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Risk management-driven policy rate gap☆

Giovanni Caggiano [a,b], Efrem Castelnuovo [c,b,*], Gabriela Nodari [d]

[a] *Monash University, Australia*
[b] *University of Padova, Italy*
[c] *University of Melbourne, Australia*
[d] *Reserve Bank of Australia, Australia*

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ABSTRACT

We employ real-time data available to the US monetary policy makers to estimate a Taylor rule augmented with a measure of financial uncertainty over the period 1969–2008. We find evidence in favor of a systematic response to financial uncertainty over and above that to expected inflation, output gap, and output growth. However, this evidence regards the Greenspan–Bernanke period only. Focusing on this period, the "risk-management" approach is found to be responsible for monetary policy easings for up to 75 basis points of the federal funds rate.

1. Introduction

> *"[...] The Federal Reserve's experiences over the past two decades make it clear that uncertainty is not just a pervasive feature of the monetary policy landscape; it is the defining characteristic of that landscape. [...] the conduct of monetary policy in the United States has come to involve, at its core, crucial elements of risk management".*
>
> Greenspan (2004)

Does the Federal Reserve act as a risk-manager? The quote by Former Federal Reserve's chairman Alan Greenspan points to a positive answer. This paper provides empirical support to this view by quantifying the implications of this "risk management" approach for the federal funds rate. We do so by estimating a Taylor rule augmented with a measure of financial uncertainty over the period 1969M1–2008M10, and by computing the "risk-management-driven policy rate gap". This gap measures the difference between the actual policy rate and the counterfactual policy rate that would have been observed had the Federal Reserve not acted as a "risk manager", i.e., had it not reacted to fluctuations in financial uncertainty. Our estimates focus on the entire sample as well as on subsamples identified by changes of the Federal Reserve's chairman to take into account possible breaks in policymakers' preferences both over risk management and over inflation and output stabilization (Clarida et al., 2000; Lubik and Schorfheide, 2004; Castelnuovo and Fanelli, 2015; Boivin and Giannoni, 2006; Castelnuovo and Surico, 2010). Importantly, we employ data available in real-time to the Federal Open Market Committee, which is crucial to correctly characterize monetary policy decisions by the Federal Reserve (Orphanides, 2001, 2002; Coibion and Gorodnichenko, 2011, 2012; Gnabo and Moccero, 2015).

We find significant evidence in favor of a systematic monetary policy response to movements in financial uncertainty. However, this evidence is limited to the Great Moderation period characterized by the lead of Greenspan and Bernanke. The Greenspan-Bernanke risk management approach is associated to a looser monetary policy with respect to the one the Federal Reserve would have implemented had it not reacted to financial uncertainty directly. The estimated median value of the "risk-management-driven" policy rate gap is 30 basis points, which is approximately a standard

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[*] Corresponding author at: University of Melbourne, Australia.
E-mail address: efrem.castelnuovo@unimelb.edu.au (E. Castelnuovo).

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policy rate move. However, in correspondence to well-identified historical events (Black Monday, 2008 credit crunch), such a gap is estimated to be three times as large due to the higher realizations of financial uncertainty.

Many empirical proxies of uncertainty have recently been proposed by the literature (for a survey, see Bloom, 2014). We focus on financial uncertainty for three reasons. First, Angelini et al. (2017), Ludvigson et al. (2018) find that financial uncertainty shocks – as opposed to macroeconomic uncertainty disturbances – are drivers of the business cycle. Second, and related to the previous point, several papers have recently documented the contribution of financial uncertainty shocks to the US business cycle (Bloom, 2009; Caggiano et al., 2014; Leduc and Liu, 2016; Basu and Bundick, 2017; Caggiano et al., 2017a,b). Third, financial uncertainty is likely to have strong connections with the uncertainty characterizing the future evolution of the US economy, above all as far as output growth is concerned (Evans et al., 2015).

The closest papers to ours are Evans et al. (2015) and Fernández-Villaverde et al. (2015). The first paper presents theoretical motivations for a risk management approach by monetary policymakers (one example being asymmetric loss functions, which imply the presence of second-order elements in the optimal monetary policy feedback function), and document a systematic response to different measures of uncertainty during Greenspan's regime (which is the only regime they investigate). The second paper shows that a nonlinear DSGE framework matches the data better when a systematic monetary policy response to fiscal uncertainty is modeled. We complement these papers by (i) showing that the Federal Reserve's risk management-type of response to macroeconomic shocks is monetary policy regime-specific, and (ii) defining and quantifying the risk-management driven policy rate gap.[1]

The rest of the paper is organized as follows. Section 2 offers details on the empirical strategy. Section 3 documents our estimates and proposes the risk-management driven policy rate gap. Section 4 concludes.

2. Empirical strategy

Taylor rule. We consider the following Taylor rule:

$$R_t^* = R^* + \phi_\pi(E_t\pi_{t,k} - \pi^*) + \phi_x E_t x_{t,q} + \phi_{\Delta y} E_t(\Delta y_{t,p} - \Delta y^*) + \phi_{unc}\, unc_t \qquad (1)$$

$$R_t = (1 - A(L))R^* + A(L)R_{t-1} + \upsilon_t \qquad (2)$$

Eq. (1) describes the evolution of the Taylor rate in absence of interest rate persistence. In this equation, $\pi_{t,k}$ stands for the average annualized inflation rate from t to $t+k$, π^* is the inflation target, $x_{t,q}$ is the average output gap from t to $t+q$, $\Delta y_{t,p}$ is the average output growth from t to $t+p$, Δy^* is the output growth target, unc_t stands for financial uncertainty, E_t denotes expectations conditional on information available to the FOMC at time t, and R^* is the Taylor rate conditional on inflation and output growth being at the target, a zero output gap, and a concern by policymakers for uncertainty equal to zero.[2] Given that the FOMC has a preference for implementing variations in the policy rate in a smooth manner (English et al., 2003; Castelnuovo, 2003), the polynomial $A(L) = \Sigma_{j=0}^{N-1} a_{j+1} L^j$ in Eq. (2) is modeled, where L is the lag operator, and N denotes the number of federal funds rate lags. Finally, we allow for the presence of monetary policy shocks via the zero-mean, constant variance error term υ_t.

Combining equations (1) and (2) yields to the following linear equation:

$$R_t = b_0 + b_\pi E_t\pi_{t,k} + b_x E_t x_{t,q} + b_{\Delta y} E_t \Delta y_{t,p} + b_{unc}\, unc_t + A(L)R_{t-1} + \upsilon_t \qquad (3)$$

where b_i, $i = 0, \pi, x, \Delta y$, and unc are nonlinear functions of the structural parameters ϕ_π, ϕ_x, $\phi_{\Delta y}$, $\Delta y_{t,p}$, R^*, and π^*.

Data. We estimate Eq. (3) with real-time data. In particular, we employ the Greenbook forecasts of current and future inflation, output gap, and output growth. The interest rate is the federal funds rate set at each FOMC meeting. The measure of financial volatility is the VXO of the "Greenbook day", which is the day in which the Greenbook is finalized (typically, a few days before each FOMC meeting). Given that before 1986 the VXO is not available, we proxy it with the volatility of S&P500 returns computed over a 30-day window before the Greenbook day.[3]

Estimation. We estimate the Taylor rule (3) via ordinary least squares, which delivers consistent estimates of the Taylor rule coefficients given the real-time nature of the data.[4] We account for heteroskedasticity by using the Newey–West correction of the variance of the estimated coefficients. As in Coibion and Gorodnichenko (2011, 2012), we set $k = 2$, $q = p = 0$, and $N = 2$. The choice of two lags of the policy rate is in line with Clarida et al. (2000), which is the seminal paper regarding Taylor rules for the United States, Coibion and Gorodnichenko (2011, 2012), who also work with real time data, and Ascari et al. (2011), who find a Taylor rule with two lags of the policy rate to be associated to a higher marginal likelihood in the context of a battery of estimated DSGE models.

We estimate Eq. (3) over the full sample 1969M1-2008M10. The beginning of the sample is justified by data availability, while the end in October 2008 is the last FOMC meeting before the beginning of the ZLB period, which can hardly be described by a standard Taylor rule modeling conventional monetary policy. As anticipated, we also estimate Eq. (3) over different subsamples. Due to sample numerosity, we bundle the regimes characterized by Martin's, Burns', and Miller's chairmanships on the one hand, and Greenspan's and Bernanke's on the other hand, under (respectively) the "Great Inflation" regime and the "Great Moderation" one (although, as regards the latter, we check our results by focusing on Greenspan's regime only). We also consider a third regime, which is the one characterized by Volcker's lead of the Federal Reserve.

3. Empirical results

Evidence of risk management. Table 1 collects our estimates, which – as for output and inflation – confirm previous findings in the literature, in particular those by Coibion and Gorodnichenko (2011, 2012).[5] Relevant for our study is the systematic response to

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[1] Another strand of the literature looks at uncertainty induces by monetary policy. For recent contributions, see Istrefi and Mouabbi (2017), Husted et al. (2018).

[2] As in Evans et al. (2015), we assume the implicit target for uncertainty to be equal to zero. This implies that also moderate, below-mean levels of uncertainty are interpreted as economically harmful by monetary policymakers. This view is corroborated by models à la Bloom (2009) and Bloom et al. (2018), which assume a non-zero inaction region for whatever positive level of uncertainty, and Basu and Bundick (2017), which deliver negative effects of uncertainty independently of the size of the uncertainty shock.

[3] Our results are robust to employing the volatility of S&P500 returns over the whole sample.

[4] See Coibion and Gorodnichenko (2011) (page 355, footnote 17) for an in-depth discussion on the properties of OLS in this context.

[5] These estimates represent the on-impact systematic response of the federal funds rate to movements in the macroeconomic aggregates on the right-hand side of the Taylor rule. We focus on the on-impact coefficients because we will use them later to construct the risk management-driven policy rate gap. The implied long-run Taylor rule coefficients, which are often documented in the Taylor rule context, and which take into account the impact of interest rate smoothing for the long-run monetary policy response to inflation, output, and financial uncertainty, are documented in our Appendix for the sake of brevity.

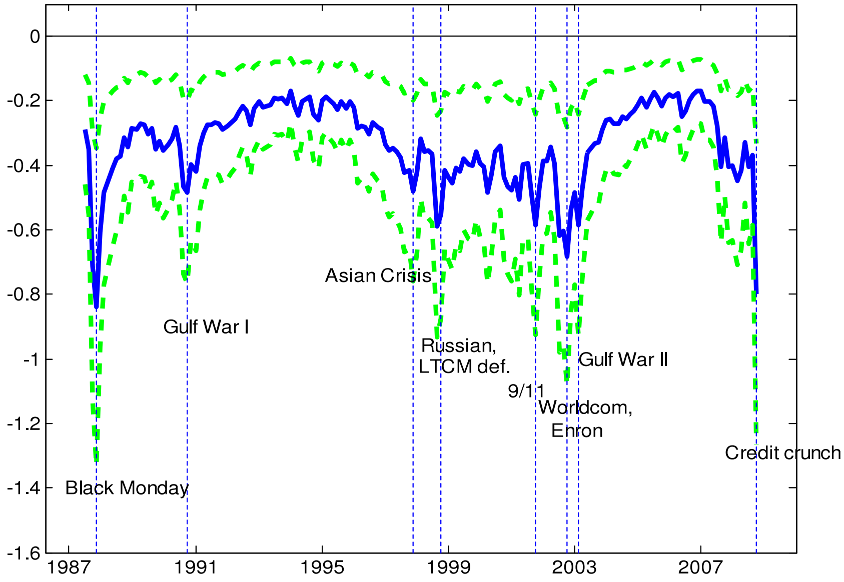

Fig. 1. Risk management-driven policy rate gap. Blue line: Policy rate gap constructed by computed the fitted value of the policy rate conditional on the estimated response to financial uncertainty. Green lines: 90% confidence bands. Blue vertical dotted lines: Historical events associated to peaks of the policy rate gap. . (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

financial uncertainty. The regimes of Greenspan and Bernanke are associated to a significant response of the policy rate to financial uncertainty. It is important to stress that this response is found to be significant in spite of the presence of inflation, output gap, output growth, and two lags of the policy rate in the Taylor rule. Our evidence points to a negative reaction of the policy rate to financial uncertainty, i.e., to a looser monetary policy than the one described by inflation and real activity only. Differently, evidence consistent with risk management is found neither during the Great Inflation period nor during Volcker's regime.

Risk management-driven policy rate gap. What is the impact of risk management on the policy rate? We quantify it by computing the difference between the actual policy rate R_t and the fitted policy rate conditional on setting the response to financial uncertainty to zero $\widehat{R}_t^{no\_unc}$. We label this object "risk management-driven policy rate gap". Formally, this gap is computed as $\widehat{R}_t^{gap} = R_t - \widehat{R}_t^{no\_unc} = \widehat{b}_{unc} unc_t$.[6]

Fig. 1 plots the risk management-driven policy rate gap. A few observations are in order. First, the gap is negative. This evidence, which is a direct implication of $\widehat{b}_{unc} < 0$, suggests a cautious behavior by the Federal Reserve in presence of uncertainty, i.e., a looser monetary policy than the one the Federal Reserve would have implemented in a world without uncertainty. Second, the median realization of this gap is 30 basis points, i.e., about the size of a standard policy move. Third, the largest realizations (in absolute value) of this gap occur in correspondence of well-identified historical events, e.g., the Black Monday (84 basis points) and the 2008 credit crunch (80 basis points), which are roughly equivalent to three standard policy moves. Other historical events, such as the two Gulf wards, the Asian crisis, the Worldcom/Enron scandals, the Russian and LTCM defaults, and 9/11 are also associated with peaks of the policy rate gap.

Table 1
Estimated Taylor rules: Short-run responses. FULL: Full sample, 1969M1–2008M10. GRINFL: Martins–Burns–Miller's sample, 1969M1–1979M7. VOLCKER: Volcker's sample, 1979M8–1987M7. GREENSP.: Greenspan-only sample: 1987M8–2006M1. GRMODER: Greenspan–Bernanke' sample:1987M8–2008M10. Responses to inflation, the output growth, the output gap, and financial uncertainty are collected from top to bottom in the Table, along with the estimated interest rate smoothing. Figures in the Table are point estimates and t-stats (in brackets). One, two, and three stars correspond to p-values < 0.10, 0.05, and 0.01, respectively. Newey–West standard errors computed to account for heteroskedasticity. Rules estimated with an interest rate smoothing structure of order 2 first; in presence of an insignificant lag of order 2, rules estimated with one lag of the policy rate only.

	FULL	GRINFL	VOLCKER	GREENSP.	GRMODER
ϕ_π	0.19^{***} (3.76)	0.14^{***} (3.34)	0.47^{***} (3.69)	0.38^{***} (4.84)	0.26^{***} (3.25)
$\phi_{\Delta y}$	0.07^{**} (2.58)	0.04^{**} (2.28)	0.18 (1.55)	0.08^{**} (3.51)	0.11^{***} (4.96)
ϕ_x	0.06^{***} (3.98)	0.07^{***} (2.98)	−0.03 (−0.52)	0.15^{***} (5.32)	0.11^{***} (4.58)
ϕ_{unc}	-0.01^{*} (−1.67)	−0.01 (−0.16)	−0.03 (−0.54)	-0.01^{**} (−2.44)	-0.02^{***} (−2.83)
a_1	0.91^{***} (32.85)	0.88^{***} (17.80)	0.70^{***} (8.87)	0.64^{***} (7.60)	0.68^{***} (7.92)
a_2	–	–	–	0.18^{**} (2.13)	0.20^{***} (2.23)
$\overline{R}^2$	0.93	0.91	0.79	0.98	0.97
Obs.	365	127	67	149	171

4. Conclusions

We estimate augmented Taylor rules with real time data which feature a measure of financial uncertainty among the explanatory variables. We find evidence of a significant policy response to financial uncertainty during the Greenspan–Bernanke period. We then propose an estimate of the "risk management-driven policy rate gap", which is the gap between the actual rate and a counterfactual policy rate implemented in absence of risk management. Such a gap is negative, an evidence consistent with a cautious approach (i.e., a loose monetary policy) by the Federal Reserve in presence of financial uncertainty The median value of the policy rate gap is 30 basis points, i.e., close to one standard policy move by the Federal Reserve, but larger values are detected in correspondence of large jumps in financial uncertainty, in particular those occurred in correspondence of the Black Monday and the 2008 credit crunch. Our findings point to the need of understanding

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[6] This way of constructing the policy rate gap neglects the dynamic feedback effect of changes in the policy rate on inflation, output, and financial uncertainty. As shown in our Appendix, an exercise conducted with a VAR modeling all these variables delivers a very similar estimates of the policy rate gap.

how optimal monetary policy should be conducted in presence of uncertainty shocks. Recent attempts along this line are Basu and Bundick (2015) and Seneca (2018).

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2018.08.003.

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