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Central Bank Independence at Low Interest Rates[†]

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Abstract

We create a new measure of the political pressure faced by the Federal Reserve based on the analysis of transcripts of the Chairs' testimonies to Congress. We find that the use of non-traditional policies at low interest rates led to increased political criticism and that criticism predicts legislative actions that threaten central bank independence. We develop a model where the probability of the monetary authority's future loss of independence is increasing in the use of non-traditional instruments, leading to attenuated monetary responses and higher inflation volatility. We show that this attenuation can be mitigated under an institutional framework with clearly defined targets where the central bank is evaluated by how efficiently it achieves its goals.

Resumen

Creamos una nueva medida de la presión política enfrentada por la Reserva Federal basada en el análisis de transcripciones de los testimonios de sus presidentes ante el Congreso de los Estados Unidos. Encontramos que el uso de políticas no convencionales en períodos de bajas tasas de interés lleva a un aumento de las críticas y que estas críticas predicen acciones legislativas que pueden amenazar su independencia. Desarrollamos un modelo en donde la probabilidad de pérdida de independencia de la autoridad monetaria aumenta con el uso de instrumentos no tradicionales, lo que lleva a respuestas monetarias atenuadas y una mayor volatilidad de la inflación. Esta atenuación puede mitigarse bajo un marco institucional con objetivos claramente definidos, donde el banco central es evaluado por la eficiencia con la que alcanza sus metas.

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1 Introduction

The global financial crisis of 2008-2009 and the coronavirus pandemic posed unique and unprecedented challenges to the conduct of monetary policy for the Federal Reserve and other central banks. With interest rates falling to historical lows, monetary authorities resorted to the use of alternative instruments to stimulate their economies and bring inflation back to targeted levels.

In this paper, we discuss how the effective lower bound (ELB) on interest rates presents not only technical but also political challenges to the implementation of monetary policy. We introduce a new measure of the political pressure faced by the Federal Reserve, based on a textual analysis of the evolution of the discourse between Chairs and politicians during semi-annual Humphrey-Hawkins Act testimonies to Congress.

We find an increase in critical questions and statements following the 2008 financial crisis. While many factors may account for this, a significant portion of this increase specifically references the Federal Reserve's use of new tools to deal with the effective lower bound on interest rates. The relationship between critical statements and references to the use of non-traditional instruments also holds when controlling for the ELB subsample, indicating that criticisms of the Federal Reserve are not driven by other circumstances associated with low interest rates.

We argue that the number of critical questions and statements directed to Chairs of the Federal Reserve during congressional testimony provides a good way to quantify the political pressure that the Federal Open Market Committee (FOMC) is exposed to over policy decisions. Following Hess and Shelton (2016), we analyze bills introduced to Congress that threaten the powers of the Federal Reserve. We find that our measure of congressional criticism correlates highly with the introduction of threatening legislation. We also find that the number of threatening bills that specifically mention unconventional monetary policy is predicted by the amount of criticism referencing new monetary policy tools, indicating that the use of these tools increased the prospect of changes to the Federal Reserve's governance.

Our empirical findings motivate our second contribution, where we analyze the impact that potential threats to central bank independence may have on policy decisions. In a hypothetical scenario where the Federal Reserve's authorities might interpret criticism as a potential impediment to independently shape the future policy path, the chosen trajectories could deviate from the unconstrained inflation-minimizing policies, internalizing the fact that, in democratic societies, a central bank's independence is inherently revocable through the actions of elected officials.

We present a simple model where the central bank takes into account that its actions may affect the probability of losing monetary independence at some point in the future. We show that a perceived probability of losing independence that is increasing in the use of non-traditional tools could lead to larger inflation volatility during ELB episodes. We additionally show how an institutional framework where the central bank is evaluated on clear and measurable goals can ameliorate the issues brought on by concerns of external intervention. Our model is consistent with the fact that, in practice, central banks that are nominally independent still try to avoid reporting negative profits (Goncharov et al., 2022). As negative profits are likelier to occur when asset purchase programs are used at the ELB (Cavallo et al., 2019), a central bank's optimal reluctance to use non-traditional tools may be motivated by the increased political scrutiny and interference that negative profits may bring (Cukierman, 2010).

The empirical aspects of our paper, in which we quantitatively measure the level of praise and criticism of Federal Reserve policy, relate to the work of Demiralp et al. (2019) who derive politicians' desired policy stance from news articles and measure their influence on interest rate swaps. In contrast, our paper focuses specifically on increased political pressure due to unconventional policy and quantifies criticism that Chairs of the Federal Reserve directly face during their testimonies to Congress.[1]

Our paper also relates to several others that deal with central bank independence and the

[1] As market participants may simultaneously learn of Chairs' views of the state of the economy during testimonies, we do not attempt to quantify effects on interest rates.

political economy of monetary policy decisions. In the words of Rogoff (2019), "central bank independence is rarely granted by constitutional decree, and even where it is, the letter of the law has little meaning if political support is lacking". Weise (2008) finds that the Federal Reserve's policy stance is more closely associated with what was desired by non-financial groups before 1979, but with the preferences of the banking industry after that. Weise (2012) argues that 1970s inflation in the United States was partly due to political pressures on the Federal Reserve. Relatedly, Hess and Shelton (2016) find that policy responded to bills threatening Fed powers before the 1980s, but did not respond after that. Our paper also complements the political pressure indexes made by Binder (2021) and Bianchi et al. (2019) by making a measure based on a text analysis of critical speeches from members of the US congress that we show it is a leading indicator to actual threatening legislation as measured by Hess and Shelton (2016). On the theoretical side, our work relates to Halac and Yared (2021), who analyze political pressure in the sense of external agents forcing the central bank to reduce the weight of inflation in their reaction function.

2 A measure of political pressure faced by the Fed

We introduce a new measure for the political pressure faced by the Federal Reserve and show how interactions between Congress and the Chairs of the Federal Reserve have evolved over time. Passed in 1978, the Humphrey-Hawkins Act requires the Federal Reserve to submit a semi-annual written report to Congress. In addition, the Chair is required to submit testimony to the Congressional record. At a minimum of twice a year, members of the Senate's Financial Services Committee and members of the House Committee on Financial Services engage in an oral question and answer session with the Chair. These meetings allow politicians to ask the Chair both specifics about monetary policy and their general views of economic issues.

We gather transcripts of the question and answer sessions starting on February 28, 2001,

the first day from which digital records of the sessions are available.[2] We then use the transcripts to code statements and questions from members of Congress that are directed to or asked of the Chair in the following manner:

$$\text{Supportive Count} = \begin{cases} +1 \text{ for each statement/question supportive of the Fed or Chair} \\ 0 \text{ otherwise} \end{cases}$$

$$\text{Critical Count} = \begin{cases} +1 \text{ for each statement/question critical of the Fed or Chair} \\ 0 \text{ otherwise} \end{cases}$$

In all cases, statements and questions are coded only if they clearly indicate criticism or support. We argue that this unique setting provides a good way to quantify how the Chair is personally exposed to political pressure over policy decisions. Historically, the Chair has played an important role in the FOMC's (Federal Open Market Committee's) decisions, and we posit that political pressure directed to the Chair is a good proxy for the political pressure felt by the FOMC.

In order to measure to what extent these counts relate to unconventional actions taken by the Federal Reserve following the financial crisis, we also record if each politician's question or statement specifically references unconventional monetary policy, defined as forward guidance or asset purchases (this includes all three Large-Scale Asset Purchase Programs and the Maturity Extension Program). This allows us to discriminate between statements that are critical or supportive because of the implementation of non-traditional policies from criticism or support due to other factors, such as the financial crisis or the implementation of financial reforms.

Finally, in order to keep track of politicians' apparent policy preferences, we keep count of the number of critical or supportive statements in each hearing that include an unambiguous preference for less accommodative (tighter) or more accommodative (looser) policy. Table 1

[2]These transcripts can be downloaded from the Congressional Publishing Office at https://www.gpo.gov/fdsys/browse/collection.action?collectionCode=CHRG.

Table 1: Summary Statistics

Variable	Average #	Std. Deviation	Observation Count
Support Fed/Chair	1.8	2	76
Criticize Fed/Chair	3.9	4.2	76
Reference Unconventional Monetary Policy	1.1	2	76
Preference for Tighter Policy	1.1	1.4	76
Preference for Looser Policy	0.4	0.7	76
Observations at ELB			28

presents summary statistics from the coded hearings.[3]

3 Empirical analysis

3.1 Hearing transcripts

Figure 1 shows the coded series. As apparent from panel (a) of the figure, criticism of the Federal Reserve and its Chairs increased during the ELB episode. Table 2 shows the results of an OLS regression predicting the number of supportive/critical statements with an indicator variable for hearings occurring during the ELB. Column (3) shows that the relationship between the ELB and criticism remains significant after controlling for an indicator for Chair Yellen's term. Though her tenure was widely viewed as a continuation of previous policies, our results shows that her term is nevertheless associated with a sizeable and significant increase in criticism.

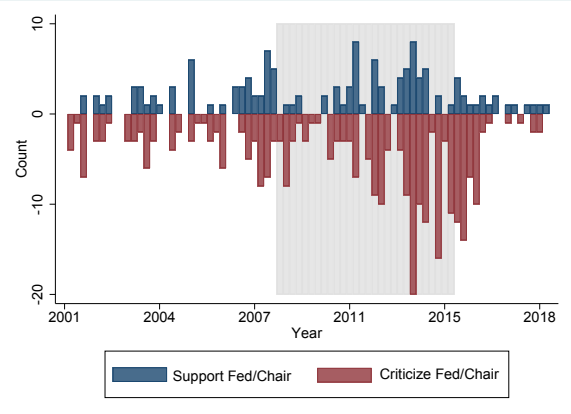
Given the increased pressure Chairs faced following the ELB, it is interesting to note whether members of Congress supported tighter or looser monetary policy. Panel (b) of Figure 1 charts, by date, the number of statements that unambiguously show a preference for tighter or looser policies. It is clear that, out of the statements coded as critical or supportive, a majority indicate a preference for tighter policy.

The increased hostility Chairs faced following the financial crisis is specifically related to the use of non-traditional tools. Panel (c) of Figure 1 illustrates the proportion of criticism

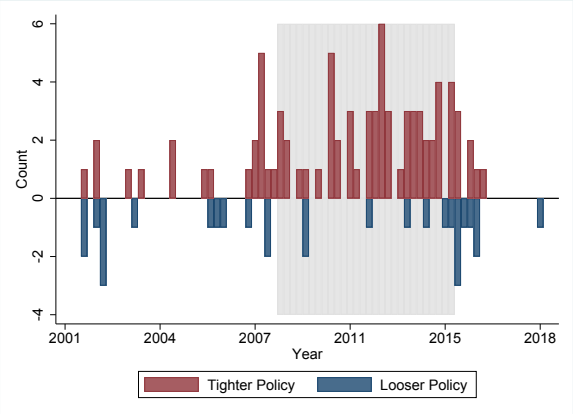
[3]We document some examples of how different statements were coded in the online Appendix . The full dataset of coded passages is available here.

Figure 1: Coded Statements

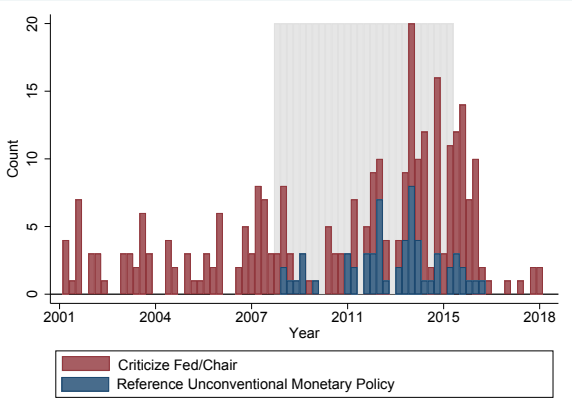
(a) Time Series of Codings



(b) Policy Preferences



(c) Criticism and New Monetary Tools



Notes: Statement counts are plotted by date from first to last observation. Counts of critical statements and looser policy are plotted as negative numbers. The shaded area indicates that short-term interest rates are constrained by the effective lower bound.

Table 2: Support and Criticism of the Federal Reserve During ELB and Normal Times

	Supportive Count	Critical Count	
	(1)	(2)	(3)
ELB Indicator	0.66	2.70***	2.11**
	(0.466)	(0.949)	(0.831)
Yellen Term			4.96***
			(0.983)
Constant	1.52***	2.87***	2.05***
	(0.283)	(0.576)	(0.525)
Observations	76	76	76
Adjusted R-squared	0.01	0.09	0.31

*** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.

that includes a negative reference to unconventional monetary policy, showing that it is not merely the financial crisis, regulatory changes, or other factors associated with low interest rates what led to increased political pressure.[4]

Table 3 empirically verifies that criticism of unconventional policy accounts for a large portion of the overall increased level of criticism during the ELB period using OLS regressions. Column (1) presents the relationship between criticism and negative references to unconventional policy, while Column (2) controls for increased criticism during the ELB period. Columns (3) and (4) additionally control for whether the politician making the statement is affiliated with the opposite party of the Chair or the opposite party of the President, showing that higher levels of criticism are associated with comments from opposition politicians. Such correlations may arise if politicians criticize the Federal Reserve to opportunistically appeal to their constituents rather than to articulate sincere concerns regarding monetary policy. Column (5) shows that Chair Yellen's term loses the statistically significant association with increased criticism after including these other covariates. In all cases, negative references to unconventional monetary policy account for a statistically significant increase in criticism. The ELB period, on the other hand, is not associated with increased criticism other than through mentions of unconventional monetary policy.

3.2 Congressional bills

While our empirical findings indicate that policymakers faced increased political scrutiny while implementing non-traditional monetary policies, it is not necessarily the case that policymakers would view this criticism as indicative of a threat to central bank independence. In this section, we provide evidence for such a threat, as we find that congressional criticism is associated with the future introduction of bills that threaten the Federal Reserve's independence.[5]

Following the work of Hess and Shelton (2016), we gather bills introduced to Congress

[4] While 21 supportive statements occur which positively mention unconventional policy, as shown in Table 2, there is no overall change in the number of supportive statements and questions through the ELB period.

[5] We thank an anonymous referee for a suggestion that led to the addition of this subsection which greatly improved the paper.

Table 3: Criticism of Fed/Chair and Negative References to Unconventional Monetary Policy

	(1)	(2)	(3)	(4)	(5)
Negative UMP Reference	1.93***	2.05***	0.89***	0.55**	0.50**
	(0.218)	(0.257)	(0.203)	(0.234)	(0.235)
ELB Indicator		-0.78	-0.26	-0.32	-0.29
		(0.822)	(0.535)	(0.515)	(0.512)
Opposite Party of Chair			0.75***	0.42***	0.36**
			(0.075)	(0.146)	(0.153)
Opposite Party of President				0.45**	0.48***
				(0.171)	(0.171)
Yellen Term					0.84
					(0.613)
Constant	2.35***	2.53***	1.08***	0.88***	0.83***
	(0.378)	(0.426)	(0.311)	(0.308)	(0.309)
Observations	76	76	76	76	76
Adjusted R-squared	0.51	0.51	0.79	0.81	0.81

*** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses. UMP denotes unconventional monetary policy.

that mention "Federal Reserve," "Board of Governors," or "Federal Open Market Committee" between 2001 and 2019. We replicate the analysis of Hess and Shelton (2016) and classify them according to their bill summaries into the seven categories presented in Table 4.[6]

We further classify bills that fall into categories 1, 2, 4, 5, and 6 as threats to the Federal Reserve. In total, we classify 292 bills as threats and 184 bills under non-threat categories.[7]

Table 4: System of Classifying a Bill's Effect on the Federal Reserve System

Category	Summary
1	*Revolutionary:* the bill fundamentally changes the monetary policy system or abolishes the Fed as we know it.
2	*Change in mandate:* the bill changes the philosophy and/or mandate of the Fed.
3	*Extending Fed powers:* open-ended goal with powers to match. Key: the Fed has discretion in interpretation or enforcement
4	*Revoking Fed powers:* opposite of 3, removes a set of powers from the Fed.
5	*Dictating policy:* Congress legislating their preferred monetary policy outcome and simply directing the Fed to enforce.
6	*Transparency and accountability:* asking the Fed to testify on certain behaviors, submit to audits, etc.
7	*Referencing the Fed* as an expert without changing their powers (e.g., calling on them for testimony or to collect and publish data).

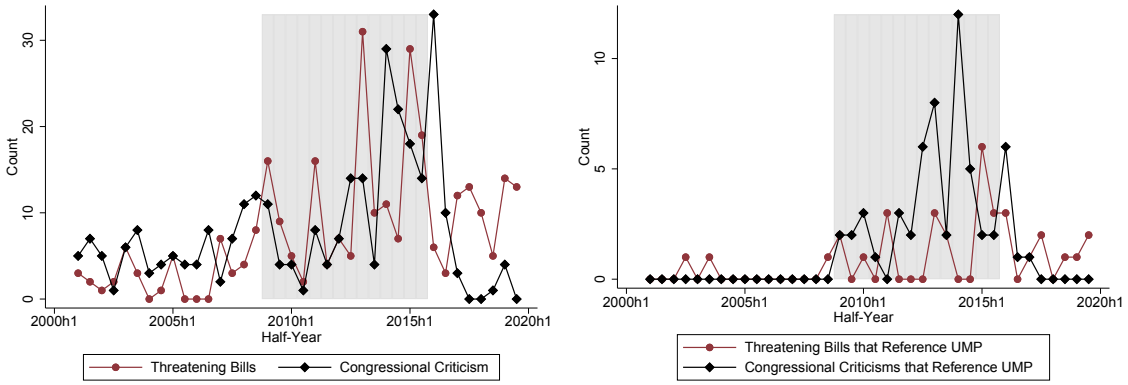
[6]The bill keyword search and bill summaries can be found at https://www.congress.gov.

[7]These totals exclude bills that erroneously fall under our keyword search but are unrelated to the

Figure 2: Threatening Bills and Critical Statements

(a) All Bills and All Criticism

(b) Bills and Criticism Referencing Unconventional Policy



Note: The shaded area indicates that short-term interests are rate constrained by the effective lower bound. UMP denotes unconventional monetary policy.

The left panel of Figure 2 shows the number of threatening bills over time, along with counts of congressional criticism, both aggregated over six month intervals in order to align with bi-annual monetary policy hearings.[8]

The right panel of the figure shows only bills and criticisms that mention non-traditional monetary policy tools. Counts of threatening bills and congressional criticisms are positively correlated, both for all bills and criticisms, and for those that specifically reference unconventional policy. Table 5 presents OLS regressions that show that congressional criticism is highly correlated with the introduction, a year later, of bills that threaten the Federal Reserve's independence. Column (2) shows that this fact holds for bills and criticisms specifically related to unconventional monetary policy, while Column (3) shows that this relationship is not mechanically driven by the lack of bills and criticism related to unconventional policy before the financial crisis.[9]

Federal Reserve. We also exclude bills from our analysis that mention the Federal Reserve only in passing in conjunction with other financial regulatory bodies, such as the Securities and Exchange Commission or Consumer Financial Protection Bureau. Such bills primarily concern the regulatory treatment of specific financial intermediaries and do not seek to specifically hamper or increase the powers of the Federal Reserve.

[8]We guide the reader to the online Appendix for time series of the non-threatening bill count and further statistical information regarding the frequencies of bill classifications.

[9]Hess and Shelton (2016) find evidence that the FOMC's monetary policy responds only to legislation with cosponsors because bills with multiple sponsors may present more credible threats to the powers of

Table 5: Threatening Bills and Congressional Criticism of the Federal Reserve

	All Bills	Bills Referencing UMP	
	(1)	(2)	(3)
One-Year-Lagged Critical Count	0.43***		
	(0.150)		
One-Year-Lagged Critical Count		0.30***	0.26**
Referencing UMP		(0.069)	(0.098)
Constant	4.48**	0.43*	0.68*
	(1.663)	(0.216)	(0.391)
Sample	Full Sample	Full Sample	Post-2008
Observations	36	36	22
Adjusted R-squared	0.17	0.34	0.22

*** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses. UMP denotes unconventional monetary policy.

We conclude that increases in congressional criticism are indicative of greater threats to the Federal Reserve's independence and that the use of non-traditional monetary policy is correlated with both an increase in congressional criticism and the introduction of threatening legislation. While we are agnostic as to the reasons for this, our analysis of critical hearing statements indicates that some politicians may have different preferences over the role of monetary policy and may hold different information sets regarding the costs and benefits of new tools. For example, Senator DeMint said in 2011 meeting of the Senate that "... quantitative easing, monetizing of debt, or however we termed that, has caused some concern about our currency, the long-term value of our currency, and it has caused a lot of us to look at ways to create a more substantial or more soundness and stability to our monetary policy." This statement reflects many politicians concerns over the observational equivalence between asset purchases and debt monetization, and the possible negative effects of new tools on inflation and the strength of the dollar. In addition, many politicians criticize the effect of the Federal Reserve's policies on credit allocation and its distributional impact on savers. For example, Congressman Hensarling noted "the Federal Reserve's unprecedented role in credit allocation, a focus distinct from its traditional role in monetary policy" in a 2014 hearing,

the Federal Reserve. We show in the online Appendix that our conclusions do not change when omitting single-sponsored bills.

and asked "should the Fed pick distinct credit markets to support while ignoring others? This clearly creates winners and losers, and under the Fed's current policies, seniors on fixed incomes are clearly losers as we continue to witness the blurring of lines between fiscal and monetary policy."

4 Central bank independence and optimal policy

In light of the evidence of increased political pressure in the US, we posit the following: suppose the use of non-traditional tools induces a perceived risk that the monetary authority may lose some of its power to shape policy independently, in either a *de jure* or a *de facto* sense. The central bank will then consider the risk of losing its monetary independence when deciding on its policy decisions, placing a wedge between the politically constrained and unconstrained optimums. We develop a simple model to show the potential consequences to the optimal conduct of monetary policy if the increased criticism and threatening legislation that we document translates into a perceived risk that the central bank may lose its independence.

4.1 The baseline model

Following Svensson (1999) and Söderström (2002),[10] the model's Phillips curve and aggregate demand equations are respectively given by

$$\pi_{t+1} = \pi_t + \alpha_y y_t + \varepsilon_{\pi,t+1} \tag{1}$$

$$y_{t+1} = b_y y_t - b_r \left(r_t^o + \tilde{r}_{t+1}^u - \pi_{t+1|t} \right) + \varepsilon_{y,t+1}. \tag{2}$$

Conventional monetary policy is captured by an observed interest rate r_t^o. All other unconventional policies are summarized by an unobserved shadow rate that, as in Wu and Xia (2016) and Wu and Zhang (2019), is assumed to be equivalent to the traditional instrument in how it affects aggregate demand. The *effective* shadow rate, denoted by $\tilde{r}_{t+1}^u \equiv (\gamma_{r,t+1}^u r_t^u + X_{t+1})$, may differ from the ex-ante desired policy rate r_t^u due to two sources of uncertainty. First,

[10] We show in the online Appendix that a static version of the model, as in Williams (2013), yields equivalent results.

there is uncertainty regarding the aggregate demand response to the policy instrument r_t^u. The manifestation of this source of uncertainty is only known to the monetary authority one period after the policy rate is decided, and is denoted by $\gamma_{r,t+1}^u \equiv 1 + \mu_{r,t+1}$. A second stochastic disturbance, $X_{t+1} \equiv \xi_{t+1} x(r_t^u)$, refers to the risk of outside interference in policy decisions. In line with our empirical results, our flexible reduced-form specification for the risk function X_t captures the idea that using unconventional instruments may lead to a higher risk of losing central bank independence in monetary policy decisions. We assume $x(r_t^u)$ to be non-negative and increasing on the absolute level of the instrument utilization, with $x(0) = 0$, and for all $r_t^u \neq 0$, $g_t \equiv x'(r_t^u)x(r_t^u)/r_t^u > 0$. The exogenous variables $\varepsilon_{\pi,t+1}$, $\varepsilon_{y,t+1}$, $\mu_{r,t+1}$ and ξ_{t+1} are zero-mean i.i.d. disturbances, with constant variances given respectively by σ_π^2, σ_y^2, σ_r^2 and σ_x^2, and are only known in period $t+1$.

With an optimal target rule, the monetary authority chooses an optimal trajectory for $\{x_{t+i}, \pi_{t+i}, r_{t+i}^o, r_{t+i}^u\}_{i=0,..,\infty}$ in order to minimize the loss function $\mathcal{L}_t = \frac{1}{2} E_t \sum_{i=0}^{\infty} \beta^i \left(\pi_{t+i} - \overline{\pi}\right)^2$, where $\overline{\pi}$ is the target level for inflation. Considering the two-period control lag on inflation, in practice the monetary authority follows an inflation forecast target with $\pi_{t+2|t}$ as the intermediate operational target (Svensson, 1997; Svensson and Woodford, 2004). As in Svensson (1999) and Williams (2013), our setup allows for a simplified period-by-period problem where at each period t the monetary authority chooses a pair $\{r_t^o, r_t^u\}$ in order to minimize the instantaneous loss function

$$L_t = E_t \left[\left(\pi_{t+2} - \overline{\pi}\right)^2 \right] \tag{3}$$

subject to a policy constraint given by

$$\pi_{t+2} = \pi_{t+2|t}(r_t^o, r_t^u) - a_r \left(\tilde{r}_{t+1}^u - r_t^u \right) + \varepsilon_{\pi,t+1} + \alpha_y \varepsilon_{y,t+1} + \varepsilon_{\pi,t+2} \tag{4}$$

where $a_y \equiv \alpha_y b_y$, $a_r \equiv \alpha_y b_r$, and $\pi_{t+2|t}(r_t^o, r_t^u) = \pi_{t+1|t} + a_y y_t - a_r(r_t^o + r_t^u - \pi_{t+1|t})$. The

problem's first order conditions lead to targeting rules for r_t^o and r_t^u given respectively by

$$\pi_{t+2|t}(r_t^o, r_t^u) - \overline{\pi} = 0 \tag{5}$$

$$\pi_{t+2|t}(r_t^o, r_t^u) - \overline{\pi} = r_t^u a_r(\sigma_r^2 + g_t\sigma_x^2) \tag{6}$$

that, considering the expression for $\pi_{t+2|t}$, yield the central bank's reaction functions:[11]

$$r_t^{o*} = \frac{1}{a_r}\left(\pi_{t+1|t} - \overline{\pi}\right) + \frac{a_y}{a_r}y_t - \left(r_t^u - \pi_{t+1|t}\right) \tag{7}$$

$$r_t^{u*} = \varpi_{ru}\left[\frac{1}{a_r}\left(\pi_{t+1|t} - \overline{\pi}\right) + \frac{a_y}{a_r}y_t - \left(r_t^o - \pi_{t+1|t}\right)\right] \tag{8}$$

The level of policy attenuation is denoted by $\varpi_{ru} = (1 + \nu_{ru})^{-1}$, with $\nu_{ru} \equiv \sigma_r^2 + g_t\sigma_x^2 > 0$, and depends on the risk of external interference and, as in Brainard (1967), the uncertainty regarding its effect on aggregate demand.[12] The functional form of $\varpi_{ru} \leq 1$ shows that, in our setup, uncertainty on the effects of the policy instrument ($\sigma_r^2 > 0$) and a monetary authority that finds its independence threatened ($\sigma_x^2 > 0$) have equivalent effects. Both will cause that, during ELB episodes, the alternative instrument will be used less than the unconstrained optimal, driving the expected intermediate target $\pi_{t+2|t}$ away from the target $\overline{\pi}$.

In order to study to what extent the aforementioned results follow under different specifications for the intervention risk function, we analyze two alternative ways of modeling the intervention. First, as a probability of completely losing policy control, and second, as an unspecified threat that, without explicitly intervening on the desired policy path, still generates an aversion to the use of the unconventional instrument.[13]

For the first alternative specification, we consider a central bank that takes into account

[11] Notice that with an effective lower bound $\underline{r}^o$, the effective r_t^o is constrained such that $r_t^o = \max(r_t^{o*}, \underline{r}^o)$. It then follows that when r_t^o is unconstrained and the relevant FOC holds (i.e. $\pi_{t+2|t}(r_t^o, r_t^u) = \overline{\pi}$), then r_t^{u*} equal zero. That condition doesn't hold, however, if r_t^o is constrained by the ELB ($r_t^{o*} < \underline{r}^o$). Only in those cases will the unconventional instrument be utilized.

[12] Our modeling contributions in this paper relate to central bank independence rather than the uncertainty of policy instruments' effects. A more thorough treatment of the effects of uncertainty would admit agents' expectational channels and learning of the policymaker (Sack, 1998; Wieland, 2000).

[13] We perform additional sensitivities on our baseline model in the appendix and show that they do not materially alter our conclusions. These additional variations include a central bank with a dual mandate, a level of external intervention that negatively correlates with the instrument utilization, and the inclusion of an additional cost channel for the transmission of the unconventional instrument as in (Sims et al., 2021).

that the control of the monetary policy could be completely taken from their hands with some probability increasing in the utilization of the unconventional instrument. Instead of assuming a stochastic interference variable X_t, we define $0 \leq p_I(r_t^u) \leq 1$ as the probability of the intervention materializing, assumed to be increasing in the absolute level of the instrument utilization, with $p_I(0) = 0$, and, for all $r_t^u \neq 0$, $\widetilde{g}_t \equiv {}^{p_I'(r_t^u)}/_{r_t^u a_r^2(1-p_I(r_t^u))} > 0$. The instantaneous loss function then becomes

$$L_t^{CB} = (1 - p_I(r_t^u))\frac{1}{2}E_t[(\pi_{t+2}^{CB} - \overline{\pi})^2] + p_I(r_t^u)L^I \tag{9}$$

where $E_t(\pi_{t+2}^{CB})$ is the expected inflation under the central bank's defined monetary policy, and $L^I \equiv \frac{1}{2}\sigma_{\overline{\pi}^I}^2$ denotes the expected loss under intervention, with $\sigma_{\overline{\pi}^I}^2 > 0$ denoting the expected inflation volatility that we assume constant over time for simplicity .

Under this setup, the optimal attenuation obtained by minimizing (9) follows a structure similar to the baseline case, with $\varpi_{ru} = (1+\sigma_r^2+\Delta L^I\widetilde{g}_t)^{-1}$, and where $\Delta L^I \equiv L^I - E_t[\frac{1}{2}(\pi_{t+2}^{CB} - \overline{\pi})^2]$ denotes the expected additional loss in case of an intervention. Intervention risk will cause attenuation so long as inflation is expected to be more volatile under external intervention (i.e., if $\Delta L^I > 0$). The optimal attenuation is increasing in ΔL^I and $\widetilde{g}_t$, meaning that the central bank will further restrain the use of the instrument the worse that inflation would perform under policy intervention, and the more intervention likelihood increases with instrument utilization. For the case that policy control is expected to be lost forever, the relevant loss function becomes $L_t^{CB}(r_t) = (1 - p^I(r_t^u))E_t[\frac{1}{2}(\pi_{t+2}^{CB} - \overline{\pi})^2 + \beta L_{t+1}^{CB}(r_{t+1})] + p^I(r_t^u)\frac{L^I}{1-\beta}$, with the expected additional loss now being expressed as $\Delta L^I \equiv L^I - E_t[\frac{1}{2}(\pi_{t+2}^{CB} - \overline{\pi})^2] + \beta E_t[\frac{L^I}{1-\beta} - L_{t+1}^{CB}(r_{t+1})]$. The additional argument reflects the impact on the optimal attenuation of taking into account the present value of the expected additional volatility that the economy will have to endure in a future without central bank independence. For a non-independent central bank that is expected to fare worse than an independent one (meaning $E_t[\frac{L^I}{1-\beta} - L_{t+1}^{CB}(r_{t+1})] > 0$), a loss of independence that is expected to last for longer would lead to a bigger ΔL^I and therefore a higher attenuation in the use of the instrument.

Our second sensitivity analysis relates to how the expected intervention enters the central bank's loss function. In our baseline model, the attenuation arises endogenously due to the risk of losing full policy control. In this alternative specification, we eliminate the intervention risk by setting $X_{t+1} = 0$ and instead, as in Williams (2013), introduce a reduced-form penalty $\lambda^u (r^u)^2$ on using the non-traditional tool directly into the loss function:

$$L_t^{\lambda_u} = E_t[\beta^2(\pi_{t+2} - \overline{\pi})^2 + \lambda_u(r_t^u)^2] \tag{10}$$

It can be shown that, setting $\lambda_u = \sigma_x^2\beta^2a^2$, the results from minimizing (10) are equivalent to the baseline specification if we assume $x(r_t^u) = |r_t^u|$. Our baseline specification is consistent with an optimal contract between the central banker and the rest of the economic agents, where the decision-making process of the monetary authority focuses on minimizing the mandated loss function (in this case, price stability), devoid of any principal-agent distortions biasing their behavior (Walsh, 1995). On the other hand, Williams (2013)'s reduced-form penalty parameter λ_u represents a distaste for using the alternative monetary instrument that could be due to, for example, a central banker's fear of being fired for using the alternative instrument. The additional argument, related to the banker's personal preferences and not to the central bank's mandate, places a wedge between the banker's optimal and the socially optimal decision on the future policy path and, as in our baseline specification, also leads to policy attenuation and higher than optimal inflation volatility. It should be noted that both in the baseline case and with a reduced-form penalty with this motivation, the attenuation bias can be traced back to a lack of certainty over the central bank's independence.

4.2 State-dependent intervention risk

A final consideration regarding intervention likelihood relates to the central bank's capacity to achieve its goals, and how, depending on the state of the economy, the likelihood of external intervention may vary.[14] Through its ability to read supply shocks and the use of monetary

[14]We thank an anonymous referee for suggesting this model extension, which greatly improved the implications of our theoretical results.

policy to negate demand shocks, a central bank that maintains inflation close to target may build trust and be less subject to threats to independence.

Maintaining the same baseline loss function from (3), we relax the assumption that the risk of intervention depends only on the utilization of the unconventional instrument to allow for a state-dependent risk of losing independence where the closer the central bank stays on target, the less likely it may face an external intervention. The risk function now takes the form of $X_{t+1} = \xi_{t+1} x(r_t^u, L^*_{t+2|t})$, with $x_2' > 0$, and where $L^*_{t+2|t} \equiv \frac{1}{2} E_t[(\pi^{CB}_{t+2} - \overline{\pi})^2]$ denotes the expected loss if there were no intervention and no disturbance in the policy multiplier (i.e. if $\mu_{r,t+1} = \xi_{t+1} = 0$ so that $\pi^{CB}_{t+2} = \pi_{t+1|t} + a_y y_t - a_r \left(r_t^o + r_t^u - \pi_{t+1|t}\right) + \varepsilon_{\pi,t+1} + \alpha_y \varepsilon_{y,t+1} + \varepsilon_{\pi,t+2}$). Under this setup, the attenuation parameter becomes $\varpi_{ru} = (1 + \sigma_r^2 + \sigma_x^2 \widetilde{g}_t)^{-1}$, where $\widetilde{g}_t \equiv (x_1' + \mathcal{D}_t) x(r_t^u, L_t^*)/r_t^u$ and $\mathcal{D}_t \equiv x_2' \frac{dL^*_{t+2|t}}{dr_t^u} = -x_2' a_r (\pi^{CB}_{t+2|t} - \overline{\pi})$. The new argument $\mathcal{D}_t$ denotes the instrument utilization's indirect effect on intervention risk through its influence on the expected fulfillment of the central bank's goals. It reflects the appearance of an additional trade-off from utilizing the unconventional instrument, where the central bank not only takes into account that using the unconventional tool increases the intervention likelihood, but also considers that a smaller attenuation allows for lower economic volatility, strengthening credibility and thus reducing intervention risk.[15]

Our model's results show the unwanted consequences that the mere possibility of external intervention can have on the optimal policy path chosen by a central bank. The model predicts an attenuation in the optimal use of new monetary instruments that is increasingly pronounced the more its utilization is associated with higher intervention risk. The results follow under a variety of assumptions on how the risk of intervention manifests. However, we show that if the goals of the central bank are clearly defined under an institutional framework in which the intervention risk depends less on which instruments are used and more on how efficiently the central bank achieves its goals, the equilibrium attenuation is diminished.

[15] In this context, a higher comovement between the intervention risk and the expected fulfillment of the central bank goals (i.e. a larger x_2') will be associated with a higher willingness from the central bank to reduce the attenuation in the instrument utilization, leading to less expected inflation volatility.

5 Conclusion

This paper documents how interactions between the Chairs of the Federal Reserve and members of Congress changed over time. We find an increase in critical questions and statements directed to Chairs of the Federal Reserve following the 2008 financial crisis. A significant portion of the increase is accounted for by the Fed's use of new tools to deal with the effective lower bound on short-term interest rates. In support of the view that our measure of congressional criticism represents credible pressure on the Federal Reserve, we find that increased criticism predicts future legislative actions that threaten central bank independence. We then show that a central bank that rationally takes into account future outcomes, including the revocable nature of its power, should attenuate the use of an alternative monetary tool when the perceived probability of losing some degree of monetary independence is increasing in the use of the instrument. Previous research has found that the Federal Reserve was well insulated from political pressure since the 1980s (Weise, 2008, 2012; Hess and Shelton, 2016). However, our quantification of congressional pressure provides evidence that new monetary policy tools may entail a political cost precisely when optimal policy may call for novel and aggressive central bank interventions.

While our paper focuses on the US experience, our findings highlight the importance of a strong institutional framework for any central bank facing the challenge of finding the optimal policy path using novel instruments that may be difficult to communicate. Furthermore, as in Bordo and Siklos (2019), who find that higher independence, transparency, and stronger institutions are correlated with higher economic stability and resiliency to shocks, we show how an institutional framework where the central bank is evaluated by clear and measurable goals can help minimize the sub-optimal economic volatility associated with perceived threats to its independence. Under a framework in which central bank targets are clearly defined, policymakers can be confident that unwanted intervention on monetary policy will be unlikely so long as they abide by their targeted mandate, provide transparent policy communications, and provide clear evidence that chosen policy paths are appropriate for reaching their targets.

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Appendix

A Examples of coded statements and summary statistics

In this section, we present examples of questions and statements coded as supportive or critical. It is valuable to illustrate how Chairs' interactions with Congress have changed over time, especially during and following the financial crisis.

Before the financial crisis and subsequent implementation of unconventional policy, many politicians were at times effusive in their praise of the Chair. In addition, praise tended to be bipartisan. For example, in the July 16, 2002 hearing of the Committee on Banking, Housing, and Urban, Senator Gramm (R-Texas) stated to Alan Greenspan:

> "Under your leadership, we have had a monetary policy which has been the envy of the world. It has been the foundation of our economic stability, and I want to thank you for your leadership."

Such statements were coded throughout the sample as +1 for the supportive count in each hearing. Similarly, Senator Dodd (D-Connecticut), author of the Dodd-Frank Act, told Alan Greenspan on March 7th, 2002:

> "It gets said often enough, but it deserves repeating- you have done a terrific job and we are all very grateful for your leadership."

These statements are indicative of the broad bi-partisan esteem and respect that the Federal Reserve commanded before the crisis. After the crisis, Chairs still did receive statements of support. For example, in the February 2015 meeting with the House, Congressman Green (D-Texas) stated to Chair Yellen:

> "I compliment not only you but also Chair Bernanke because he stood fast in some difficult circumstances. And I think the Fed has made a significant difference in the recovery that we find ourselves experiencing."

By and large, however, Chairs Bernanke and Yellen faced greater criticism after the crisis and implementation of non-traditional policies. For example, in the same session, known Fed critic Congressman Hensarling (R-Texas) stated:

> "Many prominent economists believe that the American people will enjoy a healthier economy when the Fed begins to adopt a more predictable method of rules-based monetary policy, one of its choosing."

Congressman Henslaring's preferences for monetary policy to be be set more mechanically are a common criticism of Fed decision-making, and are also highlighted by politicians in references to non-traditional policy. Later in the same session, Congressman Hensarling specifically criticized the Fed's use of forward guidance. In referencing market movements allegedly due to word changes in Federal Reserve statements, the Congressman declared that

> ".. there does not appear to be all that much "guidance" in the Fed's "forward guidance"."

Likewise, Congressman Frank Lucas (R-Oklahoma) criticized the impact of the Fed's low interest rate policies on savers, and alluding to the opioid epidemic, stated:

> "...Chair Yellen, somebody has paid for the economic methadone that we have been existing on for 6 years."

Within the context of our rules for coding, the preceding three statements would be classified as critical, while the latter two statements would classify as concerns specifically related to unconventional policy.

B Coded meetings

Date	Congress	Chair
2/2001	House	Greenspan
2/2001	Senate	Greenspan
7/2001	House	Greenspan
7/2001	Senate	Greenspan
2/2002	House	Greenspan
3/2002	Senate	Greenspan
7/2002	House	Greenspan
7/2002	Senate	Greenspan
2/2003	Senate	Greenspan
2/2003	House	Greenspan
4/2003	House	Greenspan
7/2003	Senate	Greenspan
7/2003	House	Greenspan
2/2004	House	Greenspan
2/2004	Senate	Greenspan
7/2004	Senate	Greenspan
7/2004	House	Greenspan
2/2005	House	Greenspan
2/2005	Senate	Greenspan
7/2005	House	Greenspan
7/2005	Senate	Greenspan
2/2006	House	Bernanke
2/2006	Senate	Bernanke
7/2006	House	Bernanke
7/2006	Senate	Bernanke
2/2007	House	Bernanke
2/2007	Senate	Bernanke
2/2007	Senate	Bernanke
7/2007	Senate	Bernanke
7/2007	House	Bernanke
2/2008	House	Bernanke
2/2008	Senate	Bernanke
7/2008	House	Bernanke
7/2008	Senate	Bernanke
7/2008	Senate	Bernanke
2/2009	Senate	Bernanke
2/2009	House	Bernanke
7/2009	Senate	Bernanke
7/2009	House	Bernanke

Date	Congress	Chair
2/2010	House	Bernanke
2/2010	Senate	Bernanke
7/2010	House	Bernanke
7/2010	Senate	Bernanke
3/2011	Senate	Bernanke
3/2011	House	Bernanke
7/2011	Senate	Bernanke
7/2011	House	Bernanke
2/2012	House	Bernanke
3/2012	Senate	Bernanke
7/2012	Senate	Bernanke
7/2012	House	Bernanke
2/2013	House	Bernanke
2/2013	Senate	Bernanke
7/2013	House	Bernanke
7/2013	Senate	Bernanke
2/2014	Senate	Yellen
2/2014	House	Yellen
7/2014	Senate	Yellen
7/2014	House	Yellen
2/2015	Senate	Yellen
2/2015	House	Yellen
7/2015	Senate	Yellen
7/2015	House	Yellen
2/2016	Senate	Yellen
2/2016	House	Yellen
6/2016	Senate	Yellen
7/2016	House	Yellen
2/2017	House	Yellen
2/2017	Senate	Yellen
7/2017	House	Yellen
7/2017	Senate	Yellen
2/2018	House	Yellen
3/2018	Senate	Yellen
7/2018	Senate	Yellen
7/2018	House	Powell
2/2019	Senate	Powell
2/2019	House	Powell
7/2019	Senate	Powell

C Additional empirical analysis

Table 1 presents the frequency of the seven bill classifications in our dataset. As in Hess and Shelton (2016), we find relatively few bills that propose a change to the Fed's mandate or a revolutionary change to the Fed's structure. About 40% of bills are non-threatening and either extend the Fed's powers or call on the Fed as an expert without changing their powers.

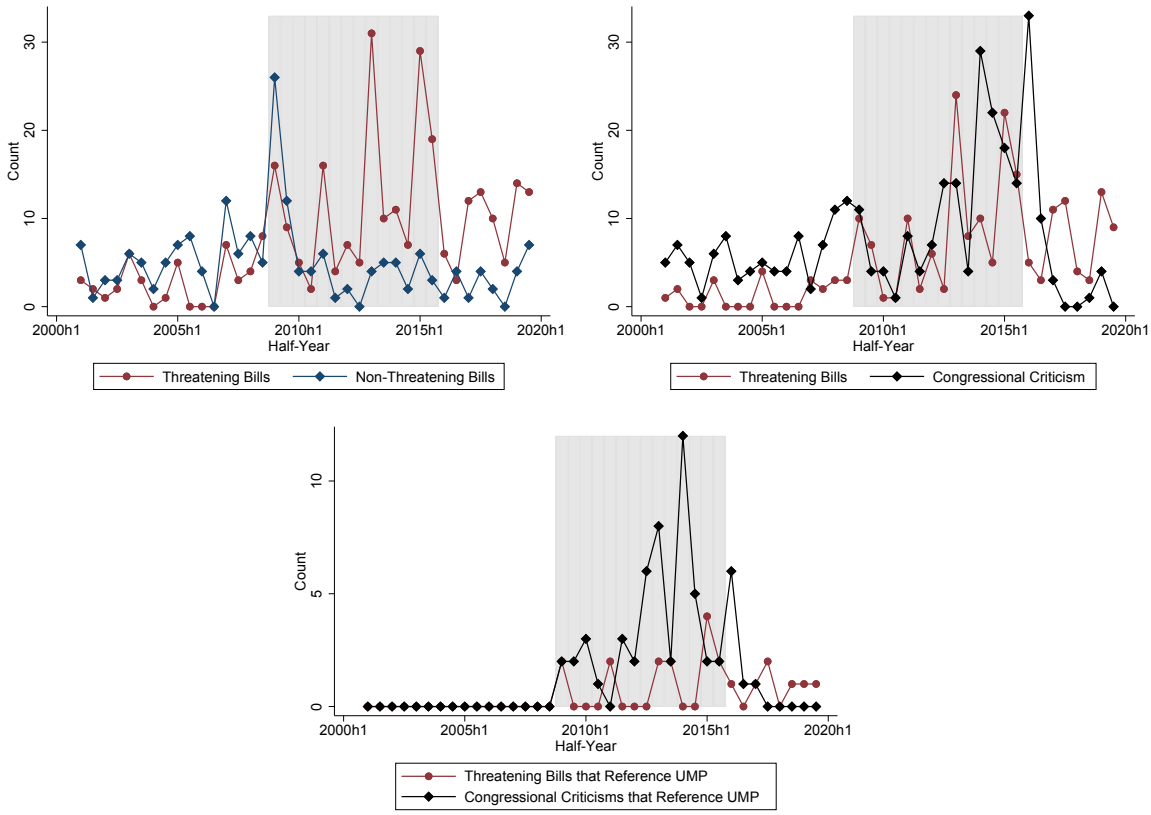
Left panel of Figure 1 presents the counts of bills that are classified as threats and the count classified as non-threatening. Immediately following the Global Financial Crisis, the number of non-threatening bills increased as legislation was proposed to extend the Federal Reserve's regulatory powers. Thereafter, the number of introduced non-threatening bills falls to pre-crisis levels. In contrast, the count of threatening bills rises following 2008, and remains elevated over the ELB period.

Table 1: Frequency of Bill Classification

	Frequency	Percent
1 Revolutionary	14	2.9%
2 Change mandate	24	4.9%
3 Extend powers	136	28.0%
4 Revoke Powers	103	21.2%
5 Dictate Policy	45	9.3%
6 Accountability	113	23.3%
7 Reference	51	10.5%
Total	486	

The middle and right panels of Figure 1 replicates charts from the body of the paper relating the number of threatening bills to the number of critical comments during congressional testimonies, but excludes bills that do not have cosponsors. Hess and Shelton (2016) present evidence that the FOMC's monetary policy decisions do not seem to be affected by single-authored legislation introduced to Congress. Table 2 predicts the threatening legislation count, for only bills with cosponsors, using the one-year-lagged number of critical congressional comments. In all cases, critical comments predict Congressional bills, including for bills and comments that both reference unconventional monetary policy as shown in Columns 2 and 3.

Figure 1: Number of Bills Proposed Each Year With Cosponsors That Mention the Federal Reserve



Note: The shaded area indicates that short-term interests are rate constrained by the effective lower bound.

Table 2: Prediction of Number of Threatening Bills with Cosponsors Using Congressional Criticism

	All Bills	Bills Referencing UMP	
	(1)	(2)	(3)
One-Year-Lagged Critical Count	0.40***		
	(0.118)		
One-Year-Lagged Critical Count		0.22***	0.18**
Referencing UMP		(0.048)	(0.069)
Constant	2.36*	0.23	0.49*
	(1.310)	(0.151)	(0.276)
Sample	Full Sample	Full Sample	Post-2008
Observations	36	36	22
Adjusted R-squared	0.22	0.36	0.21

*** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses. UMP denotes unconventional monetary policy.

D Additional sensitivities to the baseline model specification

In this section of the appendix we describe four additional extensions to the baseline model specification that are referred in the main body of the paper.

First, we show that allowing for a negative correlation between the instrument utilization and the expected external intervention can affect the central bank's optimal attenuation, as the policy rule for the unconventional instrument becomes $r_t^{u*} = \varpi_{ru}[{}^{1}/_{a_r}(\pi_{t+1|t} - \overline{\pi}) + {}^{a_y}/_{a_r} y_t - (r_t^o - \pi_{t+1|t}) - E_t(X_{t+1})]$, with $\varpi_{ru} = (1 + \frac{\nu_{ru}}{1+\partial E_t(X_{t+1})/\partial r_t^u})^{-1}$. There are two arguments that, as opposed to the baseline case, are now non-zero: $-E_t(X_{t+1})$, that reflects the optimal offsetting of the expected intervention, and ${}^{\partial E_t(X_{t+1})}/_{\partial r_t^u}$, that shows how the instrument utilization's marginal effect on the expected intervention also leads to adjustments on r_t^{u*}.

In our second extension to the baseline specification we implement a dual mandate for the central bank, common in many countries. We show that incorporating aversion to output volatility in the monetary authority's loss function yields equivalent expressions for the attenuation parameter. With a loss function given by $L_t = \frac{1}{2} E_t \left[\sum_{i=0}^{\infty} \beta^i (\pi_{t+i} - \overline{\pi})^2 + \lambda_y (y_{t+i})^2\right]$, the monetary authority's reaction functions becomes $r_t^{o*} = \Phi_{\lambda_y,\pi} \frac{1}{a_r}(\pi_{t+1|t} - \overline{\pi}) + \frac{a_y}{a_r} y_t - (r_t^u - \pi_{t+1|t})$ and $r_t^{u*} = \varpi_{ru}[\Phi_{\lambda_y,\pi} \frac{1}{a_r}\left(\pi_{t+1|t} - \overline{\pi}\right) + \frac{a_y}{a_r} y_t - (r_t^o - \pi_{t+1|t})]$, with $\Phi_{\lambda_y,\pi} = \frac{\beta a_r^2}{\beta a_r^2 + \lambda_y b_r^2} \leq 1$ denoting the effect of λ_y on the optimal policy function. As the aversion to output volatility affects the optimal utilization of the conventional and unconventional instruments in the same form, the attenuation parameter, given by $\omega_{ru,\lambda_y} = (1 + \sigma_r^2 + g_t \sigma_x^2)^{-1}$, remains unmodified.

As a third extension, we analyze the implications of unconventional policy having different propagation mechanisms than conventional policy. We have assumed that unconventional measures, as in Wu and Xia (2016) and Wu and Zhang (2019), can be fully characterized as a shadow rate in terms of its economic impact and transmission channels. However, implementing quantitative policies may give rise to an additional supply side channel which Sims et al. (2021) show can be characterized as an additional linear cost-push shock in a reduced-form. If we rewrite our Phillips curve accordingly, such that $\pi_{t+1} = \pi_t + \alpha_y y_t + \varepsilon_{\pi,t+1} + \lambda^u \tilde{r}_t^u$, where the parameter $\lambda^u \geq 0$ governs the strength of the supply-side channel,

it can be shown that the attenuation parameter becomes $\varpi_{ru} = (1 + \sigma_r^2 + \sigma_x^2 g_t - \lambda^u/a_r)^{-1}$. Intuitively, the cost channel makes unconventional policy less effective at reducing inflation, increasing its optimal utilization, and counters the optimal rate of attenuation arising from the intervention risk.[1] It should be noted, however, that the relationship between interference risk and attenuation remains unaltered when we consider the existence of an additional cost-push channel.

Finally, we show that our results remain unaltered if we consider a static framework similar to Williams (2013), where, as in our baseline, besides the monetary rule, the equilibrium in the economy is defined by an IS and a Phillips Curve given by $\pi = \overline{\pi} + \alpha_y y + \varepsilon_\pi$ and $y = -b_r(r^o + \tilde{r}^u - \pi^e) + \varepsilon_y$. The random process for the policy multiplier and the risk of outside interference in policy decisions are given respectively by $\gamma^u = 1 + \mu_r$ and $X = \mu_x x(r^u)$. As in our baseline specification, $x(r^u)$ is non-negative and increasing on the absolute level of the instrument utilization, with $x(0) = 0$, and for all $r_t^u \neq 0$, $g \equiv x'(r^u)x(r^u)/r^u > 0$. The effective unconventional instrument utilization $\tilde{r}^u \equiv \gamma^u r^u + X$ considers then the two aforementioned sources of uncertainty and may differ from the desired policy instrument r^u. The exogenous variables μ_r and μ_x are zero-mean i.i.d. disturbances with variances σ_r^2 and σ_x^2. The realizations of μ_r and μ_x are known only after the interest rate is decided. π^e denotes the expected value of π after ε_π and ε_y are observed, but before the uncertainty about μ_r and μ_x is revealed.

The central bank then chooses an optimal trajectory for $\{y, \pi, r^o, r^u\}$ to minimize the loss function $L = \frac{1}{2}(\pi - \overline{\pi})^2$, where $\overline{\pi}$ is the inflation target. The minimization leads to the rules regarding the optimal utilization of the instruments to be given by $r^{o*} = \frac{1}{a_r}\varepsilon_\pi + \frac{\alpha_y}{a_r}\varepsilon_y - (r^u - \pi^e)$ and $r_t^{u*} = \varpi_{ru}^s[\frac{1}{a_r}\varepsilon_\pi + \frac{\alpha_y}{a_r}\varepsilon_y - (r^o - \pi^e)$, where $\nu_{ru}^s \equiv (1 - a_r)(\sigma_r^2 + g\sigma_x^2)$, and $\varpi_{ru}^s = (1 + \nu_{ru})^{-1}$ is the policy attenuation parameter that we see follows the same structure as the baseline dynamic case.

[1] Sims et al. (2021) make the point that QE policies are the most efficient tool as a reaction to credit shocks, as credit shocks also appear both in the IS and Phillips curves during normal times and during periods where the interest rate is constrained by the effective lower bound.

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