sender cheap talk models find that a message sender can send imprecise but informative messages to a receiver so long as the preferences of the message sender are not too out of step with the preferences of the message receiver.

One important sender of communication is the central bank. Early signaling models in economics, especially those models in the central banking literature, often assume that the central bank has private information either about the economy or about the policy response the central bank will follow when the economy is hit with some unexpected event or shock. The central bank is assumed to have private information either about the true state of the economy, such as the health of the banking system, new unemployment figures, etc., or alternatively, private information about its own future policy response given changes in the economy. For example, the central bank knows what it will do if the unemployment rate goes above a certain level, perhaps lowering interest rates in an attempt to spur economic growth. Empirical work by Peek, Rosengren and Tootell (1999) and Romer (2000) confirms that central banks have private information and that they attempt to disseminate this private information.

Simultaneously, those receiving messages, i.e. households, are assumed to be either uninformed about the true state of the economy or alternatively, uncertain about how the central bank will respond. However, households know that, with access to the central bank's private information, they could make decisions, which will make them better off. For example, if households know that the central bank will attempt to increase the money supply in the future, leading to an increase in inflation, households may attempt to negotiate their wage contracts today so that they do not face a reduction in their inflation adjusted

wages if/when future inflation should rise. Similarly, if households expect that inflation will rise in the future, households may substitute out of holding money today into non-monetary assets. As was suggested above, both of these channels can cause higher prices today.

In these signaling models, because of the assumed asymmetry in information between the central bank and households, with the assumption that the central bank has more information that the public, the central bank has the means to alter the public's expectations about the future economy by transmitting its private information. However, the central bank is limited in the precision of the information it can convey. By precision of information it is meant how precisely the central bank can reveal the "true" state of the world to the household. Like time-inconsistency, imprecision is introduced because the central bank has an incentive to manipulate household's expectations, for example, by creating inflation surprises (Barro, 1977). This incentive for the central bank to manipulate the households' expectations restricts the precision of information the central bank can send. This is because if the household correctly anticipates that the central bank wants to manipulate their expectations, households will factor this into their beliefs, making everyone worse off (Barro, 1977). The result of this strategic behavior is that the household will not believe the central bank's messages if they are too precise.[1] The prediction from this literature is that so long as the central bank's preferences are not too out of step with the household's preferences, in equilibrium, the central bank can, in fact, send useful, even if imprecise, messages to the public (Stein, 1989).

[1] In these models precise information is impossible unless the bank has exactly the same preferences as the household. As central bankers are usually appointed because of their preferences for lower inflation than either the government or the household, the probability that this occurs is negligible.

Empirical work in economics supports the idea that communication, and especially information precision or clarity of messages, influences economic outcomes. Research by Ehrmann and Fratzscher (2007) find that central bank statements about monetary policy tends to move markets in their intended direction. Similarly, research by Rosa and Verga (2007) find that unexpected information in European Central Bank statements influences futures prices and European inter-bank lending rates. Finally, recent work by Farka (2011) and Jansen (2011), find that in the United States, both Federal Open Market Statements (FOMC) and Humphfey-Hawkins testimonies, where the Federal Reserve Bank's Chairman makes a congressional testament about monetary policy, influences market behavior. None of the studies examine whether the precision of information has an impact on households' inflation expectations, however.

Guisinger and Singer (2010) shift the focus away from central bank signaling and instead consider the influence of government signals on the public's inflation expectations and inflation outcomes. These authors find that under certain conditions, the government can influence inflation expectations and inflation outcomes, especially in the arena of exchange rate policy. This is because government pronouncements are thought to reveal important information about the government's inflation-fighting credibility, or the government's "type." As opposed to "cheap talk" models where information transmission is not costly to send, Guisinger and Singer (2010) assume that to transmit private information, governments must pay an explicit cost. They argue that one costly signal is when the government matches its exchange rate words with its exchange rate actions. Because matching their exchange rate words with their exchange rate deeds is costly, countries that do match their exchange rate pronouncements with their exchange rate actions are able to distinguish

themselves from countries which cannot afford to do this or decide not to. As a result, those countries that pay these costs signal greater commitment to inflation-fighting than those countries that do not, and consequently, cost-paying countries can reap the benefit of lower inflation. In summary, in Guisinger and Singer's model, government signaling reveals information to households and investors and this information changes the beliefs or expectations of households about the government's commitment to low inflation. Finally, this change in household beliefs then changes actual inflation outcomes.

What is problematic with the communications literature, however, is the fact that all of these signaling models assume a single unitary message sender. Whether the signal sender is the central bank or the government, assuming a monopolist signal sender has important limitations. The first problem is that by having no threat of opposition, a signal sender's strategically considers only the message receiver. Models that have only a single message sender assumes away any inter-elite opposition (or the threat of opposition) such as counter-statements or competing information from outside agencies or other elites. Yet, we know that the content of domestic politics is ripe with inter-elite strategic concerns. Once we allow for opposition or the threat of opposition, we then have to consider the strategic behavior of inter-elite signaling, where one elite sends a message conditional on their expectations of another elite's signal. Second, a monopolist signal sender cannot help explain how dissenting views may condition the content, clarity, and/or word choice of the proclamation, prior to the statement's dissemination. As was discussed in the above section on bargaining, political opposition influences whether political elites in the domestic polity will or will not make corroborating statements. In other words, by focusing on the impact of pronouncements by a single actor, the current literature assumes that political messages are

transmitted without dissent or threat of dissent. It also assumes those political conditions that may make messages more or less opaque. In working democracies, we know that a key function of political opposition groups, the media, and interest groups is to refute or confirm pronouncements made by other elites and that other elites can threaten to voice their dissent publicly and privately. A better model of strategic communication is one that includes the influence of inter-elite competition within the model prior to the release of the information to the public.

2.3.1 Multiple Senders

Central banks and governments are not monolithic. Recent scholarship by Ehrmann and Fratzscher (2007) find that communication strategies and decision-making strategies by central banks and their committees exhibit institutional variation. Studying the Federal Reserve Bank, the European Central Bank, and the Bank of England, these authors find that the effectiveness of communication is not independent from within agency, inter-elite politics. In the case of the United States, these authors find that each political elite on the FOMC makes individual statements despite what they call a "collegial approach" to decision making. Alternatively, they find that political elites in the Bank of England use a "collegial communication strategy" but each elite has individual decision making, with each member voting their own preferences. They also find that the European Central Bank (ECB) has both a "collegial approach" to communication and also a "collegial approach" to decision making. The fact that communication strategies vary suggests that inter-elite politics are important to understanding the content and clarity of official proclamations;

individual committee members may temper their own statements based on the expected strategies of their counterparts. Because inter-elite politics is important, in the next chapter, I offer a theory that explains when elites will agree with each other and explains the impact of elite consensus (disagreement) on the precision of the information disseminated to the public.

2.3.2 Endogenous Inflation Expectations

What is the mechanism that makes signaling effective? As mentioned above, in addition to "real" or non-monetary factors in economy such as the productivity of capital, land and labor, expectations of inflation can influence inflation, at least in the short-term. As was argued above, this is because inflation expectations help determine the link, or the price, between household demands for money and the supply of money circulating in the economy as well as households' demands for future wages.

The idea that household expectations matters for inflation outcomes, at least in the short term, has a long history. Economists in the 1950s and 1960s, examine the determinants of inflation. Many argue that household demand for real money balances and firm money demand are important to inflation. Inflation varies across country and over time and so Cagan (1956) first asks, if money demand is an important determinant of inflation but inflation varies, does household money demand co-vary with inflation? In particular Cagan asks whether households demand the same real (inflation adjusted) amount of money even when inflation levels are extremely high? Cagan also asks whether changes in money demand reinforce or correct inflation disequilibrium.

Cagan analyzes seven *hyperinflation countries* and finds that households' real money demand remains stable even under unstable inflationary conditions. Why would households demand the same amount of cash if the value of money is changing rapidly? In order to answer this puzzle, Cagan argues that households have "adaptive inflation expectations." Adaptive expectations implies that households are backwards-looking such that they determine their present day demand for cash balances on their past demands. Significantly, this finding implies that households are sluggish or sticky in adjusting their inflation expectations. This is a problem for inflation stabilization because it is thought that sluggishness or stickiness in inflation expectations may generate self-fulfilling inflation traps and sustain hyperinflation.

After its publication, Cagan's work generated a significant body of response, and many leading economists reexamined and extended Cagan's model. The idea of "adaptive expectations" was criticized. Much of the criticism came from Sargent and others from the rational expectations school. These authors argue that adaptive expectations ignored the household's capacity to forecast the future, a capacity which was in the household's own self-interest to develop and refine especially in environments with rapidly changing price levels. Instead of backwards looking, the rational expectations school argues that agents are forwards looking (Barro, 1977; Sargent, 1977). They argue that households have inflation expectations which are the best guess of the future (the optimal forecast). In addition, households use all available information available to forecast inflation and do not make persistent forecast errors. Thus, rational expectations models of inflation posits that under conditions of perfect information, households' expected future prices are equal to realized prices.

This debate over whether or not households have backwards and/or forwards-looking inflation expectations has preoccupied the macroeconomics literature since the 1960s. The reason is that the politics of implementing successful inflation stabilization plans critically depends on households' expectations. While backwards-looking expectations was easily criticized, more recently the idea of rational expectations is now under consideration. This is because if households have rational expectations all the time, then why do stabilization policies so often fail?

In order to account for the prevalence of policy failures, many economists (including Sargent) now model households as *learners* - making choices in an imperfect information environment which makes their forecasting problem difficult. At times, imperfect information may lead households to have adaptive expectations and at other times, perfect information may make households have rational expectation. The influence of political elite communication on households' beliefs is irrelevant in a world where there is perfect information and rational expectations all the time. This is because private agents already know all aspects of the economic environment. Models where households have imperfect knowledge about the economy but can learn about the economy easily accommodate issues of communication (Bernanke and Kuttner, 2004; Orphanides and Williams, 2005). Because learning also seems to better explain policy failures, scholars are developing new ways of theorizing households' beliefs to include learning.

How do analysts model household learning? Usually, analysts model households as learning according to some algorithm or rule. The way that many analysts have modeled learning includes a variety of learning rules. For example, one type of learning rule is Bayesian learning. Bayesian learning is where households have some prior belief and

given some new data, form a new expectation incorporating previously held beliefs with additional data. Another learning rule is based on least squares. Least squares learning is where households predict the future according to some linear, best-fit line from previously observed data. Finally, another type of learning is a constant gain sequence. In constant gain learning, past information is a weighted average of previous data, however, unlike least squares, past data is discounted geometrically. Usually, the learning rule chosen by the analyst has the potential to converge towards the rational expectations outcome, but many models allow for small departures from rational expectations.

As alluded to above, the reason why analysts incorporate learning is that by allowing for learning, the models tend to better fit the data. Standard models with rational expectations have a tendency to under predict hyperinflation persistence and/or recurrent hyperinflation. The reason why, with adaptive expectations, hyperinflation persistence occurs whereas with rational expectations it does not persist is intuitive. Assume that the household has some model with which they use to forecast the future economy and where predictions they make are from a finite, but long time-series of previously observed data. Further, assume that past inflation is very high over the previous decade. Now assume that the policymaking environment changes such that there is an attempt at inflation stabilization. If households use the previous data to extrapolate the future such that historical data is equally weighted with most recent data, such as in least squares learning, households may incorrectly predict future inflation because their forecast model does not recognize that there is a regime shift. In other words, if the household does not update his/her beliefs about the new economy in a way that overrides old data, this can lead to persistently high inflation expectations. Because inflation expectations influence inflation, persistently high inflation expectations

can cause path dependency and inflation-traps (Evans and Honkapohja, 1993; Marcet and Nicolini, 2003; Satchell and Timmermann, 1995).

As was made clear by the earlier critique by the rational expectations literature, the household has a material interest in developing a better forecast model. This is because making persistent forecast errors is costly. With the experience of the new inflation regime, households have an incentives to update their beliefs conditional on the new inflation policy.

These three types of expectations: adaptive, learning, and rational, imply important empirical differences. For a given inflation stabilization attempt, under adaptive expectations, inflation expectations will remain high and inflation stabilization will fail; political elites' announcements will have no effect on households' inflation expectation. For a given inflation stabilization attempt, under learning, there is a time lag between enactment of policy and lower inflation expectations as households learn; inflation stabilization attempts may or may not work; political elites' announcements, however, will have an effect on households' inflation expectations. Finally, under rational expectations, there is no time lag between policy implementation and expectations. If the policy is credible (incredible), inflation expectations should decline and inflation stabilization should succeed (fail); political elites' announcements will have no effect on households' inflation expectations.

As suggested above, allowing for adaptive expectation is important because inflation-traps based on expectations, even if temporary, have been used to explain hyperinflation persistence (Marcet and Nicolini, 2003; Sargent, Williams and Zha, 2009). But when do households switch from having backwards-looking expectations based only on past data to forwards-looking expectations incorporating beliefs about the future? In Marcet and Nicolini (2003) and Sargent, Williams and Zha (2009), the household's learning rule is

endogenous to the volatility of the economic environment. This means that in stable economic environments, the household is assumed to be backwards-looking but then, when the environment becomes increasingly volatile and household forecast errors more persistent, the household switches from being adaptive, and instead, adopts a different learning rule with better tracking.

Finally, in one recent paper, Cogley and Sargent (2008) develop a model where not all households learn the same way. In this model, one set of households know the true model of the economy and have rational expectations while the other set of households learns about the true model of the economy according to Bayes' rule. What is particularly interesting about this model is that these authors find that Bayesian learners outperform those households with strict rational expectations. This surprising finding results from the interesting idea that those households with rational expectations overpay for risk. They find that agents with rational expectations, when compared with Bayesian learners, pay higher risk premiums as a means to insure against their own uncertainty and potentially wrongly held beliefs. The higher price of risk for rational households causes greater income losses over time than the losses incurred by Bayesian households who can more flexibly respond to changes and uncertainty.

Furthermore, models with Bayesian households can accommodate both path dependency or inflation-traps as well as stabilization success. In the case of path dependency and inflation-traps, more weight is put on the households' prior beliefs such that the household's posterior expectations are highly influenced by their priors. This can lead to path dependency and inflation-traps. Alternatively, if the household's have relatively weaker prior beliefs, then their priors can be overwhelmed by new data and stabilization can suc-

ceed. By modeling households as Bayesian learners, the learning rule is flexible enough to allow for short-term persisting errors, while simultaneously, allows households to learn new things without being unjustifiably dogmatic.

In light of this extensive literature on inflation expectations, asymmetric information, learning rules, and their consequences for inflation outcomes, in my model all households are assumed to be Bayesian learners. I assume that households have some prior inflation belief based on past observations. After hearing messages from multiple senders with private information, households update and form their new beliefs using Bayes' rule. [2] Households' updated beliefs, technically their posterior beliefs, are thus then their new inflation forecasts for the next period. Furthermore, in signaling models, the solution concept used to compute the household's best response given new information is analogous with Bayesian learning. The empirical model in chapters 4 and 5 will test directly whether or not this is a good assumption.

2.4 Conclusion

In this chapter, I examine three prominent explanations of inflation from the existing literature. Both the bargaining literature and the institutions literature assumes that inflation is determined by slow moving variables in the economy. While this literature is certainly important, it fails to capture a number of important characteristics of the data, including but not limited to bouts of escalating inflation that are independent of changes in the money supply and variation in inflation across countries with similar institutions. Moreover, when

[2] I define this formally in the next section.

Table 2.3: Previous explanations of inflation

Variable Name	Expected Relationship	Authors cited
Political Polarization	Higher Inflation	Alesina and Drazen (1991)
Political Polarization	Higher Inflation	Cukierman, Edwards and Tabellini (1992)
Central Bank Independence	Lower Inflation	Kydland and Prescott (1977)
Number of Veto Players	Higher Inflation	Hallerberg (2002)
Veto Players * Polarization	Higher Inflation	Keefer and Stasavage (2003)
Fixed Exchange Rate Regimes	Lower Inflation	Alesina and Wagner (2006)
Flexible Exchange Rate Regimes * Democracy	Lower Inflation	Bearce and Hallerberg (2011); Dasai et al. (2003).
Election Year	Higher Inflation (next period)	Nordhaus (1989)
Left Governments	Higher Inflation	Hibbs (1977); Alesina et al. (1997)
Information	Lower Inflation	Guisinger and Singer (2010)

examining inflation stabilization attempts in a given country, the institutional approach highlights the role of nominal anchors, but cannot fully characterize a country's inflation path. Change in inflation exhibits much wider variation and institutional reforms may lag as opposed to lead changes in inflation. This suggests that something in addition to institutions explains inflation. Recent literature in the central banking and political economy literature points to the efficacy of words in acting as a nominal anchor. In spite of the tremendous progress in a number of important dimensions, however, most results tend to be based on the specific assumption of a unitary signal sender and rational expectations.

The following tables review the theoretical claims discussed in the literature review. In previous work, a country's level of political polarization is expected to be positively associated with inflation. This associated is thought to be true even for those countries that have institutional mechanisms thought to lower inflation, such as independent central banks or a smaller number of veto players. Similarly, the partisan explanation of inflation predicts that as the left's preferences are more inflation accepting, inflation outcomes will be higher.

Considering that the public receives a wider variety of economic information from an assortment of political elites, I argue that previous research that ignores multiple signal

Table 2.4: Model assumptions

	Single Actor	Multiple Actors	Expectations
Inter-Elite Bargaining		Alesina and Drazen (1991)	Rational
		Cukierman, Edwards and Tabellini (1992)	Rational
		This project	Bayesian
Commitment	Alesina and Wagner (2006)	Hallerberg (2002)	Rational/Rational
	Bearce and Hallerberg (2011)	Keefer and Stasavage (2003)	Rational/Rational
Political Business Cycle	Hibbs (1977); Alesina et al. (1997)		Adaptive/Rational
Signaling	Kydland and Prescott (1977)		Rational
	Guisinger and Singer (2010)		Rational
		This project	Bayesian

senders and the inter-elite strategies that results from variations in political elites' preferences fails to uncover those conditions that lead to variation information clarity. Furthermore, if households in the economy learn about the future economy through the things that elites say, households' expectations will influence their actions, and in turn, inflation will also change. In the next chapter, I develop a theory where the things that political elites' say are made contingent on their own preferences relative to one another and also relative to the average household. I find that political elites' strategic interaction conditions the amount of information revealed in equilibrium. One important variable that my theory identifies is the the degree of *ex ante* political opposition amongst elites. My theory suggests specific testable propositions for why we see variation in inflation expectations and inflation outcomes even when the institutional environment is the same. The remainder of the dissertation project then focuses on testing the empirical predictions of the theory.

Chapter 3

A Theory of Information Transmission

3.1 Introduction

Why do political elites make public statements about the future economy to the public? What influence, if any, do these statements have on their audience? In this chapter, I apply a multiple sender signaling model in order to show that political elites' public statements are critical for explaining inflation. One important findings is that political elites craft their messages based on the degree of *ex ante political opposition*, or how far apart political elites' inflation preferences are from one another, and also relative to a representative household. I apply the game theoretic model of information transmission developed by Krishna and Morgan (2001) to the substantive case of inflation. I use their model to determine those political conditions that constrain (or enhance) precise information dissemination from political elites to the household. Importantly for a political economy model of inflation, the model identifies those variables that predict a greater (lesser) likelihood of successful inflation stabilization.

In this chapter, I elaborate on the assumptions of the theory, their plausibility, and explain their importance to the argument. I also discuss the equilibria outcome, which result from the model's assumptions. The major contribution of the theory is the interesting idea that inter-elite strategies play an important role in determining how much *information precision*, or how much of political elites' private information, political elites will disseminate to the public. The model predicts that variation in information precision changes inflation expectations and, consequently, inflation outcomes. The model, therefore, offers an explanation of how inter-elite political competition, through its influence on information dissemination, helps to explain across-country and over-time variation in inflation. The following chapters then test the predictions developed in this chapter.

The inclusion of multiple elites in a model of political communication makes the following important contribution to the literature. First, I find that in some cases, previous explanations over-predict how much information elites will reveal to the public. By failing to consider how political elites may temper their statements based on inter-elite competition, previous models are overly optimistic about how much precise information political elites transmit. Second, I find that in other cases, previous explanations under-predict the precision of information revealed. In fact, under some conditions, perfect revelation of elites' private information can occur. This is because, by introducing the important variable of political opposition into the model, political competition amongst elites is predicted to increase the clarity and truthfulness of information disseminated to the public.

As discussed in the previous chapter, the possibility of perfect information is critical for an explanation of inflation. This i because better information is expected to reduce uncertainty and led to better economic performance. What this means is that, when there

is political opposition, elites are expected to reveal all of their private information. Under these conditions, households can learn all of elites' private information. Consequently, households should perfectly adapt their expectations, yielding lower inflation.

The rest of this chapter is organized as follows. The first section reviews the cheap talk literature, paying particular attention to the model's assumptions and their plausibility for a model of inflation. The second section presents the game theoretical model, the notation, the objective functions of the actors, and the solution concept. The third section presents the model's results, including a presentation of the expected relationships between the variables in the form of testable hypotheses. The fourth section introduces a model extension that considers the stability of the findings when I introduce heterogenous households. The final section concludes.

3.1.1 When Talk is Cheap

Cheap talk models are a subset of a class of game theoretic models called signaling models. In signaling models, a message sender, S wants to inform a message receiver, R, about something that he knows but that R does not know. In other words, S has private information. In revealing $S's$ private information, however, S wants to persuade the actions of R in a way that will benefit himself. Because R knows that the message sender is self-interested, R is skeptical about $S's$ message. Only under some conditions will R incorporate information from S into her actions.[1] The key question is, therefore, how much of $S's$ private information will S reveal?

[1] In this chapter, I use the gender him for the sender and her for the receiver, which is standard in the literature

The canonical cheap talk game is by Crawford and Sobel (1982). Crawford and Sobel's model is a single sender-receiver model, meaning that there is a single sender of information and a receiver. Crawford and Sobel find that the precision of information sent by S to R depends on how far apart R and $S's$ *ex ante* preferences are from one another. As the sender and the receiver become more alike in their preferences, S can send more precise statements about his private information. Alternatively, when the sender and the receiver have dissimilar preferences, the sender is limited in the precision of information he can reveal. This is because as the distance between the preferences of S and R grows, the receiver becomes more skeptical of the sender's message and thus more likely to ignore the information. Anticipating the household's skepticism, in order to have any influence at all, S communicates his private knowledge with greater amounts of imprecision so that his message will not be dismissed altogether. What this means is that the ability of S to craft a precise messages depends on the difference between his own *ex ante* preferences and $R's$ *ex ante* preferences.

Theoretical advances in economics and political science extend the single sender cheap talk framework to include multiple senders (Austen-Smith and Wright, 1992; Gilligan and Krehbiel, 1987; Krishna and Morgan, 2001; Minozzi, 2011). In these models, instead of a single sender, multiple senders make pronouncements to a single receiver. Like the single sender model, message senders seek to influence the receiver's actions.

One generic multiple sender model is Krishna and Morgan (2001). In their model, two experts have some private information and known *ex ante* preferences. The message receiver knows the *ex ante* preferences of the senders but does not know the message senders' private information. Senders craft proclamations that have varying degrees of precision. In

equilibrium, the precision of information sent by the senders depends not only on how far apart S and $R's$ *ex ante* preferences are from one another, but also depends on how far apart the senders' *ex ante* preferences are from one another.

One benefit of cheap talk models is their generalizability. In Crawford and Sobel as well as in Krishna and Morgan, information precision refers to the length of partitions revealed on a unidimensional line. When moving from this level of abstraction to an area of substantive importance, however, it is critical to match the model set up with the structure of the issue area. For instance, as discussed at length in the previous chapter, using a single sender model to explain inflation stabilization is inappropriate for a variety of reasons. First, neither the "government" nor the "central bank" has a strict monopoly on sending information about the future economy. In fact, many political actors, ranging from union leaders, incumbents, the opposition, the central bank, and the finance ministry have a vested interest in revealing their information to those that will listen. This is because, if by incorporating information economic outcomes are changed, then those sending the messages have something to gain.

Second, if we allow there to be multiple senders, senders need to be cognizant of what another sender will say and take this into account when crafting their own message. What this means is that the ability to dissent (and the need to anticipate the influence of possible dissenting views) must be a prominent feature of the model. In terms of the model, this means that signal sending should be sequential. For the case of inflation stabilization, therefore, both multiple actors and sequential signaling are crucial elements of the politics of economic policymaking. By crucial I mean that for a political economy model of inflation that focuses on communication, the model must have multiple actors and the

possibility of inter-elite collusion and dissent.

The Krishna and Morgan (2001) model is the best match for exploring the issues chapter 2 identifies as key to understanding the puzzle of successful inflation stabilization. Their model has multiple elites, *ex ante* exogenous differences in elite's preferences, shared private information, and the ability for elites to send consensual and/or disconfirming messages or statements. These are the same characteristics that I point out are important for a model of inflation in the previous chapter. I therefore apply the Krishna and Morgan (2001) model, their assumptions, and their propositions to fit my research question and my variables of interest. While the model dynamics and the comparative statics are the same as those presented in their paper, the level of generalizability is not. As a result, the propositions, their corollaries, and the testable predictions speak directly to inflation. What this means is that equilibria does not refer to the length of partitions on a generic number line, but instead, represents the precision of political elites' public proclamations over inflation. Message senders are political elites with underlying inflation preferences. The receiver is an uninformed household, who, in the face of economic uncertainty, would like to learn something about the future economy.

As outlined in chapter 1 and chapter 2, my argument is that household inflation expectations are derived both from households' previous experiences and also from signals, or the things political elites say about the future economy. Households incorporate information from elite cues in the media into their inflation beliefs. They get this information by listening to or reading carefully crafted elite statements in media reports. Following from the literature in comparative political behavior, I assume that media accounts are themselves derived from political elites opinions (MacKuen, Erikson and Stimson, 1992; Zaller,

1992). I then use the Krishna and Morgan (2001) model to show how the configuration of elites' *ex ante* preferences, both relative to one another and also relative to the representative household, leads to differences in the precision of information transmitted in the news media.

3.1.2 Assumptions

Implicit in my theoretical model are four main assumptions. First, unlike some models, information-dissemination occurs in a single direction, from political elites to households; I do this to determine the impact of elite communication on the public's inflation expectations. Related to this, I also assume that political elites have private information about the economy that households do not have. Second, I assume that the media correctly reports elites' opinions; in other words, I assume that elites strategically publicize their private information in the news media. Third, I assume that the household correctly interprets information they receive from elites. Fourth, I also assume that it is costless for political elites to express themselves. The next section discusses these assumptions in turn.

Information transmission is unidirectional and elites have private information

Consider a world where political elites and households have some information about the future economy but that the world is observed with error. Error makes economic forecasting difficult but not impossible. While there is uncertainty, if uncertainty is caused by measurement error of key variables, such as wrongly measuring inflation and/or wrongly measuring unemployment, actors do the best they can to predict the future. Following from the literature, this kind of uncertainty is called *measurement error*. Measurement error

means that the true model of the economy is known, but observationally, the processes are observed with error. Despite the prevalence of measurement error, political elites make policies and households take actions as though they have the right estimates. It has been shown that when actors take actions as if the measures they have are correct even when they are not, the result is *certainty equivalence* (Hansen and Sargent, 2004). So long as measurement error is random, over time as the measures improve or as the number of observations increases, elites and households' forecasts will also improve. Importantly, this means that over time, measurement error gets smaller, political elites and households have less and less uncertainty, and forecast mistakes are self-correcting.

In contrast to this kind of uncertainty, there is a more fundamental kind of uncertainty called *model uncertainty*. Model uncertainty means that either political elites and/or the public has an incomplete conceptual model of the economy. Consider the problem of forecasting under model uncertainty when compared against measurement error. If the wrong model of the economy is used to project into the future, households may make systematic mistakes. Unlike measurement error, systematic mistakes are not self-correcting.

Why is this distinction important? Recall that in chapter 2, one argument for high inflation persistence is that households, forming their inflation forecasts using previously observed data, may not know that the underlying economic model has changed. Under model uncertainty, households' expectations may be based on some model of the economy, which the household presumes to be true, but is not. If households' forecast inflation using a wrong model of the economy then it may be the case that, in the aggregate, forecast mistakes are biased. If the mistakes are biased upwards such that high inflation expectations are sustained, this can generate self-fulfilling inflation traps.

As suggested in chapter 2, households are not expected to be unjustifiably dogmatic, however, especially when making mistakes is costly. Therefore, if message senders can convince the household through the things they say that there exists a new model of the economy, and households learn about the new model, self-reinforcing inflation traps can be avoided.

While both actors may have uncertainty due to measurement error, I assume that model uncertainty is asymmetric. In my theory, political elites have the correct model of the economy whereas the representative household does not. This does not mean that the household will always make systematic mistakes. It does mean that the household can learn about the economy from the things that political elites say and that the household has an incentive to do so. Under some conditions, information that political elites craft for the household contains their private or expert information about the economy, and the household can use this true information to lower their model uncertainty if/when they choose to listen. In summary, I assume that political elites have better or private information about the true model of the economy and they disseminate this information to the household, making some of their private information public. Because only the household has model uncertainty, information dissemination occurs in a single, top down direction, from those most informed - political elites, to those less informed - the household.

Not all theories of information transmission have a top down structure. Recent work by Eusepi (2005), for example, has a model where both the central bank and the public have model uncertainty. Even under these conditions, Eusepi finds thats central banks still stabilize households' inflation expectations if the central bank informs the public about the central bank's policy rule. Importantly, Eusepi finds that the monetary authority's state-

ments can help the public learn regardless of whether political elites have model certainty or model uncertainty. What is important is that the monetary authority uses carefully crafted statements to inform the public about their likely future policy actions, which are based on their own understanding of how they will behave. Interestingly, by giving up private information about their own policymaking plans, the monetary authority can stabilize expectations even if elites' understanding of the economy is fundamentally wrong. If elites' statements are crafted *as though* they had the true model of the economy, even when they do not, the theoretical predictions are equivalent to what they would be if the monetary authority has model certainty. Given the analogous outcome, I proceed with the simpler assumption that political elites have model certainty or privately known, expert information about the future economy.

Elites' opinions supply economic news

The idea that the media contains political elites' opinions is prominent in the political science literature. Zaller (1992) argues that political elites diffuse information downwards via the mass media. Similarly, MacKuen, Erikson and Stimson (1992) argue that political elites translate what is happening in the economy and then disseminate this information to the public through the media. Both Zaller and MacKuen et al. find evidence that, "without trying, the public is exposed to the best information about the economy that exists [and] without trying, the public becomes subject to the casual influence of the professionals' more esoteric tools (p. 604)."

Empirical evidence shows that inflation and unemployment are highlighted in the media (Clarke and Whiteley, 1998, 1990; Nadeau and Amato, 1999). Not only is economic news

highlighted, but also the amount of economic news covaries with changes in macroeconomic aggregates. They find that political elites' statements about the economy are particularly important when the economy is changing. For example, Nadeau and Amato (1999) find that changes in inflation is associated with an increase in economic news such that a one percentage increase in inflation will lead to an additional fourteen paragraphs of economic news. Such a substantially large estimate, based on a sample of news reports from the United States during historically low inflation rates, means that, for countries experiencing high and hyperinflation, the effect of inflation on news content should therefore be substantially large.

Nadeau and Amato (1999) also find, however, that when they introduce political elites' prospective opinions about the economy, there is no evidence that elites' prospective opinions have an affect on the amount of economic news. These authors argue that changes in key macroeconomic outcome variables lead to an increase in news coverage, whereas elites' private information does not lead to changes in news coverage. Nadeau and Amato (1999) then conclude that elites' statements are inconsequential for news. Instead, they argue that the news is a collection of facts independent of political elites' opinions, irrespective of elites' opinions, thus calling into question a top-down structure of information dissemination.

The argument advanced in the signaling literature, however, is that political elites' opinions cause changes in the public's expectations and that in the aggregate, changes in expectations then cause changes to macroeconomic aggregates. If the signaling literature is true, the amount of news media coverage is best thought of as an intervening variable. By adding experts' opinions into the regression equation simultaneously with actual economic

outcomes, the analysis in Nadeau and Amato (1999) assumes that experts judgements about the economy and economic outcomes are two independent causal variables. An alternative explanation is one where political opinions cause changes in economic observables, which reverses the causal story.

In order to deal with the possibility of reverse causality, a better statistical test is one that corrects for endogeneity between elites' statements and economic indicators. Gabel and Scheve (2007) develop a statistical approach that considers the influence of political elites' statements on the public's opinions using an instrument. Using micro-level survey data, the authors find consistent evidence for a top-down model of information dissemination. In testing whether or not elites have an influence on support for Euro-unification, the authors find significant effects. When elites proclaim consensual views about Euro-unification, mass public opinion is more likely to support European integration. Gabel and Scheve (2007) also find that the marginal effect of elite messages on public opinion are twice as large as those studies that do not control for endogeneity. Additionally, MacKuen, Erikson and Stimson (1992) find statistical evidence that economic conditions, such as inflation and unemployment, alter the economic expectations of voters, and consequentially, cause changes in presidential approval. In light of the empirical evidence, my theoretical model adopts the assumption that political elites disseminate information to the household through mass media outlets such as newspaper stories, and in a top-down fashion.

Costless for elites to express themselves

The final assumption is that it is costless for political elites to express their opinions in the media. What this means is that political elites can make proclamations about the future

economy in the media and do not need to take any associated costly actions to demonstrate the truthfulness of their announcement. A costless signal generates no explicit guarantee that the political elite will take actions, whereas a costly signal provides better information about the credibility of the senders' commitment. Because it does not require a costly signal, a cheap talk model is the most difficult case for information transmission. For example, in a cheap talk model, the finance minister could proclaim, "inflation next month will be between 2 to 3 percent lower than this month" and yet, the finance minister does not have to do anything to guarantee this, such as reducing government spending. I proceed with the stricter assumption that political elites do not have to pay a cost in order to transmit their information. Any costs that political elites do pay only makes it easier to communicate by bolstering their credibility. Therefore the inclusion of costs or reputation would merely increase the effectiveness of information transmission to the public and as a result, the most interesting case is whether or not political elites can transit their private information to the public when talk is cheap.

3.1.3 Model Actors

Receivers - The Household

In my model, the message receiver is the representative household. I define the representative household as an economic decision maker that make contemporary and future consumption/savings and labor/leisure decisions, which depend on her expectation of future prices. In addition to expectations, the representative household also has her own ideal level of inflation. The underlying reasons for why preferences over inflation may differ

both between political elites but also across countries and over time include differences based on levels of personal debt (Frieden, 1991), differences in aversion to unemployment (Scheve, 2004), and distributional concerns over long-term tax burdens from fiscal austerity measures (Alesina and Drazen, 1991). The representative household is sensitive to fluctuations in aggregate price changes because inflation erodes her wealth and changes the relatively value of working or not working. For example, when the representative household make savings decisions, she consider future inflation because price changes impact the inter-temporal value of money. Similarly, when the representative household makes employment decisions, she evaluates the returns to working, which is based on real wages (adjusted for inflation), not nominal wages. The ability of multiple political elites, instead of only one elite, to influence her decisions is the key innovation of my model.

Like the learning literature discussed at length in chapter 2, the representative household tries to learn about the economy through the things that political elites say. Although I examine only a single representative household, because everyone in the economy has an incentive to learn about the economy using elites' information, in the aggregate, as households update their beliefs, *en masse*, households' posterior inflation beliefs influence aggregate inflation. [2]

Senders - Political Elites

As suggested above, political elites, or those actors engaged in economic policymaking, transmit information to the household through messages in the news media (Zaller, 1992). As a result of their role as experts and the resources at their disposal, political elites have

[2] I consider the the effect of heterogenous households in a model extension given in section four

private information about the future economy. The benefit of using such a wide definition of signal senders is that I include a broad class of actors while still restricting my attention to key economic policymakers. Actors with an interest in and who communicate about inflation include members of the executive and the opposition, cabinet ministers, central bank governors, ministers of finance and the economy, labor union leaders, and influential academics.

Political elites have preferences over inflation outcomes. Elite preferences over inflation outcomes, while exogenous in my model, may reflect partisanship or class differences (Frieden, 1991), differences in institutional mandates, or distributional interests over the allocated costs of fiscal austerity (Alesina and Drazen, 1991). In my model, political elites care about households' inflation beliefs because of the *expectations channel*, or how households' expectations drive actual inflation (Sargent and Wallace, 1982). Political elites, therefore, have a strategic incentive to communicate their private information publicly to an audience. This is because, if their messages are influential, elites can change the household's inflation beliefs in such a way so as to engender an inflation outcome closer to their own preferred outcome. For example, if an elite with low inflation preferences can dissuade the mass public from thinking that aggregate prices will rise, households may not demand higher wages today, firms may not see an increase in their costs, and consequently, will not pass these increases in costs on to their consumers. In other words, through the dissemination of information, political elites can try to offset or reinforce expectations, influencing the expectations channel. Because there is more than one elite, however, elites respond to and anticipate other elites' signals.

While it is true that the central bank is often a key actor that communicates about in-

flation, the central bank does not have the monopoly on sending such information. For example, in Poland in 2007, the Deputy Finance Minister Piotr Soroczynski claimed that, "annual inflation is unlikely to reach the central bank's 2.5 percent target" and only days later, the Polish Finance Minister Katarzyna Zajdel-Kurowska stated that, "Polish inflation is likely to be lower than earlier finance ministry forecasts" (Reuters News, 2007). Furthermore, in a study of Latin American economies, Stokes (2001) argues that the "government will frequently try to influence people's forecasts usually so that they will be more optimistic but sometimes so that they will be more pessimistic ... And if people listen to the government's messages about the past and how to extrapolate the future, then they may also listen to the messages of the opposition, the press, co-workers, and so on." The theoretical model, therefore, shows how multiple political elites' pronouncements are made conditional on other elites such that message senders alter the content or precision of their communications as a means to counter rival explanations and opinions. For example, during tough negotiations over Brazil's inflation stabilization program, outgoing Finance Minister Gustavo Krause pronounced that, "the best way to reduce inflation, increase employment levels and resume economic growth was through negotiations with all sectors of society." This statement made inflation-averse pundits fearful that the government was not truly committed to reforms. In order to counter their concerns, incoming Finance Minister Paulo Haddad tried to ward off opposition to the ministry's plan by claiming, "there will be no dollarization, no pre-fixing of prices, no price freezing and no confiscation of deposits", directly refuting these concerns (Dow Jones Newswire, October 2, 1992). The argument advanced in this chapter is that political elite statements are, therefore, not random talk but are instead best thought of as strategically crafted messages. As a consequence, the pre-

cision of information contained in political elites' statements is dependent on within-elite preference configurations and their strategies given the potential for rebuttals from other elites.

3.2 The Model

Communication occurs among the three actors, two political elites and one average or representative household. There is a single message receiver, the household hh, and two informed message senders, which I denote generically as political elite A and political elite B. For example, elite A and B may be "the incumbent" and "the opposition," each with their own *ex ante* preferences over inflation. Alternatively elites may be the "central bank governor" and the "finance minister." At the start of the game, some unforeseen exogenous shock hits the economy which will impact the future state of the world and inflation. I denote this as θ. I also assume that while it is the case that the elite's preferences b_i are known *ex ante* by the household, the household does not know $b_i + \theta$. Instead, the household can use important information transmitted by elites, or messages, to aid them in determining their best response. Thus, unlike political elites, the household does not know θ. Instead, the household can use informative messages from the multiple political elites to infer θ or the interval where θ is situated.

The household also knows that elites delivering messages have their own preferences on inflation, b_i. That is, the household knowns that elites are self-interested senders. The representative household's objective, therefore, is to choose an optimal inflation forecast, π^{e*}, for a given θ, knowing b_i but not θ. For example, if the household receives perfect

information about θ, the household will update their inflation beliefs exactly to θ. This is called perfect revelation. Perfect revelation is equivalent to rational expectations with perfect information because when information is perfectly revealed, agents have perfect foresight or perfect forecasts. At the other extreme, if the household receives no information, and if all θ's are assumed to be equally likely between 0 and 1, the household's best guess is the midpoint of the state space, or $\frac{1}{2}[0+1] = 1/2$.

In between these two extremes of perfect information and no new information, multiple political elites try to influence the household's inflation forecast by sending messages about the interval $[a_n + a_{n+1}]$ that θ is in. If the household believes the message, the household then responds by holding inflation expectations that are at the midpoint of this interval, $\frac{1}{2}[a_n + a_{n+1}]$. A further assumption is that A's and B's private information about the exogenous shock is the same, or in other words, that elites know the true model of the economy. Despite the fact that the information that these actors have is the same, political elites do not necessarily want to create the same inflation expectations. In most signaling models, all senders want to generate the same expectations of lower inflation. In this model (as in **?**), elites vary in the preferences they hold over where they want households' inflation expectations to be instead of varying in their "type." As discussed above, this variation in elite preferences over inflation is assumed to be exogenous to the model, and their variation in preferences results from the redistributive effects of inflation or the redistributive effects of the costs of stabilization.

In summary, the key model tension is that multiple elites have private information and also known preferences; the household knows both that the information elites hold is useful to them but also that an elite's pronouncement is entangled with the sender's own prefer-

Table 3.1: Table of notation

Symbol	Meaning
π^e	Household's inflation expectations
π^{e*}	Household's optimal inflation expectations (best response)
θ	Random exogenous shock's impact on inflation $\tilde{U} \in [0, 1]$
b_i	Ex ante preferences of designated elite $i \in A, B$ relative to the household
b_{hh}	Ex ante preferences of household
a_n	Elite's indifference point. n designates the number of a points
$m_{1,2}$	Message sent at time 1 or time 2
μ_i	Strategy a designated elite $i \in A, B$ will pursue by sending a message for a given θ

ences; the household therefore must make a decision about what future inflation will be, given this information. Alternatively, the household could chose not to listen to elites at all. Those equilibria where the household incorporates elites' messages into their decision making are called informative equilibria. I restrict my attention to these equilibria outcomes.

3.2.1 Game Sequence

The game sequence is as follows: First, nature reveals a random shock to the economy, which influences future inflation, θ. For simplicity and following from the previous literature, I assume that θ is distributed uniformly within the interval [0,1] and maps onto a single dimension. Second, after correctly observing θ, A makes a pronouncement, sending a message, m_1. Third, B observes θ and the message that A sent and sends his own pronouncement, m_2 given what A said previously. Finally, the representative household does not observe θ but observes both pronouncements, m_1, m_2. She then updates her inflation forecast π^e using Bayes' rule [3]. Each message sender speaks once. The household acts by

[3]Bayes' rule states the household's posterior beliefs are proportional to the household's prior beliefs times the likelihood, or mathematically, $p(\theta|m_1, m_2) \propto p(m_1, m_2)p(m_1, m_2|\theta)$, and where p stands for probability

formulating future inflation beliefs. Pronouncements are free, sequential, and public.

3.2.2 Utility functions

The average household has some preference over the average level of inflation, denoted b_{hh}. As standard in this literature, the average household's objective function can be represented by the quadratic loss function given in equation 1. The household's objective is to hold inflation expectations that are equal to realized prices offset by their own preferences.

$$U_{hh}(\pi^e, \theta, b_{hh}) = -(\pi^e - (\theta + b_{hh}))^2 \tag{3.1}$$

Like the average household, political elites also have preferences over inflation which are different from the household's preferences. As such, their objectives can be represented by the quadratic loss function given in equation 2. Elites' objective is to get the household to have belief's that are equal to realized prices offset by their own preferences, or biases.

$$U_i(\pi^e, \theta, b_i) = -(\pi^e - (\theta + b_i))^2; i \in A, B \tag{3.2}$$

b_A, b_B is a measure of each elite's *ex ante* preferences. For simplicity, the elite's difference in preferences relative to the household can be normalized by dividing each term by b_{hh}. As a result, the household's utility function then becomes the quadratic loss function in equation 3.

$$U_{hh}(\pi^e, \theta) = -(\pi^e - \theta)^2 \tag{3.3}$$

In order to solve for the equilibrium of the game, and following Krishna and Morgan (2001), the solutions are classified into two cases. The first case concerns the impact of information transmission in equilibrium when elites have preferences that are either both to the left or both to the right of the representative household. In other words, in this case, elites have alike preferences. I label this *ex ante* **Political Consensus**. The second case concerns the impact of information transmission in the case when elites have preferences on either side of the household and their preferences diverge or are oppositional. I label this *ex ante* **Political Opposition**. Prior to observing θ, political consensus means that both elites would prefer to move the household in the same direction, either to the left or to the right. Alternatively, prior to observing θ, political opposition means that political elites want to pull the household in opposite directions. [4]

The function representing the best response of the household in equilibrium is monotonic. This means that higher levels of θ are associated with a best response for the household to hold higher inflation preferences, $\pi^{e*}(\theta, b_i) > \pi^{e*}(\theta)$. In addition to being monotonic, unless θ is revealed perfectly for all values, the household's best response function is a step function. The reason why is that any imperfect transmission of information will cause a kink in the household's best response function, causing the household to make an informed guess based on the size of the interval. Technically, this means that the household will select the midpoint of the designated interval, $\frac{1}{2}[a_n + a_{n+1}]$. How much uncertainty there is in the message, and consequently in the household's forecast, can be measured by the length of the step, where the longer the step, the greater the uncertainty. Variation in

[4]The other assumptions that I make are that the utility functions are at least once differentiable and for inflation expectations and < 0; are once differentiable and > 0 in θ; and finally, is once differentiable and > 0 in the case of b_i. The equilibrium presented are for pure strategy equilibrium only. All of these conditions are standard in the literature and are the same as those reported in Krishna and Morgan (2001).

uncertainty maps onto a step function such that the length of the designated step is longer when uncertainty is higher than the step if the numerical target is reported precisely. In the limit, if there is no uncertainty, then the midpoint exactly equals the target. Under perfect revelation, the household's best response function is not only monotonic, but is also continuous.

As an example of the aforementioned set-up, consider US Federal Reserve Bank communication policy in the summer and fall of 2012. The Federal Open Market Committee (FOMC) publicly stated that future interest rates will remain low until "Mid 2015". A more precise statement is one where the FOMC proclaims that, in accordance with its dual mandate, the FOMC will keep interest rates low until unemployment in the United States falls to "xx" percent. The reason that the FOMC will not make such a precise statement is because of differences in preferences amongst committee members about what exactly the appropriate unemployment target should be. Therefore, due to differences in preferences among FOMC committee members, they must make imprecise statements. As a consequence of these imprecise statements, the message receiver must infer the target unemployment rate from the time frame. The public's inference of the unemployment target with only a time frame is much more uncertain than the degree of uncertainty if the FOMC revealed a numerical unemployment target.

3.2.3 Equilibrium Definitions and Further Notation

A pure strategy for elite A is denoted μ_A. This strategy specifies the message $m_1 = \mu_A(\theta)$ that elite A sends in state θ. Similarly, a pure strategy for elite B is denoted μ_B. This

strategy specifies the message $m_2 = \mu_B(\theta, m_1)$ that elite B sends in state θ. A strategy for the decision maker, π^{e*}, specifies the beliefs that she has $\pi^{e*}(m_1, m_2)$. The household's posterior beliefs are denoted $P(\cdot|m_1, m_2)$. Finally, a point a_n is any point in $\theta \in [0, 1]$ where either elite A or B is willing to partition the information space into distinguishable intervals. For example, if the space is partitioned into four intervals then $n = 3$. The corresponding information partitions are $\{[0, a_1), [a_1, a_2), [a_2, a_3), [a_3, 1]\}$. In order for political elites to distinguish these as cut points, the expected utility for the political elites, given the household's expectations above and below the cut points a_n must be equal.

Finally, another important consideration is whether a political elite is a centrist or an extremist. Following again from Krishna and Morgan (2001), an elite with preferences $b_i > 0$ holds extreme views in state θ if

$$U_i(\pi^{e*}(\theta), \theta, b_i) \leq U_i'(\pi^{e*}(1), \theta, b_i)$$

Similarly, an elite with preferences $b_i < 0$ holds extreme views in state θ if

$$U_i(\pi^{e*}(\theta), \theta, b_i) \geq U_i'(\pi^{e*}(0), \theta, b_i)$$

A political elite who is an extremist is intuitive: he has preferences so far to the right (left) of the household such that this particular elite would get more utility if the household had inflation expectations above (below) the bounds of θ than if θ was revealed. For a substantive example, consider a political elite that has preferences for lower inflation under conditions of deflation. Alternatively, if an elite prefers that the household hold increasing inflation expectations under high inflation conditions, this elite is extreme. Because I use

the quadratic loss functions, a given elite is an extremist if $|b_i| \geq 0.5$. Elites who do not hold these extreme views are called centrists.

3.2.4 Political Consensus

In the case of *ex ante* political consensus, first assume that $b_B > b_A > 0$. This is a situation when elites both have preferences to the right of the household. Right of the household here means that the elite is more inflation accepting than both political elites. One example of this kind of preference configuration is in Brazil under President Lula. With the election of President Lula, many in Brazil were deeply concerned that the government was going to go on a spending spree, increasing inflation. After the election, however, many of Lula's left-leaning supporters were disappointed that he did not spend more and complained about credit being too tight. Since his election, peak organizations and other civil society groups in Brazil have spent significant efforts mobilizing for government spending. For example the Federal Budget Organization (FBO) in Brazil lobbied extensively for an increase in government spending on social programs.

Ex ante consensus is not necessarily a pro-inflation phenomenon and may also apply to more inflation-conservative elites $b_B < b_A < 0$. A modern example of this preference alignment is Federal Reserve Board Chairman Ben Bernanke and former Treasury Secretary Henry Paulson. Bernanke as head of the central bank and appointed by former Republican President, George W. Bush, is expected to have inflation preferences to the left (more conservative, recall that the household's preferences are normalized to zero) of the representative household. Similarly, Paulson was also appointed to the Treasury by Re-

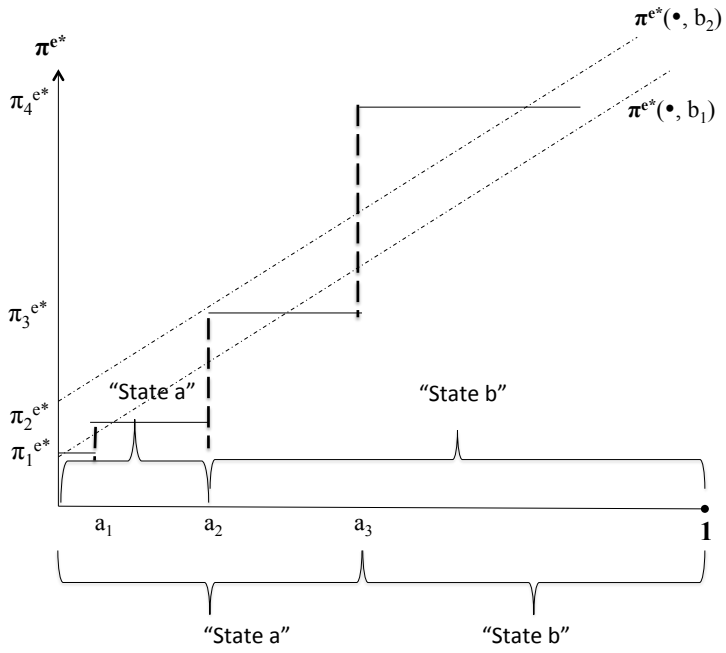
publican President George W. Bush and given his professional career as CEO of Goldman Sachs, is also thought to have inflation preferences to the left of the average household. In summary, the examples of Brazil and the United States illustrate how in a model with multiple political elites, statements can be made from elites with inflation preferences more (less) extreme than another elite, even in his own political party.

In order to understand the intuition of the game, the following figure shows the best response of the representative household to four partitions of information revealed by two political elites. The best response of the household is the step function and is shown by the black line. The utility functions of the elites are the upward sloping dashed lines. The reason the household's best response function is stepwise is, recall, that the best response for the household is to choose $\frac{1}{2}[a_n + a_{n+1}]$ in the partition they believe θ is situated. The distance between the upward sloping dashed lines for the elites are equivalent to the distance between their ideal points, or $|b_2| - |b_1|$. The partition points $\{a_1, a_2, a_3\}$ show the points at which an elite is indifferent between telling the household that θ is situated above or below that cut point.

In this example, assume that elite A's first indifference point is located at point a_2. At this point, elite A can distinguish between below and above a_2. Also assume that elite B is indifferent at point a_3. He can distinguish between above and below this point, thus providing more information about extreme values of θ. If elite A is indifferent at point a_2 then the expected utility given the household's response if the household chooses π_2^{e*} is equal to the expected utility given the household's response if the household chooses π_3^{e*}.[5] Below this point, elite A prefers π_2^{e*} for all $\theta < a_2$ and prefers π_3^{e*} for all $\theta > a_2$. The same

[5]This is the indifference criteria given in Crawford and Sobel (1982)

is true for elite B. If elite B is indifferent at point a_3 then the expected utility given the household's response if the household chooses π_3^{e*} is equal to the expected utility given the household's response if the household chooses π_4^{e*}. Below this point, elite A prefers π_3^{e*} for all $\theta < a_3$ and prefers π_4^{e*} for all $\theta > a_3$. All of this is to say that elite A can distinguish between "State a" and "State b" values of θ, whereas elite B is also useful in distinguishing between "State a" and "State b" values of θ. In order to understand this, compare this with perfect revelation. If perfect revelation of the state space was possible, then political elites would report and households would select a unique value for every possible value of θ between 0 and 1.



The figure shows the best response for the household given consensus in *ex ante* preferences. States "a" and "b" are states of the world that each elite can announce that θ is in. Each elites' indifference curve is given by the upwards function. Households' expectations are the outcome variable (vertical axis) and is mapped for every state of the economy (hor-

izontal axis). As shown in equation 4, the best response for the household given consensus in ex ante preferences when elite A's first indifferent point is located at a_2 is

$$\pi^{e*}(m_1, m_2) = \begin{cases} \pi_1^{e*} & \text{if } m_1 = m_2 = \pi_1^{e*} \\ \pi_2^{e*} & \text{if } m_1 = \pi_2^{e*} \\ \pi_3^{e*} & \text{if } m_1 = m_2 = \pi_3^{e*} \\ \pi_3^{e*} & \text{if } m_1 = \pi_1^{e*} \text{ and } m_2 = 1 \\ \pi_4^{e*} & \text{if } m_1 = \pi_3^{e*} \text{ and } m_2 = \pi_4^{e*} \end{cases} \tag{3.4}$$

The resulting partitions mean that in an information environment where there are multiple elites, under some conditions the household receives noisy but useful messages about the location of θ. If the information is imprecise, the household may hear "lower commodity prices should weaken inflationary pressures." In the information is more precise then she may hear "the effects of lower gas prices is expected to reduce year-over-year inflation between 10 and 20 percent."

The precision of information influences the degree of households' uncertainty about the future economy, changing her inflation expectations. Furthermore, the amount of uncertainty is positively associated with the length of the partition in which θ is revealed. For example, recall that when the household has no information, the household's best guess is the midpoint of $[0, 1]$. If elites effectively signal the interval in which θ is situated, the household learns more information than if elites say nothing at all. The longer the interval, the less precision of information is communicated, the greater the uncertainty. Moreover,

this works for both actors. As we saw above, when elite A's first indifference point is a_2, from elite A, the household can learn whether or not θ is above or below a_2. Similarly, when elite B's fist indifference point is a_3, the household can learn whether or not θ is above or below a_3.

What occurs if θ is just above a_1 and the first point of indifference for elite A is a_2 and A wants to say that $\theta < a_1$ making elite A better off? Elite A will prefer to send the message "π_1^{e*}" the closer θ is to a_1. If he does this, elite B can counter his pronouncement by saying "1." This disconfirming message effectively sends an alarm to the household that elite A is under-reporting the actual value of θ. What we then have to ask is whether this is an equilibrium strategy for elite A, anticipating what elite B will do. According to the best response function above, if $m_1 = a_1$ and $m_2 = 1$, then the household will choose π_3^{e*}. Because elite A prefers a_2 to a_3 for all θ below a_2, elite A will never say $\theta \in [0, a_1)$ unless he expects B to confirm. This is because if elite B does not confirm and instead will counter the message, he effectively triggers an alarm. If the alarm does sound such that B says something disconfirming, the household will choose to hold inflation expectations that are less preferred by elite A. Therefore, the introduction of a second elite prevents A from revealing θ below his first indifference point.

Now apply this logic to the situation of political elites and the household. Why would adding another elite's messages, when they have the same information, make the information revealed in equilibrium less precise than if there were only one message sender? The differences in the preferences between A and B effectively pulls A's first point of indifference towards higher values of θ. This means that A cannot reveal lower values of θ without triggering opposition by B. What solves this predicament? As elite B's preferences get

closer and closer to elite A, all of the partition values of a_n, a_{n+1} shift leftward towards the origin. This makes all of the intervals, except for the very last interval at high values of θ, shorter. As all of these intervals become shorter, more precise information is revealed at lower levels of θ; as the lower intervals become shorter, it becomes much more likely that A can reveal lower values of θ without tripping B's alarm. The result is the comparative static that A can induce lower household inflation expectations from the household by revealing more precise information the closer $B's$ preferences are to A. In terms of the politics of the model, this shows how the potential for dissent limits the precision of information that both elites can send to the household in equilibrium. In other words, "truthfulness" is gained, but at the expense of higher inflation expectations.

As shown above, when political elites have consensual preferences, as A and B grow further apart, differences in their preferences moves the first indifference point to higher levels of θ, and out away from the origin. What this means, in terms of communication, is that as a like-minded political elite becomes more extreme, the effect is that even the more moderate elite has to reduce his information precision in order to be believed. This means that in addition to paying the costs for the additional benefits of truth-telling, another interpretation is that elite A pays a cost for elite $B's$ extreme views. Furthermore, this cost is higher the further that B is from A. In order to counter $B's$ extreme preferences, A has to counter by being even less and less precise. As moderate elites become relatively more extreme elites, other elite's have to counter this growing extremity by being more vague with the household. The way in which they compensate for relatively more extreme co-elites is by reducing the precision of their statements.

3.2.5 Special Case of Multiple Sender Model: Single Sender Game

When both A and B have exactly the same *ex ante* preferences, the multiple sender game becomes a single sender game. For a four partition $n = 3$ information space, informative messages can be sent when $|b_i| \leq 0.042$. [6] When $b_A = b_B$ the first indifference point for elite A is lower than any indifference point elite A has when B is not exactly the same. As a consequence, a_n shifts towards the origin. Furthermore, if $n > 1$, all the a_n's shift towards the origin simultaneously. The corresponding inflation expectations of the household, $\pi^{e*}|a_n$, also shift downward. This increase in the precision of information leads the household to have lower inflation expectations for a given θ than if $|b_B| > 0$. In other words, for all possible values of θ the household is predicted to have lower inflation expectations on average as A and B become more alike.

Similar to earlier cheap talk models with a single sender, so long as elites' preferences are not too out of step with the households' preferences, in equilibrium, elites can send useful even if imprecise messages to the public. Also like the earlier cheap talk models, political elites' incentives to manipulate households' expectations restricts the precision of information sent. This is because the household knows elites are self-interested. As such, the household will not believe elites' messages if they are too precise. A new finding is that the inclusion of an additional elite *reduces* the precision of information sent in equilibrium when compared against a model with only a single message sender. This imprecision results from two effects. First, there is a disciplining or truth-telling effect. In this case, the more extreme elite disciplines the less extreme elite from reporting untruthful low values

[6] This is calculated using the standard function $\frac{1}{2}[1 + \sqrt{1 + \frac{2}{b}}]$ (Crawford and Sobel, 1982; Gibbons, 1992).

of θ. The cost of having such a watchdog, however, is that the household's inflation expectations will be higher than if there were only a single sender. The second effect concerns compensating for increasingly extreme views. Here, because both elites have similar directional preferences, the household is skeptical about the possibility of inter-elite collusion and the effects of the more extreme elite on the crafting of the message. In order to temper this skepticism, political elites must reveal less precise information.

In summary, when elites have *ex ante* consensual preferences are that 1) are not too extreme and 2) not too far away from one another, elites can in fact send useful even if imprecise messages to the public. In a multi-sender model, the precision of information sent in equilibrium is always lower than the precision of information when there is a monopolist message sender. This means that previous cheap talk models that assume a single message sender overstate the effectiveness of information transmission if, in the domestic policy, political elites have *ex ante* consensual preferences. [7]

3.2.6 Political Opposition

Next, consider the situation in which elites have opposing *ex ante* preferences such that their preference are on either side of the household. An example might be that United States President Barack Obama is to the right (inflation-accepting) of the representative household and that Federal Reserve Bank Chairman Ben Bernanke is to the left (inflation-adverse) of the representative household. A further assumption is that $|b_A| > -b_B$ or that President Obama is more extreme (farther away from the household) than Chairman Bernanke. Going back to our definition of centrists and extremists, recall that an elite with

[7] See Appendix A for Propositions and Proofs

preferences $b_i > 0$ holds extreme views in state θ if

$$U_i(\pi^{e*}(\theta), \theta, b_i) \leq U_i'(\pi^{e*}(1), \theta, b_i)$$

Similarly, an elite with preferences $b_i < 0$ holds extreme views in state θ if

$$U_i(\pi^{e*}(\theta), \theta, b_i) \geq U_i'(\pi^{e*}(0), \theta, b_i)$$

If θ is large enough, every right-centrist has extreme views. This is because the elite would prefer the household to have inflation expectations larger than 1. Therefore, if we designate $\alpha(b_B) < 1$ to be a state of the world such that for all shocks that are greater than this cut off point, even a right-centrist elite holds extreme views. Similarly, every left-centrist has extreme views if the state is small enough. Therefore, if we designate $\alpha(b_A) > 0$ to be a state such that for all shocks that are lower than this cut off point, even a left-centrist holds extreme views. These cut off point have a linear relationship with the size of b such that,

$$\alpha(b_B) = 1 - 2b_B \text{ if } b_B > 0; \alpha(b_A) = -2b_A \text{ if } b_A < 0.$$

Like before, we solve the model by backwards induction. While the proof is found in Krishna and Morgan (2001), what is important for the politics of the model is that the outcome of the equilibrium depends on the extremity of the opposition. This is shown by the best response function of the household in equation 5. Assume that $b_B > 0$ with the extreme cut off point $\alpha(b_B) = 1 - 2b_B$. In this game, faced with opposing elites, the

representative household will hold the following inflation expectations,

$$\pi^{e*}(m_1, m_2) = \begin{cases} \theta & \text{if } m_1 \leq 1 - 2b_B \text{ and } m_2 < m_1 + 2b_B \\ \min\{m_2, 1\} & \text{if } m_1 \leq 1 - 2b_B \text{ and } m_2 \geq m_1 + 2b_B \\ \frac{1}{2}[1 - 2b_B + 1] & \text{if } m_1 > 1 - 2b_B \end{cases} \tag{3.5}$$

What will elite B do given the expected response by the household? First, suppose that $\theta \leq 1 - 2b_B$ and $b_B = 0.25$. Now suppose that elite A sends a message where $\theta \leq m_1 \leq 0.5$. If elite B agrees with A's message then he induces θ as shown by the best response function above. If he counters, then he will induce the household to choose an action $\in [m_1 + 0.5, 1]$; Since $\theta \leq m_1$ and $|b_A| > -b_B$, the household's action is not preferred by elite B. This means that B will confirm A's pronouncement. Now what happens if elite A underestimates θ and tries to induce lower actions closer to his own ideal point by saying $m_1 < \theta$? Like before, elite B can agree or disagree with A's message. If he disagrees, he effectively triggers an alarm saying that elite A is underreporting. In response, the household will choose max $\{m_1 + 0.5, \theta + b_B\}$.

If, however, $\theta \leq 0.5$, because elite A prefers θ to either $m_1 + 0.5$ or $\theta + 0.5$, elite A is induced to not underreport. This is because elite B can again threaten to sound the alarm, causing the household to hold higher expectations which is less preferred by elite A. What is remarkable is that, as a consequence of this ability for elite B to check elite A, when elites have divergent preferences and $\theta \leq 0.5$, the best response for elite A is to reveal the *exact*

truth; in other words under certain conditions, in a cheap talk game with multiple senders it is possible to get perfect revelation of information. This is remarkable because unlike the single sender game where adding an additional voice makes the signal less precise, in the case of political opposition, under certain conditions, adding an additional voice leads to perfect information transmission. Furthermore, the best response for elite B when $\theta \leq 0.5$ is to confirm A's message. This example generalizes such that, when $\theta \leq 1 - 2b_B$, elite A will perfectly reveal his private information in equilibrium and elite B will confirm.

The fact that perfect information can be revealed is very important for the success of inflation stabilization. If we assume that households have model uncertainty and political elites do not, revelation of perfect information means that political elites perfectly disseminate and the household perfectly learns the correct model of the economy. Why this is critical is that perfect revelation of information is impossible in the case when elites have *ex ante* consensus in preferences or if there is a single sender of information. Perfect revelation is also thought to generate inflation stabilization with the lowest costs. Under conditions of perfect foresight, households' expected future prices are equal to realized prices. With perfect information, information influences the household's priors and the households correctly adapt to the new policy environment. In the case of inflation stabilization, households with perfect foresight will perfectly adjust their expectations in accordance with the new lower inflation regime. As a consequence, inflation stabilization proceeds without sluggishness or stickiness. The fact that the equilibrium requires political opposition but moderates, $\theta \leq 1 - 2b_B$, means that successful inflation stabilization are rare, but can and do occur.

Next consider the case of values of $\theta > 1 - 2b_B$? If we stick the the previous example

where $B's$ bias is $b_B = 0.25$, if elite A sends a message saying that $m_1 > 0.5$, then elite B has no need to disagree. Even if he disagrees, as shown by the best response function, the household will choose 0.5. This is because the household has the most to be learned from elite A. What if elite A tries to misreport θ and lies, for instance saying that $\theta < 1 - 2b_B$ even when it is not? In this case, if elite A sends message $m_1 < 0.5$ then elite B will disconfirm, sending message $max\{m_1 + .05, \theta + 0.5\}$. The household will choose $min\{1, m_2\}$. This means that if A underreports and B disconfirms, in response, the household will hold the highest possible inflation expectations possible. Like we saw in the case of political consensus, by disconfirming $A's$ statement, B acts like a watchdog, enticing A to tell the truth. Because B is a watchdog, it is in elite A's best interest to reveal $\theta > 0.5$ and for elite B to agree. Unlike the situation where $\theta > 1 - 2b_B$, there is no perfect revelation of information, however. Instead the information transmitted in equilibrium is a function only of elite B's preferences relative to the household. The household chooses $\frac{1}{2}[1 - 2b_B + 1]$ or, once simplified, $-b_B$. Thus, when political elites have oppositional preferences and are relatively moderate, in a model where talk is cheap, perfect transmission of political elites private information occurs. Alternatively, when political elites' have oppositional preferences but elites are more extreme, the amount of information transmitted to the household declines. [8]

[8] See Appendix A for Propositions and Proofs

3.3 Model Results

Table 2 and table 3 summarizes the results from the theoretical model. As we have seen above, including an additional elite into a standard cheap talk signaling model is critical for truth-telling. First, in the case of *ex ante* political consensus, including another elites creates more imprecision. The result is that the signaling channel is less precise than the case with only a single elite. Empirically the prediction is that households' inflation expectations will be higher when elites have consensual preferences. The benefit, however, is that by including an additional sender, the second sender induces the first sender to tell the truth, even when the first sender would prefer to lie. In general, this implies that while multiple elites decrease transparency or clarity in the signaling channel, and while the cost of doing so is, on average, higher inflation expectations, the benefit is greater truthfulness.

Second, under conditions of *ex ante* political opposition, for low values of θ, a model with multiple elites has the interesting outcome that political elites will reveal the exact truth. The perfect revelation of political elites' private information is an improvement over either a model with a single message sender or a model with multiple senders but consensual preferences. This finding suggests that political elites' communication, even when talk is cheap, can engender successful inflation stabilization. For polities with more extreme elites, however, there is a loss of information precision. The more moderate (extreme) the opposition's preferences, the more (less) precise information is revealed in equilibrium.

The results designate three types of informative equilibrium,

1. Perfect revelation when $\pi^{e*} = \theta$ if $\theta \leq 1 - 2b_B$

2. Imperfect revelation when $\pi^{e*} = \frac{1}{2}[a_n + a_{n+1}]$

Table 3.2: Table of predictions

	Ex ante Political Consensus	**Ex ante Political Opposition**
Consensual Messages	$\pi^{e*} = \frac{1}{2}[a_n + a_{n+1}]$	$\pi^{e*} = \theta$ if $\theta \leq 1 - 2b_B$ $\pi^{e*} = 1 - b_B$ if $\theta > 1 - 2b_B$
Conflicting Messages	$\pi^{e*'} > \pi^{e*}$	$\pi^{e*} = \min\{m_1 + b_B, \theta + b_B\}$ if $\theta \leq 1 - 2b_B$ $\pi^{e*} = \max\{1, \min\{m_1 + b_B, \theta + b_B\}\}$ if $\theta > 1 - 2b_B$

Table 3.3: Predicted influence of elites' *ex ante* preferences

	Precision	**Uncertainty**	**Inflation Outcomes**
Elite Consensus	Imprecise Information	Higher	Higher
Elite Opposition with Moderates	Precise Information	Lower	Lower
Elite Opposition with Extremist	Precision varies by extreme elite	Increases with extremist	Increases with extremist

3. Imperfect revelation when $\pi^{e*} = 1 - b_B$ if $\theta > 1 - 2b_B$

Again, the main proposition is that, when elites have like preferences, receiving information from like-minded elites is always informationally inferior to when elites have opposing preferences. Yet when elites have oppositional preferences, the model predicts that as oppositional elites get closer and closer together, more of elites' private information is revealed to the public. The model predicts the following testable hypotheses:

H1 Opposition Hypothesis in Moderation: *If political elites have ex ante opposition and at least one elites is a moderate, the less extreme their preferences, the more precisely they disseminate information to the household*

H2 Inflation Stabilization Hypothesis: *Countries with ex ante political opposition and moderates are more likely to have lower inflation than those countries with either ex ante political consensus or ex ante political opposition and extremists*

H3 Information Hypothesis: *As the precision of political elites' information increases, changes in households' inflation expectations will yield lower levels of aggregate inflation*

3.4 Heterogeneous Households

Work from Zaller (1992) suggests that instead of a representative household, political elites may actually have their own target audience. An elite's target audience are those households with partisan opinions similar to their own. If households select information from elites with similar opinions, this is called a "partisan effect." There is evidence that suggests that partisan effects are increasingly likely as cable news media and entertainment media replaces broadcast media and general news media (Prior, 2007). This is because, with growing disaggregation in the sources of news media, news providers have narrower and narrower audiences. Increasingly, these smaller media outlets have customers which are much more likely to be alike in their partisan opinions; they seek out news to confirm what they already know. Therefore, it is important to consider what happens to the predictions of the model when in addition to multiple elites, there are households with different partisan persuasions and that these households only listen to their most favorite and/or like minded elite(s).

Such a situation generates two sub-games of the previous model. If the household only listens to their single most preferred elite, this would transform the full multiple sender game theory game into a single sender game. In this case, the information revealed in equilibrium would only be a function of the distance between the elite's preferences and the households preferences $|b_j| - |b_{hh}|$. Greater precision of information would result when household and elite preferences are greater aligned and would be higher when household and elite preferences are less aligned.

Alternatively, if the household listened to multiple elites only from alike elites (from

either the extreme left or extreme right of his position) such that his most favored elites are still more extreme than his own preferences, this would effectively truncate the equilibrium into a single case where only the results from political consensus matters. Here, the differences between $|b_j| - |b_i|$ as well as $|b_j| - |b_{hh}|$ are the influencing variables, where $\pi^{e*'} > \pi^{e*}$ if $|b_i| - |b_j| < |b'_i| - |b'_j|$.

For either of these situations, the influential variables are the same as in the game with a single representative household. The prediction is that there will be less precise information revelation in countries where households are farther apart from their most preferred elite as well as when alike elites are far apart from each other.

3.5 Conclusion

In summary, the theory argues that households receive multiple pronouncements, or cues, about the economy from a diverse and strategically motivated group of political elites, i.e. people engaged professionally in economic policymaking. The fact that there are multiple elites sending information generates a strategic information environment, with one elite confirming or refuting another elite's cues based on what they think the other elite will say. Similar to earlier cheap talk models with a single sender, when elites' *ex ante* preferences are consensual, so long as elites' preferences are not too out of step with the household's preferences, in equilibrium elites can send useful even if imprecise messages to the public. Also like the earlier cheap talk models, elites' incentives to manipulate households' expectations restricts the precision of information because the household knows elites are self-interested. As such, the household will not believe elites' messages if they are too pre-

cise. A new finding is that by including an additional elite with consensual preference the precision of information sent in equilibrium is less than the precision of information when there is only a single message sender. This imprecision results from the fact that information revelation is a function not only of how out of step each elite is with the household, but also how out of step elites are with one another.

Furthermore, when elites have divergent *ex ante* preferences, and yet the opposition is relatively moderate, elites can perfectly and truthfully reveal information. Here communication is predicted to be the most effective. In other words, under certain conditions, those countries with political opposition can better reduce household inflation expectations than with those countries political consensus. As a result, inflation stabilization is more likely to succeed in those countries with greater political opposition but where the opposition is not too extreme. As the opposition becomes more extreme, however, there is a reduction in the information that elites can convey.

In addition, if households are heterogenous and only listen to their most favorite elite, the information revealed in equilibrium is less informative than the case where there is more homogeneity of households and divergent elites. The greater the distance between like-minded elites from one another, the greater the noise in information revealed in equilibrium and the higher the household's inflation expectations are among like-minded households.

This section identifies the empirical relationships expected from the model. It sets the ground for a discussion of how I will test these predictions using a large N empirical test, which I present in the next section.

Chapter 4

Testing the Argument: Political Opposition

4.1 Introduction

In the previous chapter, I present a theory that predicts when political elites, or those actors tasked with economic policymaking, will make precise and credible statements about future inflation and when they will not. The theory suggests that by disseminating their private information, political elites can influence the mass public's beliefs, which can lead to changes in economic outcomes. Importantly, the theoretical model generates conditional hypotheses that are new to the literature. This chapter and the remaining chapter tests the theoretical predictions derived from the theory and evaluates the evidence.

As discussed in chapter 2, previous theories contend that *political opposition*, or how far away policymakers' preferences are from one another, is positively associated with inflation. The reason is that political opposition is thought to generate roadblocks in reaching

political consensus about costly economic reforms. A lack of political consensus is expected to motivate opportunistic politicians to print new money for revenues. Printing new money is expected to increase the money supply, and an increase in the money supply is expected to cause higher aggregate prices.

Previous research also claims that countries with greater political opposition are more likely to delay economic reforms to stabilize inflation. Delaying stabilization is then expected to generate higher inflation rates (Alesina and Drazen, 1991), worsening the economy further. Similarly, Cukierman, Edwards and Tabellini (1992) suggest that incumbents in countries with greater political opposition are less likely to make costly reforms, especially reforms to the tax system. Because incumbents have limited incentive to extract new taxes for revenues, incumbents are therefore more likely to use the printing press to generate revenues. Like the above, an increase in money printing is expected to increase the money supply and increase inflation.

Unlike all of these theories, the theory that I advance suggests that when political elites have opposing *ex ante* preferences and when at least one political elite is moderate, oppositional preferences causes inter-elite competition. Inter-elite competition then benefits the household by increasing the precision of information disseminated by elites to the public. Observationally, more precise information means that elites will proclaim and households will hear, "inflation will decline by 8 percent between May and June" as opposed to less precise information such as, "inflation should decline."

According to my theory, political opposition influences the precision of information sent to the household in two important ways. First, when there is inter-elite competition, political elites are predicted to transmit credible information. Second, when there is *ex*

ante elite opposition, elites are more likely to provide precise information. An increase in credible and precise information is then predicted to lower household uncertainty about the future economy. A decrease in uncertainty is, in turn, expected to lower households' inflation expectations, and consequently, lower inflation.

Both of these dimensions, "credibility" and "precision", provide a new explanation for how inter-elite politics causes variation in countries' inflation outcomes. The argument advanced highlights how inter-elite political competition generates more truthful and precise communication flows to the public. Alternatively, inter-elite collusion or monopoly control of information either by a single elite or similar elites is expected to generate greater opacity in elites' statements to the public. Greater opacity is expected to yield greater uncertainty, higher inflation expectations, and higher inflation outcomes.

The rest of the chapter is structured as follows: the next section reviews the formal conditions of the model's propositions and the derived hypotheses. The third section explains the empirical models used to test the theoretical claims. The fourth section introduces the measurement strategy. The fifth section presents summary statistics and graphical representation of the data and the results from the statistical analysis, and examines model fit. The final section concludes.

4.2 Theoretical Model Recap

As a quick review of the previous chapter, the theoretical model has the following sequence: some random exogenous shock to the economy occurs and this shock has an impact on inflation. Multiple political elites perfectly understand the influence of this shock on the

economy. Meanwhile, households do not perfectly understand how the shock will change the economy. If political elites can reveal their private information, and in doing so, change the household's beliefs about the future economy, elites can attempt to move actual inflation outcomes closer to their own preferred outcome. Households, however, know that elites' private information is useful to them, but that elites' messages are entangled with the sender's own preferences. If political elites send messages and if the household incorporates their messages into her projections of future inflation, actual inflation outcomes will change. Because of this, multiple political elites strategically choose how much of their private information they want to disseminate to the public, hoping that the public will listen.

Each political elite is assumed to have different *ex ante* preferences over inflation outcomes. A political elite knows that he can attempt to shift the household's expectations closer to his preferred outcome by revealing his private information strategically. He also knows, however, that other political elites have the same incentive. As a result, a political elite must reveal his private information in such as way so that he fully considers what another political elite will say in response. The result of this strategic inter-play is the interesting idea that, collectively, political elites' statements are not random talk; instead, political elites' statements are conditional on the expected strategies of other political elites.

Like the early, single-sender cheap talk models, the degree of *ex ante* difference in inflation preferences between political elites and the household matters to the precision of information revealed in equilibrium. Holding all other things constant, the closer an elite's *ex ante* inflation preferences are to the household, the more precisely he will reveal his private information. The intuition is that closer senders have less incentive to move

the receiver in a direction unfavorable to the receiver. Because the inflation preferences between the sender and the receiver are closer, the receiver is more likely to incorporate the sender's information. The result is that the sender can disseminate his private information with greater precision (Crawford and Sobel, 1982).

The second comparative static is that the *ex ante* differences in preferences between multiple political elites also matters. What is interesting here is that when political elites have similar inflation preferences, or biases, such that they would like the household to adjust their expectations in the same direction, elites must make less precise pronouncements in order for the receiver to incorporate their statements into her beliefs. Holding all other things constant, when elites' *ex ante* preferences are consensual, the closer (farther) one elite's *ex ante* preferences are to another elite's preferences, more (less) precise information is revealed to the household (Krishna and Morgan, 2001).

These finding are somewhat counter-intuitive. Why would it be the case that when elites have similar preferences, elites reveal more imprecise information than if there were only a single elite? When political elites have consensual preferences, the more extreme elite disciplines the more moderate elite from opportunistically misreporting the truth. That is, by introducing a second elite, the probability of getting a "truthful" message from the other sender is greater than the case with only a single elite. Because the disciplining elite is more extreme, however, both elites have to compensate for his extreme views in order to be believed by the receiver. How elites compensate is by making less informative statements. A strategic game with multiple senders, therefore, introduces two dimensions of good information, credibility and precision.

For example, assume that there is a rise in global energy prices, and that an increase in

energy prices will influence both transitory and permanent changes to inflation. Assume also that both elites want the household to think that an increase in energy prices will not increase inflation (that is, they share the same bias). The political elite nearest the household has an incentive to trick the household, underreporting the permanent effects of the price increase. If he tries this, however, the more extreme elite has an incentive to counter his remarks. If such a sequence of events occurs, the model shows that, as a result, the household will form the highest possible inflation expectations, which is then expected to cause higher inflation. We then have to ask if this outcome is a best response for the first sender? Anticipating the effects of dissent and its consequences for inflation, the more moderate elite is better off telling the truth. Because the other sender is more extreme, however, in order to be believed by the household, the first sender has to reduce the precision of his statement. As a result, the theoretical model predicts that when there are multiple elites with consensual preferences, information revealed to the public will be credible, but elites communicate with greater opacity. Interestingly, this means that when political elites have similar biases such that they want the receiver to behave in a similar way, the model predicts that statements will be credible but at the expense of greater information opacity.

When political elites are oppositional (when they have opposing biases such that they would like the receiver to update her inflation beliefs in different ways), however, the theoretical model shows that so long as at least one elite is moderate, political elites perfectly disseminate their private information. Perfect revelation of political elites' private information results from inter-elite bargaining. When elites are politically opposed, both political elites are better off by telling the truth than they are by taking any other action. Further-

more, so long as one elite is moderate, each elite's best response is to reveal the exact truth. In other words, in a multiple sender model where signals are sent strategically, when elites have opposing preferences, and where one elite is moderate, the best strategy for both elites is for the first elite to reveal his private information truthfully and with prefect precision and the second elite's best response is to confirm the first elite's statement. The intuition is that when elites have *ex ante* political opposition, the household has little concern of inter-elite collusion. Furthermore, if the receiver incorporates elites' information into her inflation projections, she learns all of the elites' private information about the economy, overcoming her information problem.

In summary, the central claim of the theory is that political opposition causes inter-elite political competition, which is predicted to lead to better information and more efficient economic outcomes. Better information is comprised of two dimensions, credibility and clarity. Alternatively, inter-elite collusion or monopoly control is predicted to obfuscate information. The main prediction from the theoretical model, therefore, is that information precision (imprecision) generates lower (higher) inflation. In the aggregate, if households have expectations that inflation will be high, such that households negotiate these inflation beliefs into their wage contracts, and if given an increase in the cost of labor, firms recoup these costs by passing along price increases to consumers, household expectations of higher prices can engender inflation. The reverse is also true. If inflation expectations are formulated such that, taking account of precise information, the household expects that inflation will be lower than previously, in the aggregate, if households negotiate these inflation beliefs into their wage contracts, and if firms lower their prices given a decrease in the relative cost of labor, household expectations of lower prices can engender disinflation.

From these propositions the empirically testable hypotheses are,

H1 Opposition Hypothesis: *Political elites with ex ante elite opposition (consensus) will reveal more (less) precise information than either a single elite or political elites with ex ante elite consensus*.

H2 Inflation Hypothesis: *Countries with ex ante political opposition and moderates are more likely to have lower inflation than those countries with either ex ante political consensus or ex ante political opposition and extremists*

H3 Information Hypothesis: *As the precision of political elites' information increases (decreases), changes to households' inflation expectations will yield lower (higher) levels of aggregate inflation*

As with all theories, the predictions of a model are dependent not only on the values of the explanatory variables but also on the relational process between the input variables (King, 1989; Morton, 1999; Signorino, 1999). In the theory presented in chapter 3, the input variables are *ex ante* political opposition and *ex ante* political consensus. The parameters of interest are the relative distance between elites preferences relative to the household's preferences, the relative distance between elites' preferences relative to one another, and inflation shocks. The rest of this chapter discusses the empirical model that I use to test **H1**, or **Opposition Hypothesis**. The following chapter examines **H2** and **H3**.

4.3 The Empirical Model

The panel that I use to test the **Opposition Hypothesis (H1)** consists of six countries from Latin America (Argentina, Brazil, Colombia, Mexico, Peru, and Venezuela). The years examined are the period from 1993 to 2007. Each country quarter, a country exhibits a different level of information precision as well as variation in the degree of political opposition and political consensus over economic policy. The main outcome variable is the proportion of precise statements in a given quarter or, I_q. The measurement strategy that I use to construct this variable is given below. In order to test **H1**, I model information precision as a function of the degree of political consensus C_q and actual logged inflation π_q. To measure political consensus, I construct a new dataset of announced economic policy changes from the International Monetary Fund's (IMF) *Exchange Commitments and Exchange Restrictions, Annual Reports*. To measure inflation π_q, I use logged quarterly changes to consumer prices as reported in the IMF's *International Financial Statistics* database.

4.3.1 Estimation Model

The main outcome variable is information precision. This variable has two important characteristics. First, the outcome variable is a proportional continuous measure. What this means is that the data are bounded between zero and one, but are continuous between these values. Second, the dependent variable also has a high frequency of zeros. As shown below in Figure 1, zeros comprise 34 percent of the observations. Therefore, because the dependent variable is both bounded between zero and one and the data also has a positive probability mass at zero, a linear regression model is inappropriate.

Instead of using linear regression, I conduct my analysis using a zero-inflated beta regression model. A zero-inflated beta regression model is a mixture model. The model mixes together two distributions, a beta distribution, which appropriately models the proportional continuous measure bounded by zero and one, and a Bernoulli distribution, which models the discrete, zero or non-zero outcome. Mixed together, these two distributions appropriately match the "inverted j-shape" of the outcome variable.

4.4 Data and Variables

4.4.1 Dependent Variable: Information Precision

Empirically, what is observable to the analyst and to the household are political elites' statements about the economy. The theoretical model suggests that elite statements are not random talk. Instead, elites' statements are a selection of signals about the economy that are generated from a data generating process where inter-elite strategies constrain or enhance the precision of information disseminated in the media. As a result, in order to test the hypotheses listed above, it is necessary to obtain a measure of the precision of elites' statements made in the media.

In order to measure the precision of information contained in political elites' inflation pronouncements, and following from the methodology presented in Ehrmann and Fratzscher (2010), I construct a dataset of all public statements by political elites using Factiva, a news source database. Factiva contains newspaper articles and newswire reports from 14,000 news sources. Using this dataset, I extract all database entries containing

the words "minister and central bank and inflation and country name" from the popular newswire, "Reuters News."

The number of newspaper articles returned by Factiva for a given country and a given year is very large. For instance, running the search of "minister and inflation and Argentina and central bank" generates over 1000 newspaper articles between January 1, 1993 and December 31, 1993 alone. Doing such a search on the entire sample yields over 9,000 newspaper articles for the 6 Latin American countries in my dataset. With over 9,000 hits for only Latin America, human coding of each document is impossible. In addition to the laboriousness, the use of humans to hand code each newspaper article introduces the potential for measurement error which may then cause problems of reliability and validity. In fact, recent scholarship by Mikhaylov, Laver and Benoit (2012) find that human coding of the Comparative Manifestos Project yields misclassification in serious and systemic ways.

Instead of using human coding, I depend on machine learning techniques to retrieve, parse, filter and classify the newspaper articles. This allows me to get measurement of my key independent variable, "information precision" that is consistent across newspaper sources, countries, and over time. Furthermore, recent work by Klebanov, Diermeier and Beigman (2008) and Quinn (2009) demonstrate ways that machine learning can be applied to political textual analysis in ways that, while perhaps generating less semantic understanding, yield more reliable (less biased) and consistent estimates.

Like other research that relies on machine classification of textual data, there are a number of important issues. First, I conduct the database search only in English. As a result of the English search, it is likely that all statements about inflation are not reported. Another potential problem with the English search criteria is that it may be the case that the reported

pronouncements are those pronouncements expected to be of interest to foreigners. This is a potential problem because the domestic household is the audience that I am interested in. While it is very likely that domestic political elites have more than one audience, including foreign lenders and investors as well as domestic households, given that Factiva contains the newswire reports from local offices, I am confident that the statements collected contain a wide sample of all statements made and include statements of relevance to domestic households. One important indicator of the relevancy of the search to domestic households is that the local news media is discussed. For example, in one Reuters newspaper article it is stated that, "The daily *La Nacion*, quoting Economy Ministry sources, said Peronists and Radicals had agreed to pass a compulsory contribution law for those companies which do not buy solidarity bonds." This example, and others like it, suggests that Reuters newswire articles captures domestic political elites' statements reported in the local Spanish-language media.

Second, by using the terms "minister" and "central bank" in the initial search criteria, the search selection is restrictive in that it may over-select statements from incumbents and under-select statements from opposition members. Furthermore, the search may also not include statements from political elites such as labor union leaders, political opponents, or prominent academics, which are included in my definition of political elites. The theoretical model, however, argues that elites are cognizant of these other actors. The fact that other political elites may confirm or refute incumbent or ministerial statements leads incumbents and ministers to say things differently than what these actors would say if oppositional elites were absent. Therefore, as a consequence of the competitive information environment, incumbent statements should not be a random sample of elite opinions. In-

stead, incumbent and ministerial announcements should be a collection of announcements that are derived from a competitive political environment where political elites condition the things they say in the media. Therefore, while the statements from political elites outside the government are not explicitly included in the dataset, my coding scheme captures oppositional statements indirectly though the statements made by incumbents, if my theoretical argument is correct.

Once all of the articles are classified, I then develop a country quarter indicator of information precision. I do this by creating a dummy variable for each classified newspaper based on its informativeness and then summing the total number of counts for each newspaper type by country quarter. Finally, I then calculate the total proportion of "informative" articles divided by the sum of the total number of articles for a given country quarter. If my theory is correct, then what matters is not the exact content of any particular news article but the the overall informativeness of the information environment. The proportional breakdown indicates how much precise information there is at a given time period. Such a measure allows me to control for the fact that a household may or may not read a particular article, but that on average, people are exposed to different degrees of precise information via the news.

Unsupervised Learning

Using text as data to generate a measure of precision of information requires two steps, treating text as data and data coding. The first step is conceptualizing each newspaper article as unstructured data that contain political elites' information. What this means is that I treat each newspaper article as though it contained political elites' private information.

The objective is to structure the newspaper article data in such a way that the private information can be categorized and coded. Through categorization and coding, it is possible to extract a measurement of the variable, "information precision." From this classification, I then aggregate the classification of information precision into a quarterly proportional measure. Operationally, what this means is that each country quarter is assigned a value of the proportion of newspaper articles that are precise. This proportional variable is derived from the three equilibrium outcomes in the formal model. The proportion of newspaper articles that are precise in a given country quarter is then used as an input variable in the regression model.

Automated content analysis follows a logic very similar to traditional content analysis in qualitative analysis. First the data is unitized. What this means is that the unit of analysis is decided, whether the unit be words, tokens, sentences, statements, or quotes. Second, once the appropriate units are decided, the units are assigned a metric. Typical metrics include word frequencies or word counts, measures of semantic relationship between words, a measure of how closely related the words are, and finally, measures of word distance in text.

For the newspaper articles that I am interested in coding, I determine that the unit of analysis I am most interested in is token frequency. Tokens are textual data that have been pre-processed to remove whitespace, grammar and punctuation, and words that have little conceptual information but are necessary for sentence comprehension such as stop words including "and, if, but, how, then." Once the sentence is tokenized and the stop words are removed, the article's content is transformed into word tokens. For example, the statement, "Minister Calvo says that inflation will be lower next January" is transformed using the

above process into distinct tokens: "Minister" "Calvo" "says" "inflation" "lower" "next" "January."

Once the data is processed into a token word frequency table, the next step is filtering. The objective of filtering is to make sure that the articles extracted are relevant. While the initial search criteria, "minister and central bank and inflation and "country name"" pre-processes or filters some of the data, upon examination of the newspaper articles, there are many articles that are not relevant inflation pronouncements. Again, because the number of newspaper articles is very large, I turn to machine learning techniques to filter the documents into "pertinent" and "non-pertinent" inflation announcements. I filter the data by applying a k-means clustering algorithm to the tokenized word frequency table.

Filtering Pertinent and Non-pertinent Inflation Announcements using Clustering

K-means clustering is an iterative clustering algorithm that takes input data and assigns the data to K number of groups based on how well the data fits to a specified clusters' mean. For example, if there are $K = 2$ groups, then the K-means algorithm will first randomly choose two means; second, will assign a mean's label to all the input data closest to that particular mean; and third, determine if the algorithm can do better job fitting the data.

Used as a filter, K-means clustering classifies the articles into two groups, "pertinent" and "non-pertinent" inflation announcements. The clustering algorithm then returns a coding for which Reuters' articles are newspaper articles and which Reuters' articles are business journals, weekly reports, or numerical market data reports. I then discard those articles that the classifier identifies as "non-pertinent." Running the filter removes approximately one-third of the newspaper articles. Those articles remaining after filtering are then as-

sumed to be relevant inflation statements. In examining the removed newspaper articles, the K-means clustering algorithm successfully identifies "non-pertinent" in my hand-coded sample with a high degree of precision. In all cases, the newspaper articles that I remove would be hand-coded as "non-pertinent." While I can be relatively sure that the number of "false negatives" is small by surveying the discarded articles, what I have yet to determine is the number of "false positives." So long as any remaining articles are unrelated to the token frequencies, "false positives" will increase the noise of the measure but should not introduce bias.

Measuring Information Precision using Clustering

Having discarded the non-relevant statements, I then attempt to classify the remaining articles into distinct categories of ranked information precision. To start off, I run another clustering model to classify the same number of categories that I would look for if I were hand-coding the data. Because the method is unsupervised, I make only the assumption that that there are 3 equilibria and that these equilibria should be distinguishable due to differences in token frequencies. Therefore, I set the k-means clustering algorithm at $k = 3$. Like the strategy for filtering, I let the classifier assign the newspaper articles into three groups based on the best fits of the mean.

Finally, once all of the articles are classified, I then need to make an indicator to be used as an input variable. I go about this by constructing a measure of the proportion of informative news articles for a given country quarter. I do this by creating a dummy variable for each classified newspaper and the aggregating the total number of counts for each newspaper type by country quarter. Finally, I then calculate the total proportion of

"informative" articles divided by the sum of the total number of articles for a given quarter. If my theory is correct, then what matters is not the exact content of any particular news article but instead, the degree of precise information in the information environment at a given time.

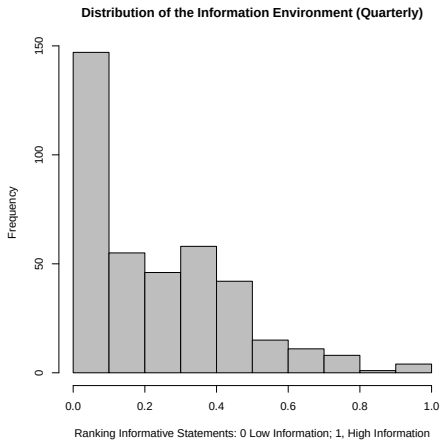


Figure 4.1: Frequency of newspaper articles by information precision

Figure 1 shows the total frequency of information precision after classification. One of the things that is striking is that, as suggested by the theory, the number of precise inflation announcements in a given quarter is relatively low when compared with the number of uninformative announcements. As suggested above, the data has an inverted J shape, with a high frequency of zeros. The theory suggests that political elites' announcements will only be precise when political elites have *ex ante* political opposition, when at least one elite is moderate, and when inflation shocks are relatively low. These conditions suggests

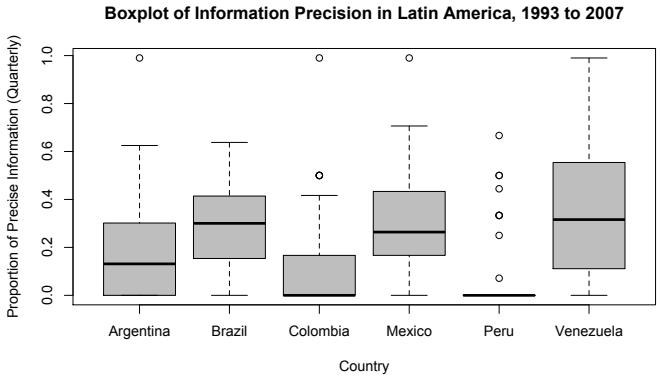


Figure 4.2: Proportion of information precision by country

that precise inflation announcements should be relatively rare and the low frequency is in fact depicted by the measurement of the textual data. While this is not conclusive evidence that the measurement strategy is valid, it is reassuring that the extracted measure takes the expected form.

Figure 2 also shows descriptive statistics for information precision by country using a boxplot diagram. There is significant variation in the distribution of the information environment across countries. Venezuela shows the largest variation in information precision whereas Peru shows the least amount of inflation related news. Brazil and Mexico appear to have similar distributions of information precision, with Brazil having slightly higher information precision on average.

4.4.2 Main Independent Variable: Elite Opposition

Political elites have different inflation preferences. One way that researchers attempt to classify and measure political elites' preferences is by looking at political elites' observable actions. Such actions may include elites' adoption of brands or labels, elites' voting

on bills or policy decisions, and finally, their speeches or the statements that they make in public. First, political elites' preferences are often revealed to the public by brands or labels. For example, in the case of inflation preferences, policymakers adopt (or are assigned) preference labels such as inflation "hawk" or inflation "dove". Because labels are simple, they provide an easy heuristic, helping the public identify and recall the inflation preferences of economic policymakers. For example, in 2012, Chicago Federal Reserve Bank President, Charles Evans was reported to be the Federal Open Market Committee's most extreme "dove". By contrast, self-proclaimed "hawk" Dallas Federal Reserve Bank President Richard Fischer is more "hawkish" than either Evans or Chairman Ben Bernanke. Brands are also publicized in the mass media. For example, Reuter's news provides an interactive media site that shows their ranking of FOMC committee members entitled, "Hawks versus Doves" (*Federal Open Market Committee Hawks v. Doves*, 2012). Similarly, in the case of other economic policymakers, such as academics or government ministers, party affiliation can provide a similar heuristic. Party labels are thought to advertise the economic preferences of ministers in clear and reliable ways. Association with one party over another may provide important clues including whether the minister is "right" or "left", or "conservative" or "liberal" on economic issues relative to one another.

In addition to labels, political elites' voting behavior is another common way that scholars attempt to measure political elites' preferences. If votes are recorded, such as roll call votes or FOMC votes, researchers can analyze voting behavior to estimate political elites' policy preferences relative to each other. Perhaps the most well known example of this methodology is the NOMINATE scores developed by Poole and Rosenthal (1997) and McCarty, Poole and Rosenthal (1997). When applied to the U.S. Congress, for example,

Poole and Rosenthal use NOMINATE data to show that, since the 1970s, party delegations in Congress have become ideologically more homogeneous and distant from one another. Recently, scholars have also turned to the examination of words, or the things that political elites say publicly, as a way to measure elites' preferences relative to one another. For example, to determine partisan ideology and position taking, Slapin and Proksch (2010) examine speeches made by members of the European Parliament. In similar work, Henderson (2012) examines House and Senate television advertisements in order to help to construct a measure of political ideology and position taking.

Unfortunately, the problem with these approaches is that these measurement strategies do not account for the strategic behavior of political elites. All of these measures assume that political elites are demonstrating their personal preferences in the actions that elites take, and yet, institutional incentives and constraints may be shaping their behavior. For example, for legislative members, roll call voting is expected to poorly reflect a legislator's own preferences. This is because political party discipline and incumbent agenda setting can shape the way the legislator votes. Carrubba and Volden (2000) find that roll call voting is biased, and that analysis of roll call voting tends to systematically overestimate party cohesion. Similarly, when considering central bank committee member voting, Meade and Sheets (2005) draw a similar conclusions. Meade and Sheets show that there is a significant difference between voiced disagreement in FOMC committee meetings and official dissent in FOMC voting. Under the Chairmanship of Greenspan, actual vote dissent occurred only 7.5 percent of the time, while voiced disagreement in the meeting minutes was much higher (Meade and Sheets, 2005). Like roll call voting in the European Parliament, FOMC votes tend to systematically overemphasize committee consensus. Even in the case of speech,

Proksch and Slapin (2012) show how observed floor speeches may not reflect the true distribution of ministers' preferences: because of strategic choices made by party leaders and party backbenchers, institutions condition both the choice of speaker and also the content of his/her speech.

The theory that I advance also suggests that elites' public statements are not random talk. As a result of strategic interaction, elites' statements are conditioned by inter-elite bargaining and how far apart their preferences are from their intended audience. Like the finding by Carrubba and Volden (2000) and Meade and Sheets (2005), analysis of political elites' preferences based on speech alone will systematically overestimate elite cohesion and generate a biased measure of political elites' preferences.

As individual measures of elites' preferences tend to be biased towards consensus, I use a simpler, indirect measure of political opposition derived from theoretical propositions discussed at length in chapter 2. Recall that the alternative explanations contend that political opposition leads to policy gridlock. The reason why is political opposition is thought to generate roadblocks in reaching political consensus about costly inflation stabilization reforms. Whether a model based on war of attrition, time inconsistency, or veto players, Alesina and Drazen (1991), Cukierman, Edwards and Tabellini (1992), and Keefer and Stasavage (2002) propose that greater levels of political opposition will be negatively correlated with the number of policy changes and that greater political consensus will be positively associated with the number of policy changes. Therefore, in constructing a measure of opposition and consensus, in order to get at the level of elite opposition or consensus in the domestic polity, I count the number of economic policy changes.

Furthermore, if political elites are more likely to vote on those policy proposals where

consensus is assured, a count measure of political consensus will systematically underestimate political opposition. In addition to being a conservative test of the hypothesis, by employing a measure of opposition based on theoretical arguments proposed by alternative explanations in the literature, I can be sure to test my theory on the same grounds as previous arguments. Recall that previous arguments suggest that political opposition causes gridlock and uncertainty and that gridlock and uncertainty lead to delays in stabilization and higher inflation. In contrast, my theory argues that political opposition cause greater precision of information and that better information reduces uncertainty and leads to lower inflation. This chapter evaluates the evidence for the first proposition while the next chapter evaluates the evidence for the second claim in my causal story.

Figure 3 illustrates changes in information precision over time for the sample of countries. While there is a slight increase in information precision over time, average information precision is relatively stable. This provides some support for the idea that changes in information precision reflect underlying domestic incentives and constraints and not a general trend of increasing information. This is important, as it is possible that with consolidation of democracy in Latin America there may be a broad and substantial increase in transparency irrespective of country specific informativeness produced by domestic political competition. As shown by the trend, however, there is little evidence of this.

Frequency of Policy Changes as a Proxy for Political Opposition

In order to derive a measure of the frequency of policy changes, I count the number of announced policy changes in the International Monetary Fund's *Exchange Commitments and*

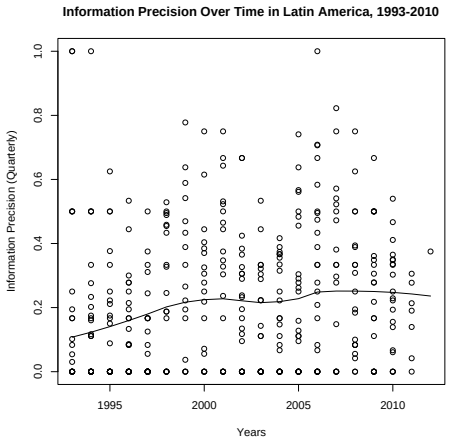


Figure 4.3: Changes in information precision by countries

Exchange Restrictions, Annual Reports.[1] This IMF publication lists announced changes to a country's domestic trade and monetary regime by calendar date. The coding strategy that I use is as follows. The IMF classifies policy changes according to topics. Reported topics are exchange rates, imports, exports, invisibles, capital, gold, non-resident accounts, and changes to the payments system. I count a policy "change" by topic as equal to 1 if there was a policy announcement reported by the IMF in a specific quarter. If there was no announcement in a quarter, I enter 0. For example, if Mexico announced a change to its import restrictions with Argentina in Q1 1999, I code this as 1 import announcement for Mexico. I do not include the Mexican announcement in Argentina's tally as I am interested in the relative frequency for which there is an announced policy change for a given country,

[1]The quarters correspond to January to March (Q1), April to June (Q2), July to September (Q3), and October to December (Q4).

not bilateral changes.

Once I have tallied all the announcements by topic area, I then construct two versions of my independent variable. The first version is the total number of policy announcements made to the IMF, irrespective of the topic area. I call this variable *total*. This measure includes all announcements irrespective of whether the announcement relates to inflation. Because it is a tally of all announcements, this variable should reflect consensus or gridlock over economic policy. Second, because I am interested in political elites' preferences over inflation, I also construct another measure of political opposition called *money*. This variable counts the quarterly number of announced changes to a country's monetary regime. This includes all announcements for exchange rates and the capital account. This measure should reflect consensus or gridlock over monetary policy.

A potential problem with the construction of the variable is that some events may be more important than others, and yet I use a simple non-weighted aggregation of all announcements. For instance, changes to a country's exchange rate are scored the same as changes to the tariff schedule. In the case of important announcements, however, usually there are multiple announcements made. Therefore, while I do not explicitly control for the magnitude of the event, important events are often implicitly weighted higher due to a higher number of corollary announcements. Future research, however, should try to capture not only the event but also a measure of the event's importance. In addition, because I am most interested in whether there was a change or not, I do not code the direction of the policy change. What this means that I do not code whether the announced policy change is restrictive or liberal, which may be related to who the policy benefits. While an understanding of liberalizing or restrictive policy changes are substantively interesting, used as

a proxy for political consensus, what matters is the relative frequency of policy changes as represented by the number of announcements, not who benefits from the policy changes.

4.5 Empirical Analysis

As suggested above and as shown by Figure 1, the dependent variable has an inverted J shape with a positive probability mass at zero. Because of this, I examine the relationship between political consensus and information precision using a zero-inflated beta regression model. The zero-inflated beta regression model is a mixture model. The model assumes that the underlying data is derived from a data generating process characterized by two distinct distributions. First, and in order to fit the high positive probability of zeros, a Bernoulli distribution models the outcome as a discrete choice between zero and non-zero outcomes. Second, in order to model the continuous but bounded variable, for those values between zero and one, I use the beta distribution. The beta distribution is flexible for modeling limited range data, such as proportional data. The distribution's density function depends on two shape parameters, μ and ψ. Using this approach, the probability density function is given by

$$(y; \nu, \mu, \psi) = \begin{cases} \nu \text{ if } y = 0 \\ \\ (1-\nu) f(y; \mu, \psi) \text{ if } y \in (0, 1) \end{cases} \tag{4.1}$$

Intuitively, what this means is that the expected value of y is the weighted average of the mean estimated by the discrete distribution and the mean of the beta distribution, with the

weights ν and $(1-\nu)$, where ν is a parameter to be estimated. The other parameters, μ and ψ, are the shape parameters of the beta distribution, and refer to the mean and precision of the distribution. Further details of this distribution and the general class of zero-inflated models are given in Ospina and Ferrari (2010, 2012).

I fit the model using the R package GAMLSS, specifying the distribution for Beta Zero-Inflated or "BEZI." I assume that the explanatory variables are the same in both the discrete and the continuous cases. Equation 2 gives the following specification,

$$\begin{aligned} \text{logit}(\nu) &= \rho_0 + \rho_1 C_q + \rho_2 \pi_q \\ \text{logit}(\mu) &= \beta_0 + \beta_1 C_q + \beta_2 \pi_q \\ \log(\psi) &= \psi_0 + \psi_1 C_q + \psi_2 \pi_q \end{aligned} \tag{4.2}$$

The parameter estimates and the corresponding standard errors for the model are summarized in Table 1. Extra care must be taken in interpreting the coefficients as they pertain to distinct estimates characterizing both distributions.

In terms of our hypothesis, the results imply a number of important things. First, looking at the estimate for ν, the results suggest that greater political consensus decreases the likelihood of observing a zero outcome. As shown in Table 1, an increase in political consensus leads to a predicted decrease in the likelihood of observing a zero by -0.40. Substantively, what this means is that an increase in political consensus is expected to increase the likelihood that political elites will disseminate some information.

Because the Bernoulli distribution models only the probability of observing zero, however, it does not present an explanation for how precisely elites will disseminate their information once they decide to make informative statements. In order to examine this, I turn to

the parameter estimates for the Beta distribution.

The Beta distribution is characterized by two shape parameters, μ and ψ. Examining the estimate for μ, Table 1 shows that, for non-zero outcomes, political consensus is negatively associated with an increase in information precision, as predicted by the theory. In fact, an increase in political consensus is associated with a -0.17 reduction in information precision. Recall that our hypothesis claimed that as political consensus (opposition) increased (decreased), we should see a negative effect on information precision. The negative coefficient, therefore, provides some support for **H1**. Moreover, the t-value associated with this effect is comparatively large, yielding greater confidence in the finding.

Another important finding is that, when we account for political consensus, changes in inflation weakly predict changes in information, and inflation is not significantly related to information precision. This finding is also important as it controls for the claim that information precision may be associated with economic crisis, irrespective of political elites' preference configuration.

In order to make sure that the findings are robust, I remove all those data points identified as outliers by the boxplot in Figure 2. Those points removed are quarters where only precise statements were made in a given county quarter (information precision $= 1$). I then re-run the model. The parameters of interest, ν, μ, ψ remain substantively important and statistically significant as before. I also rerun the model using the alternative measure of the dependent variable, *total*. The parameters of interest, ν, μ, ψ remain substantively important and similarly signed. Table 2 reports the changes in the relative estimates and standard errors due to removal of outliers ν^2 and using the total count measure for political consensus ν^3.

Table 4.1: Zero Inflated Beta Regression Model

ν	*Estimate*	*Standard Error*	*t-value*
Intercept	0.20	0.69	0.29
Political Consensus	-0.40	0.14	-2.86
Inflation (logged)	-0.15	0.15	-0.98
μ	*Estimate*	*Standard Error*	*t-value*
Intercept	-0.71	0.34	-2.08
Political Consensus	-0.17	0.02	-7.70
Inflation (logged)	0.05	0.07	0.72
ψ	*Estimate*	*Standard Error*	*t-value*
Intercept	0.51	0.44	1.16
Political Consensus	0.32	0.06	5.48
Inflation (logged)	0.18	0.10	1.87

Figure 4.4: Political Consensus and Probability of Policy Gridlock

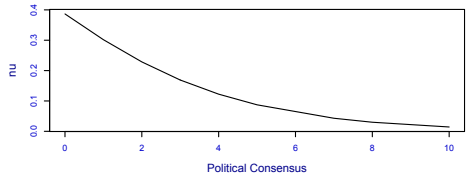
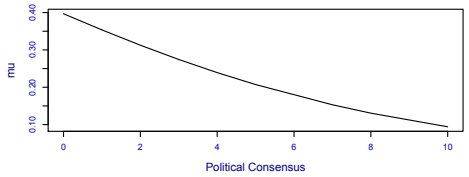


Figure 4.5: Political Consensus and Information Precision



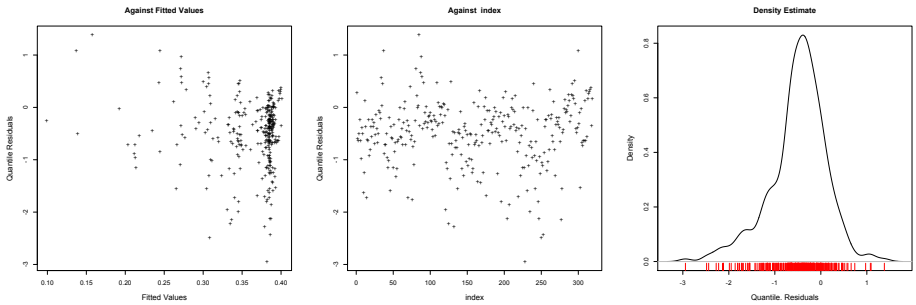


Figure 4.6: Diagnostic plots and model fit

Finally, Figure 4 shows a plot of the normalized (randomized) quantile residuals of the model from the fitted model and a plot of the fitted values of the ν, μ, σ models against

Table 4.2: Robustness Checks: Zero Inflated Beta Regression Model

ν^2	*Estimate*	*Standard Error*	*t-value*
Intercept	0.36	0.70	0.51
Political Consensus	-0.42	0.14	-2.94
Inflation (logged)	-0.18	0.15	-1.15
μ^2	*Estimate*	*Standard Error*	*t-value*
Intercept	-1.53	0.25	-6.14
Political Consensus	-0.13	0.03	-5.34
Inflation (logged)	0.20	0.05	3.70
ψ^2	*Estimate*	*Standard Error*	*t-value*
Intercept	2.41	0.48	5.03
Political Consensus	0.19	0.06	3.17
Inflation (logged)	-0.14	0.10	-1.32
ν^3	*Estimate*	*Standard Error*	*t-value*
Intercept	0.36	0.70	0.51
Political Consensus	-0.42	0.14	-2.94
Inflation (logged)	-0.18	0.15	-1.15
μ^3	*Estimate*	*Standard Error*	*t-value*
Intercept	-1.59	0.25	-6.30
Political Consensus	-0.07	0.02	-4.42
Inflation (logged)	0.21	0.05	3.91
ψ^3	*Estimate*	*Standard Error*	*t-value*
Intercept	2.43	0.48	5.10
Political Consensus	0.12	0.06	2.11
Inflation (logged)	-0.13	0.10	-1.27

the predicted values using a linear model. The plot of the randomized residuals suggests that the residuals appear to be randomly scattered around zero, with no obvious pattern. The plot of the fitted residuals show that the fitted models depart from the linear model's predictions in important ways.

4.6 Conclusion

This chapter summarizes the theoretical argument made in previous chapters and tests whether or not political opposition (consensus) affects the precision of information that political elites reveal in the news media. Previous literature contends that political opposition leads to an increase in country level inflation because policy gridlock either increases the money supply or increases future policy uncertainty. In contrast, I suggest that, under conditions of political opposition, political elites are more likely to disseminate clear and precise information to the public. After finding some supportive evidence, the following chapter examines whether or not an increase in precise and truthful information lowers uncertainty, reducing households' inflation expectations and, consequently, lowers inflation.

In order to test whether political elite opposition (consensus) matters to information precision, I construct a new dataset of elites' inflation announcements in the news. Additionally, I also construct a new dataset on announced policy changes to the monetary regime as a way to indirectly measure political elites' opposition over economic policy. As predicted by the hypothesis, I find that an increase in the level of political elite consensus is negatively associated with information precision. I also find that while this effect is negative for non-zero outcomes, political consensus is also less likely to be associated with no

inflation announcements.

This chapter highlights the relationships between inter-elite competition and information dissemination. While previous research explores the relationship between elite communication and public opinion, less understood are which political factors help determine the supply of transparent and clear information. This chapter shows how inter-elite competition can generate more precise information. Assuming that political elites have an informational advantage and a strategic interest in influencing their audience, the chapter contributes to understanding of those conditions that yield better (i.e., more truthful and precise) information flows and those conditions that do not.

Chapter 5

Testing the Argument: Economic Performance

5.1 Introduction

This chapter examines whether or not differences in information, disseminated by political elites, systematically explains differences in inflation expectations and inflation outcomes. Previous literature argues that countries with greater degrees of political opposition are more likely to have higher inflation outcomes. Evidence presented in the previous chapter, however, finds that for those countries that enact economic reforms, countries with greater political opposition are more likely associated with more precise information, whereas countries with greater political consensus are more likely associated with less precise information. The task of this chapter, therefore, is to consider whether or not information precision quells uncertainty and lowers inflation. To highlight the chapter's findings, I find that an increase in precise information is associated with a decline in inflation expecta-

tions and a decline in inflation. Furthermore, the substantive results are large, especially for those countries experiencing high and hyper inflation. In addition to finding support for these claims, I also find that countries vary substantially in their estimated effects. The next section reviews the hypotheses tested in this chapter and introduces the empirical model. The next section introduces the data. The following sections present the empirical results. The final section concludes.

5.2 Information, Inflation Expectations, and Inflation

The theoretical argument advanced in Chapter 3 suggests that political opposition increases the likelihood of political elites disseminating precise information, and that an increase in precise information should lower uncertainty, lowering households' inflation expectations, and lower inflation outcomes. The first part of this causal mechanism is examined in the previous chapter. In contrast to that chapter, in this chapter, I examine the influence of information precision on economic variables. In the previous chapter, I present evidence suggestive that, for those countries that enact economic reform, the greater the degree of political opposition (consensus), the more (less) precise information is revealed in the news. The next link, therefore, is to examine the effects of information precision on economic expectations of households and economic outcomes. One observable prediction from the model is that those countries with greater information precision, which is itself determined by elites' strategies, are also likely to have lower levels of inflation expectations and, in the aggregate, lower inflation. Therefore, the remaining testable hypotheses derived from the theoretical model are

H2 Inflation Hypothesis: *Countries with ex ante political opposition and moderates are more likely to have lower inflation than those countries with either ex ante political consensus or ex ante political opposition and extremists*

H3 Information Hypothesis: *As the precision of political elites' information increases (decreases), changes to households' inflation expectations will yield lower (higher) levels of aggregate inflation*

H3 is the hypothesis I evaluate in this chapter using the following strategy. Because the elites behave strategically and that communication is an outcome of political elites' strategies, I cannot put all of the variables together into a single regression equation. As a result, **H2** is evaluated through the aggregation of inferences made in this chapter and also the previous chapter. I present a summary of all the empirical evidence at the end of this chapter.

5.3 The Empirical Model

Individuals with different levels of inflation expectations live in countries with different inflation rates. In addition to living in a particular economic environment, individuals also live in and are influenced by different information environments. What I mean by information environment is the general sense of information about the future economy as reported by political elites and collected and distributed by the news media. Because each individual lives in a particular context, it is important to specify an empirical model that can easily accommodate differences in the economy and differences in information that households experience. Moreover, the empirical model must also be able to accommodate data at dif-

ferent levels of analysis. Such a data structure implies that the correct model specification is a multilevel model, where group-level contextual information is able to influence the individual-level variables and individual-level variables are able to influence country-level aggregates.

The panel of countries that I use to test **H3** comprises of i households. These households receive political elites' proclamations over the course of a month. They also live in a sum of j countries. This creates a dataset where households are indexed by country month. The main outcome variable that I am trying to explain is annual inflation, π_t. This is measured using data from the IMF's international financial statistics and disseminated by the World Bank's World Development Indicators. For every given month, the country has an expectation of what annual inflation is. This is important as most contracts are made for an extended period of time; labour contracts, for instance, may be made for a year. There are two important limitations of setting up this model this way. First, as the year progresses, agents should have a better understanding of annual inflation. In other words, inflation expectations may be autoregressive. I account for this by controlling for last years average inflation. Second, in very high inflation environments, the duration of important contracts is known to shorten. For example, in hyperinflation countries, workers may demand that they renew their labor contracts weekly. I do not account for the differences in contacting which may be endogenous to a countries level of inflation. I merely assume (as does the inflation expectations data) that the value of interest for the household is annual rates of inflation.

Next, I set up a model of country-level, annual inflation that is predicted to be a function of households' monthly predictions of annual inflation, $\pi^e_{m,ij}$, and previous annual inflation

levels, $\pi_{t-1,j}$, as well as accounting for a country-specific intercept. For a measure of households' inflation expectations, I use survey forecast data. For lagged inflation, I employ the same data as the outcome variable from the IMF, lagged one year. Finally, I then interact households' monthly inflation expectations, $\pi^{e}_{m,ij}$, and information they receive from their own domestic political elites, $I_{m,j}$, via the news media. The level of elites' information precision is a variable that I construct from newspaper articles in Reuters news. The measure that I use is the proportion of precise announcements made in a given country month. The measurement strategy that I use to construct this variable is outlined extensively in the previous chapter, pages 14 to 18.

5.3.1 Estimation Model

The estimation model is relatively simple. The empirical model consists of two model levels. The first model level relates the input variables to the outcome variable by way of a simple normal regression equation. In this case, the model relates inflation to households' inflation expectations, last year's inflation, the degree of informativeness of elites' pronouncements, and the interaction between households' inflation expectations and how precisely information is revealed by elites. In addition to this simple regression equation, because I expect that there is significant across country variation, the second level specifies that all of the coefficients in the first level are allowed to vary by country. In notation, such a model looks like the following

$$\pi_{t,j} = \beta_{0,j} + \beta_{1,j}\pi^{e}_{m,ij} + \beta_{2,j}\pi_{t-1,j} + \beta_{3,j}I_{m,ij} + \beta_{4,j}\pi^{e}_{m,ij} * I_{m,j} + \epsilon_{\pi} \tag{5.1}$$

$$\beta_k \sim N(\gamma_k, \omega_k^2) \tag{5.2}$$

Because the model is Bayesian and the coefficients are given their own probability distribution, the second set of equations, (4) and (5), provides specification for the hyper-parameters of the model.

$$\beta_k \sim N(\mu_k, \sigma_k^2) \tag{5.3}$$

$$\sigma_{\beta_k}^2 \sim U[0, \kappa] \tag{5.4}$$

5.3.2 Priors

The full empirical model specification includes making choices about model priors. [1] Priors are simply the analyst's beliefs about the estimates prior to observing the data. While I suspect that there is across country variation, I have no prior beliefs about which countries will exhibit stronger or weaker effects. Therefore, I assume that the parameter estimates are all drawn from a random normal distribution. One benefit of using the normal distribution is that the parameters are fully characterized by estimates of their mean and variance.

In addition to the normality assumption on all the variables of interest, I use vague but proper uniform priors over the standard deviations. This strategy is recommended by Gelman and Hill (2007) in order to assist estimation. When assuming the uniform distribution for the standard deviation, the analyst must specify an upper bound, or κ. As

[1] Model priors here are distinct from households' prior beliefs.

shown above, I denote this upper bound as κ.[2]

The benefit of using a multilevel strategy is that it is possible to model the data generating process as it works in the theory. A second benefit of a multilevel strategy is that it can account for individual- and country-level variation simultaneously and without model over-fitting (Gelman and Hill, 2007). In the theoretical model, the household is at the heart of the data generating process and is both the mechanism producing the country-level variables of interest and is simultaneously responding to country-level factors. An empirical model that only relies on individual-level data or only relies on country-level data yields a weak test of the theory. Instead, a multilevel model can account for both individual- and country-level variation at the same time. Finally, a third benefit is that, in order to test our theory explicitly, it is necessary to determine whether there is conditional variation in the regression coefficients. A non-varying regression estimate cannot provide such a test while taking into account important variation across countries.

5.4 Data

The panel that I use to test **H3** consists of the same six countries from Latin America (Argentina, Brazil, Colombia, Mexico, Peru, and Venezuela) that I examined in the previous chapter. The years in the panel are those years between 1993 and 2010. Despite the fact that there are only six countries in the sample and seventeen years (204 months), across these six countries and seventeen years, there is enormous variation in the inflation experi-

[2] An uninformative conjugate prior from the inverse gamma distribution is also often used in the literature. For a discussion on the benefits of using the vague but proper uniform priors instead of the inverse gamma faction, see Jackman (2009).

ences in the region during this time. The variety of the experiences offer an excellent test of the theory. Consider a couple of historical examples:

In 1991, Argentina enacted the "Convertibility Program." This program attempted to improve the country's macroeconomic policy credibility and to establish inflation stability. The initial success of Argentina's fixed exchange rate regime brought Argentinian inflation down to annual rates as low as negative one percent in 1999, or deflation. In 2002, however, Argentinian inflation rose again to rates over twenty-five percent. During the same period, other Latin American countries, including Mexico and Brazil, faced economic crises of their own. Mexico during this period faced double digit inflation, averaging approximately twenty percent over the 1990s, whereas Brazil, despite starting the 1990s with a major bout of hyperinflation, managed to keep inflation under ten percent throughout much of the 2000s. Venezuela's economy was less volatile but similarly plagued with inflationary problems. Inflation was as high as one-hundred percent in 1996, and never fell below double digits over the decade. Finally, Brazil reported the maximum inflation level in the region in 1993, with annual inflation reported at over two-thousand percent. Like the earlier attempts to tame hyperinflation in Argentina and in Israel, Brazil attempted to reform the macroeconomy by adopting the "Real plan." The Real plan included the introduction of a new currency, the de-inflation indexation of the economy, an initial freeze of public sector prices, and finally tightening of monetary policy. These policies sent inflation rates down from 45 percent during the second quarter of 1994 to less than one percent in 1996.

5.4.1 Dependent Variable: Inflation

As outlined previously, the main outcome variable I want to explain is annual inflation. Inflation refers to rate at which the level of prices for goods and/or services are accelerating in the economy. Deceleration in prices, such that the rate of change in prices is still positive but is slowing down, is called disinflation. For example, an inflation rate of twenty percent per annum means that the price level of goods and services is rising at a rate of twenty percent over the year. If the next year this rate of price changes is ten percent, there is inflation of ten percent and year-over-year disinflation of ten percent. If instead of being positive, price changes are negative such that the rate at which the level of prices for goods and services is declining, this is deflation. Deflation is a relatively rare phenomenon. In order to understand inflation, disinflation, and deflation, consider a metaphor: inflation can be likened to driving a car. When driving a car, the driver can either accelerate, decelerate (while still moving forwards), or move in reverse. Moving forward at an accelerating speed is inflation; moving forwards while decelerating to a stop is disinflation; finally, going in reverse is deflation.

A change in the rate of the "price level" is an abstract concept where "price level" is an unobserved variable. In order to construct a measure of the "price level," national statistical offices measure inflation by considering the rate of change of a representative basket of goods and services over time. The measure that I use is a weighted basket of goods and services purchased by households, or the consumer price index (CPI).

According to the Organization for Economic Cooperation and Development (OECD), for most countries, the compilation of CPI measures are constructed in accordance with

international statistical guidelines and recommendations. It is likely, however, that individual countries depart from international guidelines, leading to a loss of comparability across countries and over time. According to the OECD, some of the suspected cause of across county or over time problems is due to discrepancies in the choice of weights, differences in quality, new items, and major expenditures such as rents and housing which may vary across countries due to government regulation of housing markets and rent controls (OECD, 2011).

Before consumer price data is released, country data is often pre-treated by a country's national statistical office. This means, in theory, removing seasonal variations in prices. In practice, however, seasonal variation is not always taken out, or the methodology used for extracting seasonal variations may vary across country. This is another reason why country-level groupings are an important consideration.

In addition to differences in data construction, some national statistical offices have low statistical capacity and/or poor data collection. Some countries may not be able to collect and disseminate consumer price index measures at all, leading to a pattern of non-random missing data. For example, for any given sample of countries with missing data, the pattern of missing data may be related to level of income, urbanization, or institutional capacity of the reporting country. Finally, countries may also mis-report official statistics for political objectives. For example, beginning in 2006, it is thought that Argentina has systematically mis-reported its official CPI measures, reporting official inflation two to three times below actual changes in the price level of consumer products in the country (Cavallo, 2012).The government refuses to acknowledge the true rate of inflation, with the official measure at 9.5 percent (year over year), more than half the likely pace of price increases. Moreover,

independent economists are being persecuted by officials for producing accurate CPI estimates.

In order to manage these potential measurement problems and pitfalls, it is important to correct for methodological differences. Alternatively, if data correction is impossible, it is important to evaluate the degree of across-country reliability and comparability of the measurements. This concern is particularly critical in the case of missing values. Commonly, scholars tend to ignore the problem of missing data, dropping these countries from the analysis during estimation. Failure to correct for missing data, however, has known consequences (King et al., 2001). As a consequence of these warnings, direct modeling of the missing data is incorporated into the Bayesian analyses. I do this by assuming that all imputed missing data are normally distributed.

The data for inflation that I use is a country's annual consumer price measure. This data is distributed to the World Bank and is collected from national statistical offices and disseminated by the International Monetary Fund according to agreed upon international standards.

5.4.2 Independent Variable: Inflation Expectations

In order to measure one of my key independent variable, inflation expectations, I use monthly professional forecast data of current year's annual inflation. The professional forecast data is from Consensus Economics and is proprietary data. Consensus Economics is a for-profit organization that polls economic experts each month to get their views on changes in key macroeconomic indicators. Every month, Consensus Economics surveys

around 120 prominent Latin American economic and financial forecasters for their estimates of a range of variables including future growth, inflation, foreign trade, interest rates and exchange rates. The actual series that I use is the current year forecasted change in consumer prices. Measures of consumer prices are December-on-December percentage changes. Coverage starts as early as 1993 and ends in 2010. The number of forecasters polled in a given month varies, ranging from seven forecasters to twenty-three forecasters for a given month, for a total of 13,829 forecasts. While the frequency of the forecast data is monthly, each month, the forecaster forecasts the current year's annual inflation rate.

In order to show the relationship between inflation and inflation expectations, Figure 2 shows a scatterplot of logged inflation expectations and logged annual inflation for the six countries in the sample between 1993 and 2010. In order to make the countries comparable, I force the axes to have the same scale. In doing so, some of the countries with comparably lower inflation histories, such as Peru, get clumped at the bottom. It is apparent, however, that inflation is positively associated with inflation expectations. What is also apparent is that as inflation increases the distribution of inflation expectations widens substantially, leading to a funnel shape. This is perhaps best shown by Mexico, and I include a closer view of Mexico in Figure 2.

One potential problem with using experts' expected inflation data to measure households' expected inflation data is that expert forecasters may have similar private information as political elites. If the forecaster is privy to the same expert information as political elites, it may be the case that there will be stronger covariation between pronouncements by political elites and forecaster inflation expectations. Why this is important is that covariation in the data may be due to shared "private information" instead of obtained information

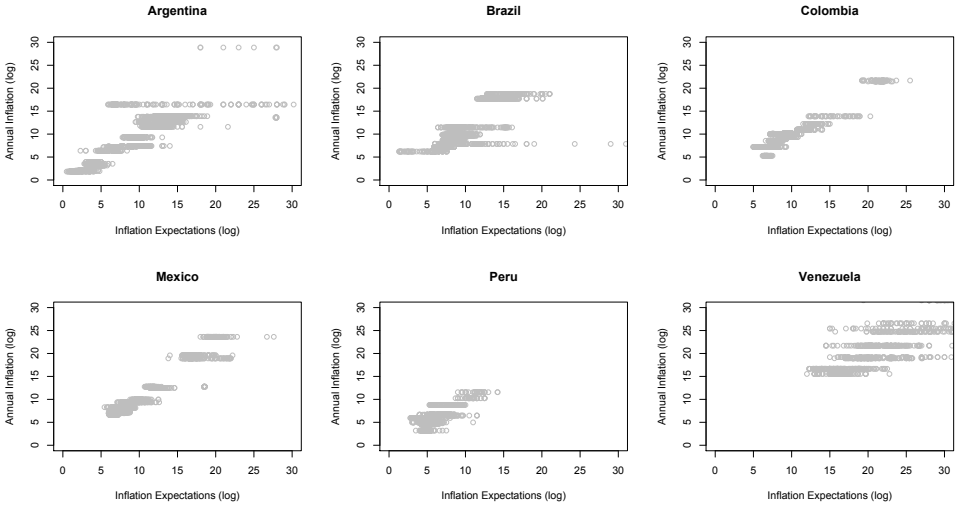


Figure 5.1: Inflation expectations and annual inflation, various countries

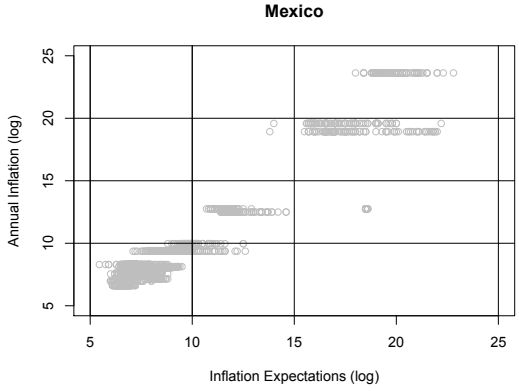


Figure 5.2: Inflation expectations and annual inflation, Mexico

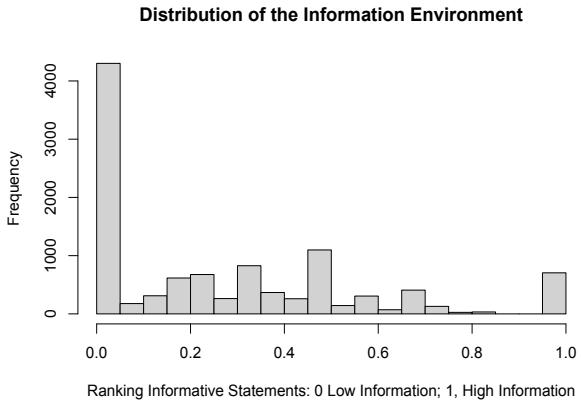


Figure 5.3: Frequency of newspaper articles by information precision (Monthly)

by political elites' signaling. Unfortunately, however, a large dataset measuring household inflation expectations for a sample of countries over time is unavailable.

5.4.3 Independent Variable: Information Precision

This variable is constructed exactly the same way as discussed in Chapter 4 (pages 8 through 14). The only difference in this application is that the information variable is aggregated to the monthly as opposed to the quarterly frequency. I do this in order to match the time frequency of the data for inflation expectations.

5.5 Classical Analysis

First, I ignore the fact that there are country-level groupings and proceed with a classical interaction model. Because both the outcome variable, inflation, and the input variables,

inflation expectations and previous year's inflation, are logged, the coefficients can be interpreted as the expected proportional change in inflation per proportional change in inflation expectations and per proportional change in previous levels of inflation (Gelman and Hill, 2007). For each one percent difference in last year's inflation, the predicted difference in inflation is 0.24 percent. The other variables, inflation expectations and informativeness, are interactive, and therefore, in order to be interpretable, we must consider their constitutive effects.

The finding from the pooled and unpooled (fixed effects) are reported in Table 1. Because our variable of interest is an interaction term, in order to interpret the interaction term it is important to measure the effects of increasing informativeness on the influence of inflation expectations on inflation. The graphs below show the marginal effects of an increase in informativeness on inflation expectations for both the pooled (left) and unpooled (right) models in Figures 5 and 6. The standard errors of the estimate at each level of informativeness are given by the dashed lines, whereas the estimated effects are given by the downward sloping line.

Table 5.1: Classical Regression Analysis with Interaction

Variable Name	Pooled Coefficient and Standard Error	t-value	Unpooled Coefficient and Standard Error	t-value
Intercept	-0.07 (0.01)	8.79		
Logged Inflation Expectations	0.78 (0.00)	226.95	0.79 (0.00)	231.79
Previous Year's Logged Inflation	0.24 (0.00)	92.21	0.23 (0.00)	85.21
Information Precision	0.14 (0.02)	7.76	0.04 (0.02)	6.05
Logged Inflation Expectations * Information Precision	-0.05 (0.01)	-6.59	-0.04 (0.01)	-4.16

The main problem with complete pooling is that complete pooling completely ignores variation in the average effects between counties. This is true not only for the intercept term, but also for the coefficients of interest. Alternatively, using the fixed effects model

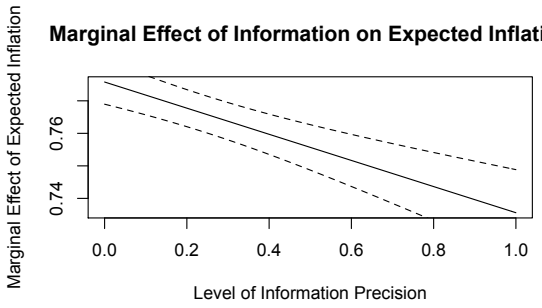


Figure 5.4: Pooled model for a selection of Latin American countries: 1993-2010

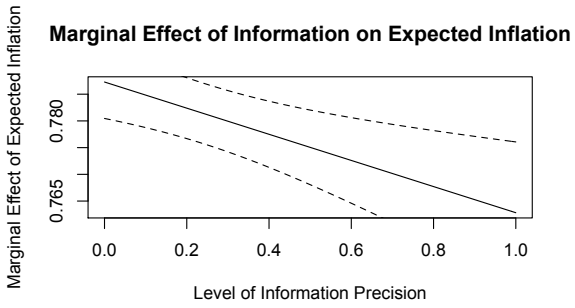


Figure 5.5: Unpooled model for a selection of Latin American countries: 1993-2010

means that the average or global estimate, either for the intercept or the coefficients, is not used at all. Because there may be important differences across countries, a better test of the theory is one that considers both country-specific and average effects in the model. In order to capture this, I turn to Bayesian multilevel modeling.

5.6 Bayesian Multilevel Modeling

As discussed at the beginning of this chapter, there are important benefits to using a Bayesian multilevel strategy when compared to classical analysis. One of the most important reason is that a Bayesian multilevel strategy can account for individual and country level variation simultaneously and without model over-fitting (Gelman and Hill, 2007). Furthermore, in order to test **H3** explicitly, it is necessary to determine whether there is conditional variation in the regression coefficients, especially the interaction term, $\beta_{j,4}$, and its components, $\beta_{j,1}$ and $\beta_{j,3}$. A non-varying regression estimate cannot provide such a test.

I fit the Bayesian multilevel model using the Gibbs sampler software JAGS. I run the model using five chains for 100,000 iterations and discard the first 10,000 iterations. After fitting the data, I conduct diagnostic plots including trace, density and autocorrelation plots.

Upon inspection of the plots, everything looks as expected except the posterior estimate of informativeness for Peru. Because the informative measure is also included in the interaction term, both parameters show a non-smooth normal posterior distribution. For these estimates, there is one larger probability density mass centered close to -0.05 and another, small probability mass centered closer to -0.2. The trace plots also show convergence for all parameters with the exception again of these same parameters. Therefore, extra caution must be taken in interpreting the parameter estimates for Peru. As we will see, this uncertainty also shows up in the extended credible intervals for Peru in the coefficient plots in figure 6.

Once I am relatively certain that the model has converged, I examine the posterior coefficient estimates for country variation. The average means are very similar to those reported in Table 1 above. I replicate that table and add in the new, grand means or average effects. One of the important differences between the models is the difference in the uncertainty estimates. The Bayesian multilevel model generates larger uncertainty estimates than either the pooled or the unpooled models. Because the Bayesian specification models missing data instead of discarding those observations with missing data from the analysis, the estimates are less likely to be biased by non-random data selection which may occur in listwise deletion, and better incorporates the missing data into each parameter's measure of variance. I do not replicate the marginal effects plots, as the grand mean coefficients are nearly identical across the model specifications.

I then examine across country variation in estimates. Figure 6 shows the estimated country-specific coefficients from the Bayesian multilevel model and their associated credible intervals. The thicker line reflects 68 percent credible intervals and the thinner line 95

Table 5.2: Across model comparison: Pooled, Unpooled, and Bayesian

Variable Name	**Pooled Coefficient and Standard Error**	**Unpooled Coefficient and Standard Error**	Bayesian MLM and Standard Error
Intercept	-0.07 (0.01)		0.07 (0.09)
Logged Inflation Expectations	0.78 (0.00)	0.79 (0.00)	0.76 (0.04)
Previous Year's Logged Inflation	0.24 (0.00)	0.23 (0.00)	0.20 (0.04)
Information Precision	0.14 (0.02)	0.04 (0.02)	0.09 (0.07)
Logged Inflation Expectations * Information Precision	-0.05 (0.01)	-0.04 (0.01)	-0.05 (0.04)

percent credible intervals. Like I mentioned above, the credible intervals for Peru are much larger than the credible intervals for the other countries. Upon inspection of the data, I find that the proportion of missing values for Peru is much larger than the proportion of missing values for the other countries. In order to show how reasonably the parameter estimates fit, I also include an illustration of their posterior probabilities. For all countries, most of the probability mass for the estimates are away from zero and negative. As discussed, there seem to be two likely outcomes for Peru, suggesting that the estimates for Peru are less stable than for the other countries.

As expected, the parameter estimates do exhibit across country variation. My main focus is the variation in the interactive term, $\beta_{j,4}$, which is shown on the bottom right of Figure 6. Putting aside Peru because of possible unreliability, Argentina has the largest negative effect, suggesting that information may play a greater role there than other countries. Interestingly, Venezuela also exhibits a relatively large negative effect. This is surprising because Freedom House indicators for media freedom place both Mexico and Venezuela in the category of not having a free press (Freedom House, 2012). In other words, despite the fact that both Mexico and Venezuela have restrictive media regimes, the influence of information precision has a larger influence on inflation expectations in Venezuela than in Mexico. This suggests that something in addition to media transparency is causing variation in the effect of information on inflation expectations.

Figure 5.6: Country-specific parameter estimates and their associated credible intervals

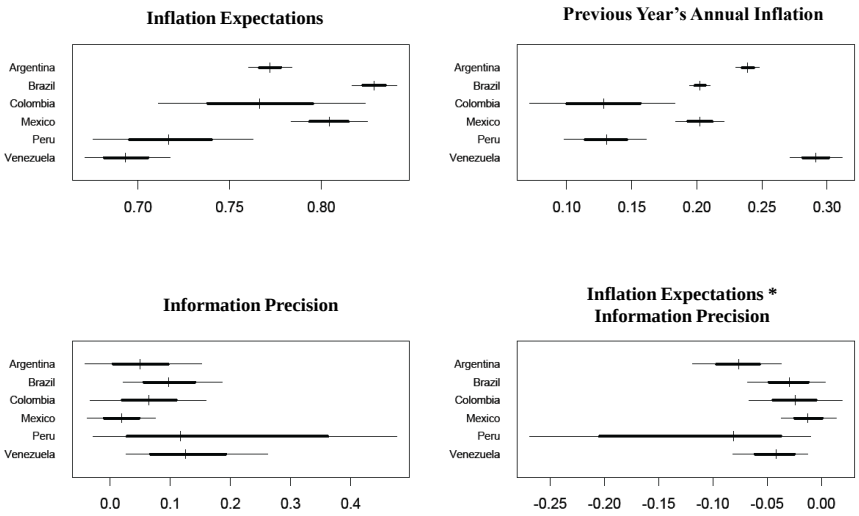
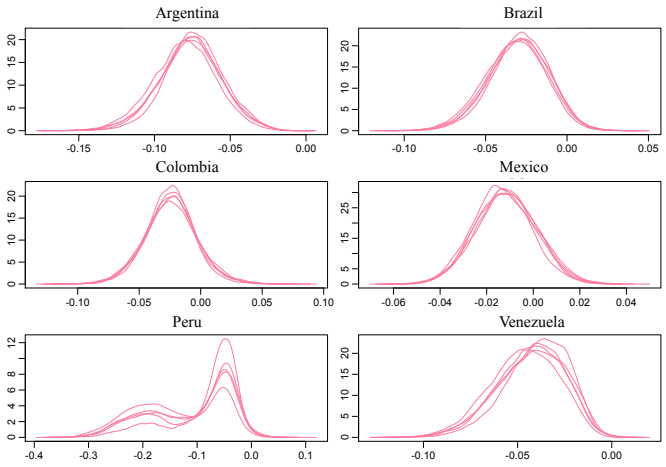


Figure 5.7: Country-specific parameter estimates for Inflation Expectations*Information and the parameter's posterior distributions



5.7 Opposition, Communication, and Economic Performance

Finally, the prediction from **H2** is that countries with greater degrees of political opposition are more likely to have greater levels of information precision. In addition, information precision is predicted to generate lower inflation expectations and lower inflation, whereas information imprecision is expected to generate higher inflation expectations and higher inflation. In the aggregate, if households have expectations that inflation will be high, such that households negotiate these inflation beliefs into their wage contracts, and if, given an increase in the cost of labor, firms recoup these costs by passing along price increases to consumers, household expectations of higher prices can engender inflation. The reverse is also true. If inflation expectations are formulated such that, taking account of precise information, the household expects that inflation will be lower than previously, in the aggregate, if households negotiate these inflation beliefs into their wage contracts, and if, given a decrease in the relative cost of labor, firms lower their prices, household expectations of lower prices can engender disinflation. As we see in Figure 6, there is some evidence that greater levels of information precision can help to lower inflation. This is due to the fact that more precise information attenuates uncertainty, lowering the effects of higher inflation expectations and consequently, lowering inflation.

In Chapter 4, I demonstrated that an increase in the level of political elite opposition (consensus) is positively (negatively) associated with an increase in information precision. I also show that while this effect is negative for positive values of information precision, political consensus is also more likely to be associated with some information. What this means is that there is some evidence to support the idea that greater political elite consensus

is necessary in order to get information. Once information is disseminated, however, it is political opposition and not consensus that matters for the precision of information in the news media. Political elites with opposition are more likely to reveal precise information to the public than similar elites in countries where opposition is smaller. While previous research does hold up in terms of the proposition that greater consensus is positively associated with the likelihood of enacting reforms, once costly reforms are undertaken, consensus actually limits the clarity of communication that political elites can disseminate. What this also implies is that those countries that do surpass the challenging hurdle of consenting to inflation reforms, competition amongst political elites enable the public to learn more precisely about the future economy from the things that political elites say.

What does this mean in terms of alternative explanations? Alternative explanations are therefore correct in specifying that when a country has a greater amount of political opposition, the country is less likely to engage in costly economic policymaking. Such a delay in stabilization, especially if it accompanies an increase in the money supply, may very well increase a country's inflation rate. What previous arguments cannot claim, however, is that countries with greater political opposition are more likely to have higher inflation. As I have shown, countries that do enact relevant policy changes produce better information (more truthful and more precise) than countries with lower levels of opposition. Truthful and clear information has a negative influence on households' inflation expectations, lowering their uncertainty about the economic future. In the aggregate, I find that an attenuation of inflation expectations due to information alone can be very large, especially for countries experiencing high and hyper inflation. In summary, there is support for hypothesis **H2**: countries that enact inflation stabilization reforms based on a collation of oppositional

but yet moderate political elites disseminate more precise information to the public. The public responds systematically to an increase in information in the news. An increase in information precision in the news attenuates their expectations, causing inflation to decline.

5.8 Conclusion

In this chapter, I empirically test whether political elites' communication strategies exert an influence on inflation. Previous literature contends that political polarization will lead to an increase in country-level inflation because of the influence gridlock has on future uncertainty. By contrast, I present a model that suggests that under some conditions, political polarization can actually lower inflation. The reasons for why this is the case is that differences in political polarization are expected to change the degree of information precision that political elites can disseminate to the public.

In order to test this claim, I construct a novel dataset where individuals living in countries receive pronouncements from political elites. I then test whether or not these announcements exert any influence on inflation expectations. As predicted by **H2**, I find that an increase in the level of informativeness of elites' statements to the public attenuates the effect of inflation expectations on inflation and lowers inflation. I also find that while this is true on average for a sample of six countries in Latin America, there is important across country variation. While all of the countries seem to show the same directional effect, some countries, such as Argentina and Venezuela, exhibit stronger effects than other countries such as Mexico.

Chapter 6

Conclusion

6.1 Introduction

This dissertation project provides a new explanation of inflation. It considers the role of communication in explaining changes in inflation expectations and changes in inflation outcomes. The project examines how political factors, namely political elite opposition and political elite consensus, helps determine the credibility and clarity of elites' speech. It presents an argument identifying when political elites will disseminate more credible and precise information to the public and when they will not. One of the important findings is that, under conditions of political opposition, political elites disseminate more precise information than they do under conditions of political consensus. A second important finding is that, due to an increase in information precision, political elite opposition attenuates households' inflation expectations, causing a reduction in inflation outcomes.

This research is distinct from previous research in important ways. The theoretical argument makes a number of departures from existing literature. Unlike previous explana-

tions that examine how changes in the money supply changes the economy, this dissertation examines how, by disseminating their private information using their words, political elites change the public's perceptions of the future economy, which then changes the economy. In other words, in this project, changes in inflation results from changes in beliefs about the future, not as a consequence of change in money growth. While this is not to say that institutions are unimportant, the argument suggests that policymakers can change inflation even in the absence of augmenting the money supply. Through the things that they say, policymakers have tools at their disposal, which can alter the economy in profound and systematic ways. Furthermore, this is true even if policymakers are outside a given institution. This is also important as it means that policymakers can be effective even during financial crises when a further reduction in interest rates using more traditional tools is impossible.

Chapter 2 introduces the previous literature. It provides a road map of previous explanations of inflation. It identifies key characteristics, which, I argue, are needed for a new model of inflation stabilization. It highlights three necessary components: inter-elite bargaining, information transmission (from those most informed to those less informed), and the ability for those less informed to learn about the economy. Chapter 3 then introduces a formal model with these features. Customizing a generic model from game theory and applying it to the study of inflation, I derive important hypotheses that predict those conditions that will lead to successful inflation stabilization and those that will not. Chapter 4 and Chapter 5 test the theoretical predictions derived by the theory.

In order to apply appropriate empirical tests, I develop two new measures and I introduce these measures in Chapter 4. The first measure is a measure of political elite oppo-

sition over monetary policy. Applying insights from previous research, which suggest that countries with greater degrees of political consensus are more likely to enact reforms, I construct a new measure of political opposition (consensus). While this measure has some benefits, it also has some important limitations. For one thing, it cannot distinguish between political opposition when there are moderates and political opposition when there are extremists. Instead, I must rely on the assumption that the more extreme the opposition is, the less likely there will be a pronounced change. The second measure that I develop is a measure of information precision. Here, I collect inflation-related news articles. I reduce each article's word counts into a word frequency table. I then group together the news articles, collecting those that have similar word counts. Discarding non-inflation related news articles, I process the remaining articles into information types. Finally, I generate a proportional measure of precise inflation news for a given quarter (Chapter 4) or month (Chapter 5). I employ this measure as an input variable in statistical analyses conducted in Chapters 4 and 5.

Both empirical chapters lend some (although not overwhelming) support for the theory that I advance. Using both new measures, the evidence presented in Chapter 4 suggests that for those countries that announce a change to the monetary regime, greater political opposition is more likely to be associated with a greater degree of information precision and greater consensus is more likely to be associated with a lesser degree of information precision. This provides some supportive evidence of my theory. Moreover, this finding is robust to a number of model changes. One thing of concern, however, is that the model's residuals tend to be negatively biased, suggesting better model fit might be possible. Future work must endeavor to develop a better model in order to further evaluate the findings reported

here. As a first step, however, the results are sufficient to suggest that future work should be directed towards these efforts. Chapter 5 also presents some support for the proposition that an increase in information precision leads to an attenuation in inflation expectations and in inflation. Another limitation is that inflation expectations data is not available for households across countries and over time. The evidence provided here may work best for an analysis of other sophisticates, who may have access to better information *a priori*. Despite these limitations, however, the most interesting result from Chapter 4 is the relatively large country-level variation in the estimated coefficients. While the Bayesian grand mean estimate does not depart very far from classical regression estimates, the country coefficients range from -0.10 for Argentina and Peru to -0.03 for Mexico. Future research should exploit this across-country variation, seeking to explain factors other than political opposition that may help to explain variation in information precision.

6.2 Implications

One important insight from my model and the empirical evaluations of the model offered is that political competition leads to an improvement in both the credibility and also the clarity of political elites' statements. As a consequence, better information also seems to yield better economic performance. This result is striking for a number of reasons. First, the argument and its application to inflation presents some evidence that democracies with competitive opposition yet moderate forces are the best form of government in terms of producing the highest information quality. While it is perhaps not surprising that democracies yield better information, unlike an argument that depends on the quality of domestic

institutions in producing good information, such as an independent media, courts, or even a central bank, the theory here shows that micro-level strategic behavior amongst competing elites will endogenously incentivize political elites to reveal better information. Therefore, the finding offer a micro-level behavioral story for why we should expect competitive democracies with moderates to have better economic performance, especially lower inflation. This is important as it coincides with a number of previous empirical findings that report a positive statistical association between democracy and lower inflation. Second, the claims and evidence offered also suggest that it is unhelpful and unwise to imagine policymakers, including central bankers, as dispassionate technocrats concerned solely with *optimal* policy. In fact, the model I offer and the empirical evidence that I present suggests that well-functioning economic policymaking has the characteristics of political plurality. This suggests that when appointing central bank governors, it is perhaps more productive to have policymakers with different inflation preferences making policy. This also suggests that policymaking by committee may actually be a more effective from of economic governance than policymaking dominated by a monopolist. Over the last decade, we have seen a number of central banks move towards decentralizing their decision-making structure. The argument advanced in the dissertation suggests that the beneficiaries of decentralization are less-informed households. The decentralization of authority benefits the household both in terms of lower uncertainty and also better economic aggregates.

6.3 Suggestions for future research

While the research here focuses on inflation, my dissertation research also provide a strong foundation for two future research ventures. Firstly, my dissertation suggests that countries with inter-elite opposition provide their public with better information than countries without this opposition. To further evaluate this argument, it is necessary to develop a better measure of elite opposition and elite consensus. Specifically, we need a new way to compare economic policy preferences of political elites or their associated preference aggregators, such as political parties, relative to one another and relative to the average household. This is no easy task. Doing so requires linking or bridging disparate actors and estimating their preferences so that they can be placed on a similar policy space, valid across countries and over time. Second, it is important to correctly estimate who is a moderate and who is an extremist relative to his competitors. Again, having such a measure would go a long way in reducing the gap between theoretical concept and measurement. Using text analysis to accomplish this, while challenging, is in my view, an important task worth surmounting. Secondly, my dissertation project also contributes to the growing literature on fiscal deficit signaling and support for painful government austerity measures, especially in democracies. With the recent American and European financial crises, increasingly, political elites are trying to sell the public tough fiscal reforms. More often than not, the venue they chose to "advertise" their preferences and information about the future economy in the wake of such crises is through the news media. Using my dissertation, I have strong foundations which I can augment in order to draw predictions about which countries are more or less likely to succeed in implementing successful fiscal reforms.

Appendix A

A.1 Proposition and Proofs for Political Consensus

Proposition 1: When political elites have consensual *ex ante* preferences and they are both to one side of the household $|b_i| > |b_j| > 0$, the household's inflation expectations will be higher (lower) the greater (smaller) the difference in their preferences.
Corollary to Proposition 1: The closer the *ex ante* preferences of i and j, the lower the household's inflation expectations on average. Under political consensus, the lowest possible average inflation expectations is when elites hold the same preferences or $|b_i| - |b_j| = 0$.
Corollary 2 to Proposition 1: When both political elites have consensual preferences the possibility for inter-elite collusion will cause the representative household to have higher inflation expectations on average.
Corollary 3 to Proposition 1: When both political elites have consensual preferences, the less extreme elite is disciplined from opportunistically under-reporting θ, however, the disciplining comes at the cost of higher inflation expectations.

Proof. A proof is presented in Krishna and Morgan (2001).

Proposition 2: If both elites have preferences that are too far from the household such that $b_{i,j} > 0.25$, then there is no informative equilibrium. The household's inflation expectations will be determined by her priors given no new information.
Corollary 1 to Proposition 2 If the household's inflation expectations are determined by her priors given no new information, and she extrapolates that future inflation will be as high (or higher) than before, there will be inflation persistence and inflation stabilization is more likely to fail.

Proof. A proof for the limits of informative equilibrium is given in Crawford and Sobel (1982).

A.2 Propositions and Proofs for Political Opposition

Proposition 3: When i and j have opposing *ex ante* preferences, $b_i < 0 < b_j$ and that $|b_i| > -b_j$ and where at least one elite is a moderate, for all $\theta \leq 1 - 2b_j$, i perfectly reveals θ and j confirms.

Corollary 1 to Proposition 3: When i and j have opposing *ex ante* preferences such that they are in between the household $b_j < 0 < b_i$ and that $|b_i| > -b_j$ and where i or j is a moderate, political opposition is more informative than any other informative equilibrium.

Proof. A proof for the limits of informative equilibrium is given in Krishna and Morgan (2001) in the Appendix.

Corollary 2 to Proposition 3: When perfect revelation occurs, self-fulfilling inflation traps and sustained hyperinflation are less likely and successful inflation stabilization is more likely to occur.

Proposition 4: When political elites have opposing *ex ante* preferences such that they are in between the household $b_i < 0 < b_j$ and that $|b_i| > -b_j$ and where i or j is a moderate, for all $\theta > 1 - 2b_j$, only imprecise information is revealed in equilibrium.

Proof. This follows from the fact that the household's best response is linear and only a function of b_j.

Corollary 1 to Proposition 4: For all $\theta > 1 - 2b_j$, information precision increases as j becomes more moderate.

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