Information Frictions, Reputation, And Sovereign Spreads ⋆

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April 8, 2022

Abstract. We formulate a reputational model in which the type of government is time varying and private information. Agents adjust their beliefs about the government's type (i.e., reputation) using noisy signals about its policies. We consider a debt repayment setting in which reputation influences the market's perceived probability of default, which affects sovereign spreads. We focus on the 2007-2012 Argentine episode of inflation misreport to quantify how markets price reputation. We find that the misreports significantly increased Argentina's sovereign spreads. We use those estimates to discipline our model and show that reputation can have long-lasting effects on a government's borrowing costs.

Keywords: Sovereign Default, Reputation, International Lending.

JEL Codes: F34, F41, G14, G15, L14

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We thank Mark Aguiar, Michele Cavallo, Hal Cole, Alessandro Dovis, Felicia Ionescu, Nobu Kiyotaki, Ricardo Lagos, Hanno Lustig, Pablo Ottonello, Diego Perez, Thomas Philippon, Venky Venkateswaran, and Adrien Verdelhan for useful comments. This paper was previously circulated as "Information Frictions, Partial Defaults, and Sovereign Spreads." Disclaimer: The views expressed here are our own and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of anyone else associated with the Federal Reserve System.

1. Introduction

Policymakers usually perceive a country's reputation as an important type of gained capital to be kept over time. From a fiscal or monetary perspective, for instance, a government's history of achieving inflation or fiscal targets may affect how agents form their expectations, and thus shape the effectiveness of new policies being implemented. From a debt repayment perspective, honoring past debt obligations may affect a government's current borrowing costs and its access to different sources of credit. A crucial aspect is then quantifying how a government's reputation is affected by the policies it chooses, and how policies are, in turn, shaped by the government's reputation.

To answer these questions, we focus on a particular setting for which reputation may be a first-order concern: debt repayment. We develop a reputational model of sovereign default and provide new empirical evidence on the link between a government's reputation and its borrowing costs. The model contains multiple alternating government types, which differ in their willingness to default on their debt. Lenders do not observe the government type but use the information transmitted in the government's policies to infer it. In this context, reputation can be understood as the market belief about a government's willingness to repay given a set of macroeconomic fundamentals. Governments care about their reputation because it affects their cost of funding. The model provides a link between a government's reputation, its borrowing costs, and the policies it implements. The strength of this link depends on the way in which agents learn about the type of government from the information provided by its policies.

Guided by the model, we then go to the data and analyze a unique experiment that allows us to study the effect of a government's reputation on its borrowing costs. In particular, we focus on the Argentine 2007-2012 episode of inflation-report tampering as a case study. During 2007-2012, the Argentine government significantly underreported its inflation rate, which implied a de facto partial default on its stock of inflation-indexed bonds (IIBs). We show that the market priced the misreport, as reflected by a significant increase in the spreads of (dollar-denominated) nominal bonds. Given that coupon payments of nominal bonds were not directly affected by the misreport of inflation, we argue that the documented effects can be attributed to changes in the government's reputation.

We discipline our reputational model based on these empirical estimates. We then use the calibrated model to back out our model-implied measure of reputation and study the role of fundamentals behind the link between reputation and sovereign spreads. We show that (i) reputation matters more during "bad" states of the economy, because spreads are more sensitive to reputation in those states, and (ii) changes in reputation can have long-lasting effects on borrowing costs. Finally, we bring the model to the data and show that Argentina's loss of reputation can explain 30-50% of the increase in its sovereign spreads during the Global Financial Crisis.

Our model is in the spirit of Kreps and Wilson (1980) and Milgrom and Roberts (1982) with uncertainty about government type. In particular, we consider an infinite-horizon model that features incomplete markets, limited commitment, alternating government types, and noisy signals. We assume a risk-averse government that faces a stochastic endowment and issues debt in international markets. It lacks commitment and can default on its debt. There are two types of government: a commitment type (C) and a strategic type (S). Types are time varying following a Markov process. We assume that the types differ in their incentives to default. In particular, the S-type faces weakly larger incentives to default. Lenders do not observe the government type, they have a prior about the government being of the C-type (i.e., reputation), and use the information transmitted by the government's policies to update this prior. Under this setup, changes in lenders' prior about the type of government affect their perceived default probability, and therefore the government's borrowing costs.

In addition to debt and default policies, the government can choose from a policy $\tilde{\pi}$ that provides a benefit in terms of current consumption. We assume that the S-type can choose any value for $\tilde{\pi}$ but the C-type commits to $\tilde{\pi} = 0$. Although there are no direct costs associated with this policy, by setting $\tilde{\pi} \neq 0$ the S-type may signal its type, which affects its borrowing costs. Lenders do not perfectly observe the policy $\tilde{\pi}$ but receive a noisy signal about it, which implies that they only learn from it gradually. We interpret this policy as any action that can potentially provide information about the type of government. For the Argentine case, for instance, $\tilde{\pi}$ can be interpreted as the inflation misreport policy, since it may be informative about the government's willingness to default.

We then use the Argentine 2007-2012 episode of inflation misreport to analyze the effects of a government's reputation on its borrowing costs. During these years, the official Consumer Price Index (CPI) was intentionally underreported by the national government (see Cavallo (2013) and Cavallo et al. (2016) for detailed discussions).[1] We focus on this episode for the following reasons. First, the misreports were large and significantly affected coupon payments of IIBs.

[1] Cavallo et al. (2016) show that the lack of reliable official data led to the creation of several unofficial inflation indicators. Agents can then use these alternative indicators to get a noisy signal about the magnitude of the misreport.

During this episode, the amount outstanding on Argentina's IIBs accounted for almost a quarter of its stock of debt, so that the underreport of inflation had a great impact on the government's stock of debt.[2] Second, the misreports occurred frequently, which allows us to work with a large number of observations. Third, Argentina was not excluded from international debt markets as a consequence of this policy. We can then use secondary markets data to quantify the contemporaneous effect of the misreports on Argentina's spreads. Lastly, the misreport only affected coupon payments of IIBs. By studying the effects of this policy on other types of bonds (e.g., nominal bonds), we can then isolate the reputational effects of the misreport.

There are two main challenges in assessing the causal effect of inflation tampering on Argentina's spreads. The first is measurement, given that lenders cannot perfectly observe the "true" inflation rate and hence the magnitude of the misreport. Moreover, based on our reputational model, only unexpected changes in the misreport should have an effect on prices. If the market was expecting the misreport, that effect should already be priced. To address this concern, we consider changes in the break-even (BE) inflation rate as a proxy for the unexpected misreport.[3] Embedded in the BE inflation rate is the market's expectation about the inflation announced by the government, since these announcements directly affect the returns of IIBs. Changes in the BE rate around days on which the government reported the inflation rate can therefore be used to infer the market's surprise.

The second challenge is reverse causality, since inflation tampering may be the government's response to a rise in spreads. If that is the case, a simple OLS regression would yield biased point estimates. To address this concern, we adopt a heteroskedasticity-based identification strategy (Rigobon and Sack (2004)) and exploit changes in the volatility of the BE inflation rate around days on which the government reported the inflation rate. The main identifying assumption is that the volatility of shocks to the BE inflation rate is significantly higher around these announcements, but the variance of shocks to sovereign spreads (and other common shocks) remains the same.

We show that the sequence of misreports significantly increased the spreads of dollar-denominated bonds issued by the Argentine government. In particular, we find that a 1–sd decrease in the BE inflation rate leads to a rise in spreads that accounts for more than two thirds of their daily dispersion. Interpreted through the lens of our reputational model, given that

[2]By misreporting its inflation rate, Argentina decreased its IIBs payments by nearly \$3.2 billion, which accounts for around 1% of its GDP.

[3]The BE inflation rate is the level of inflation that renders an investor indifferent between holding nominal bonds or IIBs.

coupon payments of dollar-denominated bonds were not directly affected by the misreports, these results suggest that a government's reputation can play an important role in the pricing of sovereign bonds.

For the quantitative analysis, we discipline our reputational model based on these empirical estimates. In particular, we use the empirical elasticity to pin down how agents learn about the type of government through the information provided by the policies it chooses. Since our empirical elasticity relies on high-frequency market reactions, we provide a simple extension of our baseline model to include secondary markets. In this way, we can capture the intraperiod effect of $\tilde{\pi}$ on sovereign spreads, as we do in the data. We then use the calibrated model to compute a measure of reputation and to assess the role of fundamentals behind the link between reputation and sovereign spreads. We show that reputation matters more during bad states of the economy. This is because in bad economic times, spreads are significantly more sensitive to lenders' beliefs, which resembles the result in Cole and Kehoe (2000). Finally, we bring the model to the data and show that changes in reputation can have long-lasting effects on borrowing costs. In particular, we find that Argentina's loss of reputation can explain up to 30-50% of the increase in its sovereign spreads during the Global Financial Crisis.

Literature Review

Our paper relates to a large literature on how the presence of asymmetric information about a government's type affects its policies and different macroeconomic outcomes. Backus and Driffill (1985); Barro (1986); Persson and Tabellini (1997); Phelan (2006); and Dovis and Kirpalani (2020) examine the role of a government's reputation in the design of fiscal, monetary, and regulatory policies. In particular, our paper contributes to a growing body of work that studies reputation dynamics when players' actions are not perfectly observable (Bohren (2021); Faingold (2020); Board and Meyer-Ter-Vehn (2013); Faingold and Sannikov (2011); Ekmekci (2011); and Cripps, Mailath, and Samuelson (2004)). A close study in this regard is Dovis and Kirpalani (2021), who analyze the optimal transparency of governments' rules in a context in which the type of government is private information. We contribute to this literature by providing a framework that links a quantitative analysis of the role of a government's reputation with a relevant empirical counterpart.

Our paper contributes to the literature on sovereign defaults and governments' reputation. Close studies in this area are Cole, Dow, and English (1995); Alfaro and Kanczuk (2005); D'Erasmo (2011); Fourakis (2021); and Amador and Phelan (2021). As in our study, these papers analyze a sovereign debt model with limited commitment à la Eaton and Gersovitz (1981), in which the type of government is time varying and private information.[4] Our contribution to this literature is twofold. First, we consider a model in which a government's actions are not perfectly observable. This implies that agents gradually learn from the information transmitted by the government's policies. Second, based on the 2007-2012 Argentine misreport of inflation, we provide new empirical evidence on the link between a government's reputation and its borrowing costs. We then use those estimates to calibrate our model. In particular, we discipline how agents learn about the government type through its policies.

Our paper is related to a large empirical literature that estimates the effects of a government's history of (outright) defaults on its borrowing costs (see, for example, English (1996); Özler (1993); Reinhart et al. (2003); Borensztein and Panizza (2009); Cruces and Trebesch (2013); Benczur and Ilut (2016); and Catao and Mano (2017)). A shortcoming of these papers is that outright defaults are infrequently observed in the data and a country is typically excluded from debt markets after an outright default, which makes it hard to identify the effects of reputation.[5] Moreover, given that an outright sovereign default typically takes a long time to resolve, the default history may not be a good predictor of the current government's reputation. We address these shortcomings by focusing on an episode of recurrent partial defaults (i.e., the misreports) and by providing a high-frequency identification strategy using financial markets data.

Our high-frequency identification strategy is closely related to Bernanke and Kuttner (2005); Rigobon and Sack (2004); and, particularly, Hebert and Schreger (2017). Our work contributes in this dimension by estimating the short-run effect of Argentina's inflation misreport on its sovereign spreads. We argue that the documented effects are mainly due to changes in the government's reputation, and provide a quantitative model to formalize the mechanism.

Lastly, our paper is related to a quantitative literature on sovereign partial defaults. Arellano et al. (2019) provide a model in which a government can partially default on its debt obligations directly. Du and Schreger (2021); Ottonello and Perez (2019); Engel and Park (2018); Phan (2017a); and Aguiar et al. (2013) formulate models in which a government can partially default on its stock of nominal bonds by increasing the inflation rate. All of these studies assume either

[4] Another related paper is Cole and Kehoe (1998), in which the government type is private information but fixed. In turn, other studies, such as Phan (2017b); Sandleris (2008); and Dovis (2019), analyze models in which the type of government is public information, but in which the government uses debt and default policies as a signaling device about the economy's fundamentals.

[5] These studies do not disentangle whether the rise in sovereign spreads after a sovereign default can be attributable to a punishment or reputational effect. The exception is Benczur and Ilut (2016), who pose a structural-form asset-pricing regression to disentangle the role of reputation.

an exogenous output loss or exclusion from the markets as a punishment for partial default.[6] We contribute to this literature by providing a micro-foundation for the costs of partial defaults, based on a government's reputation in international debt markets.

The rest of the paper is structured as follows. Section 2 presents the reputational sovereign default model with noisy signals. Section 3 describes the empirical analysis, based on Argentina's inflation-tampering episode. Section 4 presents the quantitative analysis, and section 5 concludes.

2. A Reputational Model of Sovereign Default

2.1. *Model Description*

We consider a small open economy with incomplete markets that receives a stochastic endowment y, which follows a continuous Markov process with a transition function $f(y' \mid y)$. An infinite-lived risk-averse government issues debt in international markets to smooth its consumption. The government lacks commitment and can default on its debt obligations b.

There are two types of government: a commitment type (C-type) and a strategic opportunistic type (S-type). We assume that the government's type exogenously changes over time, based on a stochastic Markov process denoted by T.[7] Government types differ in their incentives to default. In the spirit of Kreps and Wilson (1980) and Milgrom and Roberts (1982), the type is not publicly observable. Lenders have a prior ζ about the government's being of the C-type and update this prior based on the information transmitted by the government's policies.

The government issues long-term non-contingent bonds, b. We assume debt contracts that mature probabilistically, as in Chatterjee and Eyigungor (2012). Each unit of b matures in the next period with probability λ. If the bond does not mature and the government does not default, it pays a coupon z. The government lacks commitment and can default on its debt obligations. Let $d = \{0, 1\}$ denote the outright default policy on b.[8] As is standard in the literature, an outright default leads to a temporary exclusion from debt markets and an

[6] The exception is Du and Schreger (2021). In this case, the cost is endogenous and depends on the foreign currency mismatch on corporate balance sheets.

[7] A well-known result of Cripps, Mailath, and Samuelson (2004) for the context of repeated games is that in a model with *fixed* types, reputation is a short-run phenomenon—even if government actions are not perfectly observable. Any model of long-run reputation should thus include some mechanism by which the uncertainty about types is continually replenished. See Board and Meyer-Ter-Vehn (2013); Ekmekci (2011); or Bohren (2021) for different ways in which the uncertainty can be replenished.

[8] After exiting a default, the government's stock of b is zero.

exogenous output loss, $\phi_j(y)$. We assume that $\phi_C(y) \geq \phi_S(y)$ for all y, meaning that the S-type faces (weakly) larger incentives to default.[9] Changes in lenders' prior about the type of government thus affect their perceived probability of default, and therefore a government's borrowing costs.

In addition, the government can decide on another policy $\tilde{\pi} \leq 0$, which provides a benefit of $\Omega(\tilde{\pi})$ in terms of additional consumption c. We assume that $\Omega(\tilde{\pi})$ is increasing in $\mid \tilde{\pi} \mid$. The S-type can choose any value $\tilde{\pi} \leq 0$, but the C-type commits to $\tilde{\pi} = 0$. The policy does not lead to a direct cost (such as exclusion from markets or output losses). However, it provides information about the type of government. We assume that $\tilde{\pi}$ is not perfectly observable by lenders. Instead, they receive a noisy message m, whose realization depends on the government's choice for $\tilde{\pi}$.[10] For tractability, we assume that the noisy message takes two values, $m = \{L, NL\}$, where L (lie) signals $\tilde{\pi} \neq 0$.[11] The probability of receiving message L is given by

$$Prob\,(m = L \mid \tilde{\pi}) = \Gamma\left(\tilde{\pi}; \sigma, \alpha\right), \tag{1}$$

where the parameter $\sigma \geq 0$ captures the noise behind the underlying message and $\alpha \leq 0$ is a learning parameter that governs how agents learn from this policy. We assume that $\Gamma(\cdot)$ is increasing in the magnitude of $\tilde{\pi}$ (i.e. $\Gamma'_{\tilde{\pi}}(\cdot) < 0$) and (weakly) increasing in α. This implies that (for a given noise σ) agents can more easily detect $\tilde{\pi} \neq 0$ as $\alpha \to 0$.[12]

Figure 1 describes our timing assumption. Let $\mathbf{S} = (y, b, \zeta)$ be the state at the beginning of the period. Each period is divided into three stages. In stage 0, the government chooses to default or not ($d = \{0, 1\}$) on b. Lenders observe this action and update their beliefs accordingly ($\tilde{\zeta}$). If the government defaults, it faces an output cost $\phi_j(y)$ and is temporarily excluded from international debt markets at stage 1. We assume that it regains access to debt markets with probability θ in the next period. There is no recovery value and the stock of debt is $b = 0$ after exiting a default.

[9] In Alfaro and Kanczuk (2005) and D'Erasmo (2011), the types differ in their discount factor. Our specification is similar to the one in Barret (2016) or Egorov and Fabinger (2016), and it can be interpreted as differences in the disutility over an outright default (as in Cole and Kehoe (1998)).

[10] In this regard, our study is similar to Mailath and Samuelson (2001) and Holmström (1999) because it features both noisy signals and alternating types.

[11] We take this notation motivated by the Argentine case, in which the government was either lying or not about the inflation rate.

[12] The case with $(\sigma, \alpha) = (0, 0)$ implies that $\tilde{\pi} \neq 0$ is perfectly informative about the S-type.

Figure 1. Timing of Events

	If default	If no default	
Stage 0	Stage 1	Stage 1	Stage 2
- Initial $\mathbf{S} = (y, b, \zeta)$ - Default choice $d = \{0, 1\}$ - First update of beliefs $\tilde{\zeta}(d, \zeta)$	- Temporary exclusion from debt markets - Output cost $\phi_j(y)$	- Choice of b' and $\tilde{\pi}$ - Message m is realized - Second update of beliefs $\hat{\zeta}(m, \tilde{\zeta})$	- Debt issuance b'

If the government does not default, then choices for $\tilde{\pi}$ and b' are made at stage 1. We assume that both the C- and S- type follow the same debt policy, $b^{\star\prime}\left(y, b, \tilde{\zeta}\right)$. We interpret this policy as a fiscal rule that is not under the control of the j-type. Instead of imposing an arbitrary fiscal rule, we assume that bond policies are optimally chosen by another agent of the economy (say, the Congress), whose information set is the same as that of lenders. Under this assumption, bond policies are uninformative about the type of government. An advantage of this specification is that it allows us to compare our model to others on the sovereign debt literature. For instance, if we assume that the type of government is fixed and publicly known, then the bond policy $b^{\star\prime}\left(y, b, \tilde{\zeta}\right)$ would be exactly the same as the one in Chatterjee and Eyigungor (2012).

Given the choice of $\tilde{\pi}$, message m is realized and lenders once again update their beliefs $(\hat{\zeta})$ at the end of stage 1. At stage 2, the primary market for bonds opens and the government issues b' (chosen at stage 1), taking as given the bond price schedule $q(\cdot)$.[13] Under this setup, the resource constraint of the economy is given by

$$\begin{aligned} c(d=0, \tilde{\pi}, b'^{\star}) &= y - b\left[(1-\lambda)\, z + \lambda\right] + q(\cdot)\left[b'^{\star} - (1-\lambda) b\right] + \Omega(\tilde{\pi}) \qquad (2) \\ c(d=1) &= y - \phi_j(y). \end{aligned}$$

2.2. *Noisy Signals, Update of Beliefs, and Bond Prices*

As shown in the timeline of Figure 1, beliefs about the government's type are updated twice within a period: After the outright default decision d and after the message m is realized. Let $d_j^{\star} \equiv d_j^{\star}(y, b, \zeta)$ be the lenders' conjecture about the j-type government's default decision.

[13] Under our timing assumption, b' is chosen before the realized message m. In Section 4.1 we explain the benefits of such timing assumption. In particular, it allows us to isolate the effect of message m on the government's reputation and spreads.

Based on Bayes' rule, the first updating of beliefs is given by[14]

$$\tilde{\zeta}\left(d,\zeta;d_S^{\star},d_C^{\star}\right)=\frac{Prob(d\mid d_C^{\star})\times\zeta}{Prob(d\mid d_C^{\star})\times\zeta+Prob(d\mid d_S^{\star})\times(1-\zeta)}. \tag{3}$$

If the government did not default, the second updating of beliefs happens after the j-type chooses $\tilde{\pi}$ and lenders observe the message m. Let $\tilde{\Pi}_j^{\star}\equiv\tilde{\Pi}_j^{\star}(y,b,\tilde{\zeta})$ be the lenders' conjecture about the j-type's $\tilde{\pi}$ policy. For a given realization of m, the updated beliefs are given by[15]

$$\hat{\zeta}\left(m,\tilde{\zeta};\tilde{\Pi}_S^{\star},\tilde{\Pi}_C^{\star}\right)=\frac{Prob(m\mid\tilde{\Pi}_C^{\star})\times\tilde{\zeta}}{Prob(m\mid\tilde{\Pi}_C^{\star})\times\tilde{\zeta}+Prob(m\mid\tilde{\Pi}_S^{\star})\times\left(1-\tilde{\zeta}\right)}. \tag{4}$$

Taking into account the Markov transition across the two government types (T), the end-of-period posterior is given by

$$\zeta'\left(\hat{\zeta}\right)=T_{CC}\times\hat{\zeta}+T_{SC}\times\left[1-\hat{\zeta}\right]. \tag{5}$$

Equations (1), (4), and (5) imply that, through its effects on m, changes in $\tilde{\pi}$ affect a government's reputation ζ'. Panel (A) of Figure 2 provides a graphical illustration. Once the message m has been realized (and given the lenders' conjectures), ζ' is independent of the current choice of $\tilde{\pi}$ (horizontal solid lines). Ex ante, however, a larger $|\tilde{\pi}|$ increases the probability that message $m=L$ is realized, which affects the expected ζ' (dashed lines). The effect depends on how agents can learn from the policy $\tilde{\pi}$. For instance, a larger α increases the probability of message $m=L$ being realized for any $\tilde{\pi}\neq 0$, which raises the sensitivity of a government's reputation to $\tilde{\pi}$.

Given our assumptions on international lenders, the price of a bond is given by the expected value of repayment, discounted by the risk-free rate r. Let $VR_j\left(y',b',\zeta'\right)$ be the next-period value of repayment if the government is of the j-type. The bond-pricing kernel is then given by

$$q\left(y,b',\zeta'\right)=\frac{1}{1+r}\int_y\left\{\zeta' VR_C\left(y',b',\zeta'\right)+\left(1-\zeta'\right)VR_S\left(y',b',\zeta'\right)\right\}dF\left(y'\mid y\right) \tag{6}$$

with

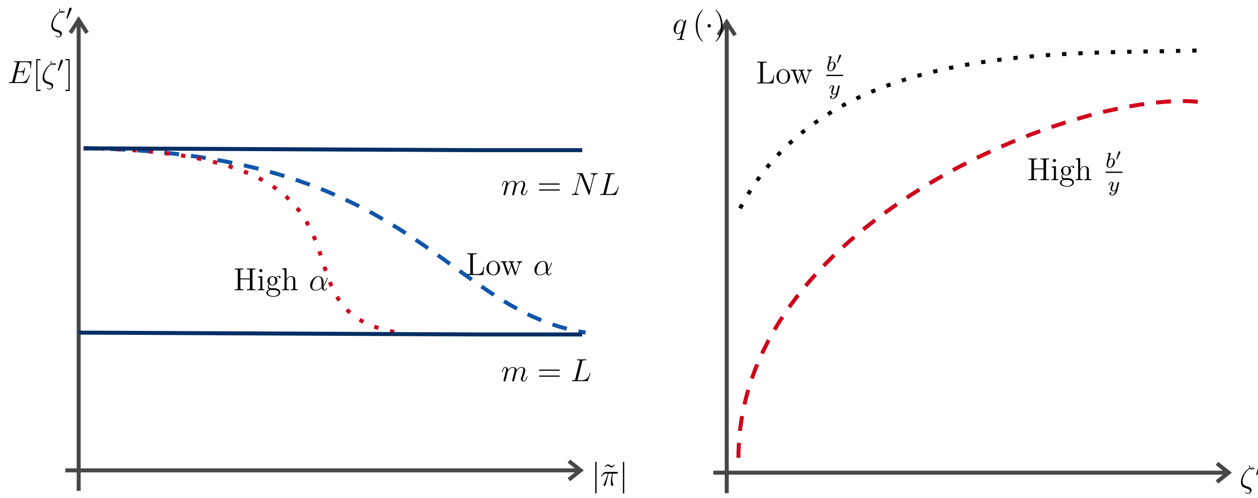
$$VR_j\left(y',b',\zeta'\right)\equiv\left(1-d_j^{\star\prime}\right)\times\left[\sum_{M=\{L,NL\}}Prob(m'=M\mid\tilde{\Pi}_j^{\star\prime})\Big(\lambda+(1-\lambda)\left[z+q_M'\right]\Big)\right], \tag{7}$$

[14]For off-equilibrium paths, we simply assume that $\tilde{\zeta}\left(d,\zeta;d_S^{\star},d_C^{\star}\right)=0$.

[15]Regardless of the choice of $\tilde{\pi}$, we assume that both messages have positive probability, so Bayes' rule always applies and there are no off-path information sets.

FIGURE 2. Noisy Signals, Reputation, and Bond Prices

(A) $\tilde{\pi}$ and Reputation (B) Reputation and Prices



Notes: Panel (A) shows the realized and expected posteriors as a function of $|\tilde{\pi}|$ for a given ζ. The top and bottom horizontal lines represent ζ' when $m = NL$ and $m = L$ are realized, respectively. The dashed lines show the expected posterior, $E[\zeta']$, for two values of α. Panel (B) shows the pricing kernel as a function of ζ' for different values of (y, b').

where $d_j^{\star\prime}$ and $\tilde{\Pi}_j^{\star\prime}$ refer to the conjectured next-period policies for type j. The term q'_M refers to the next-period price for one unit of debt. This price is also a function of lenders' conjectures and is contingent on the realization of the next-period message (see Appendix A.2).

Under the assumption that $\phi_C(y) \geq \phi_S(y)$ for all y, the S-type has weakly larger incentives to default on b. This implies that $VR_C(y', b', \zeta') \geq VR_S(y', b', \zeta')$, and thus bond prices are weakly increasing in ζ'. The effects are state-contingent, since they depend on the economy's fundamentals y and b. Panel (B) of Figure 2 illustrates this point. The figure shows the pricing kernel $q(y, b', \zeta')$ as a function of ζ', for two ratios of b'/y. When b'/y is small (dotted line), the default probability for both the C- and the S-type defaults is low. This implies a small difference between $VR_C(\cdot)$ and $VR_S(\cdot)$, and thus changes in reputation have a small effect on the pricing kernel $q(\cdot)$.

2.3. *Government's Recursive Problem*

We briefly describe the government's recursive problem, focusing on the S-type optimal choice of $\tilde{\pi}$. We leave a detailed description of the problem to Appendix A.1.

If the government is not in default, the beginning-of-period value function, $W_j(y,b,\zeta)$, depends on the optimal default decision at stage 0. For the j-type, it is given by

$$W_j\left(y,b,\zeta\right) = Max_{d\in\{0,1\}}\left\{W_j^R\left(y,b,\tilde{\zeta}\right),\, W_j^D\left(y,b,\tilde{\zeta}\right)\right\}, \tag{8}$$

where $W_j^R(\cdot)$ denotes the value function in case of repayment, $W_j^D(\cdot)$ is the value function in case of default, and $\tilde{\zeta}$ is given by Equation (3). The value of default depends on the output cost $\phi_j(y)$ and the probability of exiting the default status θ. In this section, we describe the $W_j^R(\cdot)$ function and in Appendix A we describe the $W_j^D(\cdot)$.

At stage 1, taking as given the bond policy rule $b^{\star\prime} \equiv b^{\star\prime}\left(y,b,\tilde{\zeta}\right)$, the S-type solves for the optimal $\tilde{\pi}$ policy. In particular, it chooses $\tilde{\pi}\in[\underline{\pi},0]$ to maximize the weighted average of the value function in stage 2, $V_S(\cdot)$, where the weights are given by the probability that message m is realized, given the choice of $\tilde{\pi}$. The problem is as follows:

$$W_S^R\left(y,b,\tilde{\zeta}\right) = \max_{\tilde{\pi}} \sum_{M=\{L,NL\}} Prob(m=M|\tilde{\pi}) \times V_S\left(\tilde{\pi},y,b,\hat{\zeta}(M)\right) \tag{9}$$

$$s.t. \quad \tilde{\pi}\in[\underline{\pi},0],$$

where $\hat{\zeta}(m)$ is the posterior defined in Equation (4) and $V_S(\cdot)$ is given by

$$V_S\left(\tilde{\pi},y,b,\hat{\zeta}(m)\right) = u(c) + \beta\int_y \left\{T_{SS}W_S\left(y',b^{\star\prime},\zeta'\right) + T_{SC}W_C\left(y',b^{\star\prime},\zeta'\right)\right\} dF\left(y' \mid y\right) \tag{10}$$

$$\text{s.t. } c = y - b\left[(1-\lambda)z+\lambda\right] + q\left(y,b^{\star\prime},\zeta'\right)\left[b^{\star\prime}-(1-\lambda)b\right] + \Omega(\tilde{\pi}),$$

where β is the government's discount factor and ζ' is given by Equation (5). The S-type, thus, faces a stochastic trade-off when choosing the optimal $\tilde{\pi}$. Conditional on the realization of message m, since $\Omega(\tilde{\pi})$ is increasing in the magnitude of $\tilde{\pi}$, the value function V_S is increasing in $|\tilde{\pi}|$. A larger $|\tilde{\pi}|$, however, increases the probability that message $m=L$ is realized, which decreases $\hat{\zeta}$ and raises borrowing costs.

2.4. *Link with the Argentine Case*

The previous model provides a mapping from a government's policies to its reputation, and from reputation to bond prices. Underlying this mapping is the way in which agents can learn from those policies; in particular, from $\tilde{\pi}$. The policy $\tilde{\pi}$ can be interpreted as any government action that signals its type. Based on our Argentine case of study, we will interpret this policy as a misreport of the inflation rate that dilutes the real value of inflation indexed bonds (IIBs). Under this interpretation, the parameter α determines how agents learn about the type of government based on the sequence of misreports.

We assume that the government faces a constant legacy stock of IIBs, whose coupon payments are linked to the inflation announced by the government. For tractability, we assume that this debt is a perpetuity, whose coupons are denoted by B. The S-type can affect coupon payments B by underreporting the inflation rate and choosing $\tilde{\pi} \in [\underline{\pi}, 0]$. Under this setup, notice that $\tilde{\pi} < 0$ implies an indirect partial default on B.

If not in default, the resource constraint of the economy can be written as

$$c(d=0, \tilde{\pi}, b^{\star\prime}) = \; y - b\left[(1-\lambda)\, z + \lambda\right] + q\left(\cdot\right)\left[b^{\star\prime} - (1-\lambda)b\right] - B \times \left(1+\tilde{\pi}\right).$$

In Section 3, we use the Argentine episode of inflation misreport to infer the sensitivity of $q(y, b', \zeta')$ to changes in a government's reputation ζ'. To this end, we use high-frequency market reactions to estimate the elasticity of q to changes in $\tilde{\pi}$. In Section 4, we then use those estimates to discipline our quantitative model. In particular, we use the empirical elasticity to pin down α, which links the misreports with the government's reputation. Since our empirical elasticity relies on high-frequency market reactions, we provide a simple extension of our baseline model to include secondary markets. In this way, we can capture the intraperiod effect of $\tilde{\pi}$ on q. This extension nests the baseline model and is described in Appendix A.4.

3. Empirical Analysis: The Case of Argentina

In this section, we provide evidence on the effect of a government's reputation on its borrowing costs. To this end, we use the Argentine 2007-2012 episode of inflation misreport as a case study. During this period, the official CPI was intentionally underreported by the national government. The sequence of misreports directly affected the coupon payments of IIBs, and therefore it can be interpreted as an indirect partial default on these bonds.

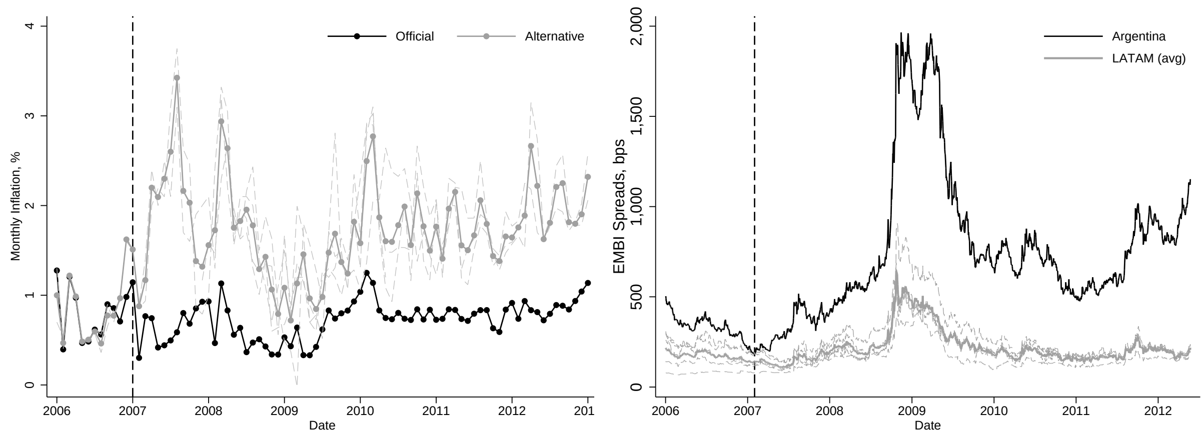
We focus on the Argentine government's systematic misreport of inflation for the following reasons. First, the misreports were large and significantly affected coupon payments of IIBs. During this period, the amount outstanding of Argentina's IIBs accounted for almost a quarter of its debt according to official data.[16] By lowering interest payments and principal, the underreport of inflation had a great impact on the government's stock of debt and implied an indirect partial default on the stock of IIBs.[17] Second, the misreports occurred frequently, allowing us to work with a relatively large number of observations. Third, Argentina was not excluded from international debt markets as a consequence of this policy. We can then use secondary markets

[16]See https://www.argentina.gob.ar/economia/finanzas/deudapublica/informes-trimestrales-de-la-deuda.

[17]By misreporting its inflation rate, Argentina decreased its IIBs payments by nearly \$3.2 billion, which accounts to around 1% of its GDP.

FIGURE 3. Argentina's Misreport of Inflation and Decoupling of Spreads

(A) Argentina's measures of inflation (B) Latin America's bond spreads



Notes: The left panel shows the monthly official inflation rate announced by the Argentine government (black line) and alternative measures of inflation (gray lines). The right panel shows annualized EMBI spreads for Argentina (black line) and for other Latin American countries (gray lines). Vertical lines denote the first month in which the Argentine government underreported the inflation rate.

data to quantify the contemporaneous effect of the misreports on Argentina's spreads. Lastly, coupon payments of dollar-denominated bonds were not directly affected by the misreport of inflation. This allows us to isolate the reputational effect of the misreport.

For most of the first half of the 2000s, Argentina's inflation rate was relatively low compared with its historical values, but it peaked in 2005 at more than 10%.[18] The response of the government was to impose a series of price controls in 2006 and to pressure the staff of the National Statistics Institute (INDEC) to manipulate computation of the price index elaborated on the INDEC. In February 2007, the government directly intervened with the INDEC and fired its highest ranked members, including the statistician in charge of elaborating on the CPI.[19]

The left panel of Figure 3 shows the announced inflation rate for the period under analysis. The reported inflation was consistently lower than other (private) measures of inflation, which we regard as noisy signals for market participants. The magnitude of the underreport—the difference between alternative measures and the official measure—was sizable and persistent.

[18]The average annual inflation rate for 1984-2004 was 74% and the median rate was 11.4%. In contrast, the average annual inflation rate for 2000-2004 was 7.6% and the median was 3.5%.

[19]See Cavallo et al. (2016) for a complete timeline of all events from 2006 to 2015.

The right panel of Figure 3 shows that in tandem with the government's systematic misreport of inflation, the Argentine spreads for dollar-denominated bonds started to decouple from those of the rest of Latin America. This is surprising for at least three reasons. First, Argentina's fundamentals were in line with those of other Latin American countries.[20] Second, the coupons for dollar-denominated bonds were not directly affected by the misreport of inflation. Third, by underreporting the inflation rate, the Argentine government significantly decreased the real value of its stock of IIBs. In the absence of a reputational type of channel, the lower real stock of debt should decrease the spreads of nominal bonds denominated in dollars.[21] In what follows, we measure the extent to which this increase in spreads can be attributed to the inflation misreport and provide evidence in favor of a reputational channel.

3.1. *Identification Strategy*

Our main hypothesis is that the underreporting of inflation is informative for lenders regarding the government's willingness to default on its obligations, and should then affect sovereign spreads. There are, however, two main challenges to the identification of this effect: (i) measurement and (ii) reverse causality. The first arises because the government's misreport is not directly observable. The second arises because the misreport may be a government's best response to a deterioration of the economy's fundamentals.

To the extent that agents had anticipated the underreport, the government's announcement of inflation does not provide the market with additional information, and sovereign spreads should not react to that announcement. In other words, only unexpected movements in the misreport provide information to agents. The first main challenge is thus to quantify the unexpected part of the misreport.

Our premise is that changes in the break-even inflation rate (ΔBE_t) around days on which the government announces the inflation rate can be used as a proxy for the unexpected misreport. The break-even rate is the level of inflation that renders an investor indifferent between holding nominal bonds or IIBs. It can be computed as $BE_t = YLD_t^{\mathcal{NB}} - YLD_t^{\mathcal{IIB}}$, where $YLD_t^{\mathcal{NB}}$ is the yield of a nominal bond denominated in local currency (pesos) and $YLD_t^{\mathcal{IIB}}$ is the yield of an inflation-linked bond with similar maturity. Embedded in BE_t is the market's expectation

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[20]In Appendix B.2, we provide some figures to show that if anything, GDP growth in Argentina was higher than the average growth rate for the region. Argentina's stock of external debt, moreover, displayed a downward trend during this period.

[21]In canonical models of sovereign debt (e.g., Arellano (2008) or Chatterjee and Eyigungor (2012)), sovereign spreads are decreasing in the stock of a government's real stock of debt.

regarding the inflation announced by the government, since these announcements directly affect the return of the IIBs.[22] The main advantage of using ΔBE_t is that it is a high-frequency variable that allows us to focus on narrow windows around inflation announcements. The day before the government's announcement of inflation (i.e., at time $t-1$), absent a liquidity-premium component, we should expect $BE_{t-1} \simeq \mathbb{E}_{t-1}(\hat{\pi}_t)$, where $\mathbb{E}_{t-1}(\hat{\pi}_t)$ is the market's expected announcement at time t. After the government reports $\hat{\pi}_t$, the change in the BE rate should thus be close to $\Delta BE_t \simeq \hat{\pi}_t - \mathbb{E}_{t-1}(\hat{\pi}_t)$.

Changes in the break-even inflation rate allow us to capture the difference between the government's announced inflation rate and the announcement expected by the market. However, in the Argentine case, there are two different components behind ΔBE_t: (i) the unexpected misreport and (ii) news about the "true" inflation rate.[23] In Appendix B.5 and in Subsection 3.4, we present evidence that suggests that changes in BE_t around days on which the government reported the inflation rate were mainly driven by changes in the unexpected misreport.

Apart from measurement, another concern is that agents may learn through time about the type of government. If the government's reputation (ζ) is already deteriorated, then an unexpected misreport should not have a significant effect on bond prices. The sequence of misreports in early 2007 may thus have different implications compared with the sequence of misreports in 2010. To overcome this concern, we split our analysis across different years. For our main specification, we focus on the period between the first misreport of inflation (January 2007) and the beginning of the Global Financial Crisis (GFC). We take the collapse of Bear Stearns in March 13, 2008 as the start of the crisis. We then study the effects for later periods and provide evidence in favor of the hypothesis that agents learned about the type of government through time.

A second challenge behind the identification is reverse causality. That is, the underreport of inflation may be the government's optimal response to a change in sovereign spreads, SP_t, due

[22]This is because the coupon payments of IIB are directly linked to the inflation reported by the government. The argument implicitly assumes a frictionless market. The BE rate may also reflect a liquidity or risk premium component. To the extent that this premium is constant across time, changes in the BE rate are still a good proxy for the unexpected misreport of inflation.

[23]To see this, assume that the announced $\hat{\pi}$ can be decomposed in a "true" inflation component π and a misreport component $\tilde{\pi}$. Then, $\Delta BE_t \simeq (\pi_t - E_{t-1}\pi_t) + (\tilde{\pi}_t - E_{t-1}\tilde{\pi}_t)$, where the first term is the surprise regarding true inflation and the second term is the surprise regarding the misreport.

to a worsening of fundamentals. In addition, there may be (potentially unobserved) common shocks that drive, at the same time, changes in BE_t and SP_t.[24]

To address these concerns, we adopt a heteroskedasticity-based identification strategy as the one used in the monetary policy literature to identify monetary policy shocks (Rigobon and Sack (2004)). In particular, we exploit high-frequency changes in the volatility of ΔBE_t around days on which the government announced the inflation rate.

This type of identification allows us to tackle both the reverse causality and common factors concerns. First, by focusing on changes in BE_t in narrow windows around the inflation announcement, we can ameliorate the concern that the misreport was an optimal response to an increase in SP_t. This is because the process of measuring and announcing the inflation rate takes time (even if it is not correctly measured), and it is therefore unlikely that the current (daily) change in SP_t is behind the announced inflation. Moreover, unlike an event-study analysis, the heteroskedasticity-based identification strategy does not require the complete absence of common shocks—an assumption that may be too strong in our setup. Instead, it relies on the weaker assumption that the volatility of these shocks remains constant around days on which the government announced the inflation rate.

3.2. *Data and Summary of Events*

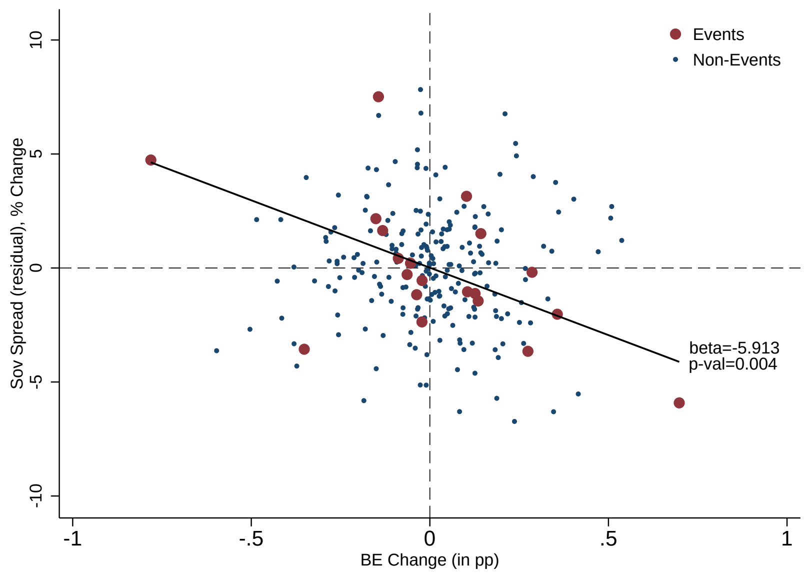
We use the J.P. Morgan EMBI spread as a measure of the Argentine government's spreads. This index captures spreads for bonds denominated in foreign currency. We use changes in the break-even inflation rate as a proxy for the unexpected misreport of inflation, as explained in Section 3.1. A problem with the Argentine case during the period of study is the lack of bonds denominated in local currency, which are needed to construct the BE inflation rate.[25] To circumvent this issue, we use dollar-denominated bonds, adjusting their yields using the expected depreciation rate of the Argentine peso implied by currency forward contracts. Appendix B.4 provides details on the construction of the BE inflation rate and Appendix B.6 discusses the role of the exchange rate behind this measure.

For our baseline analysis, we focus on the period January 2007 to February 2008. Figure 4 shows the relation between ΔBE_t and changes in Argentina's sovereign spreads after controlling

[24]Examples of these common factors are changes in risk aversion, flight-to-liquidity, or flight-to-safety type of events.

[25]There is only one bond denominated in pesos for which we have data during our sample period, and the first observation is for the month of July—i.e., 6 months after the government started misreporting the inflation rate.

Figure 4. Break-even Inflation Rate



Notes: The figure shows the daily change in BE_t and the daily log change in Argentina's sovereign spreads, SP_t, after controlling for global factors. Global factors include the VIX index and returns on the S&P 500 and MSCI Emerging Markets ETF indices. Sample period: January 2007-February 2008.

Table 1. Summary Statistics

Moments	Non-Event	Event
Mean $\Delta ln(SP)$	0.067	-0.680
SD $\Delta ln(SP)$	2.670	3.572
Mean ΔBE	0.003	-0.003
SD ΔBE	0.188	0.290
Cov($\Delta ln(SP)$,ΔBE)	-0.006	-0.515
Observations	232	23

Notes: The table reports the mean and standard deviation of the daily change in BE_t, the mean and standard deviation of the daily log change in SP_t, and their covariance during event and non-event windows. Event-window days are defined as 2-day windows around days on which the Argentine government reported the inflation rate. Non-event days are all the others. Sample period: January 2007-February 2008.

for global factors. Red dots indicate 2-day windows around the days on which the Argentine government reported the inflation rate; this is described in Appendix B.3. We name these days event days (E). All other days are classified as non-event days (NE). For non-event days (blue dots), the relation is not significant. On the other hand, during the event days (red dots), the relation is negative and significant, indicating that an increase in the unexpected underreport of inflation is associated with an increase in sovereign spreads.

Table 1 reports summary statistics on daily changes in the BE rate and sovereign spreads for event and non-event days. The covariance between these variables is close to zero for non-event days but decreases sharply during event days. More importantly, the volatility of ΔBE_t increases substantially during event days. In the next subsection, we use this difference in volatilities to identify the effect of the misreport on sovereign spreads.

3.3. *Framework and Results*

To allow for the possibility that (i) sovereign spreads may affect ΔBE_t and (ii) the presence of unobserved common factors, we consider the following system of equations:

$$\Delta \ln SP_t = \alpha_0 + \alpha_1 \Delta BE_t + \alpha_2 X_t + \epsilon_t \tag{11}$$

$$\Delta BE_t = \beta_0 + \beta_1 \Delta \ln SP_t + \beta_2 X_t + \eta_t, \tag{12}$$

where $\Delta \ln SP_t$ is the log change in sovereign spreads for bonds denominated in dollars and X_t is a vector of common shocks. We further assume that the shocks ϵ_t and η_t have no serial correlation and are uncorrelated with each other and with the common shocks X_t.

Our coefficient of interest is α_1. According to our reputational model, we should expect α_1 to be negative. That is, an increase in the unexpected underreport of inflation (i.e., a decrease in ΔBE_t) should have a negative effect on the government's reputation, leading to a rise in its sovereign spreads.

If we simply run OLS on Equation (11), there are two potential sources of bias: simultaneity and omitted variables. The former appears if $\beta_1 \neq 0$. The latter exists if $\alpha_2 \neq 0$ and $\beta_2 \neq 0$. In order for the OLS estimate of α_1 to be unbiased, an exogenous change in $\Delta \ln SP_t$ must have no effect on ΔBE_t and there must be no omitted common shocks. As previously explained, these two assumptions are implausible in our context.

To tackle these problems, we follow a heteroskedasticity-based identification approach. The formal identifying assumption is that the variance of shocks to ΔBE_t, η_t, is higher around days on which the government announces the inflation rate, while the variances of the common shocks, X_t, and of the shocks to $\Delta \ln SP_t$, ϵ_t, remain invariant. That is,

$$\begin{aligned} \sigma_{\eta,E} &> \sigma_{\eta,NE} \\ \sigma_{\epsilon,E} &= \sigma_{\epsilon,NE} \\ \sigma_{X,E} &= \sigma_{X,NE}. \end{aligned} \tag{13}$$

Let Φ_j be the var-cov matrix between $\Delta \ln SP_t$ and ΔBE_t for $j = \{E, NE\}$. If the identifying assumptions hold, it is easy to show that

$$\Delta\Phi = \left(\frac{1}{1-\alpha_1\beta_1}\right)^2 \left[\sigma^2_{\eta,E} - \sigma^2_{\eta,NE}\right] \begin{bmatrix} \alpha_1^2 & \alpha_1 \\ \alpha_1 & 1 \end{bmatrix}, \tag{14}$$

where $\Delta\Phi \equiv \Phi_E - \Phi_{NE}$. From the expression above, it is clear that we can estimate our coefficient of interest in at least two different ways:

$$\hat{\alpha}_1 = \frac{\Delta\Phi_{1,2}}{\Delta\Phi_{2,2}} \tag{15}$$

$$\tilde{\alpha}_1 = \frac{\Delta\Phi_{1,1}}{\Delta\Phi_{1,2}}. \tag{16}$$

As is clear from Equation (14), these estimators are relevant only if $\Lambda \equiv \sigma_{\eta,E} - \sigma_{\eta,NE} > 0$. For our identifying assumption to work, thus, the market should be surprised about the inflation announced by the government. Appendix Table B.3 shows that for the period under analysis (January 2007-February 2008), we can reject the null that $\Lambda = 0$. Interestingly, we cannot reject the null hypothesis during and after the GFC. We interpret this as evidence to suggest that the market learned about the type of government and was no longer surprised by the sequences of misreports.

As shown in Rigobon and Sack (2004), the estimators in Equations (15) and (16) can be implemented in an instrumental variables framework.[26] Under our null hypothesis, however, $\Delta\Phi_{1,2} = 0$, which renders the $\tilde{\alpha}_1$ estimator inappropriate (see Hebert and Schreger (2017)). For the remainder of the analysis, all results are based on the $\hat{\alpha}_1$ estimator.

Table 2 shows the results based on the IV estimator for $\hat{\alpha}_1$. Each column provides the estimates for a different definition of the event and non-event windows. In all of our instrumented regressions, we include a set of global factors to control for aggregate credit market conditions. In particular, we include daily changes in the VIX index, the S&P 500 index, and the MSCI Emerging Markets ETF index. While the addition of these controls is not necessary, given

[26]The estimates are consistent even if the shocks σ_η, σ_ϵ, or σ_X have heteroskedasticity over time.

Table 2. Effects of Inflation Misreport on Sovereign Spreads

	(1)	(2)	(3)	(4)
ΔBE	-10.714***	-13.212***	-9.151***	-10.565**
95perc CI	[-21.90, -5.75]	[-18.43, -6.16]	[-12.72, -2.91]	[-12.43, -4.38]
Observations	240	240	60	70
Events	2-day window	3-day window	2-day window	3-day window
Non-events	All other days	All other days	4-day window	4-day window
Controls	Yes	Yes	Yes	Yes

Notes: The table shows results for the heteroskedasticity IV estimator. The dependent variable is $\Delta lnSP_t$. Definitions of "events" vary across the four columns. Controls include the VIX index, the S&P 500 index, and the MSCI Emerging Markets ETF index. Standard errors and confidence intervals are computed using a stratified bootstrap procedure. 95% confidence intervals are in brackets. ***, **, *, denote significance at 1%, 5%, and 10%, respectively. Sample: January 2007-February 2008.

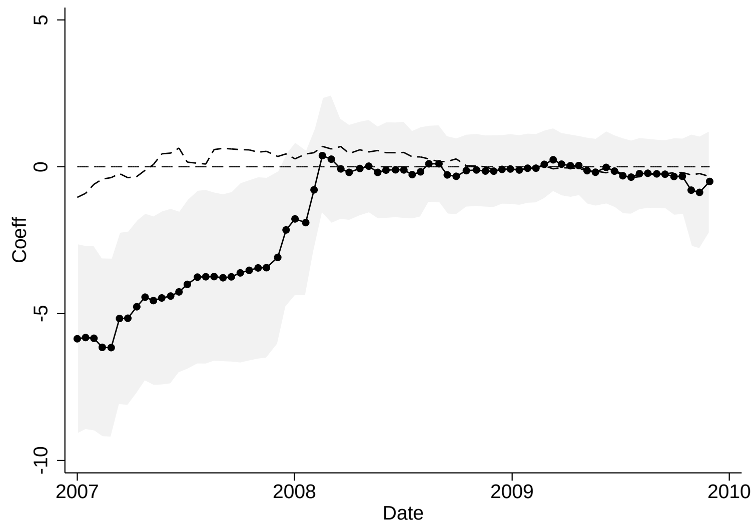
our identifying assumptions, their inclusion allows us to reduce the magnitude of our standard errors.

In all specifications, the point estimate $\hat{\alpha}_1$ is negative and statistically significant, which is in line with our reputational channel. Our estimates show that a 1 pp decrease in ΔBE_t (i.e., an increase in the unexpected underreport of inflation) leads to an $9\% - 10\%$ rise in sovereign spreads. In terms of economic magnitudes, the reported estimates imply that a 1–sd decrease in ΔBE_t can account for more than two thirds of the daily dispersion of $\Delta \ln SP_t$ (during the event windows).

The results in Table 2 are based on the period between the first misreport and the start of the financial crisis (January 2007-February 2008). For sample periods after 2007, we cannot reject the null hypothesis that $\Lambda = 0$ and we can therefore not apply the Rigobon and Sack methodology. We consider instead OLS regressions and a standard event-study analysis, based on 2-day windows around the inflation announcement. In these cases, the (stronger) identifying assumption would be that changes in the BE rate during the 2-day windows are driven exclusively by the government's inflation announcement. The estimates are therefore subject to the concern that other factors may have changed during those event days and affected both the BE rate and sovereign spreads. Appendix B.8 provides additional details.

Figure 5 presents the OLS estimates for α_1 for a rolling window of 12 months. The black dotted line shows the estimates for α_1 around days in which the government announced the

Figure 5. OLS Estimates - Rolling Windows



Notes: The figure shows OLS estimates for α_1 based on 12-month rolling windows. The black dotted line shows the estimates around days in which the government announced the inflation rate (event days). The dashed line shows the estimates for all the other days. See Appendix B.8 for details.

inflation rate. The dashed line shows the estimates for all the other days. The estimates are negative and significant only for event days. Moreover, the estimates are significant only for the first year of the sequence of misreports. Interpreted through the lens of our reputational model, the results suggest that after 2007, the lenders' prior about the government type (ζ) reached its lower bound, and therefore the misreports no longer affected sovereign spreads.

For the event-study analysis, we classify events as a "good news event" (GNE) or a "bad news event" (BNE) based on the change in BE_t around the government's inflation announcement. For instance, event window j is classified as a BNE if $\mu^{E,j}_{\Delta BE} < \mu_{\Delta BE}$, where $\mu^{E,j}_{\Delta BE}$ is the mean daily change in BE_t across event window j and $\mu_{\Delta BE}$ is the mean change across all days in the sample. Appendix B.8 presents the results. For our baseline sample period, the results show an asymmetric response of spreads to news events. In particular, we find a large and positive increase (decrease) in Argentina's sovereign spreads during BNE (GNE). During BNE, for instance, Argentina's sovereign spreads increased on average by 1.5 pp (daily). After March 2008, however, we find no relation between BNE or GNE and changes in Argentina's spreads, which is consistent with the OLS estimates in Figure 5.

3.4. *A Reputational Channel?*

Although the results so far are in line with our reputational channel, other channels may be at play. In this section we consider alternative explanations and provide empirical evidence that supports our reputation channel.

A first concern is based on the fact that changes in the BE_t may be capturing not only news regarding the misreport but also news about the "true" inflation rate; see, for instance, Nakamura and Steinsson (2018). If that were the case, news about the true inflation rate could affect the real economy, which in turn ends up affecting sovereign spreads regardless of the Argentine government's reputation. A second alternative channel is that the inflation misreport may induce distortions in the real economy. Regardless of its sign, inflation misreport could distort relative prices, increase uncertainty, and reduce investment. All of these factors may end up affecting the default risk of the government, regardless of its reputation.

Both of these channels seem at odds with the results presented so far. First, for a high-inflation economy such as Argentina, if $\Delta BE_t < 0$ is actually capturing a lower than expected "true" inflation rate, this may be perceived as a good signal about the fundamentals of the economy, which should reduce the default risk. We should thus expect a positive link between ΔBE_t and ΔSP_t, contrary to the results presented in Table 2. Second, if the misreports are creating distortions in the real economy, we would expect a U-shaped relation between ΔBE_t and $\Delta \ln SP_t$, which is at odds with Figure 4 and our event-study analysis (Appendix B.8), in which we show an asymmetric response of spreads to good news events and bad news events.

To formally address these alternative explanations, we extend our heteroskedasticity-based framework to allow for the possibility that ΔBE_t may affect the fundamentals of the economy directly. In Appendix B.10, we also consider a monthly structural VAR (as in Mertens and Ravn (2013) and Gertler and Karadi (2015)) to further study the different mechanisms through which inflation misreport may end up affecting sovereign spreads.

We extend the system of equations in (11)-(12) to account for potential effects of ΔBE_t on the real economy. We use the daily return (R_t) of an index of publicly traded Argentine firms (MERVAL) to proxy for changes in the real economy. In particular, we consider the following system:

$$\Delta BE_t = \beta_0 + \beta_1 \Delta \ln SP_t + \beta_2 R_t + \beta_3 X_t + \eta_t \tag{17}$$

$$\Delta \ln SP_t = \alpha_0 + \alpha_1 \Delta BE_t + \alpha_2 R_t + \alpha_3 X_t + \epsilon_t \tag{18}$$

$$R_t = \gamma_0 + \gamma_1 \Delta BE_t + \gamma_3 X_t + \nu_t, \tag{19}$$

Table 3. Effects of Inflation Misreport on Stock Returns

	(1)	(2)	(3)	(4)
ΔBE	0.091	0.014	-0.431	-1.017
95perc CI	[-1.87, 1.99]	[-1.70, 1.95]	[-3.04, 1.26]	[-2.70, 1.20]
Observations	223	223	55	65
Events	2-day window	3-day window	2-day window	3-day window
Non-events	All other days	All other days	4-day window	4-day window
Controls	Yes	Yes	Yes	Yes

Notes: The table shows the results for the heteroskedasticity IV estimator. The dependent variable is R_t. Controls include the VIX index, the S&P 500 index, and the MSCI Emerging Markets ETF index. Standard errors and confidence intervals are computed using a stratified bootstrap procedure. 95% confidence intervals are in brackets. ***, **, *, denote significance at 1%, 5%, and 10%, respectively. Sample: January 2007-February 2008.

where we assume that η_t, ϵ_t, ν_t, and X_t are uncorrelated.

In Appendix B.9, we show that under $\sigma_{\eta,E} > \sigma_{\eta,NE}$, we can no longer identify our parameter of interest, α_1. Under this setup, the heteroskedasticity-based approach allows us to identify γ_1 and $\tilde{\alpha_1} \equiv \alpha_1 + \alpha_2\gamma_1$. Notice that α_1 would account for the "reputational channel," whereas $\alpha_2\gamma_1$ accounts for the "fundamentals channel" —i.e., the effect of the inflation announcement on sovereign spreads through the real economy. Thus, $\gamma_1 \neq 0$ would invalidate our interpretation based on a reputational effect. In other words, if $\gamma_1 \neq 0$, the estimates reported in Table 2 may be simply driven by the effects of the inflation announcement on the real economy.

Table 3 presents IV estimates for γ_1. Point estimates are small in absolute value, their sign varies with the specification, and none is statistically significant. Based on these results, the misreport of inflation does not seem to have a direct effect on the Argentine stock market. We take this as additional evidence to support our reputational channel.

We further extend the system of equations in (17)-(19) to allow for the possibility that the stock market is directly affected by changes in sovereign spreads (see Appendix B.9). This specification is motivated by Hebert and Schreger (2017), who find that an increase in a sovereign's default risk significantly decreases the stock returns of the domestic market. Under this setup, we analytically show that our point estimate for γ_1 would have a positive bias. This implies that if anything, our estimate for α_1 is downward biased (in terms of magnitudes). Our results, therefore, may be interpreted as a lower bound.

In Appendix B.10, we complement the previous analysis with a structural VAR that incorporates the interactions between inflation misreport, spreads, and a measure of economic activity. Considering the changes in misreport as a policy variable, we identify structural shocks to the misreport equation using high-frequency changes in break-even inflation during event windows. The results are in line with those of Table 3. In particular, we show that upon a 1–sd structural shock to inflation misreport, spreads increase by 6% on impact. The response of economic activity, albeit negative, is lagged and not statistically significant.

4. Quantitative Analysis

In this section we use our empirical elasticity, as well as other moments for the Argentine economy, to discipline the reputational model described in Section 2. We then use the calibrated model to back up our model-implied measure of reputation and study the role of fundamentals behind the link between reputation and sovereign spreads. Finally, we use our model to disentangle the percentage of Argentina's spreads that can be attributed to reputation. In Appendix C.5, we describe the algorithm used to solve the model.

4.1. *Calibration and Model Fit*

The model is calibrated at quarterly frequency. The calibration follows a two-step procedure. First, we fix a subset of parameters to values that are either standard in the literature or based on historical Argentine data. We then internally calibrate the remaining parameters to match relevant moments for Argentina's sovereign spreads and other business-cycle statistics.

In terms of functional forms, we assume a CRRA utility function: $u\left(c\right)=\frac{c^{1-\gamma}}{1-\gamma}$, with risk-aversion parameter γ. The endowment process follows an AR(1) process given by $ln\left(y_t\right)=\rho_y\, ln\left(y_{t-1}\right)+\epsilon_{y,t}$, with $\epsilon_{y,t}\sim N(0,\sigma_y)$. As in Chatterjee and Eyigungor (2012), the exogenous default cost on income is modeled as $\phi_j\left(y\right)=\max\left\{\left(\bar{\chi_0}+\chi_j\right)y+\bar{\chi_1}y^2,0\right\}$, where $j=\{C,S\}$, $\bar{\chi_0}<0$, and $\bar{\chi_1}>0$. We set $0>\chi_S=-\chi_C=\bar{\chi}_2$ in order to get a larger default set for the strategic type.

Motivated by the Argentine case, we consider the following specification for the probability of receiving message m. We assume that agents do not observe the inflation misreport $\tilde{\pi}$ but they receive a noisy signal about it, $\tilde{\pi}^o$. In particular, we assume that $\tilde{\pi}^o\mid\tilde{\pi}\sim N(\tilde{\pi},\sigma)$, where σ captures the noise of the signal. We further assume that agents detect the misreport (i.e., $m=L$ is realized) if $\tilde{\pi}^o<\alpha$, where $\alpha<0$. Under this set-up, $Prob\left(m=L\mid\tilde{\pi}\right)=\Phi_{(\tilde{\pi},\sigma)}\left(\alpha\right)$, where $\Phi_{(\tilde{\pi},\sigma)}$ is the cumulative distribution function of a normal random variable with mean $\tilde{\pi}$

Table 4. Calibration of the Model

Panel A: Fixed Parameters			Panel B: Calibrated Parameters		
Param.	Description	Value	Param.	Description	Value
γ	Risk aversion	2.00	β	Discount rate	0.95
z	Coupon payments	0.03	$\bar{\chi}_0$	Default cost—level	−0.242
λ	Debt maturity	0.05	$\bar{\chi}_1$	Default cost—curvature	0.325
r	Risk-free interest rate	0.01	$\bar{\chi}_2$	Default cost—differential	−0.006
T_{jj}	Persistence j-type	0.969	B	Inflation-indexed debt service	0.02
ρ_y	Endowment, autocorrelation	0.93	α	Probability threshold	−0.028
σ_y	Endowment, shock volatility	0.02			
θ	Reentry probability	0.0385			
σ	Precision of signal	0.011			

and standard deviation σ. For a given noise of the signal σ, thus, the parameter α determines how fast agents can learn about the type of government from the observed misreports.

Table 4 describes the model calibration. Panel (A) lists the parameters we fix in the calibration. We set the risk aversion, $\gamma = 2$, to a standard value in the literature. The real rate is set to $r = 1\%$, in line with the observed average real rate in the United States. The reentry parameter is set to $\theta = 0.0385$, which implies an average exclusion period from international markets after a default of 6.5 years.[27] We set $\lambda = 0.05$ to match an average debt maturity of 5 years and $z = 0.03$ to match the debt service, as in Chatterjee and Eyigungor (2012). Regarding the frequency at which the government type changes, we set $T_{CC} = T_{SS} = 0.969$ to reflect an election cycle of 8 years. Parameters for the endowment process, ρ_y and σ_y, are estimated based on log-linearly detrended quarterly real GDP data for Argentina.[28] Lastly, we fix σ to match the noise behind the alternative measures of the Argentine inflation rate (as shown in Figure 3). In particular, we set $\sigma = 0.011$ to match the quarterly cross-sectional volatility across the observed misreports during 2007-2012.

[27]This measure is taken from Chatterjee and Eyigungor (2012) and is constructed as an average of the time it took Argentina to reach settlement on the defaulted debt in different default episodes, based on data provided by Beim and Calomiris (2001); Benjamin and Wright (2009); and Gelos et al. (2011).

[28]We use data for the 1980.Q1-2012.Q4 period to compute the log-linear trend for GDP. We allow for a break in the trend in 2001 because Argentina underwent a severe crisis at the end of that year that ended with a default in 2002. The results are robust to other years and other specifications.

Table 5. Targeted Moments

Target	Description	Data	Model
$\mathbb{E}[D/Y]$	Average debt	72%	72%
$\mathbb{E}[SP]$	Average bond spreads	624bp	624bp
$\sigma(SP)$	Volatility spreads	288bp	252bp
$\mathbb{P}[DF]$	Default frequency	3.3%	3.6%
IIB_s/TD_s	Inflation-indexed debt relative service	27%	26%
$\eta_{BE,SP}$	Semi-elasticity BE to spreads	-10.71	-9.98

Notes: The table shows the moments targeted in the calibration and their model counterparts. For data on spreads and debt, the sample period is 1993.Q4-2008.Q1, excluding the default episode that started in December 2001. The semi-elasticity $\eta_{BE,SP}$ is the one computed in Section 3. Model-implied moments are computed based on windows in which the government is not in default.

We calibrate the remaining parameters of our model (Panel (B) of Table 4) to match key data moments of the Argentine economy, detailed in Table 5. In particular, we jointly calibrate the discount factor β and the default cost parameters $\{\bar{\chi}_0, \bar{\chi}_1, \bar{\chi}_2\}$ to target Argentina's average default rate, average external debt, average spread, and volatility of spreads.[29] We target an annual default frequency of 3.3%, since Argentina has defaulted four times since the 1900s.[30] For the other three moments, we target an average external-debt-to-GDP ratio of 72%, an average spread of 624 basis points (bps), and a standard deviation of spreads of 288 bps.[31,32] We set B to match the share of Argentina's debt services attributed to IIBs between 2007 and 2012 (27%).

[29]In the model, annualized spreads are given by $SP = \left(\frac{1+r_b(y,b',\zeta')}{1+r}\right)^4 - 1$, where $r_b(y,b',\zeta')$ is the internal rate of return, as implied by $q(y,b',\zeta') = \frac{[\lambda+(1-\lambda)z]}{\lambda+r_b(y,b',\zeta')}$.

[30]Beim and Calomiris (2001) report a default episode in 1956 and another one in 1982. More recently, Argentina defaulted in 2001 and in 2014.

[31]These moments are computed for the 1993.Q4-2008.Q1 period. Argentina was in default until 1993 and no spreads data are available prior to that year. From this period, we exclude the 2001.Q3-2005.Q3 subsample because Argentina defaulted in December 2001 and was excluded from debt markets until 2005. We do not include the period of the GFC because our model does not consider mechanisms to explain changes in spreads due to foreign conditions (for instance, changes in risk aversion).

[32]As in Chatterjee and Eyigungor (2012), we match only a portion of Argentina's external debt because we do not model repayment. In Argentina's case, the repayment of debt defaulted on has been around 30%.

Lastly, we internally calibrate the learning parameter α to match the semi-elasticity between Argentina's sovereign spreads and changes in the break-even (BE) inflation described in the empirical analysis in Section 3. To obtain a tight link between model and data, we compute the price for an auxiliary IIB (with the same maturity structure as b) and use that price to compute the BE inflation rate, which is a function of the lenders' prior ζ and the conjectured $\tilde{\Pi}^{\star}_{S}$. Since our empirical elasticity is measured at a high frequency, we extend the baseline model of Section 2 to allow for two instances of trading in secondary markets within a period. The first trading instance (A) is at the beginning of stage 1 and before the message m is realized; the second (B) occurs after lenders observe message m and update their beliefs (i.e., $\hat{\zeta}(m)$) accordingly. See Appendix A for details.

Under this extension, we can capture changes in the BE inflation rate and spreads induced by an update in lenders' beliefs about the government type (i.e., reputation) coming from the realization of message m. Our timing assumption (as described in Figure 1) implies that b' is chosen before the trading instance A. Thus, changes in the BE rate and spreads between trading instances A and B only capture the information provided by the message m and are not driven by changes in the bond policy.

We denote $\Delta BE\,(m) \equiv \Delta BE\left(y, b, \tilde{\zeta}, \hat{\zeta}(m)\right)$ and $\Delta lnSP\,(m) \equiv \Delta lnSP\left(y, b, \tilde{\zeta}, \hat{\zeta}(m)\right)$ to be the changes in prices between trading instances A and B, conditional on the realized message m. Because both $\Delta BE\,(m)$ and $\Delta lnSP\,(m)$ are endogenous variables, in order to isolate the causal effect of the misreport on spreads we construct a counterfactual in which we shock the optimal misreport policy by $\epsilon_{\tilde{\pi}} \sim U(-\bar{\pi}, \bar{\pi})$, with $\bar{\pi} > 0$. This shock affects the realization of message m and hence the posterior and bond prices. Let m be the realized message under the optimal policy, $\tilde{\pi}^{\star} \equiv \tilde{\pi}^{\star}\left(y, b, \tilde{\zeta}\right)$, and let m_{ϵ} be the realized message under the counterfactual in which the misreport is $\tilde{\pi}^{\star} + \epsilon_{\tilde{\pi}}$. Our model-implied elasticity is defined as

$$\eta_{BE,SP} \equiv \mathbb{E}\left[\frac{\Delta lnSP\,(m_{\epsilon}) - \Delta lnSP\,(m)}{\Delta BE\,(m_{\epsilon}) - \Delta BE\,(m)}\right].$$

The last row of Table 5 shows that the model is able to match our empirical semi-elasticity. In Appendix A.4 we provide further details regarding the construction of $\eta_{BE,SP}$ and in Appendix C.2 we perform a sensitivity analysis.

We now assess how the model performs in terms of untargeted moments for both standard and model-specific ones. Table 6 shows that our calibrated model is consistent with key business-cycle moments of the Argentine economy. In particular, it closely approximates the relative volatility and correlation of consumption and trade balance with output. The model also

TABLE 6. Untargeted Moments: Business Cycle Statistics

Target	Description	Data	Model
$\sigma(\log C)/\sigma(\log Y)$	Relative volatility consumption	1.13	1.31
$\sigma(TB/Y)/\sigma(\log Y)$	Relative volatility trade balance	0.32	0.46
$\mathrm{corr}(\log C, \log Y)$	Correlation consumption & endowment	95%	95%
$\mathrm{corr}(TB/Y, \log Y)$	Correlation trade balance & endowment	−31%	−49%
$\mathrm{corr}(SP, \log Y)$	Correlation spreads & endowment	−42%	−70%

Notes: The table compares a set of untargeted data moments with their model counterparts. Data for consumption and output are for the 1980-2012 period and exclude the 1982 and 2001 default episodes. Data for spreads and trade balance start in 1993. The terms $\log C$ and $\log Y$ denote the log-linear cycle for consumption and output, respectively.

TABLE 7. Untargeted Moments: Misreport, BE, and Spreads

Target	Description	Data	Model
Panel A: Quarterly Frequency			
$\mathbb{E}[\tilde{\pi}]$	Average inflation misreport	−3.47%	−1.87%
$\sigma(\tilde{\pi})$	Volatility inflation misreport	2.31%	0.91%
$\mathrm{corr}(\tilde{\pi}, \log Y)$	Correlation misreport & output	−58%	−30%
Panel B: High Frequency			
$\sigma(\Delta BE)$	Volatility break-even inflation	0.29%	0.17%
$\mathrm{corr}(\epsilon_{\tilde{\pi}}, \Delta BE)$	Correlation misreport & break-even inflation	44%	69%
$\mathrm{corr}(\epsilon_{\tilde{\pi}}, \Delta \ln SP)$	Correlation misreport & spread	−36%	−61%

Notes: The table compares a set of moments that are specific to our model with their data counterpart. The last three rows show high-frequency changes around days on which the government announces the inflation rate. In the model, we compute these changes by comparing prices at trading instances A and B (i.e., before and after the realization of message m). For the data column, ΔBE and $\Delta lnSP$ are computed for event days only, as described in Table 1, and are based on the 2007-2008 period.

captures the negative correlation between spreads and output, which is a common feature of emerging economies (see, for example, Neumeyer and Perri (2005) and Aguiar and Gopinath (2007)).

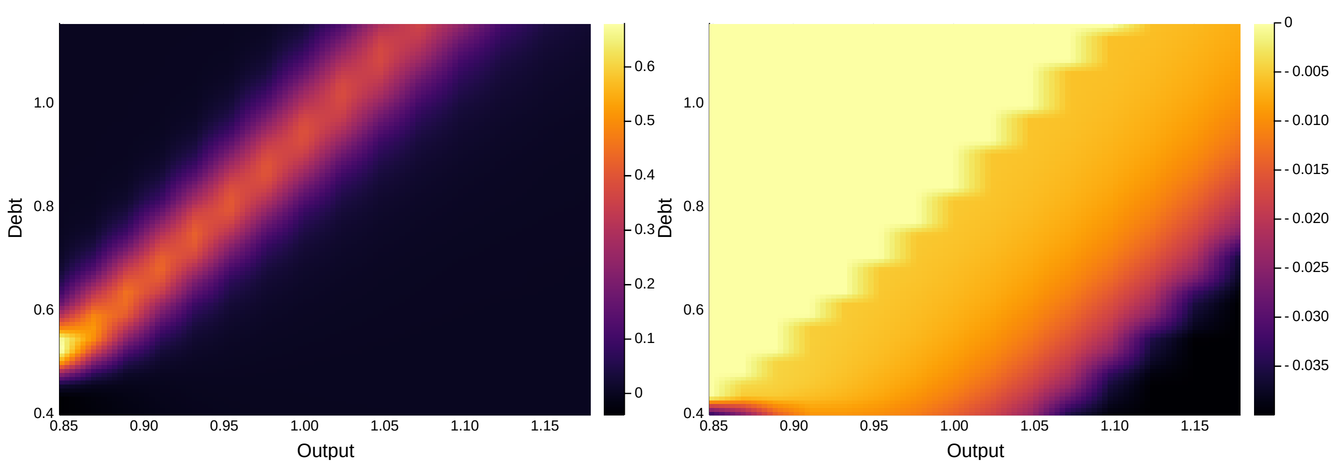
Table 7 shows a set of untargeted moments that are specific to our model. The top panel shows that the model is roughly consistent with the average quarterly misreport, its volatility, and the negative relation between the misreport and the output cycle. For the data counterparts, although we do not observe the actual misreport of inflation, we proxy it by computing the difference between the inflation announced by the government and the average across alternative measures of inflation. The bottom panel compares different moments based on high-frequency changes around days on which the government announces the inflation rate. In the model, we compute these changes by comparing bond prices before and after the realization of message m_ϵ, based on an unexpected shock to the misreport $\epsilon_{\tilde{\pi}}$. In the data, although unobservable, we proxy $\epsilon_{\tilde{\pi}}$ as the change in the observed misreport across two consecutive months—see Appendix equation (B.2). The model matches the volatility of ΔBE and its correlation with $\epsilon_{\tilde{\pi}}$. It also captures the negative correlation between $\epsilon_{\tilde{\pi}}$ and $\Delta lnSP$ that we observe in the Argentine data.

4.2. *Links between Reputation and Fundamentals*

In what follows, we use the model disentangle the fraction of a government's spreads that can be explained by its reputation. We refer to this measure as the "reputation premium." We then analyze the role of macroeconomic fundamentals (y and b) behind the link between reputation and spreads.

FIGURE 6. Fundamentals and Reputation

(A) $q(y,b,\zeta_H) - q(y,b,\zeta_L)$ (B) $\tilde{\pi}(y,b,\zeta_H)$



Notes: Panel (A) shows the effect of a change in a government's reputation (from ζ_L to ζ_H) on its bond prices for different combinations of (y, b). Panel (B) shows the optimal $\tilde{\pi}$ policy for different states (y, b). In both cases, the upper left area coincides with points in the state space in which both the C- and S-type default.

We first analyze the effect of reputation on bond prices and we describe the optimal $\tilde{\pi}$ policy for different points of the state space. Panel (A) of Figure 6 shows the effect of a change in ζ on bond prices for different combinations of (y, b). In the upper left corner (high b, low y), both the C- and S-type choose to default, and therefore the effect of ζ on bond prices is negligible. In the lower right corner, on the other hand, the default probability for the C- and S-type is close to zero, and thus changes in reputation do not affect bond prices. On the main diagonal, however, the default probability of the S-type is (weakly) larger than that of the C-type—see Appendix Figure C.1. In these points of the state space, thus, changes in ζ do affect bond prices significantly. Panel (B) shows that as we approach this area, the S-type optimally chooses to decrease the magnitude of $\tilde{\pi}$, since it does not want to reveal its type.

We define *reputation premium* (Υ) as the additional borrowing cost a government faces for not having a "good' reputation. Formally, it is the difference between realized (i.e., observed) sovereign spreads and those under a counterfactual in which the government's reputation is the maximum possible,

$$\Upsilon\left(y, b, \zeta\right) \equiv SP\left(y, b, \zeta\right) - SP\left(y, b, \zeta_H\right), \tag{20}$$

where ζ_H is the upper bound for the lenders' prior.

Table 8 provides different moments describing the reputation premium based on model simulations. On average, the premium is 95 bps, which accounts for 13% of sovereign spreads. More importantly, the table shows that spreads in our model would be 40% less volatile absent the reputation premium.

The bottom panel of Table 8 shows that the incidence of the reputation premium is state-contingent: (i) the premium accounts for about 20% of spreads when output is one standard deviation below its average, and (ii) the correlation between reputation premium and output is highly negative. Figure 7 illustrates these points in more detail. It shows the fraction of spreads explained by the reputation premium for different values of output (Panel A) and observed spreads (Panel B). The figure shows that the reputation premium can account for up to 50% of spreads when the economy is in a severe recession or when the default probability is high.

Table 8. Decomposition of Spreads: The Reputation Premium

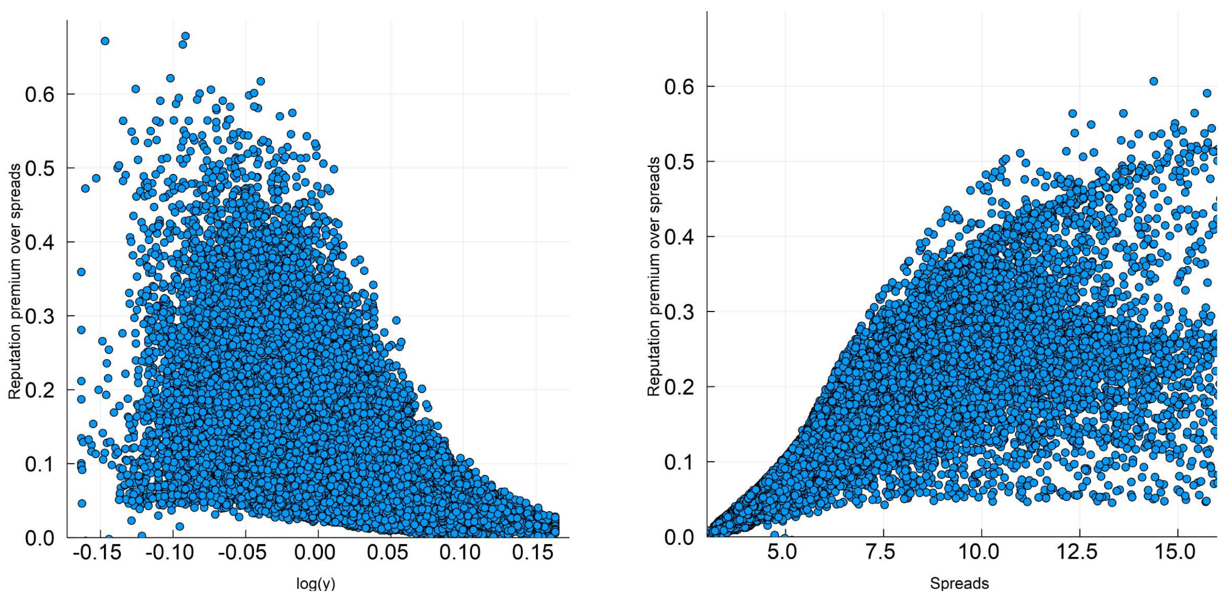
Moment	Description	Value
$\mathbb{E}[\Upsilon]$	Average reputation premium	95bp
$\mathbb{E}[\Upsilon/SP]$	Incidence reputation premium on spreads	13%
$\sigma(\Upsilon)/\sigma(SP)$	Reputation premium volatility	44%
$\sigma(SP\|\zeta_H)/\sigma(SP)$	Spread volatility under high reputation	60%
$\mathbb{E}[\Upsilon/SP\|Y < Y_l]$	Incidence with low output	21%
$\text{corr}(\Upsilon, \log Y)$	Correlation reputation premium & output	−63%
$\text{corr}(\Upsilon/SP, \log Y)$	Correlation reputation incidence & output	−67%

Notes: The table shows moments related to the reputation premium Υ and the link between Υ and the economy's fundamentals.

Figure 7. Reputation Premium and Fundamentals

(A) Reputation Premium vs Output

(B) Reputation Premiums vs Spreads



Notes: The figure shows the incidence of the reputation premium for different macroeconomic fundamentals. Panel (A) shows the reputation of premium (as a share of spreads) for different levels of output. Panel (B) shows the same measure but for different levels of observed spreads.

TABLE 9. The Costs of Information Frictions

	Debt and Spreads			Reputation Premium	
	$\mathbb{E}[D/Y]$	$\mathbb{E}[SP]$	$\sigma(SP)$	$\mathbb{E}[\Upsilon]$	$\sigma[\Upsilon]$
Baseline Model	73%	647bp	265bp	90bp	91bp
Fixed C-type	83%	497bp	201bp	0bp	0bp
Perfect Information	75%	595bp	236bp	0bp	0bp

Notes: The table shows moments for debt and spreads, conditioning on cases in which the government is of the C-type. The first row shows the results for our baseline model with alternating types and imperfect information. The second row shows a counterfactual in which the type of government is fixed (and observable). The last row shows the case in which the type of government alternates but it is perfectly observable.

4.3. *The Costs of Information Frictions*

We next analyze the costs of information frictions about the government type. In particular, we study, from the perspective of the C-type, the spreads that it faces under the baseline model and under two counterfactuals. The first one (*fixed C-type* case) is a counterfactual in which the type of government is fixed (and known by lenders). The second one (*perfect information* case) is a counterfactual in which the type of government is time varying but lenders can perfectly observe it. Table 9 presents the results.

In the baseline model, even after we condition for periods in which the C-type is in charge of the government, the reputation premium still accounts for a sizable share of spreads (around 13%) and explains a third of its volatility. This is because lenders' beliefs are slow moving and the C-type cannot perfectly reveal its type to lenders. Under the *fixed C-type case*, the government attains a much larger debt and, at the same time, faces lower spreads. This result thus highlights that the mere existence of the S-type significantly affects the borrowing costs faced by the C-type. Our model can thus help explain why countries in which political parties have displayed different preferences over default in the past may face higher spreads.

The last row of Table 9 provides a counterfactual that allows us to disentangle the costs of information frictions. In particular, it shows the spreads faced by the C-type under the *perfect information* case. Under this counterfactual, the C-type avoids paying the reputation premium, and thus, it is able to increase its stock of debt and decrease its spreads. While the C-type is negatively affected by not being able to perfectly reveal its type, the S-type may benefit from it.[33] In Appendix C.3, we analyze the welfare implications of information frictions. We show that, on average, the government would be better off in the perfect information case.

4.4. *The Argentine Case*

We use the calibrated model to simulate Argentine spreads during the 2006.Q1-2012.Q4 period. To this end, we enter the observed evolution of the log-linear cycle of GDP during this period; see Appendix Figure C.6 for the path for output. We choose the initial value of debt to match the observed spread in 2006.Q1. We assume that the government is initially of the C-type and becomes of the S-type starting in 2007.Q1.[34] We simulate the economy 20,000 times and take averages across simulations. Starting in 2007.Q1, each simulation i differs in its realized sequence of messages, $\{m_t^i\}_{t=1}^T$. We filter by simulations in which at least one message $m = L$ was realized during the first semester of 2007.

Panel (A) of Figure 8 shows the dynamics of spreads in the data (dashed line) and the average model-implied dynamics (solid line). The dotted lines represent the bottom and top 2.5 percentiles of the model simulations. Overall, the model provides a path for Argentine spreads that moves in line with that of the data. In particular, it accounts for a large share of the increase in Argentina's spreads during the GFC period. This is surprising, given that the model assumes risk-neutral lenders and abstracts from changes in the risk premium or lenders' net worth.[35]

The other panels of Figure 8 compare the implied dynamics of our baseline simulation against two counterfactuals. In the first counterfactual, the government remains of the C-type and its reputation varies based on the realized message m and the Markov chain T. In the second counterfactual, we assume that the reputation is fixed at ζ_H. For the two counterfactuals, we set the same path of debt as the one observed under the baseline simulation.[36]

Starting in 2007.Q1, Panel (B) shows that spreads under the baseline simulation (blue solid line) start to decouple from those implied by the counterfactuals (gray and red lines). This is because the S-type optimally chooses to reveal its type by setting $\tilde{\pi} < 0$ (Panel C), which implies that message $m = L$ is realized more frequently and the government's reputation

[33] While not reported in Table 9, conditional on the S-type, the average spread is 600 bps under imperfect information and 615 bps under perfect information for similar levels of debt.

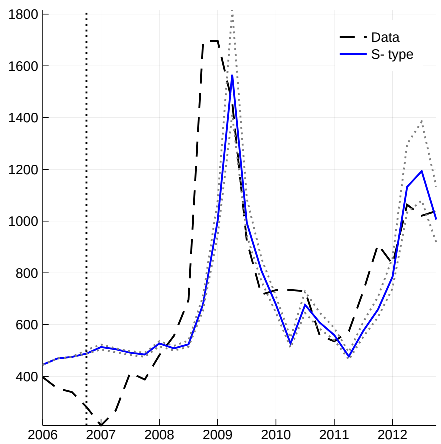
[34] We set the initial reputation to $\zeta = 0.60$, which is the average reputation under the C-type.

[35] For papers that study the role of global factors and international lenders, see, for example, Borri and Verdelhan (2011); Aguiar, Chatterjee, Cole, and Stangebye (2016); Bai, Perri, and Kehoe (2019); Bocola and Dovis (2019); Lizarazo (2013); Morelli, Ottonello, and Perez (2022).

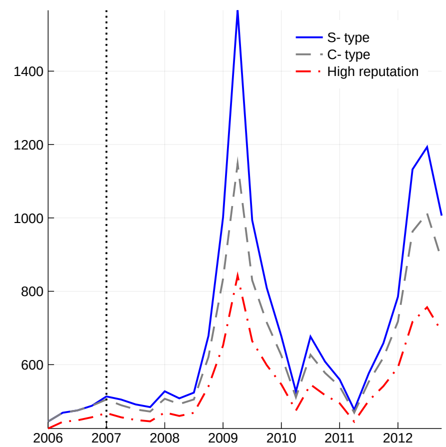
[36] This way we can isolate changes in spreads that are simply driven by differences in the stock of debt.

FIGURE 8. Model Simulations: Comparison with Data and Counterfactuals

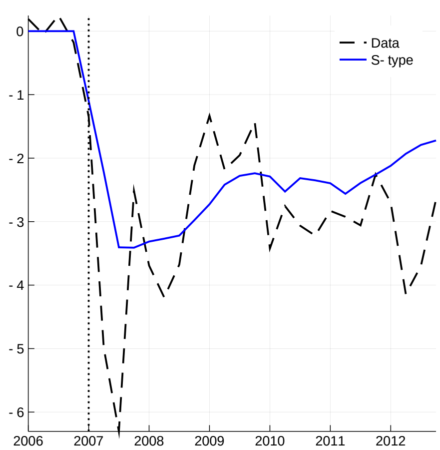
(A) Model vs Data: Spreads



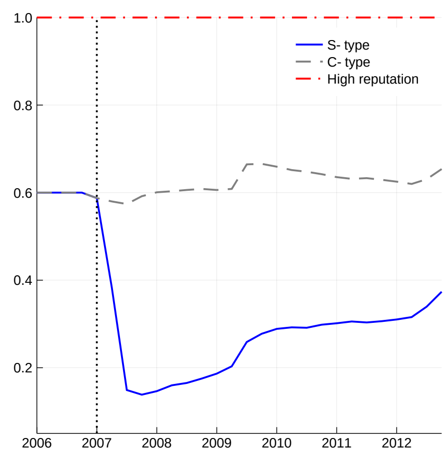
(B) Counterfactuals: Spreads



(C) Inflation Misreport $\tilde{\pi}$



(D) Reputation ζ



Notes: Panel (A) shows the evolution of Argentina's sovereign spreads for the 2006.Q1-2012.Q4 period (dashed line) and model-implied dynamics. The solid line shows the average spread across the simulations and dotted lines show the 2.5 and 97.5 percentiles. Panel (B) shows the model-implied dynamics under the S-type scenario (solid line), the C-type scenario (dashed line), and the constant high-reputation scenario (dashed-dot line). Panel (C) shows the optimal misreport policy $\tilde{\pi}$. Panel (D) shows the evolution of ζ under the different counterfactuals.

declines (Panel D). Even though it is untargeted in the calibration, notice that the model is able to match reasonably well the observed paths of misreports.

Overall, the previous analysis highlights that the decrease in reputation led to a striking additional response of Argentina's spreads. In particular, Argentina's loss of reputation can explain 30-50% of the increase in its sovereign spreads during the GFC.

5. Conclusion

In this paper we study how a government's reputation is shaped by its policies and quantify how markets price this reputation. To this end, we focus on a debt-repayment setting in which reputation is a first-order concern. We develop a sovereign default model with uncertainty about the government's type and noisy signals. In the model, agents observe signals about the government's policies and use those signals to update their beliefs about its type (i.e., reputation). Changes in reputation affect the markets' perceived probability of default and therefore the sovereign spreads. Guided by the model, we use the 2007-2012 Argentine episode of inflation misreport to provide new empirical evidence on the link between reputation and borrowing costs. We argue that this policy provided (noisy) information to lenders regarding the type of government, which affected its reputation. We find that the market priced the sequence of misreports, as reflected in a significant increase in the spreads of Argentina's dollar-denominated bonds. Our quantitative model shows that changes in reputation can have long-lasting effects. In particular, we find that the loss in Argentina's reputation due to the misreport is crucial for matching the observed excess sensitivity of Argentina's spreads during the GFC and, to some extent, its posterior decoupling from the rest of the region.

More generally, our results stress the role of reputation as a type of gained capital that is salient for policymakers. Reputation and the existence of asymmetric information can affect other areas of policy interest, such as the effectiveness of government stabilization policies, the rule of law and a country's investment environment, international trade and relations with foreign countries and organizations, and government contracts with other entities. We leave a more detailed analysis of the role of reputation in these areas to future research.

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Appendix A. A Reputational Model of Sovereign Default

In this Appendix, we provide the details for the model described in Section 2. We start by describing the government's recursive problem and the bond pricing kernel. We then define the equilibrium for this economy. Lastly, we provide an extension of the model that includes a secondary market for government bonds. This allows us to compute a model-implied semi-elasticity between changes in the BE and sovereign spreads, which allows us to link our model to the empirical analysis.

A.1. *Government's Recursive Problem*

We outline the j-type government's recursive problem in the following steps. First, we describe the government's optimal default decision (stage 0). We then describe the S-type optimal choice of $\tilde{\pi}$ (stage 1) and bond policy issuance (stage 2).

Stage 0: Optimal Default Decision

At stage 0, assuming the country is currently out of a default, the government chooses whether to default. Each type j solves the following problem:

$$W_j\left(y,b,\zeta\right) = Max_{d\in\{0,1\}}\left\{W_j^R\left(y,b,\tilde{\zeta}\right),\, W_j^D\left(y,b,\tilde{\zeta}\right)\right\}, \tag{A.1}$$

where $W_j^R\left(\cdot\right)$ denotes the value function in case of repayment, $W_j^D\left(\cdot\right)$ is the value function in case of default, and $\tilde{\zeta} \equiv \tilde{\zeta}\left(d=1,\zeta;d_S^\star,d_C^\star\right)$ denotes the lenders' posterior given by Equation (3), which depends on the lenders' conjectures $(d_S^\star, d_C^\star)$. Let $d_j(y,b,\zeta)$ denote the optimal default policy for type j.

If the government defaults, it faces an output cost $\phi_j(y)$ and is temporarily excluded from international debt markets. We assume that it regains access to debt markets with probability θ. There is no recovery value and the stock of debt is $b=0$ after exiting a default. The value of default for the j-type is given by

$$\begin{aligned} W_j^D\left(y,b,\tilde{\zeta}\right) =& u\left(y-\phi_j\left(y\right)\right)+ \\ &+\theta\beta\int_y\left\{T_{jj}W_j\left(y',0,\zeta'\right)+T_{j(-j)}W_{(-j)}\left(y',0,\zeta'\right)\right\}dF\left(y'\mid y\right) \\ &+\left[1-\theta\right]\beta\int_y\left\{T_{jj}\tilde{W}_j^D\left(y',\zeta'\right)+T_{j(-j)}\tilde{W}_{(-j)}^D\left(y',\zeta'\right)\right\}dF\left(y'\mid y\right) \\ s.t.\quad & \zeta' = T_{CC}\times\tilde{\zeta}+T_{SC}\times\left[1-\tilde{\zeta}\right], \end{aligned} \tag{A.2}$$

where $(-j)$ refers to the type other than j and $\tilde{W}_j^D(\cdot)$ denotes the value function if the government is already in default. It is given by

$$
\begin{aligned}
\tilde{W}_j^D(y,\zeta) = & u(y-\phi_j(y)) + \\
& +\theta\beta\int_y \left\{T_{jj}W_j(y',0,\zeta') + T_{j(-j)}W_{(-j)}(y',0,\zeta')\right\}dF(y' \mid y) \\
& +[1-\theta]\beta\int_y \left\{T_{jj}\tilde{W}_j^D(y',\zeta') + T_{j(-j)}\tilde{W}_{(-j)}^D(y',\zeta')\right\}dF(y' \mid y) \\
s.t. \quad & \zeta' = T_{CC}\zeta + T_{SC}[1-\zeta].
\end{aligned}
\tag{A.3}
$$

Notice that the only difference between Equations (A.2) and (A.3) is the evolution of the posterior: In the latter expression it evolves exogenously, while in the former it depends on the default choice.

Stage 1: Optimal Debt Issuance and $\tilde{\pi}$ Policies

At the beginning of stage 1, lenders have adjusted their beliefs based on the observed choice of d. The economy's state is thus given by $(y, b, \tilde{\zeta})$. If the government is not in default, it then chooses its optimal debt issuance and $\tilde{\pi}$ policies.

Since the goal of the analysis is to focus on the information provided by the $\tilde{\pi}$ policy, we assume that bond policies are uninformative about the type of government. To this end, as in Amador and Phelan (2021), we assume that both the C- and S- type follow the same debt policy $b^{\star\prime}\left(y, b, \tilde{\zeta}\right)$.[37] We interpret $b^{\star\prime}(\cdot)$ as a fiscal rule that is not under the control of the j-type. Instead of imposing an arbitrary fiscal rule, we assume that bond policies are optimally chosen by another agent of the economy: the Congress. We assume that the Congress does not observe the type of government and it has the same information set as that of the market. Thus, the priors and conjectures of lenders and Congress are the same, which implies that the bond policy is completely uninformative about the government type.

[37] In a continuous-time infinite-horizon model with perfectly observed actions and no exogenous cost of default, Amador and Phelan (2021) show that this restriction is without loss of generality. This is because the S-type does not have incentives to completely reveal its type by choosing a different bond policy.

Under these assumptions, given the state $\left(y, b, \tilde{\zeta}\right)$ and the conjectured $\tilde{\pi}$ policy for the S-type, the bond policy rule $b^{\star\prime} \equiv b'(y, b, \tilde{\zeta})$ is obtained from the following problem:

$$b^{\star\prime} = ArgMax \quad \tilde{\zeta} \times \left\{ \sum_{M=\{L,NL\}} P\left(m = M \mid 0\right) V_C \left(0, y, b, \hat{\zeta}(M)\right) \right\} + \tag{A.4}$$

$$\left(1 - \tilde{\zeta}\right) \times \left\{ \sum_{M=\{L,NL\}} P\left(m = M \mid \tilde{\Pi}_S^{\star}\right) V_S \left(\tilde{\Pi}_S^{\star}, y, b, \hat{\zeta}(M)\right) \right\}.$$

The value function $V_j\left(\cdot\right)$ is defined as[38]

$$V_j\left(\tilde{\pi}, y, b, \hat{\zeta}(m)\right) = u\left(c\right) + \beta \int_y \left\{ T_{jj} W_j\left(y', b^{\star\prime}, \zeta'\right) + T_{j(-j)} W_{(-j)}\left(y', b^{\star\prime}, \zeta'\right) \right\} dF\left(y' \mid y\right) \tag{A.5}$$

$$\text{s.t. } c = y - b\left[\left(1 - m_b\right) z_b + m_b\right)\right] + q\left(y, b^{\star\prime}, \zeta'\right)\left[b^{\star\prime} - (1 - m_b) b\right] + \Omega(\tilde{\pi}),$$

where the posterior $\hat{\zeta}(m) \equiv \hat{\zeta}\left(m, \tilde{\zeta}; \tilde{\Pi}_S^{*}, \tilde{\Pi}_C^{*}\right)$ is given by Equation (4) and ζ' is given by Equation (5). When solving for the optimal bond policy, the Congress takes the pricing kernel $q\left(y, b', \zeta'\right)$ as given, but it internalizes the effects of a larger bond issuance on bond prices.

Regarding the optimal $\tilde{\pi}$ policy, taking as given the bond policy $b^{\star\prime}$, the S-type solves the following problem:

$$W_S^R\left(y, b, \tilde{\zeta}\right) = \max_{\tilde{\pi}} \sum_{M=\{L,NL\}} Prob(m = M|\tilde{\pi}) \times V_S\left(\tilde{\pi}, y, b, \hat{\zeta}(M)\right)$$

$$s.t. \quad \tilde{\pi} \in \left[\underline{\pi}, 0\right]. \tag{A.6}$$

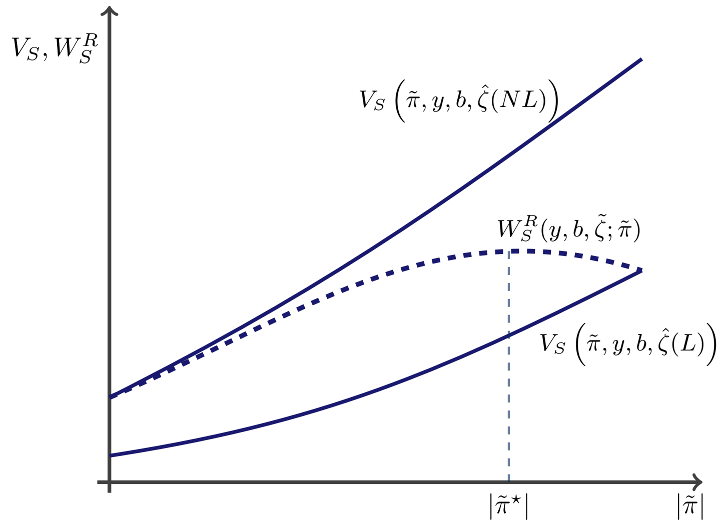
Figure A.1 provides a graphical illustration behind the optimal choice of $\tilde{\pi}$. For a given realization of message m, under the assumption that $\Omega(.)$ is increasing in the magnitude of $\tilde{\pi}$, then $V_S\left(\tilde{\pi}, y, b, \hat{\zeta}(m)\right)$ is increasing in $\mid \tilde{\pi} \mid$. It also attains a higher value when $m = NL$ because of the effect the message has on reputation and bond prices. The dashed line depicts the weighted average between $V_S\left(\tilde{\pi}, y, b, \hat{\zeta}(NL)\right)$ and $V_S\left(\tilde{\pi}, y, b, \hat{\zeta}(L)\right)$, where the weights are given by $Prob(m \mid \tilde{\pi})$. When choosing $\tilde{\pi}$ the government internalizes its effects on the probability that message m is being realized. The choice of $\tilde{\pi}$, thus, involves a stochastic trade-off between higher current consumption and lower reputation. We denote $\tilde{\pi}_S(y, b, \tilde{\zeta})$ to be the optimal policy for the strategic type.

As for the C-type, since it never misreports, we can define its value function at stage 1 as

$$W_C^R\left(y, b, \tilde{\zeta}\right) = \sum_{M=\{L,NL\}} Prob(m = M|\tilde{\pi} = 0) \times V_C\left(0, y, b, \hat{\zeta}(M)\right). \tag{A.7}$$

[38]Notice that $b^{\star\prime}$ is also an argument of $V_j\left(\cdot\right)$ but we omit it for notation easiness.

FIGURE A.1. Optimal Choice of $\tilde{\pi}$ - Graphical Illustration



Notes: The figure shows how the value function V_S varies with $\tilde{\pi}$ for the two possible realizations of the message m. The dashed line depicts the linear combination between the two value functions, where the weights depend on the probability of message m being realized, given $\tilde{\pi}$.

Stage 2: Bond Issuance

At stage 2, after the message m has been realized, the primary market for bonds opens and the government issues $b^{\star\prime}$. Our timing assumption implies that the Congress does not adjust its choice of b' based on the realization of m. As we explain in Appendix A.4, this assumption allows us to isolate the effect of the message m on spreads (i.e., the reputational effect), which is important to match the empirical semi-elasticity of our empirical analysis.

A.2. *Pricing Kernels*

We assume that bonds are priced by risk-neutral investors. Let r denote the risk-free rate at which they discount payoffs. Let ζ' be the updated end-of-period posterior, as defined in Equations (3)-(5). Let $VR_j\left(y', b', \zeta'\right)$ be the next-period value of repayment if the government is of the j-type. The bond-pricing kernel is

$$q\left(y, b', \zeta'\right) = \frac{1}{1+r} \int_y \left\{ \zeta' VR_C\left(y', b', \zeta'\right) + \left(1-\zeta'\right) VR_S\left(y', b', \zeta'\right) \right\} dF\left(y' \mid y\right) \tag{A.8}$$

with

$$VR_j\left(y', b', \zeta'\right) \equiv \left(1 - d_j^{\star\prime}\right) \times \left[\sum_{M=\{L,NL\}} Prob(m' = M \mid \tilde{\Pi}_j^{\star\prime}) \Big(\lambda + (1-\lambda)\left[z + q_M'\right]\Big) \right], \tag{A.9}$$

where $d_j^{\star\prime} \equiv d_j^\star(y', b', \zeta')$ refers to the (conjectured) next-period default choice for type j, given the next-period initial state. Similarly, $\tilde{\Pi}_j^{\star\prime} \equiv \tilde{\Pi}_j^\star(y', b', \tilde{\zeta}')$ refers to the conjectured next-period optimal $\tilde{\pi}$ policy, with $\tilde{\zeta}' \equiv \tilde{\zeta}\left(d' = 0, \zeta'; d_S^{\star\prime}, d_C^{\star\prime}\right)$ (as defined in Equation (3)). The term q_M' refers to the next-period price for one unit of debt. This price is contingent on the realization of message m' and it is given by

$$
\begin{aligned}
q_M' &= q\left(y', b'', \zeta''\right) \\
\hat{\zeta}' &= \hat{\zeta}\left(M, \tilde{\zeta}'; \tilde{\Pi}_S^{\star\prime}, \tilde{\Pi}_C^{\star\prime}\right) \text{ [as defined in Equation (4)]} \\
\zeta'' &= T_{CC} \times \hat{\zeta}' + T_{SC} \times \left(1 - \hat{\zeta}'\right) \\
b'' &= b^{\star\prime}\left(y', b', \tilde{\zeta}'\right) \text{ [as defined in Equation (A.4)].}
\end{aligned}
$$

A.3. *Definition of Equilibrium*

Definition 1. *Perfect Bayesian Equilibrium (PBE)*
A PBE is a collection of value functions, $\left\{W_j(\cdot), W_j^R(\cdot), W_j^D(\cdot), \tilde{W}_j^D(\cdot), V_j(\cdot)\right\}_{j=\{C,S\}}$*; policy functions* $\{d_j(\cdot), \tilde{\pi}_j(\cdot), b'(\cdot),\}_{j=\{C,S\}}$*; lenders' conjectures* $\left\{d_j^\star(\cdot), \tilde{\Pi}_j^*(\cdot), b^{\star\prime}(\cdot)\right\}_{j=\{C,S\}}$*; lenders' system of beliefs* $\left\{\tilde{\zeta}(\cdot), \hat{\zeta}(\cdot)\right\}$*; and bond prices* $q(\cdot)$ *such that:*

1. *Given* $(d_S^\star(\cdot), d_C^\star(\cdot))$*, the posterior* $\tilde{\zeta}(d, \zeta; d_S^\star, d_C^\star)$ *is derived from Equation (3).*
2. *Given* $\left(\tilde{\Pi}_S^\star(\cdot), \tilde{\Pi}_C^\star(\cdot)\right)$*, the posterior* $\hat{\zeta}\left(m, \tilde{\zeta}, \tilde{\Pi}_S^\star, \tilde{\Pi}_C^\star\right)$ *is derived from Equation (4) and* $\zeta'(\hat{\zeta})$ *is obtained from Equation (5).*
3. $b'(\cdot)$ *solves the problem in Equation (A.4), where* $V_j(\cdot)$*, as defined in Equation (A.5), is the associated value function.*
4. *Given the value function* $V_S(\cdot)$*,* $\tilde{\pi}_S(\cdot)$ *solves the problem in Equation (A.6) and* $W_S^R(\cdot)$ *is the associated value function. As for the C-type,* $\tilde{\pi}_C(\cdot) = 0$ *(by assumption) and* $W_C^R(\cdot)$*, defined in Equation (A.7), is the associated value function.*
5. *The value functions in case of default,* $W_j^D(\cdot)$ *and* $\tilde{W}_j^D(\cdot)$*, are consistent with Equations (A.2) and (A.3).*
6. *Given the value functions* $W_j^R(\cdot)$ *and* $W_j^D(\cdot)$*,* $d_j(\cdot)$ *solves the problem in Equation (A.1) and* $W_j(\cdot)$ *is the associated value function.*
7. *Given lenders' conjectures* $d_j^\star(\cdot)$ *and* $\tilde{\Pi}_j^\star(\cdot)$*, bond prices are consistent with Equations (A.8) and (A.9).*
8. *Lenders' conjectures coincide with optimal policies:* $d_j^\star(\cdot) = d_j(\cdot)$*,* $\tilde{\Pi}_j^\star(\cdot) = \tilde{\pi}_j(\cdot)$*.*

A.4. *Model Extension: Secondary Markets and Link with Empirical Analysis*

The semi-elasticity between sovereign spreads and the BE inflation rate computed in the empirical analysis of Section 3 relies on high-frequency data. In particular, it is constructed in a short window around the government's report of inflation. Our model, however, is calibrated at a quarterly frequency. Because our goal is to use this elasticity to discipline the learning parameter α, in order to address this frequency disconnect, we extend our baseline model by allowing different trading instances within the same period.

Figure A.2 describes the timing assumption under this extension. In particular, we allow for two instances of trading in secondary markets (SM) within a period. The first trading instance (A) is at the beginning of stage 1, right after the government's default decision and before message m is realized. The second one (B) occurs after lenders observe message m and update their beliefs (i.e., $\hat{\zeta}(m)$) accordingly. In both cases, SM bond prices are cum dividend and thus include the expected dividend payments at the end of period t, when the primary market (PM) opens.

Figure A.2. Timing of Events: Infinite-period Model

	If default	If no default	
Stage 0	Stage 1	Stage 1	Stage 2
- Initial $\mathbf{S} = (y, b, \zeta)$ - Default choice $d = \{0, 1\}$ - First update of beliefs $\tilde{\zeta}(d, \zeta)$	- Temporary exclusion from debt markets - Output cost $\phi_j(y)$	- Trading in SM A - Choice of b' and $\tilde{\pi}$ - Message $m = \{L, NL\}$ - Second update of beliefs $\hat{\zeta}(m, \tilde{\zeta})$ - Trading in SM B	- Primary markets open: Coupon payments & debt issuance b'

Let $q_A(y, b, \tilde{\zeta})$ denote the pricing kernel at trading instance A. This price depends on the expected value of the bond at trading instance B, once message m is realized but before coupons are paid. It is given by

$$q^{(A)}(y, b, \tilde{\zeta}) = \tilde{\zeta} q_C^{(A)}(y, b, \tilde{\zeta}) + \left(1 - \tilde{\zeta}\right) q_S^{(A)}(y, b, \tilde{\zeta}), \tag{A.10}$$

where for each $j = \{C, S\}$

$$q_j^{(A)}\left(y, b, \tilde{\zeta}\right) = \sum_M Prob\left(m = M \mid \tilde{\Pi}_j^{\star}\right) q^{(B)}(y, b, \hat{\zeta}(m)), \tag{A.11}$$

where $\tilde{\Pi}^{\star}_j \equiv \tilde{\Pi}^{\star}_j(y, b, \tilde{\zeta})$ is the conjectured misreport policy, $\hat{\zeta}(m)$ is given by Equation (4), and $q_B(y, b, \hat{\zeta}(m))$ is the price of a bond at trading instance B. This price, in turn, is given by

$$q^{(B)}(y, b, \hat{\zeta}(m)) = \left\{ \lambda + (1-\lambda)\left(z + q(y, b'^{\star}, \zeta')\right) \right\}, \tag{A.12}$$

where $b^{\star\prime} \equiv b^{\star\prime}(y, b, \tilde{\zeta})$ is the bond policy, ζ' is given by Equation (5), and $q\,(y, b', \zeta')$ is the price of a bond in the primary market. Under this setup, the price of a bond in the primary market is given by:

$$q\,(y, b', \zeta') = \frac{1}{1+r}\int_y \left\{ \zeta'\,(1 - d^{\star\prime}_C)\, q^{(A)}_C\left(y', b', \tilde{\zeta}'\right) + (1-\zeta')\,(1 - d^{\star\prime}_S)\, q^{(A)}_S\left(y', b', \tilde{\zeta}'\right) \right\} dF\,(y' \mid y)\,, \tag{A.13}$$

where $d^{\star\prime}_j \equiv d^{\star}_j(y', b', \zeta')$ refers to the conjectured next-period default choice for type j and the posterior $\tilde{\zeta}'$ is given by $\tilde{\zeta}' \equiv \tilde{\zeta}\,(d' = 0, \zeta'; d^{\star\prime}_S, d^{\star\prime}_C)$ (as defined in Equation (3)). Most importantly, notice that by replacing Equation (A.10)-(A.12) in Equation (A.13), we can obtain the pricing equation of the baseline model (as described in Equation (A.8)). In other words, the proposed extension nests our baseline model.

This model extension allows us to compute the intraperiod change in bond prices before and after the realization of message m. Given our timing assumption regarding the choice of the bond policy, the realized message m does not affect debt issuances. Thus, changes in bond prices between trading instances A and B are purely driven by changes in a government's reputation.

Lastly, we introduce a measure of the BE inflation rate in the model. To this end, we first compute the price of an auxiliary inflation-indexed bond (IIB) with the same maturity structure as b, but whose payoffs depend on the government's misreport. The pricing kernel of this IIB is analogous to that of the nominal bond, with the only difference being that the (expected) bond payments are adjusted by $\left(1 + \tilde{\Pi}^{\star}_j\right)$. The model-implied measure of BE inflation for trading instances (A) and (B) are given by

$$\begin{aligned} BE^{(A)}(y, b, \tilde{\zeta}) &= Yield^{(A)}_{[IIB]}(y, b, \tilde{\zeta}) - Yield^{(A)}(y, b, \tilde{\zeta}) \\ BE^{(B)}(y, b, \hat{\zeta}(m)) &= Yield^{(B)}_{[IIB]}(y, b, \hat{\zeta}(m)) - Yield^{(B)}(y, b, \hat{\zeta}(m)), \end{aligned}$$

where the (annualized) yields can be computed directly from the pricing kernels. We can then compute intraperiod price changes between instances A and B as follows:

$$\Delta BE(m) = BE^{(B)}(y, b, \hat{\zeta}(m)) - BE^{(A)}(y, b, \tilde{\zeta}) \tag{A.14}$$

$$\Delta \text{ln}SP(m) = \text{ln}SP^{(B)}(y, b, \hat{\zeta}(m)) - \text{ln}SP^{(A)}(y, b, \tilde{\zeta}). \tag{A.15}$$

Conditional on the state of the economy, notice that these model-implied changes only depend on the realization of the message m. In this regard, they resemble the high-frequency measures for ΔBE and $\text{ln}SP$ that we compute in our empirical analysis.

A final issue to consider is that in the model, changes in the government's reputation are driven by the realizations of m; these realizations, in turn, depend on the optimal choice of $\tilde{\pi}$ (which is an endogenous object). That is, both $\Delta BE(m)$ and $\Delta\text{ln}SP(m)$ are endogenous variables. In the data, our estimation approach was precisely chosen to address this reverse-causality concern. In the model, we can isolate the causal effect of the misreport on spreads by constructing a counterfactual in which we shock the optimal misreport policy by $\epsilon_{\tilde{\pi}}$. This shock affects realization of message m and hence the posterior $\hat{\zeta}(m)$ and prices. Let m be the realized message under the optimal $\tilde{\pi}^\star \equiv \tilde{\pi}^\star\left(y, b, \tilde{\zeta}\right)$ policy and let m_ϵ be the realized message under the counterfactual in which the misreport is $\tilde{\pi}^\star + \epsilon_{\tilde{\pi}}$. Our model-implied elasticity is then defined as

$$\eta_{BE,SP} \equiv \mathbb{E}\left[\frac{\Delta lnSP\left(m_\epsilon\right) - \Delta lnSP\left(m\right)}{\Delta BE\left(m_\epsilon\right) - \Delta BE\left(m\right)}\right]. \tag{A.16}$$

In the quantitative analysis, we calibrate the learning parameter α so that our model-implied elasticity, $\eta_{BE,SP}$, matches the one in our empirical analysis.

Appendix B. Empirical Analysis

In this Appendix we provide additional material for our empirical analysis in Section 3.

B.1. *Data Sources*

Data on official inflation are obtained from the *Instituto Nacional de Estadística y Censos* (INDEC). Actual report dates were obtained from historical articles posted online by the newspaper *La Nación*, accessible through the Wayback Machine.[39] See Appendix B.3 for the complete list of announcement dates. Data on Argentine consumption are obtained from national sources. Data on bond yields and bond characteristics are obtained from Bloomberg. Data on Argentina's stock index (Merval); forward contracts for the Argentine peso are also obtained from Bloomberg. We retrieve these data for the period 2007-2012.

For global control variables (used throughout the paper), we retrieve the S&P 500 index, VIX index, and MSCI Emerging Markets ETF index from Datastream. These data are at daily frequency since 2003.

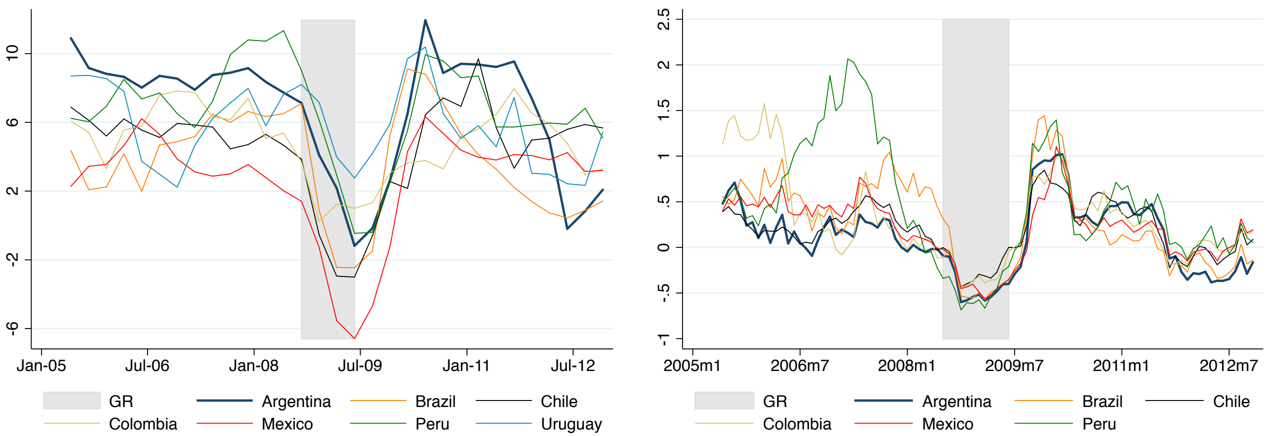
B.2. *Argentina's Fundamentals*

Figure B.1 shows that during the period of study, Argentina's fundamentals were in line with those of the region. The left panel of Figure B.1 shows that Argentina's GDP growth showed a behavior similar to the one observed in other Latin American countries. If anything, Argentina was growing faster than the rest of the region before the GFC. The right panel of Figure B.1 shows that the dynamics of the stock market were also aligned with those of the region. Lastly, although not plotted, Argentina's stock of debt was on a downward trend since 2006.

[39]See https://archive.org/web/.

Figure B.1. Argentina versus LATAM countries

(A) GDP growth (real, year-year in %) (B) Stocks growth (USD, year-year in %)



B.3. *List of Argentina's Historical Inflation Announcements*

Table B.1 lists all the days on which the Argentine government reported the inflation rate between 2007 and 2010. To construct the list, we accessed historical articles from the Argentine newspaper *La Nación*, using the tool provided by the Wayback Machine.

Table B.1. Reporting Dates

Event	Inflation for:	Reported Day	Monthly Rate (%)	Event	Inflation for:	Reported Day	Monthly Rate (%)
1	Jan-07	2/5/2007	1.14	25	Jan-09	2/11/2009	0.53
2	Feb-07	3/5/2007	0.30	26	Feb-09	3/11/2009	0.43
3	Mar-07	4/11/2007	0.77	27	Mar-09	4/14/2009	0.64
4	Apr-07	5/4/2007	0.74	28	Apr-09	5/13/2009	0.33
5	May-07	6/5/2007	0.42	29	May-09	6/11/2009	0.33
6	Jun-07	7/5/2007	0.44	30	Jun-09	7/14/2009	0.42
7	Jul-07	8/7/2007	0.50	31	Jul-09	8/12/2009	0.62
8	Aug-07	9/7/2007	0.59	32	Aug-09	9/4/2009	0.83
9	Sep-07	10/5/2007	0.80	33	Sep-09	10/14/2009	0.74
10	Oct-07	11/6/2007	0.68	34	Oct-09	11/12/2009	0.80
11	Nov-07	12/6/2007	0.85	35	Nov-09	12/11/2009	0.83
12	Dec-07	1/7/2008	0.93	36	Dec-09	1/15/2010	0.93
13	Jan-08	2/7/2008	0.93	37	Jan-10	2/12/2010	1.04
14	Feb-08	3/6/2008	0.47	38	Feb-10	3/12/2010	1.25
15	Mar-08	4/10/2008	1.13	39	Mar-10	4/14/2010	1.14
16	Apr-08	5/9/2008	0.83	40	Apr-10	5/12/2010	0.83
17	May-08	6/10/2008	0.56	41	May-10	6/14/2010	0.75
18	Jun-08	7/11/2008	0.64	42	Jun-10	7/14/2010	0.73
19	Jul-08	8/11/2008	0.37	43	Jul-10	8/13/2010	0.80
20	Aug-08	9/11/2008	0.47	44	Aug-10	9/15/2010	0.74
21	Sep-08	10/10/2008	0.51	45	Sep-10	10/15/2010	0.72
22	Oct-08	11/11/2008	0.43	46	Oct-10	11/12/2010	0.84
23	Nov-08	12/10/2008	0.34	47	Nov-10	12/16/2010	0.73
24	Dec-08	1/13/2009	0.34	48	Dec-10	1/14/2011	0.84

B.4. *Analysis of Bond Yields and Break-even Inflation Rate*

We provide additional details of the Argentine government's bond yields and construction of the BE inflation rate. Table B.2 shows static information for the Argentine bonds for which we could retrieve daily data from Bloomberg for the period 2007-2012. The top panel shows the case of nominal bonds (in both dollars and pesos) and the bottom panel shows information for inflation-indexed bonds (IIBs).

Table B.2. Static Information for Argentina's Bonds

(a) Dollar-denominated Bonds

ISIN	Maturity	Currency	Coupon Frequency
ARARGE03F482	12jun2012	ARS	S/A
ARARGE03F243	28mar2011	USD	S/A
ARARGE03F342(*)	12sep2013	USD	S/A
ARARGE03F144(*)	03oct2015	USD	S/A
ARARGE03F441	17apr2017	USD	S/A
US040114GL81	31dec2033	USD	S/A
US040114GK09	31dec2038	USD	S/A

(b) Inflation-linked Bonds

ISIN	Maturity	Currency	Coupon Frequency
ARARGE03B309	15mar2014	ARS	Monthly
ARARGE03E931(*)	30sep2014	ARS	S/A
ARARGE035162	03jan2016	ARS	Monthly
ARBNAC030255	04feb2018	ARS	Monthly

Notes: The table shows static information for all of the bonds in our sample. The top panel shows information for nominal bonds (in both dollars and pesos). The bottom panel shows information for IIBs. Bonds with an asterisk (*) are the ones used in the main analysis.

We use the yields of these bonds to compute a measure of the BE inflation. Let $Yield^{\$}_{m,t}$ be the annualized yield of a nominal bond (in pesos) with maturity m. Let $Yield^{IIB}_{m,t}$ be the yield of an IIB with maturity m. Then the BE inflation is defined as

$$BE_{m,t} = Yield^{\$}_{m,t} - Yield^{IIB}_{m,t}.$$

A major setback is that only three nominal bonds denominated in pesos are actively trading during the period considered. Moreover, there is only one bond for which we have yields data during 2007, and the first observation is in July (6 months after the government started misreporting the inflation rate). To circumvent this issue, we construct a measure for the BE rate using the yields of nominal bonds in dollars (call it $Yield^{US\$}_{m,t}$) and the expected devaluation of the peso, as implied by forward contracts. Let F_0 denote the spot exchange rate. Let F_m be the future exchange rate m months from today. Let $\delta^e_m \equiv \frac{F_m - F_0}{F_0}$ be the expected devaluation rate in m-periods. We compute the annualized BE inflation rate as

$$BE_{m,t} = Yield^{US\$}_{m,t} - Yield^{IIB}_{m,t} + \delta^e_m. \tag{B.1}$$

Ideally, to compute the BE rate we need to consider bonds with the same maturity and frequency of coupon payments. From Table B.2, notice that all of the nominal bonds pay coupons on a semi-annual frequency. Only one IIB pays coupons at this frequency (highlighted with an asterisk). This is the bond we use in our main analysis. To compute the BE rate, we then use the average yield for the two dollar-denominated bonds whose maturities are closest to this IIB.[40]

The top panel of Figure B.2 shows annual yields for the dollar-denominated bonds.[41] The bottom panel shows yields for the IIBs. Blue lines depict the bonds used in our main analysis. The left panels show yields for the 2006-2012 period, and the right panels focus on the pre-crisis period. Overall, all of the different yields move in tandem, particularly in the pre-crisis period.

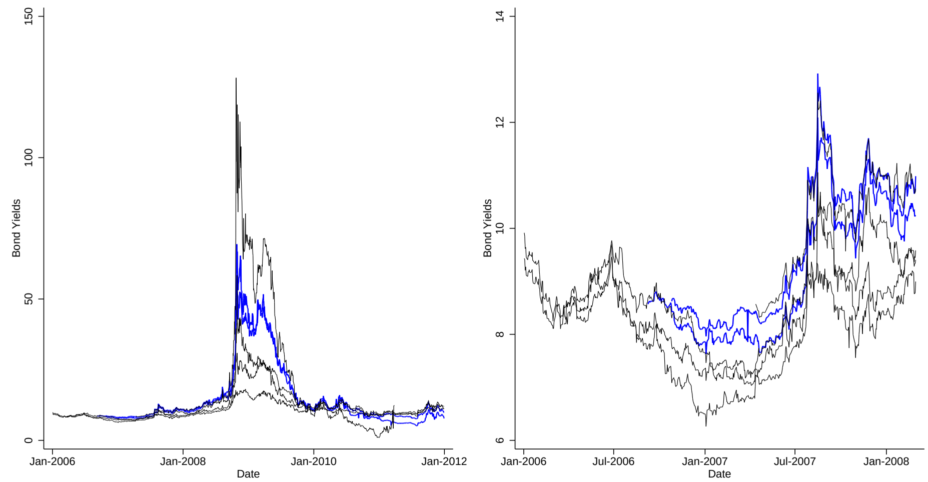
Figure B.3 shows different measures of the BE inflation rate. In all of the cases depicted, we use the IIB with semi-annual payments. Thus, each line of Figure B.3 corresponds to a different dollar-denominated bond. The blue line shows the measure of the BE inflation rate used in our main analysis. Overall, all of the measures strongly co-move during the sample period.

[40]Results are robust to using different dollar-denominated bonds.

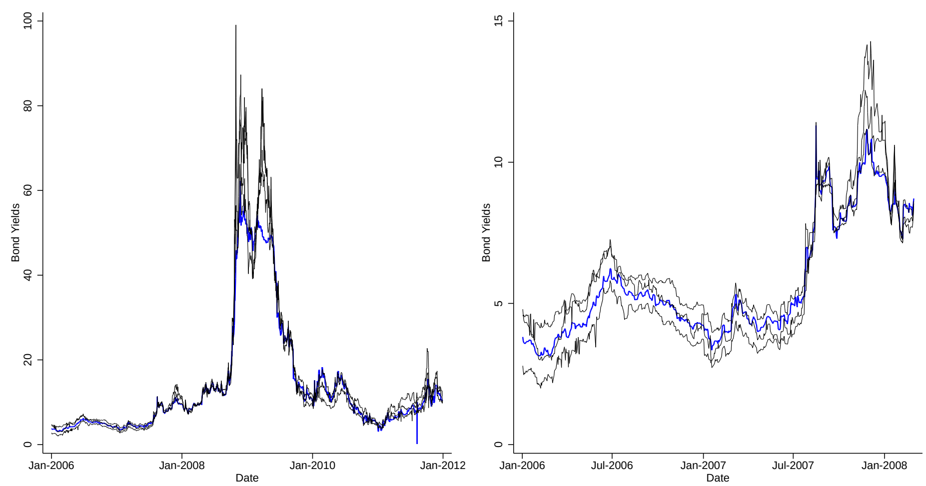
[41]Yields for the last two dollar-denominated bonds in Table B.2 are omitted because the maturity of these bonds is significantly larger.

FIGURE B.2. Yield of Argentina's Bonds

(A) Dollar-denominated Bonds

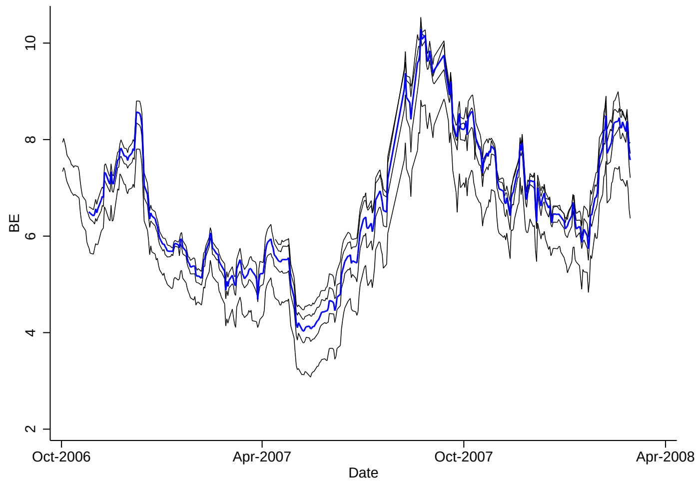


(B) Inflation-index Bonds



Notes: The figure shows the annual yields for different dollar-denominated bonds and inflation-linked bonds issued by Argentina's national government. The blue line corresponds to the bonds used in the main analysis. Left panels include the 2006-2012 period. Right panels zoom in on the pre-crisis period.

Figure B.3. Break-even Inflation Rate—Different Measures



Notes: The figure shows different measures of the break-even inflation rate. The blue line corresponds to the measure used in the main analysis.

B.5. *Inflation Misreport and Changes in the BE inflation rate*

In our main analysis, we use changes in the BE rate around inflation announcements as a high-frequency proxy for the unexpected component of the misreport. To assess whether this is a reasonable assumption, we compare the daily change in the BE (around the day in which the government reported the inflation) with the monthly change in the "observed" misreport. The underlying idea is that, to the extent that agents learn gradually from previous misreports, the change in the observed misreport should be informative about the unexpected component. We define the observed change as:

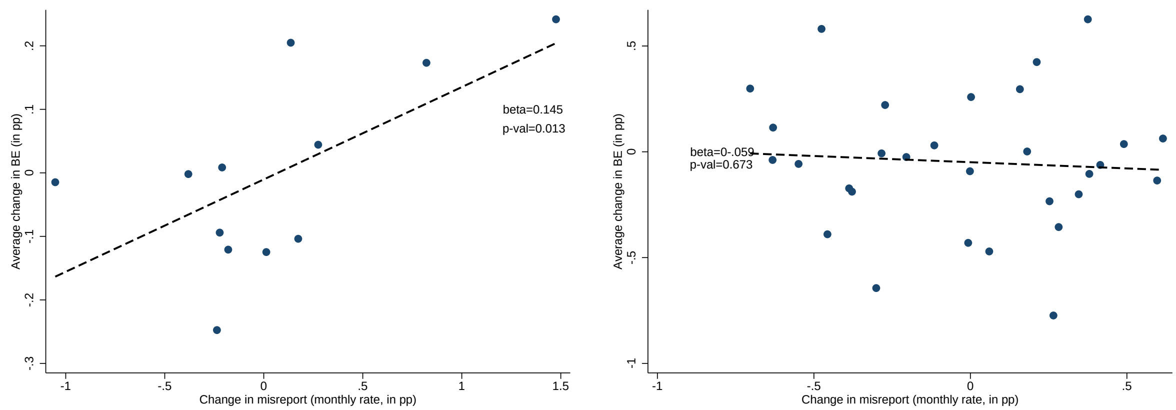
$$\epsilon_{\tilde{\pi},t} \equiv \tilde{\pi}_t^o - \tilde{\pi}_{t-1}^o, \tag{B.2}$$

where $\tilde{\pi}_t^o$ is the observed inflation misreport at time t —i.e., the difference between the inflation announced by the government and the one obtained from alternative (private) sources.

Figure B.4 compares the change in the BE rate with the change in the observed misreport. Panel (A) shows a positive (and significant) relation between these two variables prior to March 2008. However, Panel (B) shows that this relation disappears post March 2008, suggesting that agents were no longer surprised and that the misreport was already priced. Although the analysis is qualitative in nature, we take this as evidence suggesting that the change in the BE rate is a good proxy for the unexpected component of the inflation misreport.

FIGURE B.4. Changes in Break-even Inflation Rate and Inflation Misreport

(A) Pre March 2008 (B) Post March 2008



Notes: The figure shows the change in the BE inflation rate against the change in the "observed" inflation misreport. We define the observed misreport as the difference between the inflation announced by the government and the one provided by alternative (i.e., private) sources. Panel (A) is for the sample prior to March 2008, and Panel (B) is for post March 2008. See text for details.

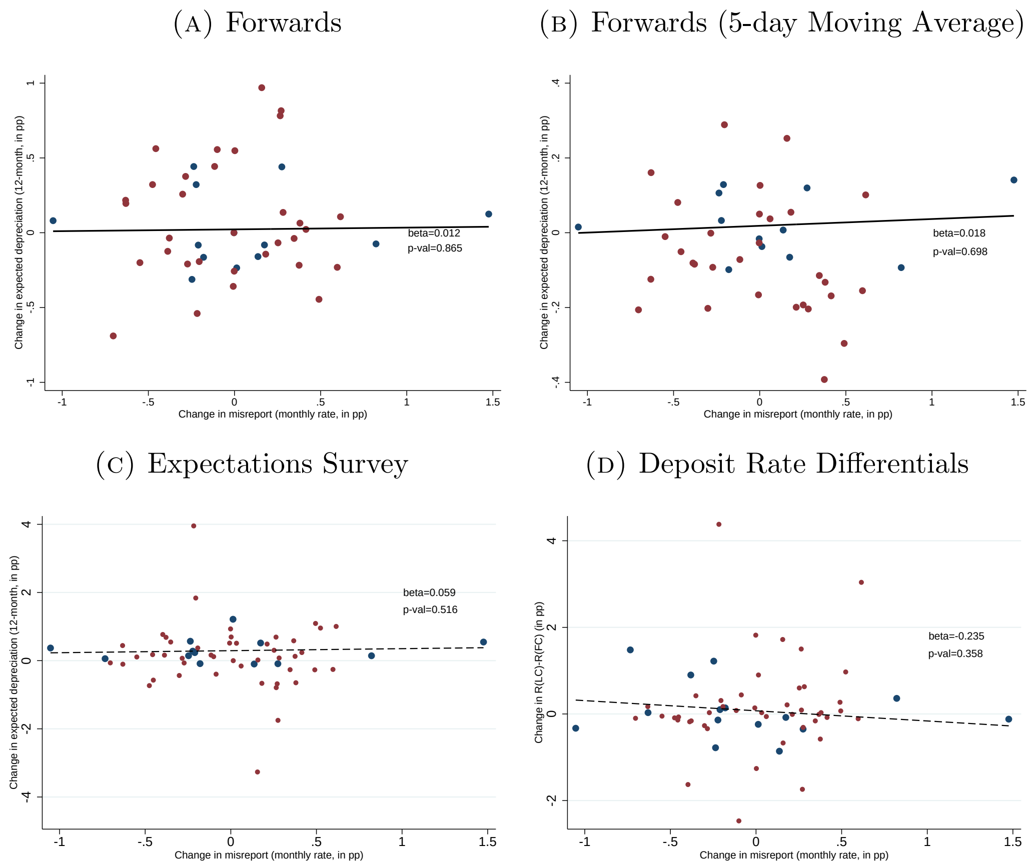
B.6. *Discussion: Exchange Rate Risk*

A concern of using the expected depreciation rate to construct the BE inflation rate (as shown in Equation B.1) is the presence of exchange rate risk. That is, the dynamics of the BE rate around days in which the government announces the inflation could be driven by adjustments in the expected depreciation rate.

To address this concern, Figure B.5 compares the change in the expected (12-month) depreciation rate against the monthly change in the inflation misreport ($\epsilon_{\tilde{\pi},t}$, our proxy for the unexpected misreport). Panel (A) shows the results when using currency forward contracts to compute the daily change in the expected depreciation rate around days in which the government reported the inflation rate. The results suggest that there is no relation between these two measures.

An additional issue to consider is that currency forward contracts tend to be quite volatile. This implies that the volatility of expected depreciation computed from these forwards can be relatively high, and this could be driving the low correlation with changes in the observed misreport. To tackle this point, in Panel (B) we consider a 5-day moving average for the forward-implied expected depreciation rate. Even after this smoothing, there is still no relation

Figure B.5. Changes in Expected Depreciation Rate and Inflation Misreport



Notes: This figure shows the change in expected 12-month depreciation rate against the change in inflation misreport. Panels (A) and (B) show the change in the expected depreciation based on exchange rate forward contracts. Panel (C) uses a measure of depreciation based on a weekly survey conducted by the Argentine Central Bank. Panel (D) computes a monthly measure of expected depreciation based on the difference between local and foreign currency time deposit rates. In all cases, blue (red) dots are for the sample prior (post) March 2008. Best fit line is for the sample prior to March 2008. Source: Bloomberg and Central Bank of Argentina.

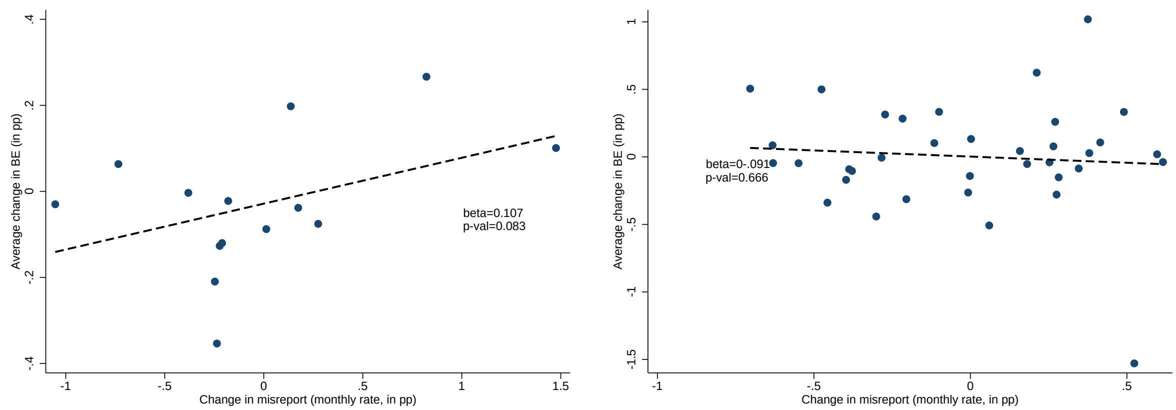
between these two variables. To avoid the complications that may arise due to the volatility of currency forward contracts, we use this moving average in our baseline analysis.

We complement the previous analysis with two lower-frequency measures of the expected depreciation rate. First, we use data on nominal exchange rate expectations based on a survey conducted by the Argentine Central Bank at a weekly frequency. Professional forecasters (e.g. banks, hedge funds, brokers, think tanks, and universities) are asked about their expected exchange rate for the current and following calendar years. We use the cross-sectional average response to construct a weekly time series of expected 12-month depreciation rate. Panel (C)

Figure B.6. Changes in Yields Differential and Inflation Misreport

(A) Pre March 2008

(B) Post March 2008



Notes: The figure shows the change in the yield differential between dollar-denominated and IIB bonds against the change in the "observed" inflation misreport. We define the observed misreport as the difference between the inflation announced by the government and the one provided by alternative (i.e., private) sources. Panel (A) is for the sample prior to March 2008, and Panel (B) is for post March 2008.

of Figure B.5 compares this measure with the monthly change in observed misreport. Results suggest there is no relation between these two variables.[42] Second, in Panel (D) we show the expected depreciation computed from the difference between local currency and foreign currency time deposit rates at monthly frequency, obtained from the Argentine Central Bank. Results are similar to the previous cases.

Finally, Figure B.6 shows the relation between the change in misreport and the change in the yields differential, $Yield^{US\$}_{m,t} - Yield^{IIB}_{m,t}$. For the pre March 2008 sample, there is a positive relation between these two variables. The relation vanishes for the later part of our sample period.

To sum up, the results from this Appendix suggest that, out of the two components behind our measure of the BE rate (as defined in Equation (B.1)), the yields differential is the one that co-moves with the inflation misreport.

[42] It is not necessarily the case that survey responses occur after the government's announcement of inflation. In 73% of the cases, however, the survey responses are the week after the inflation report. Results are similar if only those months are included in the figure.

B.7. *Test of Identifying Assumption*

We present an F-test to verify the main assumption of the Rigobon and Sack approach—namely, that the variance of the shocks to ΔBE_t is larger on event days. As it can be seen from Equation (14) in the main text, the Rigobon and Sack instrument is relevant only under the assumption that $\Lambda \equiv \sigma_{\eta,E}/\sigma_{\eta,NE} > 1$. To test this, we conduct a hypothesis test in which $\sigma(\Delta BE)_E = \sigma(\Delta BE)_N$. Our one-sided alternative hypothesis is that $\sigma(\Delta BE)_E > \sigma(\Delta BE)_N$. The F-tests reported in Table B.3 strongly reject the hypothesis of equal variances, which provides evidence in favor of $\Lambda > 1$. Tests based on a bias-corrected stratified bootstrap show that we can also reject the hypothesis of equal variances for our baseline specification (Window 1). Although not reported, the tests are not significant during and after the GFC. We interpret this as evidence that the market was no longer surprised by the sequence of misreports after mid-2008.

Table B.3. Test of Identifying Assumption

	Window 1	Window 2	Window 3	Window 4
Window Type				
Event	2-day window	3-day window	2-day window	3-day window
Non-event	All other days	All other days	4-day window	4-day window
Standard Deviation				
Event	0.290	0.261	0.290	0.261
Non-event	0.188	0.188	0.179	0.179
Ratio Test: $\sigma_{\Delta BE,E} > \sigma_{\Delta BE,NE}$				
F-test				
F-value	2.375	1.930	2.608	2.114
$P(F > f)$	0.001	0.004	0.004	0.011
BC Bootstrap - One-Sided CI				
90% CI Lower Bound	1.172	1.103	1.157	1.080
95% CI Lower Bound	1.049	1.013	1.024	0.980

Notes: The table reports the standard deviations of the daily change in BE inflation rate. The bottom panel shows two tests for the equality of variances of changes in the BE rate. We include results for a traditional F-test and a bias-corrected bootstrap test. Different columns present the results for different event and non-event windows. Sample period: January 2007-February 2008.

B.8. *Robustness Analysis*

We next add a robustness analysis to our empirical analysis in Section 3. In particular, we consider OLS regressions and a standard event-study analysis, based on narrow windows around the inflation announcement.

The analysis relies on a stronger identifying assumption compared with the heteroskedasticity-based identification analysis presented in the main text. In particular, it requires that changes in Argentina's BE inflation rate during event windows are driven exclusively by the inflation announcement. Both the OLS and event-study estimates are thus subject to the concern that other (potentially unobserved) common factors may have changed during those event days. Another problem is the smaller sample size, since we only focus on days around the inflation announcement. Nevertheless, the analysis is still useful to further study the relation between ΔBE_t and $\Delta ln(SP_t)$ around days on which the government announces the inflation rate, and to analyze how this relation changes across time.

B.8.1. *OLS Estimates*

We start by describing the regression behind Figure 5. We consider the following specification:

$$\Delta \ln SP_t = \alpha_0 + \alpha_1^E \Delta BE_t \times \mathbb{I}_{t,E} + \alpha_1^{NE} \Delta BE_t \times \mathbb{I}_{t,NE} + \alpha_2 F_t + \epsilon_t,$$

where $\mathbb{I}_{t,E}$ and $\mathbb{I}_{t,NE}$ are indicators for event and non-event days (based on a 2-day window around the inflation announcement) and F_t is a vector of global controls (as described in the main text). To construct the figure, we run the previous specification across different days of our sample, based on a 12-month rolling window.

For the rest of this subsection, we split our sample between event and non-event days, and for each set of events, we consider the following specification:

$$\Delta \ln SP_t = \alpha_0 + \alpha_1 \Delta BE_t + \alpha_2 F_t + \epsilon_t.$$

Panel (A) of Table B.4 shows the OLS estimates for our baseline sample period (January 2007-February 2008). When we focus on narrow windows around the announcement of inflation, the estimates are negative and significant (and in line with those presented in the main text). However, when both event and non-event days are included in the sample, the OLS estimates are nonsignificant. This suggests that, outside of announcement days, changes in sovereign spreads are unrelated to changes in the BE rate. Although the Argentine government kept misreporting the inflation rate after 2008, the results are not significant once we exclude the first year of the sequence of misreports. Panel (B) shows estimates for January 2010-February 2011.[43] Through the lens of our reputational model, these facts suggest that after the first year of the misreports, the lenders' prior ζ reached its lower bound. Hence, future misreports

[43]Although not reported, the results are also not significant for the 2008-2009 period. This may not be surprising, given that changes in Argentina's sovereign spreads during the GFC may have mostly been driven by external factors.

Table B.4. OLS Regression

(a) January 2007-February 2008

	(1)	(2)	(3)	(4)	(5)
Event Window	Full Sample	2-day Window		3-day Window	
ΔBE	-1.194	-5.554***	-0.194	-5.610***	-0.078
Standard Error	(1.030)	(1.902)	(1.018)	(1.311)	(1.060)
Observations	240	20	220	30	210
Days Included	All	Event Days	Non-Event Days	Event Days	Non-Event Days
Controls	Yes	Yes	Yes	Yes	Yes

(b) January 2010-February 2011

	(1)	(2)	(3)	(4)	(5)
Event Window	Full Sample	2-day Window		3-day Window	
ΔBE	-0.471*	-0.110	-0.448	-0.368	-0.404
Standard Error	(0.268)	(1.123)	(0.280)	(0.754)	(0.292)
Observations	265	25	240	39	226
Days Included	All	Event Days	Non-Event Days	Event Days	Non-Event Days
Controls	Yes	Yes	Yes	Yes	Yes

Notes: The table shows results for the OLS estimators. The dependent variable is $\Delta lnSP_t$. Panel (A) shows estimates for the January 2007-February 2008 period. Panel (B) shows results for the January 2010-February 2011 period. The first column includes all days in the sample. Other columns only include 2- and 3-day windows around the inflation announcement. Controls include the VIX index, S&P 500 index, and MSCI Emerging Markets ETF index. Robust standard errors are reported in parentheses. ***, **, *, denote significance at 1%, 5%, and 10%, respectively.

have no impact on the Argentine government's reputation and its spreads. In other words, the market was no longer surprised by the misreports.

B.8.2. *Event Study Results*

We next present a standard event-study analysis to estimate the effect of the misreports on Argentina's sovereign spreads. Let NE denote the set of non-event days and $L =| NE |$. We first estimate a factor model for the non-event-days,

$$\Delta \ln SP_t = \phi_0 + \phi_1 F_t + \nu_t,$$

where F_t is the same vector of global controls used in the main analysis. We then use those estimates to generate a time series of abnormal changes in Argentina's sovereign spreads and estimate its variance (assuming that errors are homoskedastic). That is,

$$\Delta \ln SP_t^A = \Delta \ln SP_t - \hat{\phi}_0 - \hat{\phi}_1 F_t$$
$$\hat{\sigma}_{SP}^2 = \frac{1}{L} \sum_{t \in NE} (\Delta \ln SP_t^A)^2.$$

Next, we classify our event windows into two categories depending on the observed change in BE inflation (ΔBE_t). Let $\mu_{\Delta BE}^{E,j}$ be the mean for ΔBE_t across event window j, and ($\mu_{\Delta BE}^{NE}$) be the mean of ΔBE_t for non-event days. From the pool of event days we create two categories:[44]

(1) If $\mu_{\Delta BE}^{E,j} < \mu_{\Delta BE}^{NE}$, we label the event window j as a bad news event (BNE).
(2) If $\mu_{\Delta BE}^{E,j} > \mu_{\Delta BE}^{NE}$, we label the event window j as a good news event (GNE).

In the first case, for instance, the drop in the BE inflation rate during event window j is larger than the average change for non-event days. This can be interpreted as an increase in the unexpected underreport of inflation, and thus a bad news event.

For each category $k = \{BNE, GNE\}$, we compute the cumulative abnormal change across all events of the same type k: $CA(SP)_k = \sum_{t \in k} \Delta \ln SP_t^A$. Notice that CA(SP) adds abnormal changes in different windows (non-consecutive days). Finally, we report the $J1$ statistic described in Campbell et al. (1997):

$$J1_k = \frac{CA(SP)_j}{\sqrt{L_k \times \hat{\sigma}_{SP}^2}},$$

where $L_k =| E_k |$ denotes the total number of days for each type of event k. Under the null hypothesis that misreports events have no effect on $\Delta \ln SP$, $J1_k$ is asymptotically distributed as a standard normal variable. The problem is that there are few observations in each category,

[44]Ideally, we would like to have three categories: bad news, no news, and good news. Given our small sample, we decided to focus only on two broad categories. Results are similar if we classify events based on the median change (instead of on the mean change).

Table B.5. Event-study Approach

Event Type	# Events	Obs	$\Delta ln(\bar{SP^A})$	J1-stat	$\Delta\bar{B}E$
		2007-2008			
Good News Event	7	13	-2.334	-3.155	0.135
Bad News Event	5	10	1.467	1.739	-0.118
		2010-2011			
Good News Event	4	7	-0.062	-0.085	0.340
Bad News Event	9	18	0.494	1.075	-0.210

Notes: The table shows the results for the event-study analysis. Events are classified as good or bad news based on the average change in the BE rate around the Argentine government report of inflation. The top panel shows results for January 2007-February 2008. The bottom panel shows results for January 2010-February 2011. $\Delta\ln(S\bar{P}^A)$ denotes the average across $\sum_{t\in k}\Delta\ln SP_t^A$.

and therefore asymptotic normality may be a poor approximation. The results should thus be interpreted as suggestive evidence only.

Table B.5 reports results based on a 2-day window. For the January 2007-February 2008 period (top panel), there is an asymmetric effect of changes in BE on SP. The average (daily) change in (log) spreads is 1.5% and -2.3% in the bad and good news event, respectively. For the January 2010-February 2011 period, the effects are smaller in magnitude and not significant.[45] The results are consistent with our reputational channel and in line with those presented in the main text.

B.9. *The Reputation Channel*

We provide further evidence that supports the reputation channel. As a starting point, we extend our baseline model and allow for the possibility that the inflation misreport can directly affect the real economy (Equations (17)-(19) in the main text). For convenience, we replicate that system of equations below:

$$\Delta BE_t = \beta_0 + \beta_1 \Delta \ln SP_t + \beta_2 R_t + \beta_3 X_t + \eta_t \tag{B.3}$$

$$\Delta \ln SP_t = \alpha_0 + \alpha_1 \Delta BE_t + \alpha_2 R_t + \alpha_3 X_t + \epsilon_t \tag{B.4}$$

$$R_t = \gamma_0 + \gamma_1 \Delta BE_t + \gamma_3 X_t + \nu_t, \tag{B.5}$$

[45] Although not reported, the effects for 2008-2009 are also not significant.

where we assume that η_t, ϵ_t, ν_t, and X_t are uncorrelated. Substituting Equation (B.5) into Equations (B.3) and (B.4), it is straightforward to show that

$$\Delta BE_t\left(1-\beta_2\gamma_1\right)=\left(\beta_0+\beta_2\gamma_0\right)+\beta_1\Delta\ln SP_t+\left(\beta_2\gamma_3+\beta_3\right)X_t+\left(\eta_t+\beta_2\nu_t\right) \tag{B.6}$$

$$\Delta\ln SP_t=\left(\alpha_0+\alpha_2\gamma_0\right)+\left(\alpha_1+\alpha_2\gamma_1\right)\Delta BE_t+\left(\alpha_3+\alpha_2\gamma_3\right)X_t+\left(\epsilon_t+\alpha_2\nu_t\right). \tag{B.7}$$

Under the same set of assumptions as in Section 3.3, while we cannot identify α_1, it is clear that our identification strategy allows us to identify $\tilde{\alpha_1}\equiv\alpha_1+\alpha_2\gamma_1$. To the extent that $\alpha_2\neq 0$ and $\gamma_1\neq 0$, our baseline estimates for α_1 would be biased.

In what follows, we discuss in detail the possible signs of these biases. According to the sovereign debt literature, we would expect α_2 to be negative and significant: A fall in economic activity (as proxied by stock market returns) should increase a country's default risk. Thus, our baseline estimate for α_1 would be biased if $\gamma_1\neq 0$.

The sign of γ_1 is a priori unclear (see the discussion in Section 3.4). A $\gamma_1>0$ would be consistent with negative distortions in the real economy due to the inflation misreport, or a negative aggregate demand shock that decreases both the expected inflation (and hence the BE rate) and stock returns. If that were the case, we would have $\alpha_2\gamma_1<0$, which produces a negative bias in our estimate for α_1. Since $\mid\tilde{\alpha_1}\mid>\mid\alpha_1\mid$, we would then be *overestimating* the direct effects of ΔBE_t on spreads. On the other hand, $\gamma_1<0$ would be consistent with a positive supply shock that reduces expected inflation and increases the stock market return. In that case, we would then be *underestimating* the direct effects of ΔBE_t on spreads.

While we cannot identify α_2, under the system of equations (B.3)-(B.5), we can identify the γ_1 parameter. By substituting Equation (B.4) into (B.3), we get the following system:

$$\Delta BE_t\left(1-\beta_1\alpha_1\right)=\left(\beta_0+\beta_1\alpha_0\right)+\left(\beta_2+\beta_1\alpha_2\right)R_t+\left(\beta_3+\beta_1\alpha_3\right)X_t+\left(\beta_1\epsilon_t+\eta_t\right) \tag{B.8}$$

$$R_t=\gamma_0+\gamma_1\Delta BE_t+\gamma_3X_t+\nu_t. \tag{B.9}$$

From here, it is clear that our set of identifying assumptions allows us to identify the γ_1 parameter. Table 3 (in the main text) shows the results. Across all specifications, the point estimates for γ_1 are not statistically significant. That is, the misreport of inflation does not seem to have a direct effect on the Argentine stock market, which mitigates any concerns about biases in our baseline estimate for α_1. We take this as further evidence that supports our reputational channel.

We end our discussion of possible biases by considering the case in which ΔSP_t could affect R_t, as Hebert and Schreger (2017) find. To do this, we consider the following system of equations:

$$\Delta BE_t = \beta_0 + \beta_1 \Delta \ln SP_t + \beta_2 R_t + \beta_3 X_t + \eta_t \tag{B.10}$$

$$\Delta \ln SP_t = \alpha_0 + \alpha_1 \Delta BE_t + \alpha_2 R_t + \alpha_3 X_t + \epsilon_t \tag{B.11}$$

$$R_t = \gamma_0 + \gamma_1 \Delta BE_t + \gamma_2 \Delta SP_t + \gamma_3 X_t + \nu_t, \tag{B.12}$$

where we have replaced Equation (B.5) with (B.12). Under the same set of assumptions as those in the main text, it is easy to show that the following parameters can be identified: $\tilde{\alpha_1} \equiv \frac{\alpha_1+\alpha_2\gamma_1}{1-\alpha_2\gamma_2}$ and $\tilde{\gamma_1} \equiv \frac{\gamma_1+\alpha_1\gamma_2}{1-\alpha_2\gamma_2}$.

According to Hebert and Schreger (2017), we should expect a negative effect of sovereign spreads on stock returns (i.e., $\gamma_2 < 0$). Provided that $\alpha_2 < 0$—which is in line with the sovereign debt literature—and $\alpha_1 < 0$—consistent with our reputational channel—the IV estimate for γ_1 from Table 3 would have a *positive* bias. That is,

$$\tilde{\gamma_1} \equiv \frac{\gamma_1 + \overbrace{\alpha_1}^{-}\overbrace{\gamma_2}^{-}}{1 - \underbrace{\alpha_2}_{-}\underbrace{\gamma_2}_{-}} \approx \gamma_1 + BIAS_{+}. \tag{B.13}$$

The fact that our point estimates for $\tilde{\gamma_1}$ (i.e., those reported in Table 3) are not statistically significant suggests that $\gamma_1 \leq 0$. In that case, notice that the bias for the α_1 parameter is also positive. That is,

$$\tilde{\alpha_1} \equiv \frac{\alpha_1 + \overbrace{\alpha_2}^{-}\overbrace{\gamma_1}^{-}}{1 - \underbrace{\alpha_2}_{-}\underbrace{\gamma_2}_{-}} \approx \alpha_1 + BIAS_{+}. \tag{B.14}$$

Therefore, our estimates for $\tilde{\alpha_1}$ (i.e., those reported in Table 2) are upwardly biased. Given that they are negative, we should interpret them as a lower bound (in terms of magnitude).

B.10. *Identified Structural VAR*

In this section we provide further empirical evidence that supports our baseline analysis in Section 3.3. In particular, we construct and estimate a structural VAR that incorporates the interactions between inflation misreport, spreads, and economic activity. We then identify structural shocks to misreport and study their effects on the economy.

Let $\boldsymbol{Y}_t \equiv (M_t, SPt, R_t)$, where M_t is the underreport of inflation, SP_t is the sovereign spread, and IP_t is an indicator of economic activity. Consider the following structural and reduced-form

VAR:

$$\text{Structural Form} \quad \boldsymbol{A}\boldsymbol{Y}_t = \sum_{j=1}^{p} \boldsymbol{C}_j \boldsymbol{Y}_{t-j} + \boldsymbol{\epsilon}_t$$

$$\text{Reduced Form} \quad \boldsymbol{Y}_t = \sum_{j=1}^{p} \boldsymbol{B}_j \boldsymbol{Y}_{t-j} + \boldsymbol{u}_t,$$

where $\boldsymbol{u}_t = \boldsymbol{S}\boldsymbol{\epsilon}_t$ and $\boldsymbol{S} = \boldsymbol{A}^{-1}$, and $\boldsymbol{B}_j = \boldsymbol{A}^{-1}\boldsymbol{C}_j$. The vectors $\boldsymbol{\epsilon}_t$ and $\boldsymbol{u}_t$ represent structural and reduced-form shocks, respectively.

Let ϵ_t^p be the structural policy shock to inflation misreport and $Y_t^p \in \boldsymbol{Y}_t$ the government's policy choice on misreport. Let $\boldsymbol{s}$ denote the column in $\boldsymbol{S}$ associated with ϵ_t^p. Then, the response of the endogenous variables to a shock to misreport is given by

$$\boldsymbol{Y}_t = \sum_{j=1}^{p} \boldsymbol{B}_j \boldsymbol{Y}_{t-j} + \boldsymbol{s}\epsilon_t^p.$$

This means that, given estimates for $\{\boldsymbol{B}_j\}_{j=1}^p$, we only need to identify $\boldsymbol{s}$ to compute the impulse responses. To this end, we follow an instrumental approach similar to Mertens and Ravn (2013) and Gertler and Karadi (2015). The method consists on finding a vector of instruments $\boldsymbol{Z}_t$ so that

$$E\left[\boldsymbol{Z}_t \epsilon_t^p\right] = \boldsymbol{\Phi}$$

$$E\left[\boldsymbol{Z}_t \boldsymbol{\epsilon^{q\prime}}_t\right] = \boldsymbol{0},$$

where $\epsilon_t^{q\prime}$ is the vector of structural shocks other than the policy shock. Given that vector of instruments, the procedure for obtaining estimates of $\boldsymbol{s}$ can be decomposed in two broad steps.[46] First, we obtain estimates of $\boldsymbol{u}_t$ by OLS. Second, we identify $\boldsymbol{s}$ using the estimated reduced-form residuals and the vector of instruments. Let u_t^p be the estimated residuals associated with the equation for inflation misreport, and let $\boldsymbol{u}_t^q$ be the residuals from the other equations. Let $\boldsymbol{s}^q$ be the vector linking $\boldsymbol{u}_t^q$ to ϵ_t^p. As discussed in Mertens and Ravn (2013) and Gertler and Karadi (2015), we can obtain an estimate of $\boldsymbol{s}^q$ and s^p from a two-stage OLS estimation. In the first stage, we regress u_t^p onto $\boldsymbol{Z}_t$ to get $\hat{u}_t^p$. Note that the variation in $\hat{u}_t^p$ is due to ϵ_t^p. In the second stage, we regress $\boldsymbol{u}_t^q$ onto $\hat{u}_t^p$ to obtain the estimates of $\boldsymbol{s}^q$ and s^p.

An additional complication in our application is that true inflation misreport, M_t, is not observable. Instead, market participants observe an alternative inflation measure that is centered in the true value of inflation, but subject to measurement errors. Therefore, this alternative

[46]We refer the reader to Mertens and Ravn (2013) and Gertler and Karadi (2015) for further details.

measure provides a noisy signal, $\tilde{M}_t$, of the true value of misreport. In particular, we assume that $\tilde{M}_t = M_t + \eta_t$, where η_t is i.i.d. and orthogonal to M_τ, SP_τ, and IP_τ for any $\tau \in \mathbf{Z}$ (integers set). Being measurement errors, we also assume that $E\left[\eta_t {\epsilon^p}_t\right] = 0$, $E\left[\eta_t \boldsymbol{\epsilon^{q\prime}}_t\right] = \mathbf{0}$, and $E\left[\eta_t \boldsymbol{Z}_t\right] = \mathbf{0}$. Although strong, these are sufficient conditions to identify our parameters of interest.

It could be the case that the sufficient conditions may not hold. For instance, to the extent that the consumption baskets considered in the official and alternative measures of inflation differ, dynamics in misreport may have important seasonal components. To control for this, we seasonally adjust observed misreport before introducing it into the VAR. It could also be the case that the volatility of η_t depends on the level of misreport. To mitigate this concern, we normalize misreport at time t by the official level of inflation. A more formal way to account for possible heteroskedasticity would be to estimate a VAR GARCH-in-mean econometric model, but we have too few observations for this to be possible.

The noisy signal could potentially affect the procedure, both in the estimation of the reduced-form VAR and the identification of the structural policy shock. In what follows, we argue that under the current assumptions, that would not be the case. We first focus on the estimation of the reduced-form VAR. For simplicity of exposition, assume a VAR(1). Under noisy misreports, the system of equations would be given by

$$
\begin{aligned}
M_t &= \tilde{B}_{11} M_{t-1} + \tilde{B}_{12} SP_{t-1} + \tilde{B}_{13} IP_{t-1} + \underbrace{\left(u_{1t} + \tilde{B}_{11}\eta_{t-1} - \eta_t\right)}_{\tilde{u}_{1t}} \\
SP_t &= \tilde{B}_{21} M_{t-1} + \tilde{B}_{22} SP_{t-1} + \tilde{B}_{23} IP_{t-1} + \underbrace{\left(u_{2t} + \tilde{B}_{21}\eta_{t-1}\right)}_{\tilde{u}_{2t}} \\
IP_t &= \tilde{B}_{31} M_{t-1} + \tilde{B}_{32} SP_{t-1} + \tilde{B}_{33} IP_{t-1} + \underbrace{\left(u_{3t} + \tilde{B}_{31}\eta_{t-1}\right)}_{\tilde{u}_{3t}},
\end{aligned}
$$

or $\boldsymbol{Y}_t = \tilde{\boldsymbol{B}}_1 \boldsymbol{Y}_{t-j} + \tilde{\boldsymbol{u}}_t$, with $\boldsymbol{Y}_t = [M_t, SP_t, IP_t]'$ and $\tilde{\boldsymbol{u}}_t = [\tilde{u}_{1t}, \tilde{u}_{2t}, \tilde{u}_{3t}]'$. Since $M_{t-1} \perp \eta_{t-1}$, $SP_{t-1} \perp \eta_{t-1}$ and $IP_{t-1} \perp \eta_{t-1}$, the OLS estimator would actually return an unbiased point estimate for B_1—the matrix of coefficients in the absence of noisy misreport. A similar argument follows for a VAR(p).

We now turn to the identification of the structural shock. Under the noisy misreport, the first equation of the SVAR would be

$$\boldsymbol{A}_1 \boldsymbol{Y}_t = \sum_{j=0}^{p} \boldsymbol{C}_{1j} \boldsymbol{Y}_{t-j} + \underbrace{\left(\epsilon_t^p - a_{11}\eta_t + \sum_{j=0}^{p} c_{j,11}\eta_{t-j} \right)}_{\tilde{\epsilon}_t^p},$$

where $\boldsymbol{A}_1$ and $\boldsymbol{C}_{1j}$ are the first rows of $\boldsymbol{A}$ and $\boldsymbol{C}_j$, respectively. A similar specification would hold for the other equations, defining a new vector of innovations $\tilde{\boldsymbol{\epsilon}}^{q\prime}$. Given the orthogonality assumptions on η_t, we have

$$E\left[\boldsymbol{Z}_t \tilde{\epsilon}^p{}_t\right] = E\left[\boldsymbol{Z}_t \left(\epsilon_t^p - a_{11}\eta_t + \sum_{j=0}^{p} c_{j,11}\eta_{t-j} \right)\right] = E\left[\boldsymbol{Z}_t \epsilon^p{}_t\right]. \tag{B.15}$$

Thus, we could still use $\boldsymbol{Z}_t$ to identify the structural shock to the misreport equation. Furthermore, under the assumed additive specification for $\tilde{M}_t$, the SVAR would be capturing the response of the true misreport (since only ϵ_t^p is realized). Therefore, under the assumed framework, the fact that we observe a noisy signal for the true value of misreport would not invalidate our analysis.

We estimate the previous SVAR using monthly data. We define inflation misreport as the difference between an alternative measure of the inflation rate and the inflation rate reported by the Argentine National Institute of Statistics and Censuses (INDEC); see Figure 3. Given that Argentina is a small open economy, we control for global variables that may affect the results.[47] For sovereign spreads, we take the residual of a projection of daily spreads (in logs) onto the set of global factors used in Section 3.3 (VIX, SP, and EEM). We then compute the median value for each month. Our measure of economic activity is the "Estimador Mensual de Actividad Economica," as reported by the INDEC. This is a seasonally adjusted monthly variable that captures Argentine nonfinancial economic activity. We take the residual of the projection of this index onto the following set of external variables: oil price, US unemployment rate, and the US 10-year Treasury yield.

We consider log-changes in the BE inflation rate, $\Delta \ln BE_t$, to be our instrument for the identification of structural misreport policy shocks.[48] In the first step of the procedure, we use

[47]We do not introduce these global variables into the VAR because it would significantly increase the number of coefficients to estimate and yield a relatively small number of observations.

[48]Results are qualitatively similar if we instead consider changes in levels of BE. However, in that case the F-test suggests that the instrument is weak. We believe this is driven by a low variation in ΔBE_t due to a lower-frequency aggregation (i.e., monthly frequency).

monthly data for the period Feb-2006 to Dec-2010 to estimate the reduced-form VAR. Given the small number of observations, we only choose one lag for the VAR. In the second step, we use data on $\Delta \ln BE_t$ for the period Feb-2007 to Aug-2008 to identify the vector $\boldsymbol{s}$. We choose a later starting period for the instrument than for the reduced-form VAR, since the government's misreport started in Feb-2007. We also choose an earlier ending period, since in Section B.8.1 we show empirical evidence suggesting that after mid-2008 the market was no longer surprised by the misreports. The results that follow are quantitatively similar when using the sample Feb-2006 to Aug-2008 for the reduced-form VAR (not shown), but less precisely estimated due to a reduction in the number of observations.

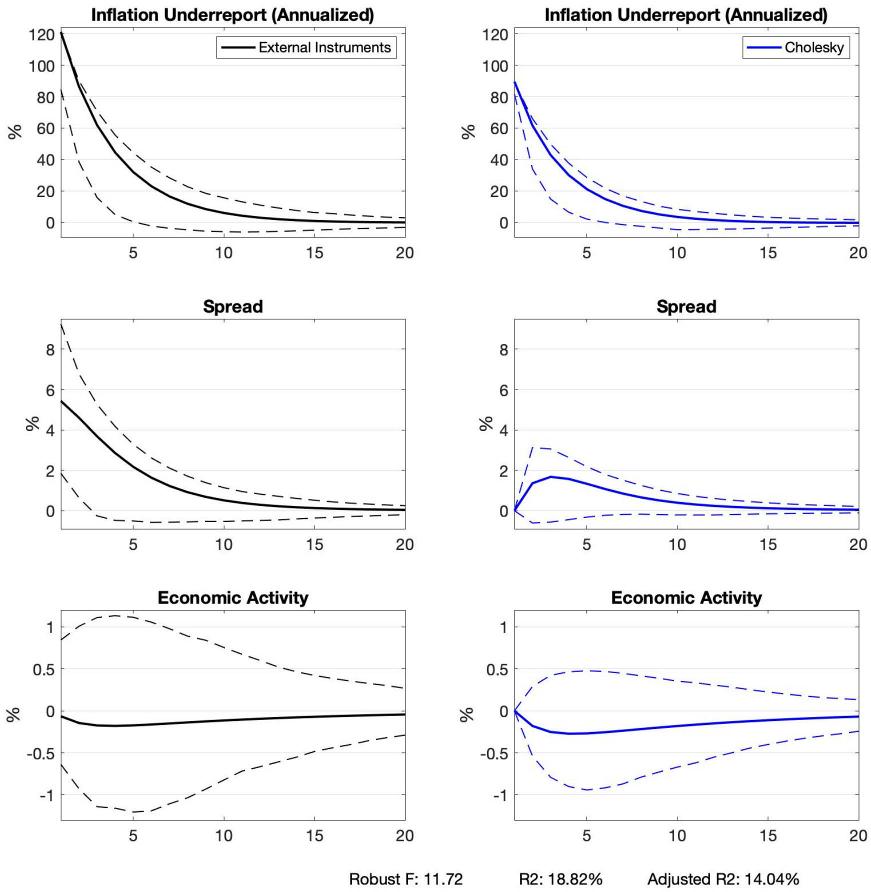
Figure B.7 shows the results of the estimation. The three left panels show the response of inflation underreport, spreads, and economic activity upon a 1–sd structural shock to misreport policy. As we can see, misreport increases on impact, and so do spreads. These increases are both economically and statistically significant.[49] Furthermore, the robust F-test is greater than 10, suggesting that the external instrument is valid.[50] For the response of economic activity, the identified SVAR suggests a lagged negative response but it is not statistically significant.

For comparison, the right panels of Figure B.7 show the response of the endogenous variables when assuming a Cholesky decomposition for identification. The assumed (decreasing) order of exogeneity is economic activity, spreads, and inflation underreport. The response of spreads upon a 1–sd shock to misreport is still positive, albeit of smaller magnitude. The response of economic activity is similar to the identified SVAR and not statistically significant.

[49] Confidence intervals are at 90% and are computed using wild bootstrap.

[50] See Stock et al. (2002) for a discussion of the validity of instruments.

Figure B.7. Impulse Response to a Misreport Shock



Notes: This figure shows the response of inflation underreport, spreads, and economic activity to a 1–sd structural shock to misreport. See text for details on the VAR. Dashed lines denote the 90% confidence interval, constructed using wild bootstrap. The robust F-statistic from the instrument regression is above the threshold of 10 suggested by Stock et al. (2002) in order to be confident that a weak instrument problem is not present.

Appendix C. Quantitative Analysis

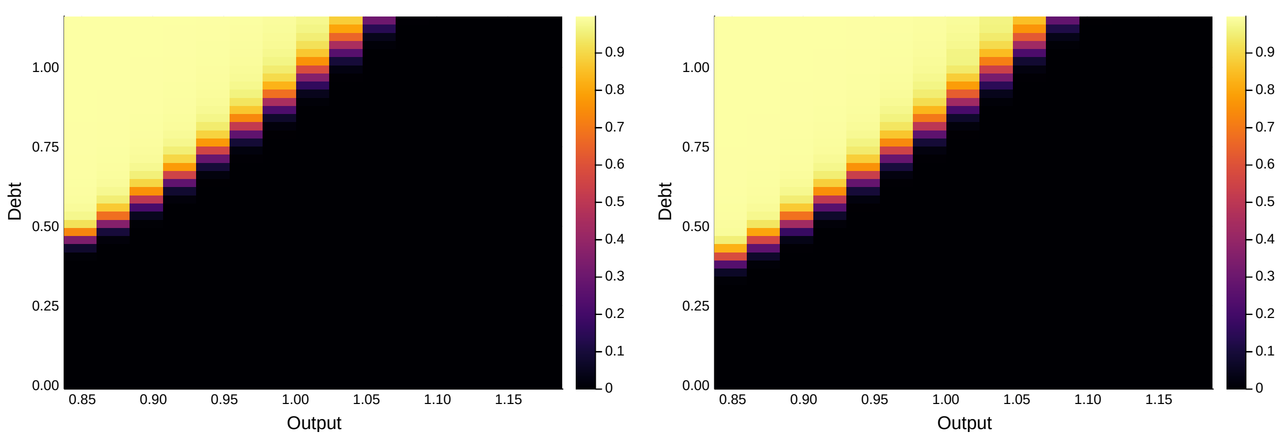
This appendix complements our main quantitative analysis. First, we present figures that describe the optimal default policy functions and the bond pricing kernel. Second, we show how our model-implied elasticity varies with different values for the learning parameter. Third, we provide a welfare analysis by comparing our baseline model with imperfect information with a case in which types are perfectly observable. Lastly, we provide additional details regarding the construction of the Argentine counterfactual during the GFC and the solution method.

C.1. *Default Policies and Bond Prices*

Figure C.1 shows the optimal default-repayment policy for the C-type (Panel A) and for the S-type (Panel B). The figure assumes a relatively high reputation ($\zeta = 0.8$). The area in the upper-left corner represents the state space in which the j-type defaults on its debt ($d = 1$). These are combinations of the state space in which debt is high and output is low. Notice that, by assumption, the default set for the S-type is slightly larger than the one for the C-type.

Figure C.1. Default - Repayment Sets

(A) Default Set - C-type (B) Default Set - S-type



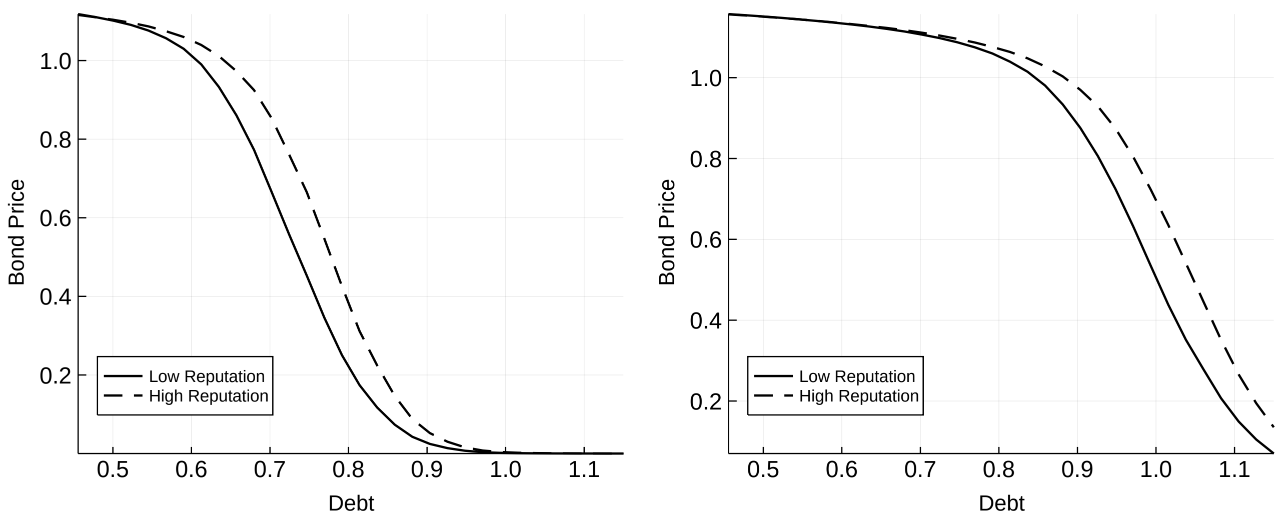
Notes: The figure shows the default/repayment sets for the C-type (left panel) and for the S-type (right panel). The area in the upper-left corner of each panel represents the points of the state space in which the government defaults ($d = 1$).

The different default sets imply that changes in ζ' affect the markets' perceived probability of a default and, thus, the government's borrowing costs. The effect is larger, as we move closer to the default area. This is illustrated in Figure C.2. The figure shows the bond pricing kernel $q(y, b', \zeta')$ for different values of b' and ζ'. The left panel considers the case when output is low and the right panel considers the case when output is high. The effect of reputation on bond prices depends on the macro fundamentals (b, y). For instance, for a stock of debt of $b' = 0.7$, changes in ζ' have almost no effect on the bond price if output is high. When output is low, however, as the government is closer to its default boundary, changes in ζ' can have a sizable effect on bond prices.

Figure C.2. Bond Pricing Kernel

(a) Low Output

(b) High Output

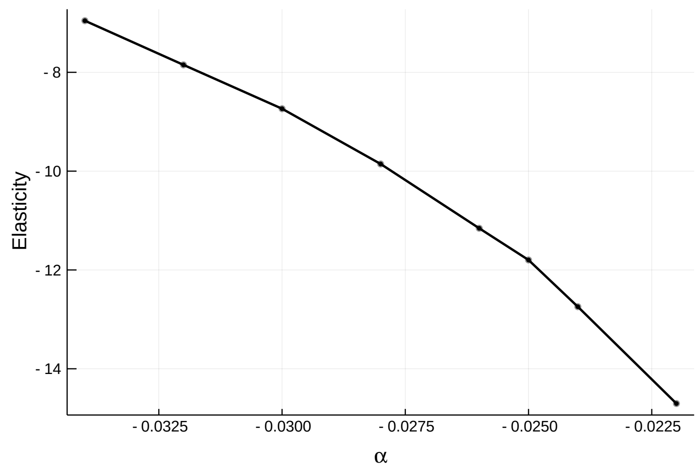


Notes: The figure shows the bond pricing kernel $q(y, b', \zeta')$, for different combinations of b' and ζ'. The left (right) panel shows the case when output is low (high).

C.2. *Sensitivity Analysis*

We analyze the sensitivity of our model-implied elasticity $\eta_{BE,SP}$ to different values of the learning parameter α. To this end, we solve our baseline model for various values of α, while keeping all other model parameters fixed. Figure C.3 shows the results. Overall, there is a monotone relation between α and $\eta_{BE,SP}$, which indicates that the parameter is well identified in the model.

FIGURE C.3. Elasticity - Sensitivity Analysis



Notes: The figure shows the model-implied elasticity, $\eta_{BE,SP}$, for different values of the learning parameter α.

C.3. *Welfare Analysis*

In this section, we analyze the welfare costs of information frictions about the government type. To this end, we compare the government's value function in our baseline model with a counterfactual in which the type of government is perfectly observable.

In particular, we compute how much we would need to compensate the government (in consumption units) for it to be indifferent between the baseline model and the *perfect information* case. Using the fact that preferences in the model are CRRA, the certainty equivalent consumption (CEC) is given by

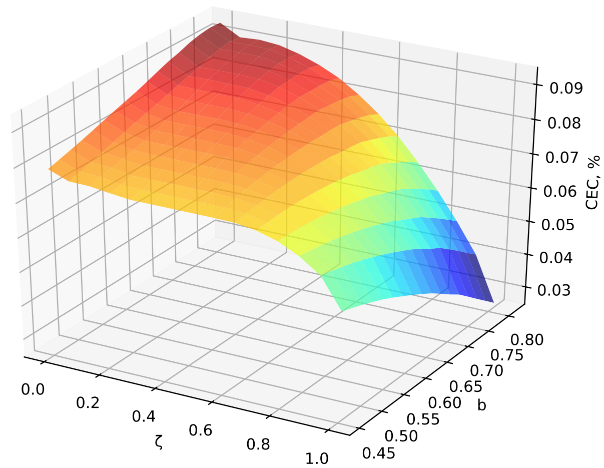
$$\omega(y,b,z) = \left[\frac{\tilde{W}\,(y,b)}{W^{\star}(y,b,z)}\right]^{\frac{1}{1-\gamma}} - 1, \tag{C.1}$$

where $W^{\star}(\cdot)$ denotes the value function under the baseline model, and $\tilde{W}(\cdot)$ is the value function under the alternative scenario. A positive value of $\omega(y,b,z)$ means that the government is better off in the *perfect information* case.[51]

Figure C.4 shows the results for different combinations of (b,ζ). The CEC measure is always positive, meaning that the government would be better off by being in a scenario with perfect information. More importantly, the CEC is larger when reputation is low and debt is high. This is because, in those points of the state space, the C-type faces significantly larger borrowing costs, since it is not able to perfectly reveal its type.

[51]We define $W^{\star}$ and $\tilde{W}$ as the averages between the value functions for the C- and S-type.

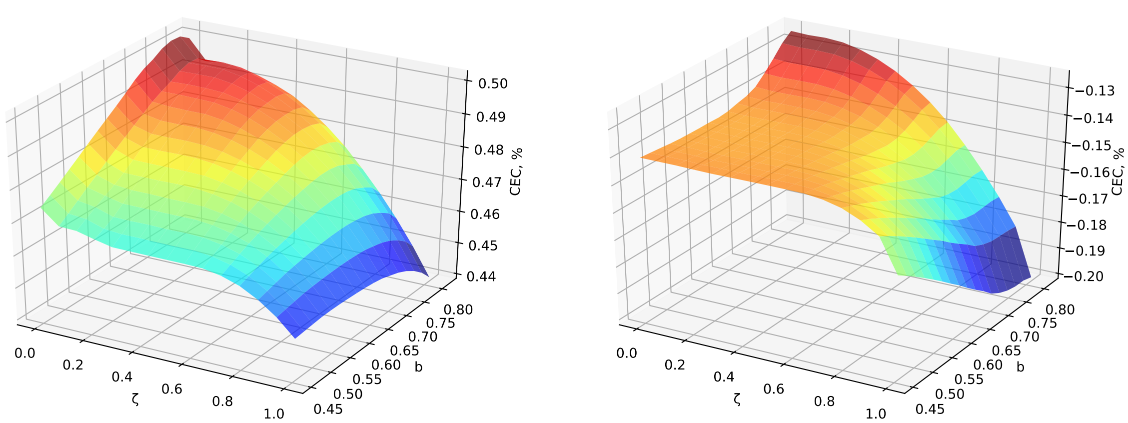
FIGURE C.4. CEC - Baseline Model vs. Perfect Information Case



Notes: The figure shows the additional certainty equivalent consumption (CEC) that makes the government indifferent between the baseline model (with imperfect information) and a case in which the type of government is perfectly observable. The figure assumes that output is at its mean.

FIGURE C.5. CEC - Baseline Model vs. Fixed Types Case

(A) C-type (B) S-type



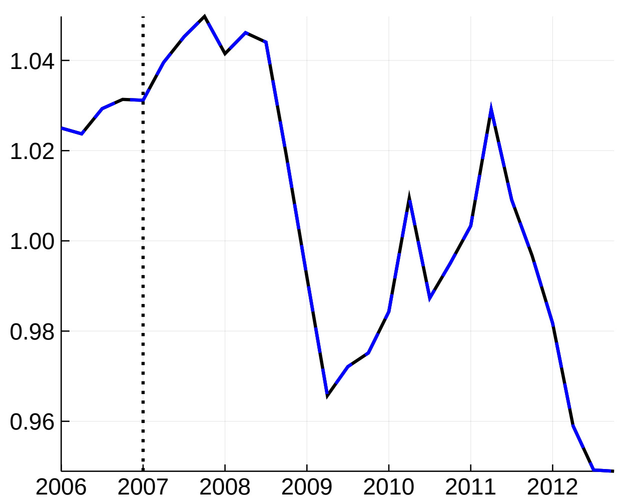
Notes: The figure shows the additional CEC that makes the j-type indifferent between the baseline model (with imperfect information) and a case in which government's types are fixed (and observable). Panel (A) shows the results for the C-type. Panel (B) shows the results for the S-type. The figure assumes that output is at its mean.

Lastly, we analyze the welfare implications associated with the presence of alternating types. Figure C.5 shows the CEC that makes the j-type indifferent between the baseline model (with imperfect information and alternating types) and a case in which types are fixed (and observable).[52] Panel (A) shows that the C-type is significantly worse off in the baseline scenario. Panel (B), on the other hand, shows that the S-type is better off in the baseline model (the CEC is negative). This is because under imperfect information, the S-type can attain a larger level of debt and lower borrowing costs.

C.4. *Evolution of Output During 2006-2012*

Figure C.6 shows the simulated path for output used in the simulated dynamics of Section 4.4. Results are based on a log-linear trend. Argentina underwent a severe financial crisis during 2001-2002 that produces a structural break in the log-linear trend. Therefore, we estimate the log-linear trend with a structural break starting in 2002. Results are almost identical if we instead consider the HP cycle of output. We opted for the log-linear cycle to keep consistency with the model calibration and computation of moments from Section 4.1.

Figure C.6. Path for Output



Notes: The figure shows the imputed evolution of output for the simulation in Section 4.4. This corresponds to Argentina's log-linear cycle of GDP for the period 2007:Q1-2012:Q4.

[52]The analysis has the caveat that the preferences are different under the fixed type counterfactual, since each j-type is not subject to changes in preferences over default.

C.5. *Solution Method*

In this section, we describe the algorithm used to solve the quantitative model described in Section 2. We use a global solution method, based on value function iterations and linear interpolations. The state of this economy is (y, b, ζ). We discretize the output process y using Tauchen's method. We choose 15 gridpoints for y, 46 for b, and 15 for ζ. Gridpoints for the ζ grid are evenly spaced in the $[0, 1]$ range. For the case of the grid for b, we use 13 evenly spaced points for $b \in [0, 0.40]$ and 33 points for $b \in (0.4, 1.15]$. We use more points in the later case because the pricing kernel exhibits larger nonlinearities in that range.

The steps of the algorithm are as follows:

(1) We start with a guess for the value functions $W_j(y, b, \zeta)$ for $j = \{C, S\}$. We also guess the lenders' conjecture $d_j^\star(y, b, \zeta)$ and $\tilde{\Pi}_j^\star(y, b, \tilde{\zeta})$, and the bond pricing kernel $q(y, b', \zeta')$.
(2) At stage 1, if the government is not currently in default, the state of the economy is $(y, b, \tilde{\zeta})$, where $\tilde{\zeta} = \tilde{\zeta}(d = 0, \zeta, d_C^\star, d_S^\star)$ as shown in Equation (3). Taking as given the conjectured $\tilde{\Pi}_j^\star(y, b, \tilde{\zeta})$, for each message $m = \{L, NL\}$, we compute the lenders' posterior $\hat{\zeta}(m) = \hat{\zeta}(m, \tilde{\zeta}, \tilde{\Pi}_C^\star, \tilde{\Pi}_S^\star)$ based on Equation (4).
(3) Based on the guesses of step (1) and the updated posteriors of step (2), we can then solve for the optimal bond policy, $b^{\star\prime}(y, b, \tilde{\zeta})$, as described in Equation (A.4). To this end, we use a simple bisection algorithm (Brent's method) and we linearly interpolate the value functions and bond prices when evaluating off-grid points.
(4) Taking as given the solution for $b^\star(y, b, \tilde{\zeta})$, we solve for the S-type $\tilde{\pi}(y, b, \tilde{\zeta})$ policy, as described in Equation (A.6), where $V_j(y, b, \tilde{\zeta})$ is given by Equation (A.5). We use the same bisection algorithm of step (3). We then use $V_j(y, b, \tilde{\zeta})$ to compute $W_j^R(y, b, \zeta)$, following Equations (A.6) and (A.7).
(5) We compute the value function for the case in which the government defaults in the current period, $W_j^D\left(y, b, \tilde{\zeta}\right)$, as given by equation (A.2). We also compute the value function for the case in which the government is already in default, $\tilde{W}_j^D(y, \zeta)$, as shown in Equation (A.3).
(6) At stage 0, we solve for the government's optimal default choice, as shown in Equation (A.1). We then update our guess for $W_j(y, b, \zeta)$. Similarly to Chatterjee and Eyigungor (2012), we convexify the default decision in order to achieve convergence. In particular, we assume that each period, the government's value function $W_j^D(\cdot)$ is subject to an i.i.d. shock $\epsilon_w \sim \mathcal{N}(1, \sigma_w)$ so that the government defaults if $W_j^R(\cdot) < W_j^D(\cdot) \times \epsilon_w$. We choose σ_w small enough ($\sigma_w = 0.0015$) so that the convexified solution does not significantly

differ from the "true" solution of the model. Let $d_j(y, b, \zeta)$ denote the optimal default choice.

(7) Taking as given the conjectures $d_j^\star(y, b, \zeta)$ and $\tilde{\Pi}_j^\star(y, b, \tilde{\zeta})$, we update the bond price kernel $q(y, b', \zeta')$ according to Equation (A.8).

(8) We update the guesses for the lenders' conjectures, $d_j^\star(y, b, \zeta)$ and $\tilde{\Pi}_j^\star(y, b, \tilde{\zeta})$ based on the updated solutions for $d_j(y, b, \zeta)$ and $\tilde{\pi}_j(y, b, \tilde{\zeta})$ (from steps 4 and 6).

(9) We iterate over the previous steps until convergence of the value function, conjectures, and bond pricing kernel.