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Working Paper No. 2109
April 2021

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Ease on the Cannons, Tighten on the Trumpets: Geopolitical Risk and the Transmission of Monetary Policy Shocks*

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April 22, 2021

Abstract

Recent advances in the use of high-frequency external instruments to separate the signaling channel of monetary policy from exogenous interest rate changes have solved a number of puzzling responses to supposedly contractionary monetary policy shocks. We show that their effects on U.S. banks' balance sheets, asset markets, and economic activity hinge on the level of geopolitical risk at the time of the FOMC announcement. The S&P500 falls and credit spreads rise by more, while bank balance sheets contract, if geopolitical risk is above its sample median in the quarter or month of the shock. The state-dependent effects are due to a tightening of credit- and risk-related national financial conditions and imply that, while preparing its monetary policy decisions, the Board of Governors should also keep track of the geopolitical environment.

Keywords: C&I loans; Geopolitical risk; Monetary policy; State-dependent effects

JEL classification: E43; E44; E51; E52

*We thank Marek Jarociński and Peter Karadi for sharing their monetary policy shock series as well as Dario Caldara and Matteo Iacoviello for making their geopolitical risk and threat indices publicly available.

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1 Introduction

Recent advances in the use of high-frequency external instruments facilitate distinguishing between the signalling channel of monetary policy and exogenous shifts in the federal funds rate, arguably solving a number of long-standing puzzles in the literature studying the effects of monetary policy shocks. Jarociński and Karadi (2020) and Miranda-Agrippino and Ricco (forthcoming), for example, show that, once they control for the "information component" of FOMC announcements by imposing opposite sign restrictions on high-frequency changes in federal funds futures and stock prices and by cleansing high-frequency changes in federal funds futures of their serial correlation and any predictable components using the Fed's internal Greenbook forecasts, respectively, the remaining monetary policy instruments have an unambiguously contractionary effect on U.S. economic activity and inflation.

At the same time, there is growing awareness that geopolitical events and the associated risks may be independent drivers of economic fluctuations. Based on the perception that business leaders, financial investors, and policy makers recognize geopolitical risks as an important determinant of financial market dynamics and firms' investment behavior, Caldara and Iacoviello (2019) construct a geopolitical risk (GPR) index by running automated text searches of the electronic archives of 11 leading English-language newspapers published in the U.S., the UK, and Canada, which cover geopolitical events of global interest. Starting in January 1985, the resulting GPR index scales the number of articles mentioning the term "geopolitical risks" (or several variants of it) by the total number of articles published in each given month.[1] The authors show that an unpredictable increase in their index leads to a significant and persistent reduction in U.S. business fixed investment, employment, consumer confidence, and the level of the stock market.

[1]The authors define "geopolitics" as the practice of states and organizations to control and compete for territories, and "geopolitical events" as the result of power struggles that cannot be resolved peacefully. Their GPR index captures both the risks associated with an escalation of existing events and the risk that new events materialize (see Caldara and Iacoviello, 2019, p. 5). According to the authors, the European Central Bank, the International Monetary Fund, and the World Bank, among others, are tracking geopolitical risks based on their index.

In this paper, we show that the effects of state-of-the-art high-frequency instruments of exogenous monetary policy shocks on the balance sheets of FDIC-insured banks hinges on the level of the GPR index at the time of the FOMC announcement. A supposedly contractionary monetary policy shock reduces the growth rate of total outstanding C&I loans, while it raises the share of overdue loans and charge-offs, *if and only if* the GPR index is above its sample median, while the effects are qualitatively reversed when the GPR index is below its sample median. We then consider a variety of monthly indicators to investigate potential channels for this state dependence and find several interesting results.

First, the impulse response function of the S&P 500, which is restricted in high-frequency data in order to identify exogenous monetary policy shocks in Jarociński and Karadi (2020), is short-lived and largely statistically insignificant for low-GPR states but persistent and highly significant for high-GPR states in the month of the FOMC announcement. Second, the predicted Gilchrist and Zakrajšek (2012) spread increases for a longer time period and by more when the shock occurs in a high-GPR state, whereas we find little state dependence for the excess bond premium. Considering the Federal Reserve Bank of Chicago's *National Financial Conditions Index* (NFCI) and its component sub-indices, we show that the more pronounced and persistent tightening of financial conditions after a monetary shock in a high-GPR state is reflected primarily by the NFCI credit and risk sub-indices, whereas the responses of financial and non-financial leverage do not seem to be state-dependent, pointing towards a dominant role for credit demand. Third, we show that the state dependence carries over to the impulse responses of monthly indicators of U.S. economic activity, including the *Chicago Fed National Activity Index* (CFNAI), industrial production, unemployment, and the University of Michigan's *Consumer Sentiment Index*, as well as the consumer price index and the WTI spot price of crude oil.

In our analysis, we build on a state-dependent local projections approach to condition the impulse responses to an exogenous monetary policy shock, as identified by Jarociński and Karadi (2020), on the level of the GPR index at the time of a given FOMC announcement.

Caldara and Iacoviello (2019) also construct two sub-indices to distinguish between episodes of elevated geopolitical risk due to the realization of adverse events and episodes of elevated risk without the realization of an event. While their geopolitical acts (GPA) index thus covers articles discussing actual war-related and terrorist acts, the geopolitical threats (GPT) index covers articles addressing geopolitical, war-related, nuclear and terrorist threats. Consistent with the conclusion in Caldara and Iacoviello (2019) that geopolitical acts have economically small effects, while geopolitical threats lead to a larger decline in economic activity, we find that the state dependence described above is associated with the GPT index rather than the GPA index. In our robustness checks, we also show that the state dependence of impulse response functions is qualitatively robust to using an alternative high-frequency instrument of monetary policy shocks proposed by Miranda-Agrippino and Ricco (forthcoming), although the latter is available for only part of our baseline sample period.

Our work relates to the abundant literature on the identification and effects of monetary policy shocks based on high-frequency data originating with Kuttner (2001), Bernanke and Kuttner (2005), and Gürkaynak et al. (2005a,b) as well as the recent attempts to identify and describe an information channel of monetary policy (see, e.g., Campbell et al., 2012, 2016; Nakamura and Steinsson, 2018; Lakdawala, 2019). To this literature, we contribute the new insight that the effects of state-of-the-art monetary policy shocks may vary over time even after explicitly controlling for the information channel, as in Jarociński and Karadi (2020) and Miranda-Agrippino and Ricco (forthcoming), for example.

For this purpose, we build on the econometric methodology in Jordà (2005).[2] Similar to the original paper, we estimate state-dependent local projections in order to investigate the effects of monetary policy shocks. Related to our work, Tenreyo and Thwaites (2016) study the effects of monetary policy shocks conditional on the state of the U.S. business cycle, while Rüth (2017) studies the effects of monetary policy shocks conditional on the U.S. financial cycle, approximated by the excess bond premium of Gilchrist and Zakrajšek

[2]For similar applications of local projections in empirical macroeconomics, see Stock and Watson (2007) and Swanson (2021), for example.

(2012) as an indicator of financial market tightness. To this literature, we contribute novel insights from combining a high-frequency instrument of exogenous monetary policy shocks with a plausibly exogenous measure of geopolitical risk, which has been shown to influence the aggregate U.S. economy and individual firms' investment decisions.

A number of subsequent contributions have shown that, besides an index of stock-market volatility, geopolitical risk serves as an important leading indicator of international recessions (Neville et al., 2019), and that unexpected changes in the geopolitical risk affect bulk cargo ocean shipping freight rates, a proxy for industrial commodity demand and global real economic activity (Drobetz et al., forthcoming), while Lee (2019) explores the joint probability distribution of geopolitical risk and stock market valuations, focusing on country-specific differences. With the former, we share the use of Caldara and Iacoviello (2019)'s GPR index as an indicator of geopolitical risk.[3] In contrast to these and further studies, however, we *condition* the impulse responses to an exogenous monetary policy instrument on the GPR index rather than focusing on the latter as an independent source of shocks.

Finally, our work is related to the empirical literature on the relationship between uncertainty and business cycle fluctuations (see, e.g., Bloom, 2009; Bachmann et al., 2013; Jurado et al., 2015; Baker et al., 2016). Explicitly distinguishing between financial, macroeconomic, and policy uncertainty using "shock-based" restrictions, Ludvigson et al. (forthcoming) find that unexpected increases in financial uncertainty cause sharp and persistent declines in real activity with little evidence of reverse causality, whereas higher macroeconomic and policy uncertainty in recessions represents an endogenous response to business cycle fluctuations. In contrast, geopolitics and the associated risks are credibly exogenous to the U.S. economy.

The rest of the paper is structured as follows. Section 2 describes the data, while Section 3 presents the econometric model. Section 4 discusses our main empirical results and Section 5 two fundamental robustness checks. Section 6 concludes.

[3] In earlier work, Blomberg et al. (2004) use the ITERATE data set for terrorist events in order to study the macroeconomic consequences of terrorism and conclude that the latter is associated with a redirection of resources from private investment towards government spending. The authors also find that the negative effect of terrorism on growth is smaller and less persistent than that of external wars or internal conflict.

2 Data

Our empirical analysis draws on U.S. banks' aggregate balance sheets as well as financial and macroeconomic time series. While the former are only available in quarterly frequency, we consistently consider the latter in monthly frequencies.

2.1 Bank balance sheet data

Our main variables of interest capture the exposure of the U.S. banking sector to C&I loans. The underlying data are from the Federal Deposit Insurance Corporation's (FDIC) *Quarterly Banking Profile* (QBP), which provides a comprehensive overview of financial results for FDIC-insured financial institutions.[4] From the QBP, we select a subset of variables that covers the quantity and (ex-post) quality of loans to the U.S. corporate sector. Specifically, we consider quarterly realizations of the following variables:

1. *Total outstanding* refers to the aggregate volume of outstanding C&I loans.
2. *30–89 days past due rate* denotes the fraction of outstanding C&I loans for which interest payments are overdue between 30 and 89 days.
3. *90+ days past due rate* denotes the fraction of outstanding C&I loans for which interest payments are overdue by 90 days or more.
4. *Non-accrual status rate* denotes the fraction of outstanding C&I loans for which interest is no longer accrued.

While commercial and industrial loans in the second and third category are still accruing interest, the fourth category measures the exposure to loans for which interest is no longer accrued.[5] Moreover, we consider two FDIC variables that provide information on the fraction of defaulted relative to outstanding loans and the cumulative amount recovered, respectively:

[4] The data are publicly available from the FDIC Quarterly Banking Profile.

[5] Accrued interest is the amount of interest that has been charged on a loan as of a certain date but not yet paid, i.e. interest income due but not yet received.

5. *Charge-off rate* denotes the total amount of loans that have been charged off and added to the allowance for loan and lease losses as a fraction of outstanding C&I loans.

6. *Recovery rate* denotes the cumulative amount of recoveries on loans which have been added to the allowance for loan and lease losses as a fraction of outstanding C&I loans.

The balance sheet data of FDIC-insured institutions are nominal *in millions of current USD*. To ensure stationarity, variables 2–6 are transformed by expressing them as a fraction of total outstanding C&I loans in a given quarter, while *total outstanding* itself is expressed in quarter-on-quarter growth rates. Although the bank balance sheet data are available from 1984:Q1 onwards, up to 1989:Q4, the data on loan performance excludes savings institutions that submit so-called *Thrift Financial Reports* (TFRs). For consistency, we therefore use the data from 1990Q1 onwards, while the first-differencing of total outstanding loans delays the effective start of our sample period to 1990Q2.

2.2 Macroeconomic and financial data

To gauge potential channels through which geopolitical risk may affect the transmission of monetary policy shocks, we consider a selection of macroeconomic and financial time series, all of which are available at the monthly (or higher) frequency. Among these are the S&P 500 stock market index as well as the so-called *excess bond premium* and the *predictable component* of the Gilchrist and Zakrajšek (2012) spread.[6]

We also consider monthly indicators of U.S. economic and financial conditions provided by the Federal Reserve Bank of Chicago. As a measure of real economic activity, we use the *Chicago Fed National Activity Index* (CFNAI).[7] To capture changes in financial conditions, we draw on the *National Financial Conditions Index* (NFCI), its component sub-indices, and

[6] For the variables in Gilchrist and Zakrajšek (2012), we consider the data updated through January 2016 and made available by the authors on `http://people.bu.edu/sgilchri/Data/data.htm`.

[7] Starting in March 1967, the CFNAI provides a standardized measure of U.S. economic activity. An index of zero indicates that the economy is growing at its average historical rate. A negative index indicates below-average activity, and vice versa (see `https://www.chicagofed.org/publications/cfnai/index`).

the *Adjusted* NFCI (ANFCI), which accounts for the prevailing macroeconomic conditions.[8] Among the sub-indices, the *NFCI risk* tracks the volatility and funding risk in the financial sector, the *NFCI credit* measures credit conditions, and the *NFCI leverage* and *non-financial leverage* reflects debt-to-equity ratios in the financial and non-financial sector (i.e. households and non-financial corporations), respectively. The explicit purpose of the ANFCI is to adjust for the state of the business cycle and the level of inflation. Hence, a *positive* index indicates that national financial conditions are *tighter* than what economic growth and inflation would typically suggest.

As further indicators of actual and perceived economic conditions, we consider industrial production, the unemployment rate, and the University of Michigan's *Consumer Sentiment Index*. To capture price developments, we include the consumer price index (CPI) for all urban consumers and items and the WTI spot crude oil price deflated by the CPI.[9]

2.3 Monetary policy shocks and geopolitical risk

Our empirical analysis draws on two driving forces: A measure of domestic monetary policy shocks and a proxy for the level of global geopolitical risk. For the former, we use the high-frequency instrument proposed by Jarociński and Karadi (2020), which presumes the *negative co-movement* between changes in 3-month federal funds rate futures (FFF) and the S&P 500 in a 30-minute window around FOMC announcements. The aim is to distinguish between conventional monetary policy and so-called *central bank information shocks*, which contain information about the central bank's assessment and communication of current and future economic conditions and are assumed to induce *positive* high-frequency co-movement between FFF rates and stock market returns, in order to eliminate a potential bias in the estimated effects of monetary policy shocks. The resulting shock series is available

[8]All NFCI measures are standardized to have zero means and unit standard deviations. A *positive* index indicates *tighter-than-average* financial conditions. The NFCI sub-indices follow the same logic. All data are available starting in August 1971 (see `https://www.chicagofed.org/publications/nfci/index`).

[9]All data are obtained from the Federal Reserve Bank of St. Louis' *Federal Reserve Economic Data*. The corresponding mnemonics are INDPRO, UNRATE, UMCSENT, CPIAUCSL, and WTISPLC.

for February 1990 through May 2019, which also determines our baseline sample period.[10]

We are interested in the effects of monetary policy shocks on U.S. financial and economic conditions conditional on the level of geopolitical risk. The reason is that the latter is both economically relevant and plausibly exogenous with respect to the decisions of U.S. banks, firms, and households. As an indicator of geopolitical risk (GPR), we draw on the GPR index constructed in Caldara and Iacoviello (2019) by performing an automated text search of the electronic archives of 11 leading English-language newspapers published in the U.S., the UK, and Canada.[11] The index corresponds to the ratio of articles mentioning at least one keyword out of six relevant categories relative to all articles published in a given month, normalized to have an average value of 100 during 2000–2009. The baseline GPR index subsumes two sub-indices quantifying geopolitical *threats* (GPT) and geopolitical *acts* (GPA), respectively. The GPT index comprises the categories geopolitical, nuclear, terrorist, and war threats, while the GPA index comprises the categories terrorist and war acts.[12]

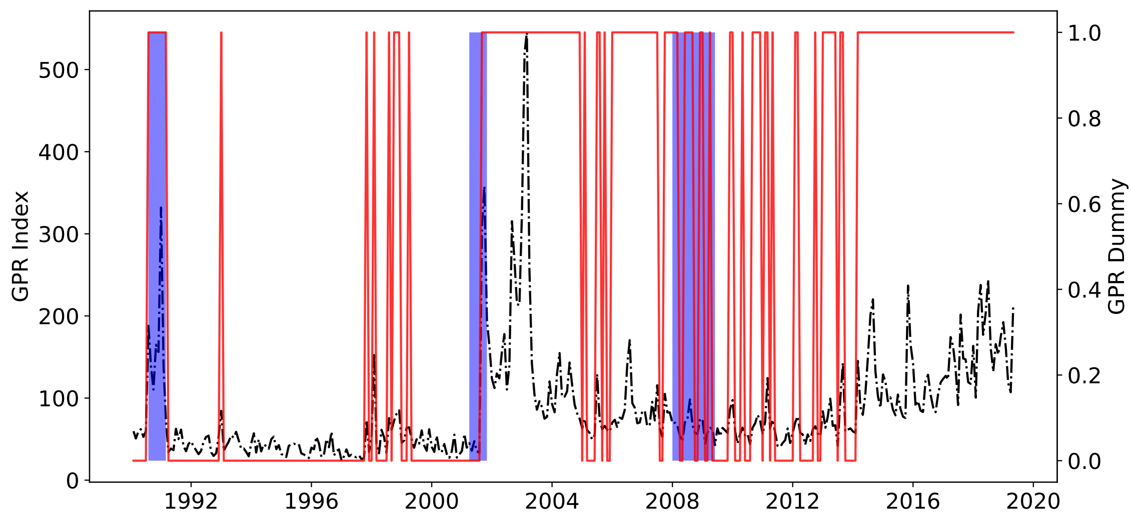
Based on visual comparison with the CBOE's S&P100 volatility index (VXO) and the economic policy uncertainty (EPU) index of Baker et al. (2016), the authors argue that their index captures events that are exogenous to the U.S. business and financial cycle rather than reflecting financial market risk or economic policy uncertainty. Testing for Granger (1969) non-causality, they further show that past observations of U.S. macroeconomic and financial data or measures of financial risk and the EPU have *no predictive power* for the GPR index. Accordingly, the authors conclude that the latter is "largely exogenous to the U.S. economy at business cycle frequency" (see Caldara and Iacoviello, 2019, p. 4).

[10] In our robustness checks, we replicate our main findings for an alternative measure proposed by Miranda-Agrippino and Ricco (forthcoming), which cleanses high-frequency innovations in federal funds futures rates around FOMC announcements of their serial correlation and any predictable components using the Fed's internal Greenbook forecasts. While the aim of their approach is similar to Jarociński and Karadi (2020), the resulting time series of monetary policy instruments are merely available for January 1991 through December 2009.

[11] The text search comprises *The Boston Globe*, *Chicago Tribune*, *The Daily Telegraph*, *Financial Times*, *The Globe and Mail*, *The Guardian*, *Los Angeles Times*, *The New York Times*, *The Times*, *The Wall Street Journal*, and *The Washington Post*.

[12] In our robustness checks, we consider only the former, as geopolitical events, such as terrorist attacks or wars, have a comparatively small and short-lived impact on the U.S. economy (see Caldara and Iacoviello, 2019, Fig. 9). The monthly GPR, GPT, and GPA indices are available from Matteo Iacoviello's webpage.

Figure 1: Geopolitical risk and NBER recessions



Note: The black broken line plots the Caldara and Iacoviello (2019) GPR index. The red solid line plots the GPR dummy. Blue shaded areas indicate NBER recessions. All variables are in monthly frequency.

3 Econometric Approach

In order to detect a potential relationship between geopolitical risk (GPR) and the effects of monetary policy shocks on the balance sheets of FDIC-insured institutions, we condition the impulse responses to the high-frequency instrument in Jarociński and Karadi (2020) on the level of geopolitical risk in the period of the shock. For this purpose, we convert the continuous GPR index of Caldara and Iacoviello (2019) to a dummy variable that takes on a value of unity, when the GPR index is above its sample median for February 1990 through May 2019, and a value of zero, when the GPR index is below its sample median. Accordingly, a value of one indicates a *high-GPR environment*.

Figure 1 plots the GPR dummy against the underlying continuous index and indicates U.S. recessions as timed by the National Bureau of Economic Analysis (NBER). The figure illustrates that, while both the GPR index and our dummy increase during the early 1990s and the early 2000s recessions, this is not the case during the Great Recession of 2007–2009. Moreover, both the GPR index and our dummy have been continuously elevated since 2014 until the end of our sample period, a period of persistent economic expansion.[13]

It is then straightforward to estimate the state-dependent effects of monetary policy shocks by including two distinct coefficients for high and low GPR, respectively, in a local projections approach. In what follows, we present our baseline econometric model as well as the state-dependent extension, in which we condition on the level of geopolitical risk.

3.1 Baseline model

Our baseline model adopts the local projections approach proposed by Jordà (2005), where the effect of a driving variable x_t on an endogenous variable y_t at horizon h is identified by a direct regression of y_{t+h} on x_t, while controlling for a horizon-specific intercept term and possibly a time trend or lagged observations of the endogenous variable. In our model, x_t corresponds to the time series of monetary policy shocks from Jarociński and Karadi (2020), which is exogenous to the econometric framework and taken as given. For each variable of interest, y_t, we estimate a sequence of separate regressions,

$$y_{t+h} = \alpha_h + \beta_h mps_t + \gamma(L)y_{t-1} + \eta t + \epsilon_{t+h}, \tag{1}$$

where α_h denotes a horizon-specific intercept term, η the slope of the linear time trend, $\gamma(L)$ a lag polynomial of order p, and β_h the coefficient of interest on the monetary policy shock. A sequence of quarterly or monthly dummies is suppressed for ease of notation.

For the FDIC data, which are available in quarterly frequency, we set $h = 8$ and $p = 4$. For the financial and macroeconomic variables in monthly frequency, we set $h = p = 12$. Note that the disturbance term η_{t+h} may be serially correlated and heteroscedastic. Hence, inference is based on HAC-robust Newey and West (1987) standard errors. When we consider

[13]Caldara and Iacoviello (2019) acknowledge that the "high values of geopolitical risk in the 2010s appear puzzling in absence of large-scale wars or big cross-border terrorist attacks." and argue that they "capture a multitude of risks, including the continuing threats from entities such as Al Qaida, ISIS, North Korea, and Iran" (p. 9). Hence, it is comforting that the state-dependent impulse responses to monetary policy shocks in this paper are robust to using the alternative high-frequency instrument proposed by Miranda-Agrippino and Ricco (forthcoming), which restricts our sample period to January 1991 through December 2009.

quarterly outcome variables, the monthly monetary policy shock series from Jarociński and Karadi (2020) is time-aggregated to quarterly frequency by simple averaging.

3.2 State-dependent model

State-dependent local projections are explored already in Jordà (2005), where the impact of a federal funds rate shock on U.S. inflation, the output gap, and the federal funds rate is investigated in two separate specifications, where the relevant state is determined based on an inflation rate above 4.75% and a federal funds rate above 6% at lag three, respectively.[14]

We follow Jordà (2005) and recent applications of state-dependent local projections with externally identified shocks such as Rüth (2017) and Ramey and Zubairy (2018), for example. Our state-dependent extension uses the same notation as the baseline model in (1), i.e.

$$\begin{aligned} y_{t+h} = {I_t}^{\text{GPR}} \left[\alpha_{h,high} + \beta_{h,high} mps_t + \gamma_{h,high}(L) y_{t-1}\right] + \\ \left(1 - {I_t}^{\text{GPR}}\right) \left[\alpha_{h,low} + \beta_{h,low} mps_t + \gamma_{h,low}(L) y_{t-1}\right] + \eta t + \epsilon_{t+h}, \end{aligned} \tag{2}$$

where ${I_t}^{\text{GPR}}$ denotes the GPR state dummy and coefficients with a subscript addendum *high* and *low* pertain to the high-GPR and low-GPR environment, respectively, in the period of the monetary policy shock.[15]

Recall that we define the GPR state dummy to take on a value of unity in periods, where the GPR index of Caldara and Iacoviello (2019) exceeds its sample median, whereas it takes on a value of zero when the level of geopolitical risk is below its sample median. Formally,

$${I_t}^{\text{GPR}} = \begin{cases} 1 & \text{if} \quad GPR_t > GPR_{median} \\ 0 & \text{otherwise.} \end{cases} \tag{3}$$

[14] He concludes that the inflation-output trade-off of the federal funds rate shock depends on the prevailing state, while it is independent of whether this state is determined based on inflation or the past federal funds rate. For instance, inflation and output respond more in a low-inflation than in a high-inflation environment (see Jordà, 2005, pp. 178–179).

[15] The impulse response functions based on the linear model in (1) and the state-dependent model in (2) are estimated using Phillip Adämmer's `lpirfs` R package.

Accordingly, the sample period is equally split into high-GPR and low-GPR states, which facilitates an efficient estimation of the state-dependent coefficients in (2).[16] When considering quarterly outcome variables, both the monetary policy shock series and the GPR index are time-aggregated to quarterly frequency. In this case, the GPR dummy in (3) is constructed based on quarterly averages of the underlying monthly index.

4 Empirical Results

In this section, we present the state-specific impulse responses to a contractionary monetary policy shock, as identified by Jarociński and Karadi (2020), for three categories of outcome variables. Our main interest is in the responses of the aggregated balance sheets of FDIC-insured institutions in high- and low-GPR states. We then consider the responses of a number of monthly indicators of U.S. financial conditions in order to shed light on potential channels for any state dependencies. Finally, we investigate whether the latter carries over to the responses of actual and perceived U.S. economic conditions. A short preliminary analysis aims at validating our econometric approach of conditioning the effects of a monetary policy shock on the level of geopolitical risk.

4.1 Preliminary analysis

Implicit in the state-dependent regression model in (2) is the assumption that the GPR dummy is *predetermined* with respect to the U.S. economy and with respect to the time series of monetary policy shocks. A sufficient, albeit not necessary, condition for this is that the Caldara and Iacoviello (2019) GPR index is *exogenous* with respect to mps_t. Given that its exogeneity can only be falsified, we conduct a series of statistical tests to rule out that the level of geopolitical risk responds to monetary policy shocks, and vice versa.

[16]While a similar dummy approach is applied in Jordà (2005) and Ramey and Zubairy (2018), for example, other studies use a *smooth transition approach* in order to determine the relevant state (see, e.g., Auerbach and Gorodnichenko, 2013; Tenreyo and Thwaites, 2016; Rüth, 2017).

Table 1: Hoeffding (1948) tests of contemporaneous independence

	Monthly data		Quarterly data	
H_0	D test statistic	p-value	D test statistic	p-value
GPR and MPS are independent	0	0.456	0	0.744
GPT and MPS are independent	0	0.337	0	0.581

Table 2: Granger (1969) non-causality tests based on bivariate VAR models

	AIC		SIC	
H_0	Lags	Test statistic	Lags	Test statistic
Monthly data				
GPR does *not* Granger-cause MPS	15	0.510	1	0.000
		(0.936)		(0.983)
GPT does *not* Granger-cause MPS	15	0.454	1	0.021
		(0.962)		(0.885)
MPS does *not* Granger-cause GPR	15	1.245	1	0.115
		(0.233)		(0.735)
MPS does *not* Granger-cause GPT	15	0.873	1	0.053
		(0.595)		(0.817)
Quarterly data				
GPR does *not* Granger-cause MPS	7	0.290	1	0.153
		(0.957)		(0.696)
GPT does *not* Granger-cause MPS	7	0.256	1	0.092
		(0.970)		(0.762)
MPS does *not* Granger-cause GPR	7	1.778	1	0.688
		(0.094)		(0.408)
MPS does *not* Granger-cause GPT	7	1.632	1	0.520
		(0.129)		(0.472)

Note: p-values in parentheses

Table 3: Descriptive statistics of Jarociński and Karadi (2020) MP shocks by GPR state

	Monthly data		Quarterly data	
	Mean	Standard deviation	Mean	Standard deviation
Baseline	−0.006038	0.044054	−0.006041	0.024379
Low GPR	−0.007053	0.048698	−0.007513	0.025937
High GPR	−0.005023	0.038976	−0.004545	0.022814
Low GPT	−0.007106	0.048792	−0.007513	0.025937
High GPT	−0.004975	0.038855	−0.004545	0.022814

Note: Sample means and standard deviations of monetary policy shocks in low-GPR and high-GPR states for February 1990 through May 2019

As a starting point, we conduct the non-parametric test of independence proposed by Hoeffding (1948) on the monetary policy shock (MPS) series and the GPR and GPT index, respectively. Under the null hypothesis, two random variables X and Y with a continuous joint cumulative distribution function (CDF) $F(x, y)$ are independent, if and only if the test statistic $D(x, y) \equiv 0$.[17] Based on the test results and p-values in Table 1, we cannot reject the null hypothesis that the Jarociński and Karadi (2020) monetary policy shocks and the Caldara and Iacoviello (2019) GPR and GPT index follow *independent random processes* for either monthly observations or their quarterly time aggregates. However, it is important to note that Hoeffding (1948)'s test is based on *contemporaneous* observations of two (or more) variables and neglects thus potential lead-lag patterns in the data.

Table 2 therefore reports the results of a series of Granger (1969) non-causality tests based on bivariate vector-autoregressive (VAR) models in the MPS series and the GPR or GPT index for monthly observations and quarterly time aggregates. In each VAR model, the optimal lag length is determined based on the Akaike (1974) information criterion (AIC) and Schwarz (1978) information criterion (SIC) with a maximum lag length of 24 and 8 for monthly and quarterly data, respectively. The results for the GPR index in the top panel

[17] The D statistic is based on the distance between the joint CDF, $F(x, y)$, and the product of the marginal CDFs, $G(x) \cdot H(y)$, and depends only on the rank order of the observations. $\sqrt{n}(D - \Delta)$, where n denotes the sample size, has a normal limiting distribution for any parent distribution which is degenerate in the case of independence (see Hoeffding, 1948, p. 546). Note that D is robust against a wide range of deviations from the null hypothesis such as non-monotonic relationships, for example.

indicate that, in monthly data, the null hypothesis of Granger non-causality between MPS and the level of geopolitical risk is *not* rejected in either direction. While we reject the null hypothesis of Granger non-causality from MPS to the level of geopolitical risk in quarterly data at the 10% level, this may well be a statistical artefact due to repeated testing. Hence, we conclude that past realizations of MPS have *no predictive power* for the GPR index over and above its own lagged realizations, and vice versa. The conclusions for the GPT index are qualitatively identical. We also note that our results are robust to very different optimal lag lengths based on the AIC and the SIC, respectively.

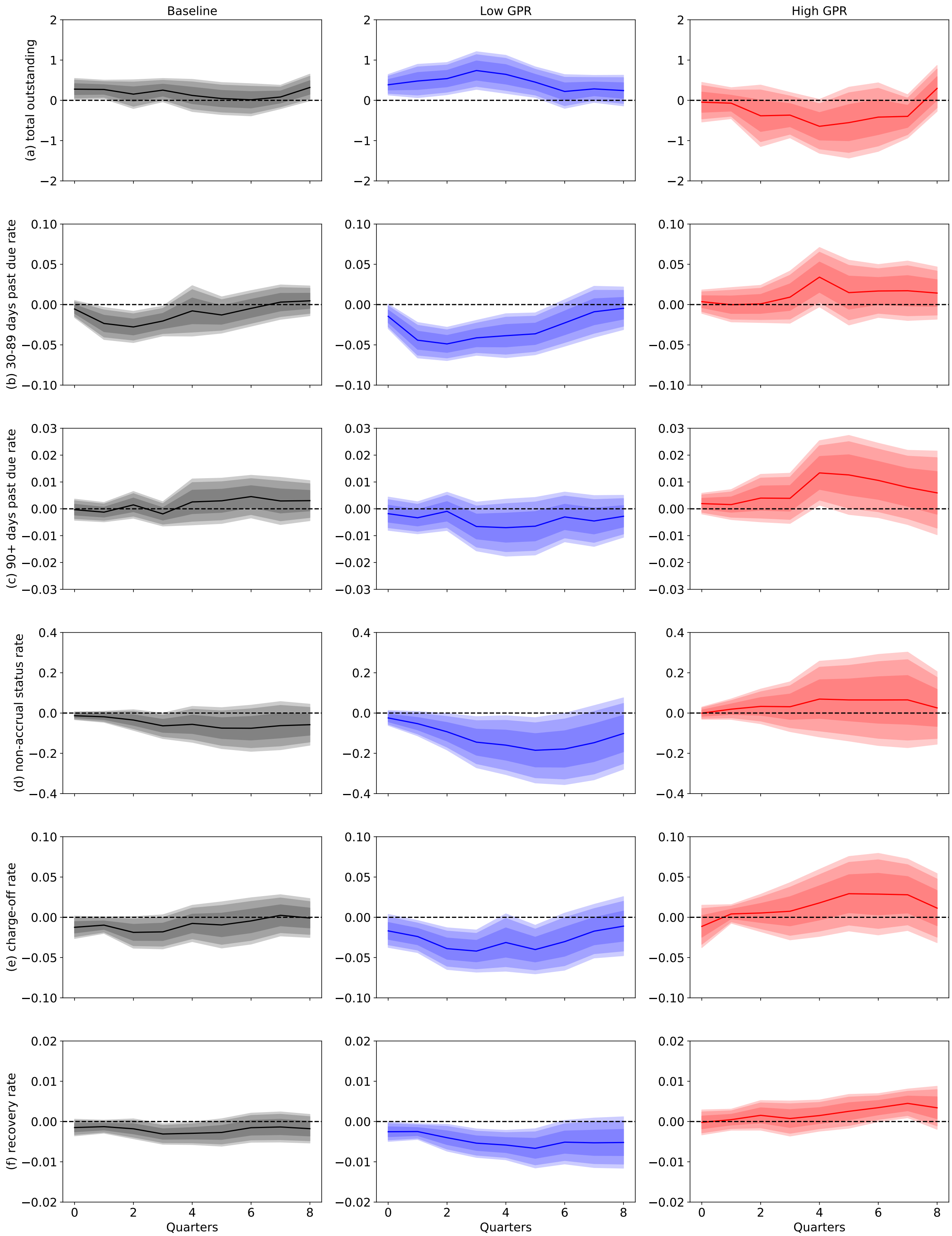
We conclude that the results of the Hoeffding (1948) and Granger (1969) non-causality tests in Tables 1 and 2 do *not* contest the validity of the state-dependent approach in (2). Table 3 therefore reports descriptive statistics for the time series of monetary policy shocks based on the entire sample period as well as by GPR and GPT state. The similarity of the means and standard deviations across low- and high-GPR states suggests that the partitioned shock series are *not* substantially different in sign or size for either monthly or quarterly data. If anything, the realizations of monetary policy shocks are slightly *less negative* and *smaller* in high-GPR states than in low-GPR states.

4.2 U.S. bank balance sheets

Figure 2 plots the impulse response functions of selected bank balance sheet variables to a typical (i.e. one-standard-deviation) contractionary monetary policy from Jarociński and Karadi (2020), identified by the simultaneous increase in the price of 3-month federal funds futures and decrease in the S&P 500 in a 30-minute window around FOMC announcements. While the left panels show the responses based on the baseline linear model in Equation (1), the center and right panels show the responses based on the state-dependent model for low and high geopolitical risk (GPR), respectively.

Panel (a) illustrates that, on average over the sample period, a contractionary monetary policy shock has a statistically significant positive effect on the quarter-on-quarter growth

Figure 2: Impulse responses of bank balance sheet variables to a monetary policy shock



Note: Impulse responses to a one-standard-deviation contractionary shock for the baseline model in (1) and the state-dependent model in (2). Point estimates with 68, 90, and 95% confidence intervals based on Newey and West (1987) HAC-robust standard errors.

rate of total outstanding loans, which increases above trend in the quarter of the shock and the subsequent quarter, before reverting to its long-run equilibrium and turning insignificant from quarter 2 onwards. While this is at odds with our expectations, the center and right panels reveal that the impulse response function based on the model in (1) masks qualitatively different effects in high- and low-GPR states. When the Caldara and Iacoviello (2019) GPR index is *below* its sample median in the period of the shock, an arguably contractionary monetary policy induces an even larger increase in the growth rate of total outstanding loans that is statistically significant up to five quarters after the shock. In contrast, the shock has a contractionary effect on loan growth, when the GPR index is *above* its sample median in the period of the shock. In this case, the growth rate of total outstanding loans falls short of its long-run equilibrium. Four quarters after the shock, the impulse response function is statistically significant at the 5% level.

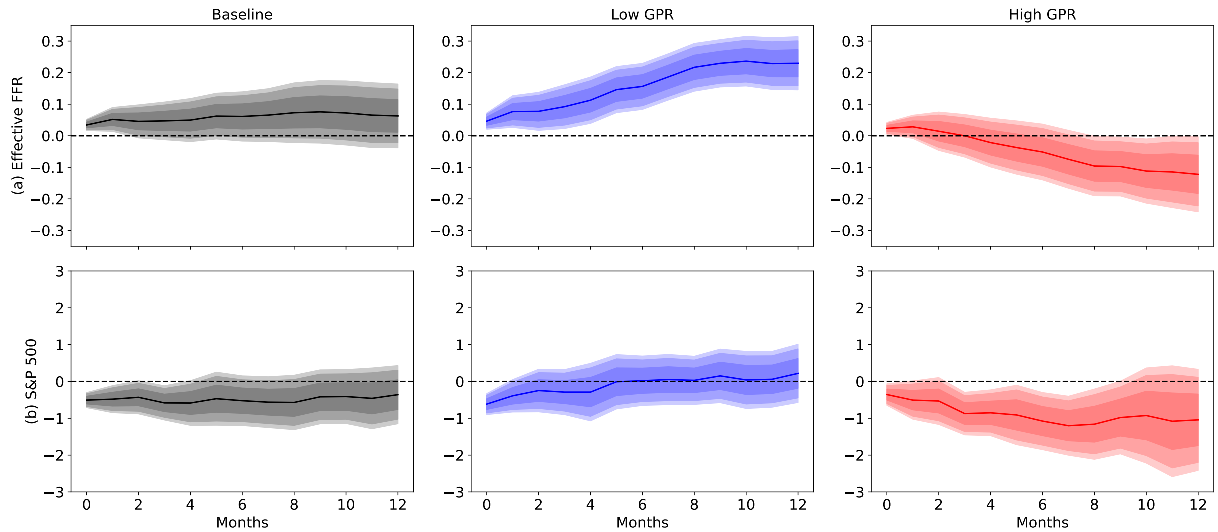
Next, we consider how the shock affects the share of outstanding loans, for which interest payments are 30–90 days past due, 90+ days past due, and in non-accrual status, respectively. From panel (b), the share of outstanding loans with interest payments deferred by 30–89 days is falling in response to an arguably contractionary monetary policy shock. One candidate explanation is that interest payments are deferred by 90 days or more or that interest on these loans is no longer accruing. We find no evidence of a longer deferral or suspension of interest payments in panels (c) or (d), respectively. On average over our sample period, the effect on deferrals indeed seems to be negative and statistically significant between one and three quarters after the shock. Once we condition on low- and high-GPR states, however, we again find qualitative differences in the impulse response functions. When the GPR index is *below* its sample median, deferrals and suspensions of interest payments decrease in response to a contractionary monetary policy shock. The response is significant at the 5% level for the share of loans 30–89 days past due between one and five quarters, at the 32% level for the share of loans 90+ days past due between three and five quarters, and significant at the 5% level for the share of loans in non-accrual status. In contrast, the share of outstanding loans with deferred or non-accruing interest payments increases, when the GPR index is *above* its sample median. The corresponding impulse response function is significant at the 10% level for the share of loans 30–89 days past due and significant at the 5% level for the share of loans 90+ days past due after four quarters, whereas the increase in the share of loans in non-accrual status is statistically insignificant at conventional levels.

Panels (e) and (f) of Figure 2 show the effect of a contractionary monetary policy shock on the amount of charge-offs and recoveries, respectively, as a fraction of outstanding loans. On average over the sample period, we find that both charge-offs and recoveries fall in response to the shock. The impulse response function is statistically significant at the 10% level on impact and up to three quarters for charge-offs and at the 5% level in quarters 3–4 for recoveries. Quantitatively, the reduction in charge-offs dominates the reduction in recoveries as a fraction of outstanding loans. As a result, net charge-offs also fall (not shown). Once we condition on the GPR dummy, the reductions in the charge-off and recovery rates are even more pronounced in low-GPR states, whereas both increase in high-GPR states. While the former impulse response functions are significant at the 5% level for different horizons on impact and up to five quarters after the shock, the increase in the charge-off rate is significant at the 10% level in quarters 5–7. Although statistically significant at the 5% level after seven quarters and at the 10% level in quarters 6–7, respectively, the increase in the recovery rate is quantitatively much smaller.

To sum up, the impulse response functions in the left panels of Figure 2 based on the linear model in (1) reveal some unexpected results. The growth rate of total outstanding loans *increases*, while the share of loans with deferred and suspended interest payments as well as the share of total and net charge-offs *decreases* in response to a supposedly contractionary monetary policy shock from Jarociński and Karadi (2020).[18] Once we condition on the level of geopolitical risk (GPR), we find that the puzzling results described above arise only in low-GPR states, whereas the impulse responses in high-GPR states are consistent with the

[18] It is important to note that we make use of the full sample of monetary policy shocks provided by the authors, which runs from February 1990 through May 2019. Thus, we avoid the risk of sub-sample bias.

Figure 3: Impulse response functions of effective federal funds rate and the S&P 500



Note: Impulse responses to a one-standard-deviation contractionary shock for the baseline model in (1) and the state-dependent model in (2). In panel (b), $y_t = 100 \cdot \log(\text{S\&P } 500_t)$. Point estimates with 68, 90, and 95% confidence intervals based on Newey and West (1987) HAC-robust standard errors.

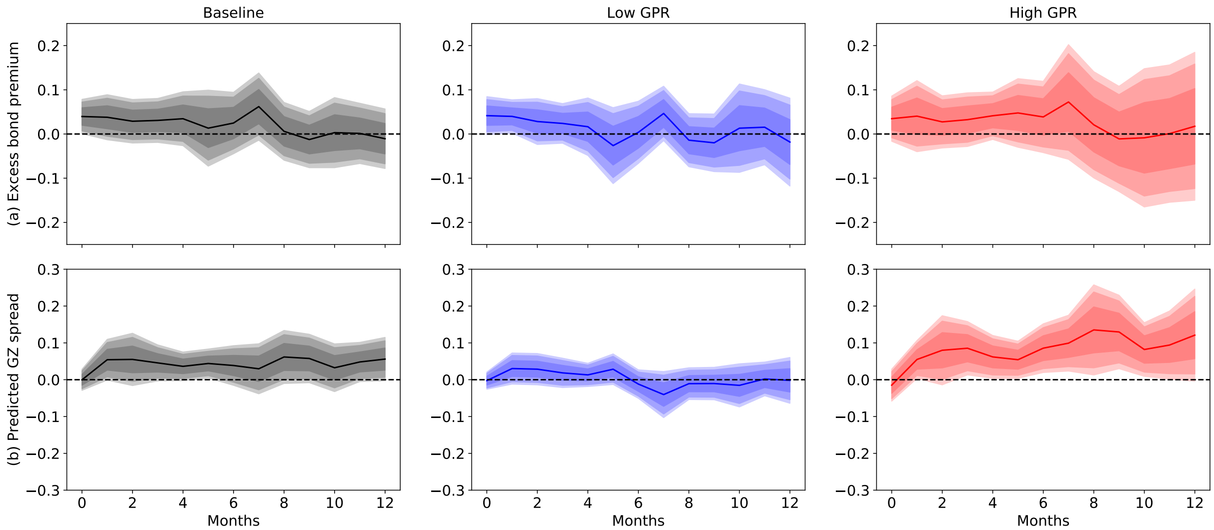
conventional wisdom that a contractionary monetary policy shock reduces (the growth rate of) outstanding loans, while it raises the deferral and suspension of interest payments as well as the charge-off rate.

4.3 Transmission and financial conditions

By construction, a contractionary monetary policy shock in Jarociński and Karadi (2020) raises the value of 3-month federal funds futures and lowers the value of the S&P 500 index in a narrow, 30-minute window around FOMC announcements. In Figure 3, we consider the impulse response functions for monthly realizations of the *effective* federal funds rate (FFR) and the S&P 500 rather than their high-frequency counterparts in order to see, whether the supposedly homogenous realizations of monetary policy shocks differ across GPR states.

Consider first the impulse responses in the left column. In contrast to the high-frequency responses, a contractionary monetary policy shock raises the FFR with a one-month lag rather than on impact. The S&P 500, on the other hand, decreases on impact, in line with

Figure 4: Impulse response functions of excess bond premium and predicted GZ spread



Note: Impulse responses to a one-standard-deviation contractionary shock for the baseline model in (1) and the state-dependent model in (2). Point estimates with 68, 90, and 95% confidence intervals based on Newey and West (1987) HAC-robust standard errors.

the identifying assumption (for high-frequency data) in Jarociński and Karadi (2020).[19] The center and right panels of Figure 3 illustrate the state dependence in the impulse response functions. While the FFR initially increases in low- and in high-GPR states, it reverts back to its long-run trend five months after the shock in a high-GPR state. It is important to note that the state-dependent responses of the FFR reflect systematic differences in the Fed's endogenous response to rather than the exogenous monetary policy shocks. This is also consistent with the state-dependent responses of U.S. stock prices. While the S&P 500 initially falls by a similar magnitude in either GPR state, it quickly reverts back to its long-run trend in the low-GPR state, whereas it continues to fall for at least 12 months in the high-GPR state. Eight months after the shock, the impulse response functions are statistically different at the 5% level.

The state-dependent impulse responses of the S&P 500 suggest that the transmission of monetary policy shocks through financial markets depend on the level of geopolitical risk. In

[19]The impulse response function of the FFR is robust to the inclusion of a liner time trend. Note also that the cumulated impulse response functions of *month-on-month returns* of the S&P 500 are virtually identical to the impulse response functions in Figure 3, which are based on *levels*.

order to investigate this channel in more detail, Figure 4 plots the impulse response functions of the excess bond premium (EBP) and the predicted GZ spread, a measure of the effective risk-bearing capacity of financial markets and the component of credit spreads attributable to macroeconomic and company fundamentals, respectively, proposed by Gilchrist and Zakrajšek (2012).[20] While the EBP has been used in the literature as a measure of credit *supply* conditions, the predicted GZ-spread captures credit *demand* conditions as well as changes in objective (rather than subjective) determinants of aggregate default risks.

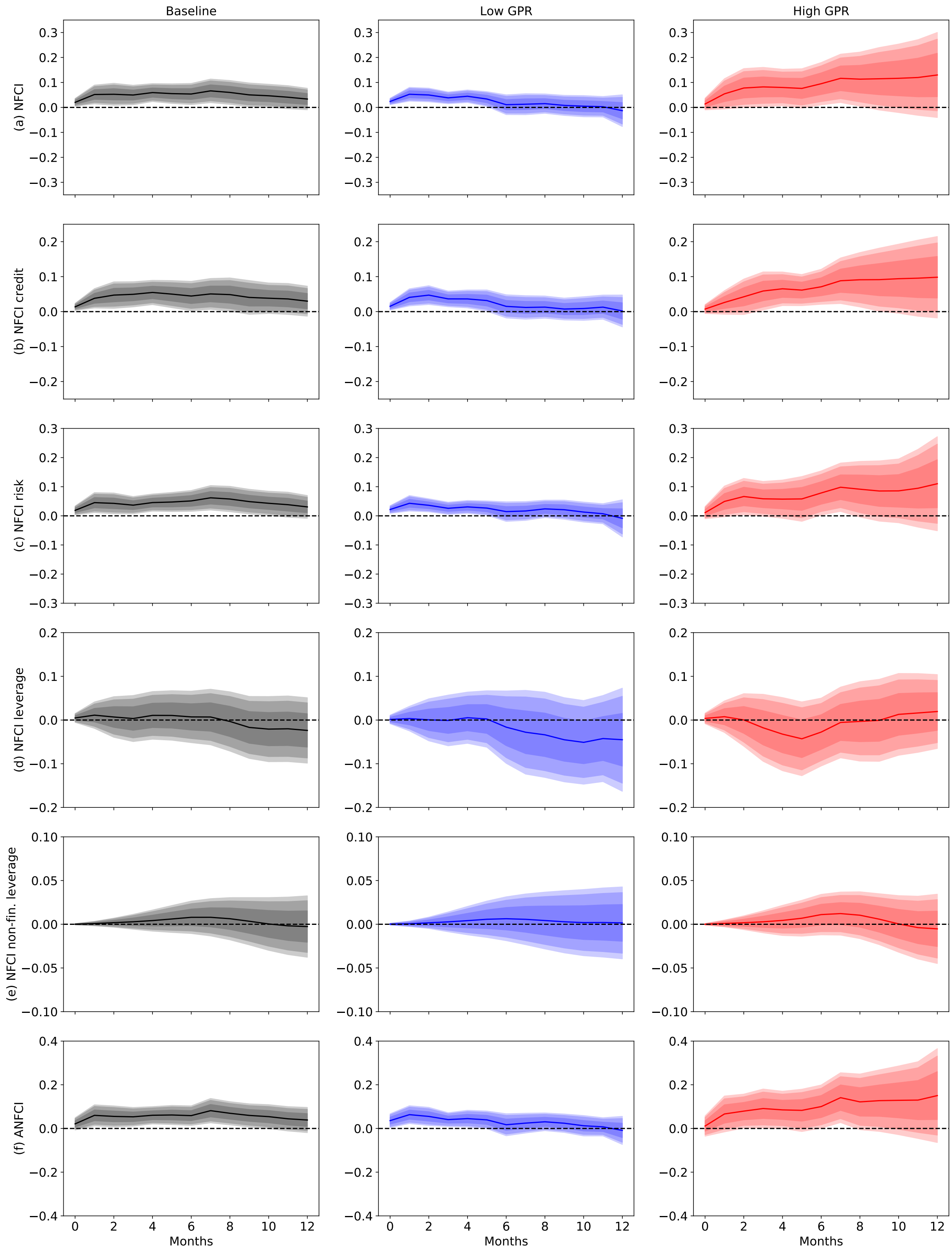
The upper left panel suggests that a contractionary monetary policy shock raises the EBP on impact, albeit the impulse response function is statistically indistinguishable from zero at the 10% level for the subsequent twelve months (except in month 7). The center and right panels illustrate that the effects are qualitatively similar across GPR states. While the impulse response function of the EBP appears to be somewhat more elevated and persistent in high-GPR states, none of the differences are statistically significant at conventional levels.

In contrast, there is clear evidence of state dependence in the impulse response function of the predicted GZ spread. On average over the sample period, the latter increases from month 1 onwards and is statistically significant at the 10% level for much of the subsequent twelve months. This seems to be driven exclusively by the response in high-GPR states, whereas the response in low-GPR states is indistinguishable from zero after six months. We therefore conclude that the state-dependent transmission of monetary policy shocks through financial markets is mainly due to a deterioration of macroeconomic and company fundamentals.

In Figure 2, we consider the impulse response functions of the *National Financial Conditions Index* (NFCI) and its four component sub-indices published by the Federal Reserve Bank of Chicago. The NFCI provides comprehensive information on U.S. financial conditions in money, debt and equity markets as well as the traditional and "shadow" banking systems. An increase in either (sub-)index indicates a *tightening* of financial conditions.

[20]The EBP and the predicted GZ spread are comprised in the overall GZ spread, a measure of credit spreads constructed by Gilchrist and Zakrajšek (2012) based on a large cross-sectional data set of U.S. corporate bond yields.

Figure 5: Impulse responses of national financial conditions to a monetary policy shock



Note: Impulse responses to a one-standard-deviation contractionary shock for the baseline model in (1) and the state-dependent model in (2). Point estimates with 68, 90, and 95% confidence intervals based on Newey and West (1987) HAC-robust standard errors.

Panel (a) illustrates that, on average over the sample period, national financial conditions tighten in response to a contractionary monetary policy shock. Considering the center and right panels, the state-dependent impulse responses are qualitatively identical with those of the predicted GZ spread in Figure 4. While the NFCI increases on impact and reverts to its long-run trend after six months in a low-GPR state, it continues to increase throughout the subsequent twelve months, when the shock occurs in a high-GPR state. Seven months after the shock, the impulse responses are statistically different at the 10% level.[21]

The differences in state-dependent impulse response functions are qualitatively identical and quantitatively even more pronounced for the NFCI credit and risk sub-index in panel (b) and (c), respectively. In contrast, the leverage positions of financial and non-financial firms in panels (d) and (e) seem to be affected neither significantly on average over the sample period nor differently for low- and high-GPR states.[22]

Panel (f) plots the impulse response functions of the *adjusted* NFCI (ANFCI), which purges national financial conditions for the effects of current economic conditions. Given that the responses of the ANFCI to a monetary policy shock are virtually identical with those of the overall NFCI in panel (a) both on average over the sample period and in low- and high-GPR states, the state dependence of the impulse response functions in Figure 5 seems to be orthogonal to the state of the U.S. business cycle and the level of inflation.

4.4 Effects on economic activity

As a final analysis, we investigate whether the state-dependent impulse response functions of U.S. bank balance sheet variables and financial conditions are transmitted to (or reflected in) measures of national economic activity and consumer sentiment as well as consumer and oil prices. For this purpose, Figure 6 plots the corresponding impulse response functions for

[21]Note also the relatively wide 95% confidence bands after 12 months, which comprise everything from a zero response to a substantial tightening of the overall NFCI.

[22]If anything, there is suggestive evidence that the leverage conditions of financial institutions *ease*, while those of non-financial firms *tighten* somewhat in response to a contractionary monetary policy shock. Note that the easing of leverage conditions for financial firms is consistent with the reduction in the growth rate of total outstanding loans in high-GPR states in Figure 2.

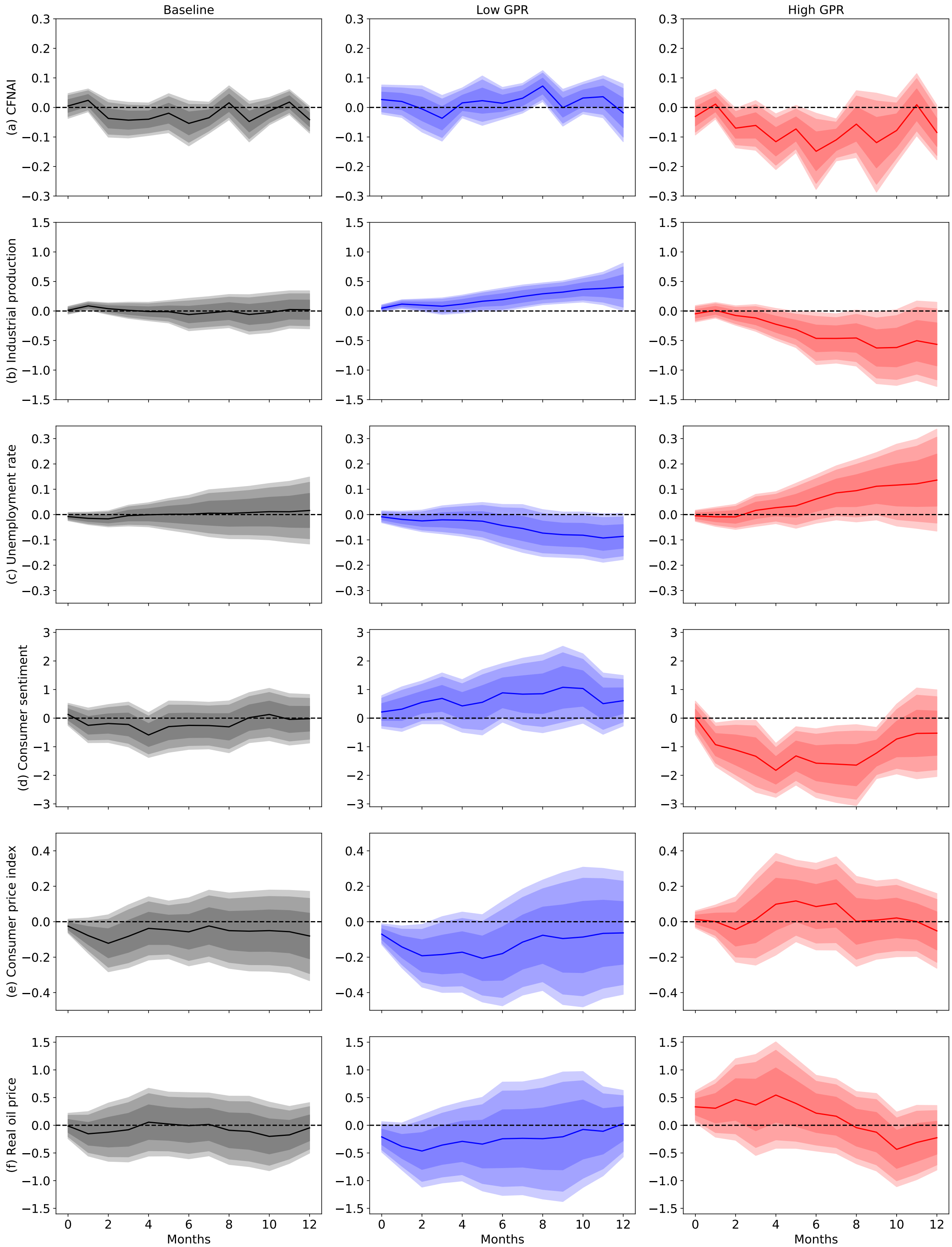
the baseline linear model in (1) and the state-dependent model in (2).

Panel (a) indicates no statistically significant effect of a typical monetary policy shock on the Chicago Fed National Activity Index (CFNAI) on average over the sample period. Once we condition on the level of geopolitical risk in the month of the shock, however, we obtain qualitatively different impulse response functions. When the GPR index is *below* its sample median, a supposedly contractionary shock is followed by a statistically insignificant increase in the CFNAI on impact and a significant increase at the 5% level eight months after the shock. When the GPR index is *above* its sample median, the same type of shock (according to Jarociński and Karadi, 2020) leads to a decrease in the CFNAI that is statistically significant at the 5% level in months 4, 6, and 7. Accordingly, the monetary policy shocks are unambiguously contractionary only when they occur in high-GPR states.

Consistently, the impulse response functions for U.S. industrial production and the unemployment rate in panels (b) and (c) illustrate an expansionary (contractionary) effect when the shock occurs in a low-GPR (high-GPR) state. In comparison with the CFNAI, the responses of these slower-moving variables are somewhat delayed and not yet reverting to their long-run trends after twelve months.

In order to investigate the effect of a contractionary monetary policy shock on private consumption, we also consider the impulse response functions of the University of Michigan's *Consumer Sentiment Index* in panel (d). For the baseline linear model, we find that consumer sentiment drops moderately in response to a supposedly contractionary shock, although the impulse response function is statistically significant only at the 32% level after four months. Once we consider state-dependent impulse responses, however, the effect becomes positive and statistically significant at the 10% level after six and ten months, when the shock occurs in a low-GPR state, whereas it is negative and statistically significant at the 5% level between one and nine months, when the shock occurs in a high-GPR state. This represents one of the most striking findings of our empirical analysis and suggests substantial state dependence in U.S. consumers' perception of conventional monetary policy actions.

Figure 6: Impulse response functions of economic activity, consumer sentiment, and prices



Note: Impulse responses to a one-standard-deviation contractionary shock for the baseline model in (1) and the state-dependent model in (2). Point estimates with 68, 90, and 95% confidence intervals based on Newey and West (1987) HAC-robust standard errors.

We furthermore investigate the effects of monetary policy shocks on the U.S. price level by plotting the impulse responses of the consumer price index (CPI) to a one-standard-deviation shock in panel (e) based on the baseline linear model in (1) and the state-dependent model in (2). On average over the sample period, a contractionary monetary policy shock lowers the CPI, consistent with the effect of a negative aggregate demand shock across a wide range of theoretical macroeconomic models. This effect is more persistent and significant at the 5% level in months 1 and 2, when the shock occurs in a low-GPR state. In contrast, the CPI displays a tendency to increase about three months after the shock, when the latter occurs in a high-GPR state, although the corresponding impulse response function is barely significant at the 32% level after five months.

In order to investigate the "missing deflation" in the impulse response to a contractionary monetary policy shock in the high-GPR state, we finally consider the response of the real oil price in panel (f), measured by the spot price per barrel of West Texas Intermediate (WTI) deflated by the CPI and multiplied by 100. On average over the sample period, the panel on the left indicates a statistically insignificant negative effect on the real oil price between one and three as well as eight and twelve months after the shock. Once we condition on the level of the GPR index in the period of the shock, this negative effect becomes statistically significant at the 32% level on impact and up to three months after the shock. In contrast, the impulse response function of the real oil price is positive and statistically significant at the 32% level on impact and for five months, when the shock occurs in a high-GPR state.

The fact that the CPI and the *real* WTI spot price (deflated by the CPI) respond in the same direction in either state indicates that the *nominal* WTI response is even stronger. As a result, the "missing deflation" in response to a supposedly contractionary monetary policy shock in the high-GPR state may be due in part to an offsetting increase in oil prices, which enter directly into the energy component of the overall CPI, consistent with the results in Aastveit et al. (2020) for the period following the financial crisis of 2007–2009.

5 Robustness checks

In this section, we discuss two important robustness checks of our main empirical results. First, we condition on geopolitical threats rather than geopolitical risks, in general. Second, we replace the monetary policy shock series of Jarociński and Karadi (2020) by an alternative measure constructed in Miranda-Agrippino and Ricco (forthcoming) based on high-frequency changes in federal funds futures around FOMC announcements.

5.1 Geopolitical threats

The baseline GPR index of Caldara and Iacoviello (2019) consists of two sub-indices that quantify geopolitical threats (GPT) and geopolitical acts (GPA), respectively. While the GPT index comprises newspaper articles on geopolitical, nuclear, terrorist, and war *threats*, the GPA index comprises newspaper articles on terrorist and war *acts*. Given that the latter have a comparatively minor impact on the U.S. economy (see Caldara and Iacoviello, 2019, Fig. 9), we focus on the former in our robustness checks.

Accordingly, we replicate the impulse response functions in Figures 2 through 6, while conditioning on the state of geopolitical threats rather than geopolitical risks. To be specific, we construct a dummy variable that takes on a value of unity, when the Caldara and Iacoviello (2019) GPT index is above its sample median for February 1990 through May 2019 and zero else, and re-estimate the baseline linear model in (1) and the state-dependent model in (2). The corresponding summary statistics of the Jarociński and Karadi (2020) monetary policy shocks for low- and high-GPT states are reported in Table 3.

It is important to note that the sample means and standard deviations of the monetary policy shocks by GPR and GPT state are very similar in monthly and identical in quarterly data. As a consequence, it is not surprising that the impulse response functions conditional on the GPT state are qualitatively identical and quantitatively very similar to those conditional on the GPR state for all variables considered in Section 4.[23]

[23]The results based on the GPT index are available from the authors on request.

5.2 Alternative monetary policy shocks

As another robustness check, we consider the impulse responses to the monthly series of monetary policy shocks constructed in Miranda-Agrippino and Ricco (forthcoming). Similar to Jarociński and Karadi (2020), this alternative measure is based on high-frequency changes in federal funds futures in a 30-minute window around FOMC announcements. Rather than purging the effects of central bank information shocks by imposing negative comovement of U.S. federal funds futures with the S&P 500, however, the authors cleanse the high-frequency surprises of their serial correlation and any predictable components using the Fed's internal Greenbook forecasts. Given that the resulting time series of monetary policy shocks runs from January 1991 through December 2009 only, the comparison with our baseline results must be taken with a grain of salt.[24]

Despite the different approaches to constructing the monetary policy shock series and the different sample periods, we find that the impulse response functions based on the baseline model in (1) and the state-dependent model in (2) are qualitatively very similar to, albeit sometimes less statistically significant than those in Section 4. Importantly, the responses of our monthly indicators to the Miranda-Agrippino and Ricco (forthcoming) instrument differ qualitatively between low- and high-GPR states, consistent with our previous findings based on the Jarociński and Karadi (2020) monetary policy shocks. In response to a contractionary monetary policy shock, for example, the effective FFR increases on impact and continues to increase for the subsequent eight months in a low-GPR state, while it increases only shortly and drops below its long-run trend four months after a shock in a high-GPR state. Similarly, the S&P 500 recovers within four months after a shock occurring in a low-GPR state, while it remains subdued for at least twelve months after a shock in a high-GPR state. On impact, the effective FFR and the S&P 500 thus display the same negative comovement imposed on their high-frequency equivalents in Jarociński and Karadi (2020).

[24] The shorter sample period implies both a sample composition effect and a nontrivial loss of power, as the number of observations drops by about one third. For monthly data, the sample size reduces from 352 to 224 observations, while the number of low- and high-GPR states reduces from 176 to 112, respectively.

For the quarterly bank balance sheet variables, we find few statistically significant impulse response functions based on the baseline linear model. At the same time, the state-dependent impulse responses to a contractionary monetary policy shock from Miranda-Agrippino and Ricco (forthcoming) are qualitatively identical with those in Figure 5. Given that the Jordà (2005) local projections in (1) and (2) are now estimated based on a sample of only 76 total and 38 state-specific observations, the statistical significance of any differences across GPR states is impeded. Nevertheless, we conclude that our main finding of an important role for geopolitical risk in the transmission of exogenous monetary policy shocks is not specific to the high-frequency measure in Jarociński and Karadi (2020) but persists for alternative state-of-the-art instruments.[25]

6 Conclusion

Recent advances in the use of high-frequency external instruments facilitate distinguishing between the signalling channel of monetary policy and exogenous changes in the federal funds rate, arguably solving a number of long-standing puzzles in the literature studying the effects of monetary policy shocks. In this paper, we have shown that, even after purging the effects of so-called central bank information shocks, the remaining monetary policy shocks are *not the same*. Based on the high-frequency instrument proposed by Jarociński and Karadi (2020) and the geopolitical risk (GPR) index constructed in Caldara and Iacoviello (2019), we find that a supposedly contractionary monetary policy shock reduces the growth rate of outstanding commercial and industrial loans, raises credit spreads, tightens financial market conditions, and dampens actual and perceived real economic activity if and only if the shock occurs in an environment of comparatively high geopolitical risk.

Our findings are based on quarterly observations of FDIC-insured banks' balance sheets as well as monthly observations of U.S. economic and financial conditions. Consequently, the state-dependent effects of monetary policy shocks are not confined to a particular frequency

[25] The results for the Miranda-Agrippino and Ricco (forthcoming) shocks are available from the authors.

but seem to be present in macroeconomic time series at different frequencies. Moreover, we obtain very similar results for an alternative measure of monetary policy shocks constructed in Miranda-Agrippino and Ricco (forthcoming), which purges the high-frequency changes in federal funds futures in a narrow time window around FOMC announcements for their serial correlation and any predictive components using the Fed's internal Greenbook forecasts, even though the latter series is available for only part of our baseline sample period.

These findings are relevant for academics and policy makers alike. From a researcher's perspective, the state-dependent effects of monetary policy shocks in this paper shed light on the empirical importance of transmission channels, which must be incorporated in theoretical macroeconomic models in order to make meaningful predictions about the effects of exogenous monetary policy shocks. For the Board of Governors and other decision-making bodies, it is crucial to be aware that monetary policy decisions are taken in an environment above and beyond national economic and financial conditions. Given that the state-dependent effects of monetary policy shocks conditional on the level of geopolitical risk are present even in the *adjusted* NFCI, which explicitly controls for the state of the business cycle and the level of inflation, monetary policy makers should also keep tack of geopolitical conditions. In contrast to geopolitical threats and acts, which arise exogenously and are thus beyond the control of the Board of Governors, monetary policy and central bank communication may be tailored to the economic and financial cycle as well as the geopolitical environment. Or paraphrasing the popular stock-market adage "buy on the sound of cannons, sell on the sound of trumpets" attributed to London financier Nathan Rothschild, the Fed might want to "ease on the cannons" and "tighten on the trumpets."

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